

**PARAMETRIC PAYOUTS AND ENVIRONMENTAL CONSERVATION:
HOW A TECH-BASED INSURANCE POLICY COULD PAVE THE WAY
FOR ECONOMICALLY VIABLE CONSERVATION EFFORTS**

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This year, the state government of Quintana Roo, Mexico, the Nature Conservancy, and the reinsurance company, Swiss Re, created the first parametric insurance policy to be taken out on a natural resource; the Mesoamerican Reef. This innovative policy creates a technology-based approach to establishing economically viable environmental conservation by assigning a quantitative value to a vulnerable resource that protects the \$10 billion tourism industry in the Caribbean. It also creates an entirely new and unregulated subsector of the insurance field. Although this type of policy sets the stage for innovative environmental conservation efforts, parameters and payout mechanisms might not align to achieve efficient or fair results without regulation or government oversight. Adopting standards like those present in the regulation of private green bonds should be the first step in approaching regulation because it would allow for the industry to grow while holding companies accountable. However, if the insurance policies are going to effectively ensure environmental conservation, nationally recognized and legally enforceable regulation will have to follow the implementation of private standards.

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I. INTRODUCTION

The Mesoamerican coral reef, in the Caribbean Sea, is the world's second-longest barrier reef and spans the coastlines of Mexico, Honduras, Belize, and Guatemala.¹ The reef provides numerous environmental benefits, ranging from housing one of the most diverse ecosystems in the world to providing marine resources

¹ See *Mesoamerican Reef Facts*, WORLD WILDLIFE FUND, <https://www.worldwildlife.org/places/mesoamerican-reef> (last visited Oct. 29, 2018).

that yield a strong tourism industry.² Arguably more significant, however, is the reef's ability to protect coastal communities from powerful storm surges and climate disasters.³ When healthy, a coral reef can significantly reduce wave energy before the wave hits the coastal shore, providing a defense to onshore development from damages caused by storm winds and wave currents.⁴ This function provides incredible environmental and economic benefits to coastal states such as Mexico's Quintana Roo, which is a part of the ten-billion-dollar tourism industry that is dependent upon functional beaches and marine life.⁵

Unfortunately, over the past few years this natural defense mechanism has been threatened by "[f]looding, erosion, inundation, and extreme weather events," that have drastically degraded infrastructure, tourism, and trade.⁶ This has led to extreme negative effects on both local and national economies.⁷ Weather-related economic losses have increased nearly four-fold between the year 1980 and today, and more than \$560 billion in insurance has been

² *Mesoamerican Reef*, WORLD WIDE FUND FOR NATURE, http://www.wwfca.org/en/species_and_places/mesoamerican_reef/ (last visited Oct. 26, 2018).

³ See *Insuring Nature to Ensure a Resilient Future: Can a New Fund in Mexico Create a First-Ever Insurance Policy on Nature?*, NATURE CONSERVANCY (Mar. 8, 2018), <https://global.nature.org/content/insuring-nature-to-ensure-a-resilient-future> [hereinafter *Insuring Nature*] (stating that in 2005, Mexico's coast was hit by two hurricanes that caused extensive damage to the whole coast, but the area protected by the Mesoamerican coral reef, Puerto Morelos, experienced significantly less damage).

⁴ See *id.* ("A healthy coral reef can reduce up to 97 percent of a wave's energy before it hits the shore.").

⁵ See Mark Tercek, *Business to the Rescue! Insurance for Reef Restoration*, NATURE CONSERVANCY (Mar. 8, 2018), <https://global.nature.org/content/business-to-the-rescue-insurance-for-reef-restoration>.

⁶ See *Insuring Nature*, *supra* note 3; WEALTH ACCOUNTING AND VALUATION OF ECONOMIC SERVICES AND WORLD BANK GROUP, *MANAGING COASTS WITH NATURAL SOLUTIONS: GUIDELINES FOR MEASURING AND VALUING THE COASTAL PROTECTION SERVICES OF MANGROVES AND CORAL REEFS* 9 (2016), [https://thought-leadership-production.s3.amazonaws.com/2016/02/12/15/46/09/e53a750a-c2fc-4cec-beba-ebeba0222b6/Technical%20Rept%20WAVES%20Coastal%202-11-16%20web%20\(1\).pdf](https://thought-leadership-production.s3.amazonaws.com/2016/02/12/15/46/09/e53a750a-c2fc-4cec-beba-ebeba0222b6/Technical%20Rept%20WAVES%20Coastal%202-11-16%20web%20(1).pdf) [hereinafter *Managing Coasts with Natural Solutions*].

⁷ See *Managing Coasts with Natural Solutions*, *supra* note 6, at 9.

paid out between 1980 and 2015.⁸ The increase in storm surges, vulnerability of natural barriers, and threats to the economy⁹ have led local governments and environmental groups to collaborate and create an innovative solution that could lay the framework for the future of technological solutions to environmental disasters.¹⁰

The Nature Conservancy, alongside the State Government of Quintana Roo, has teamed up with Swiss Re, an insurance company, to create the first ever parametric insurance program¹¹ for a natural

⁸ See *Climate Change and Risk Disclosure*, NAT'L ASS'N OF INS. COMM'RS (July 11, 2018), https://naic.org/cipr_topics/topic_climate_risk_disclosure.htm; see also *Managing Coasts with Natural Solutions*, *supra* note 6, at 9 (“Insurers have paid out more than \$300 billion just for coastal damages from storms in the past 10 years, which often goes toward rebuilding similar coastal infrastructure that is still vulnerable to coastal storms and flooding.”).

⁹ See, e.g., Nicole Chavez, *Hurricane Maria Killed 2,975 People in Puerto Rico. It's The Second Deadliest US Storm In Over a Century*, CNN (Aug. 29, 2018), <https://www.cnn.com/2018/08/29/us/puerto-rico-deaths-new-york-9-11-trnd/index.html>; ‘Beryl’ Strengthens, Expected To Hit Caribbean As Hurricane, WALL ST. J. (July 6, 2018), <https://www.wsj.com/articles/beryl-strengthens-expected-to-hit-caribbean-as-hurricane-1530896268>; Janice Dean, *Hurricane Florence Could Be One Of The Worst Hurricanes to Ever Hit The East Coast*, FOX NEWS (Sept. 11, 2018), <http://www.foxnews.com/us/2018/09/11/hurricane-florence-could-be-one-worst-hurricanes-to-ever-hit-east-coast.html>; LAUNCH OF THE COASTAL ZONE MANAGEMENT TRUST, NATURE CONSERVANCY 1, https://thought-leadership-production.s3.amazonaws.com/2018/03/08/14/23/46/1ac3a4be-11d2-4651-9d98-50326d81e1b8/TNC_Mexico_CoastalManagementTrust_Factsheet.pdf (last visited Nov. 13, 2018) [hereinafter *Coastal Zone Management Trust*] (“Past storm events have closed hotels and businesses for long periods, cutting off income and employment until they can be repaired and reopened.”).

¹⁰ The increased vulnerability of coastal areas has fostered an environment where The Nature Conservancy, the State Government of Quintana Roo, Mexico, hotels and local business owners, and local scientists have partnered together to create a trust that will receive taxes from the tourism industry and other funds from The Rockefeller Foundation in order to provide financial support to a conservation plan taken out on the Mesoamerican reef near Puerto Morelos, a town in Quintana Roo. See *Insuring Nature*, *supra* note 3.

¹¹ Parametric insurance differs from traditional insurance because the payout is triggered by the occurrence of predetermined contractual terms rather than a damage assessment made after the event. For example, a parametric insurance plan could state that if wave velocity during a storm reaches a certain amount, a payout would be issued, rather than waiting until after the storm subsides and the actual damages are assessed. This increases efficiency and allows the insured

resource.¹² The program is backed by the Coastal Zone Management Trust (the Trust), which receives funding from the tourism industry, the Rockefeller Foundation, and payouts by the local government.¹³ The Trust will fund the continuous maintenance of the reef¹⁴ and the purchase of the parametric insurance.¹⁵ Not only will maintaining the reef protect the tourism industry in Quintana Roo, but it will also “bolster economic resilience of the region; encourage conservation of a valuable natural asset; and create a scalable new market for the insurance industry—a model which could be applied to other regions and ecosystems.”¹⁶

The parametric structure of the insurance policy uses technology to create an economically efficient way to implement environmental restoration. Parametric insurance, unlike traditional insurance, issues a payout to the insured based on a trigger, rather than an assessment of the damage caused by an event.¹⁷ The parametric plan adopted for the Mesoamerican reef uses the trigger of wind speed hitting the reef.¹⁸ Research has shown that coral reefs fail to recover properly after a Category Four or Five hurricane, and, therefore, the insurance plan has established the parametric trigger of wind speed aligning with a Category Four hurricane—around 110 knots.¹⁹ In short, when the wind hits this predetermined speed in the area near the reef, an automatic payout is made to the local government so that

party to begin making the repairs needed. *See* Andre Martin, *What Is Parametric Insurance?*, SWISS RE CORP. SOLS. (Aug. 1, 2018), https://corporatesolutions.swissre.com/insights/knowledge/what_is_parametric_insurance.html.

¹² *Coastal Zone Management Trust*, *supra* note 9, at 3.

¹³ *See Insuring Nature*, *supra* note 3 (explaining that funding comes through taxes from the tourism industry, government funds, and support from the Rockefeller Foundation).

¹⁴ The reef will be maintained through rescuing broken corals, gathering larvae and allowing them to grow in a safe environment before reattaching to the reef, managing fishing activity, putting in artificial structures for the coral to grow back upon, and simply reattaching pieces of coral that have been detached by the storm. *See Coastal Zone Management Trust*, *supra* note 9, at 4.

¹⁵ *See id.* at 3.

¹⁶ *See Insuring Nature*, *supra* note 3.

¹⁷ *See Tercek*, *supra* note 5.

¹⁸ *See id.*

¹⁹ *See id.*; *Coastal Zone Management Trust*, *supra* note 9, at 3.

it can begin repair and restoration of the natural resource without waiting for a damage assessment and without having to allocate funds to other costs that would be lumped together under a traditional insurance plan.²⁰ This payout is made regardless of storm predictions, and the plan does not have to deal with the uncertainty of weather patterns, because the payout is issued when the *actual* wind speed is measured to be the predetermined amount.²¹ The local government will receive the payout within days because scientists have concluded that coral needs immediate attention for it to recover effectively.²²

This parametric insurance program not only benefits the industries protected by the reef, but it also assists environmental advocates who now have a mechanism to make environmental restoration economically feasible.²³ As the first implementation of parametric insurance applied to a natural resource, this program sets the stage for future economically feasible environmental protection.²⁴

The Mesoamerican reef parametric insurance program also provides an opportunity to detail the legal uncertainties surrounding the creation of a new market within the insurance industry. Lack of

²⁰ See *Coastal Zone Management Trust*, *supra* note 9, at 3 (explaining that the insurance policy is strictly for the payouts associated with windspeed rather than any other type of damage, fees, or activities that are associated with traditional insurance plans).

²¹ See *id.* (stating that the technology measuring the trigger is in the area of the reef and all that matters is whether the trigger is met, not whether the actual insured asset is damaged).

²² See Adele Peters, *This Coral Reef Will Have Its Own Innovative Insurance Policy*, FASTCOMPANY (Aug. 17, 2017), <https://www.fastcompany.com/40452568/this-coral-reef-now-has-its-own-innovative-insurance-policy> (quoting Kathy Baughman McLeod, the managing director of climate risk and investment at The Nature Conservancy in saying that “[t]he corals break off and you’ve got to pick them up, and rest them, and they have to be reattached. That can all happen, but they can’t be left to break off and float away, because they’ll die and you’ll lose the health of the reef.”).

²³ See *Coastal Zone Management Trust*, *supra* note 9, at 3 (explaining that environmentalists will now be able to demonstrate “the value of nature as a cost-effective way of protecting people and property from flood and storm damage related to climate change”).

²⁴ See *Insuring Nature*, *supra* note 3.

regulation, differences in technological standards, and the application of a new type of insurance inside a traditional insurance legal regime pose significant legal consequences without providing guidance on how to resolve them. Further, industry predictions suggest that insurance plans, and more specifically parametric insurance plans, will be more effective if they are grounded on smart contracts.²⁵ As an inherently effective platform for smart contracts, emerging blockchain technology is predicted to be a strong presence in the insurance field.²⁶ Because of this predicted trend and because it is the first policy taken out on a natural resource, the Mesoamerican parametric insurance program provides an opportunity to analyze the legal complications of technology-based insurance and consider why both private and public regulation should be implemented.

This recent development argues that parametric insurance should follow the regulatory regime of green bonds, where private industry standards have shaped broader government regulation in order to provide structure and terms that a court can follow. Part II will explain the emerging field of parametric insurance. Part III will analyze the successes and pitfalls of the few parametric insurance plans that have previously been implemented as well as discuss technology-based solutions to the current complications that have emerged. Part IV will explain why the traditional insurance legal regime is insufficient for parametric insurance plans and should be supplemented through private and public regulatory standards. Finally, Part V will discuss why this proposed regulation should mirror that of green bonds.

²⁵ Mark Carter, *Parametric Insurance: Breaking the Mold of Traditional Insurance*, IBM: INDUS. INS. BLOG (Jan. 22, 2018), <https://www.ibm.com/blogs/insights-on-business/insurance/parametric-insurance-breaking-the-mold-of-traditional-insurance/>. A smart contract is defined as “an agreement in digital form that is self-executing and self-enforcing.” Kevin Werbach & Nicolas Cornell, *Contracts Ex Machina*, 67 DUKE L.J. 313, 320 (2017).

²⁶ See Carter, *supra* note 25.

II. THE EMERGING FIELD OF PARAMETRIC INSURANCE: WHAT IT IS AND HOW IT HAS BEEN IMPLEMENTED IN CATASTROPHIC RISK SITUATIONS

Parametric insurance is based on “the probability of a predefined event happening instead of indemnifying actual loss incurred.”²⁷ The plan is based on two elements: (1) a triggering event, and (2) a payout mechanism that is both predetermined and custom-created to ensure equity between the cost and the payout.²⁸ Once the triggering event occurs, a payout is made instantaneously,²⁹ allowing the insurance holder to begin to make repairs to her property without the time consuming indemnification process.³⁰ Natural phenomena such as earthquakes, floods, precipitation levels, or wind speeds are the most common types of triggering events, but power outages, crop yield, and other intangible market factors have also been used.³¹ Anything that is “fortuitous” and “can be modelled” will be an effective trigger.³² The classification and enumeration of the parameters,³³ however, is what makes a truly efficient parametric insurance scheme.³⁴ The parameters are of heightened significance because they are the focus of the insurance plan, rather than the

²⁷ Martin, *supra* note 11.

²⁸ *See id.*

²⁹ For the Mesoamerican reef project, “[the] claim will be paid in 10 days or less” because of the vulnerability of coral and the quick time frame necessary for effective restoration. *See* Peters, *supra* note 22. This quick timeframe is one of the key benefits of parametric insurance because it fosters protection of assets that normally need rapid attention. *See id.*

³⁰ *See* Martin, *supra* note 11.

³¹ *See id.*

³² *See id.*

³³ For purposes of the insurance policy, the “parameter” is the index associated with the insured loss meaning, or in layman’s terms the circumstances of the trigger (e.g., temperature, wind speed). *See, e.g., AXA Launches AXA Global Parametrics*, AXA (Mar. 9, 2017), <https://group.axa.com/en/newsroom/press-releases/axa-launches-axa-global-parametrics> (stating these parameters must be developed through balancing the potential of risk occurring and the recognition of data on an appropriate threshold for a payout).

³⁴ Denise Johnson, *Experts See Expanding Role for Parametric Insurance, Including for U.S. Disasters*, *INS. J.* (Nov. 22, 2017), <https://www.insurancejournal.com/news/national/2017/11/22/472010.htm>.

damage accrued or the actual asset.³⁵ The parameters are effectively replacing the human conducted damage assessment processes and are basing the amount of a payout on previously collected data regarding storm damage costs, predictions of storm likelihood, and how much recovery would cost.³⁶

Because the payouts are automatic, parametric insurance programs function best when a third party who truly understands the risks at stake is conducting the measurements of the trigger.³⁷ The customization and instantaneous payouts allow for a cheaper and more flexible insurance policy that can be applied yearly or for the short-term period that risk is actually present, such as hurricane season or a cyclical period of drought.³⁸ Because of this, parametric insurance plans provide an incentive for the insured to create an insurance policy for difficult-to-insure natural resources or intangible business concepts.³⁹ Creating insurance policies for these resources not only creates a new sector of the insurance field, but also creates an economically feasible way to justify the importance of conservation to government and business leaders who have previously refused to recognize the value of nature⁴⁰—something

³⁵ *See id.*

³⁶ *See id.*

³⁷ *See id.* (explaining that entities like the National Oceanic and Atmospheric Administration can issue measurements on wind speed that can both be used as a historical framework for the policy, but also as the parametric triggers themselves).

³⁸ *See id.* (stating that a purchaser can adopt a parametric insurance plan for short periods such as hurricane season or times that are historically related to lower yielding crops).

³⁹ *See id.*

⁴⁰ *See Insuring Nature, supra* note 3 (“Coral reefs also provide significant coastal protection benefits to nations around the world. If just the top 1 meter of a coral reef is lost, annual expected damages from global flooding doubles. With billions of dollars of built capital protected by coral reefs from flooding around the world, it’s clear that there is a market ripe for financial products and mechanisms that would protect reefs and ensure greater coastal resilience. More importantly, it’s clear that lives and livelihoods are at stake. Recent research suggests hurricanes could become more intense in the future, putting coastal communities at even greater risk. We can’t afford to do nothing—literally.”).

environmental advocates have struggled to do in the past.⁴¹ This working relationship between economics and conservation helps both natural resources and threatened ecosystems by establishing the quantifiable worth of the natural asset.⁴² To quantify the worth, parties will not only consider the risk of damage, but also the value of preserving the asset protected.⁴³ Once the worth is quantified through the assigned contract payout prices, environmental advocates and scientists will be more effective in requesting maintenance funds, which will allow the resource to recover rather than deteriorate.⁴⁴ This relationship is sufficiently depicted in the Mesoamerican reef program, where assigning a numerical worth of the reef provides a monetary incentive to restore the reef as damage occurs before the entire resource is diminished of use.⁴⁵

⁴¹ See Tercek, *supra* note 5 (“Environmentalists have long argued that preserving reefs, wetlands, forests, and other natural ecosystems will provide important services to people, from improving air and water quality to reducing the onshore impact of storms. But now people like me have a powerful new ally on our side—business leaders and deal-makers.”).

⁴² See *Insuring Nature*, *supra* note 3 (explaining that by establishing a payout price through the insurance plan, the parties are assigning a quantifiable number associated with value to a natural asset which traditionally can only be talked about in qualitative environmental terms).

⁴³ See *id.* For example, the Mesoamerican reef lies between the ocean storms and a \$10 billion tourism industry, so the value of that protection is factored into the cost and payouts associated with the insurance. *Id.*

⁴⁴ See *Coastal Zone Management Trust*, *supra* note 9, at 3 (stating that one of the stakeholders in the coral reef insurance program, the Nature Conservancy, has “demonstrated the value of nature as a cost-effective way of protecting people and property from flood and storm damage related to climate change” through projects like this insurance program and others that revolve around preservation and restoration); see also Mark Tercek, *The Best Investment Opportunity Ever: Investing in Nature 101*, NATURE CONSERVANCY (Nov. 4, 2017), <https://www.nature.org/en-us/about-us/who-we-are/our-people/mark-tercek/the-best-investment-opportunity-ever-investing-in-nature-101/> (“These natural solutions can be great investments. Often, they work just as well as—or even better than—traditional manmade infrastructure. They often cost less. And they usually deliver important co-benefits for free—things like habitat for plants and animals, green space in underserved neighborhoods and opportunities for recreation and tourism.”).

⁴⁵ See Tercek, *supra* note 5 (stating that although coral reefs will recover from storm events naturally, the funds are needed to take immediate recovery steps including decreasing the water pollution around the reef, reintroducing fish

As seen through storm event news coverage in the Mesoamerican area,⁴⁶ losses covered in parametric catastrophe insurance policies can be extensive and global in nature, creating a scheme that is difficult for a single party to cover.⁴⁷ Therefore, insurance companies take out reinsurance to diversify the losses associated with the larger contracts.⁴⁸ “Reinsurance can be understood simply as insurer’s insurance,” and is a mechanism for transferring risk.⁴⁹ The contracts created with a reinsurer are indemnity agreements,⁵⁰ not obligations to pay the individual obtaining the original insurance policy.⁵¹ Catastrophe reinsurance is typically established through an aggregate occurrence contract, which pays for losses in all contracts caused by the same natural occurrence such as a hurricane.⁵² For example, when a hurricane strikes a coastal neighborhood, the harm may be small to the individual, but the aggregate harm felt by the neighborhood might be an unmanageable loss for the primary insurance company.⁵³ Because reinsurance delves into the protection of aggregate harm, having reinsurance “provides incentives for the primary insurers to engage in mitigation and prevention of catastrophe losses.”⁵⁴ This is

species around the reef, and introducing artificial infrastructure for the reef to grow upon).

⁴⁶ See *Insuring Nature*, *supra* note 3 (“In 2005, Mexico’s Caribbean coast was struck by two hurricanes, causing USD\$8 billion in damages and closing hotels and other businesses in Cancún long enough to cause further economic impact.”).

⁴⁷ Qihao He, *Regulation by Government-Sponsored Reinsurance in Catastrophe Management*, 23 CONN. INS. L.J. 291, 295 (2017).

⁴⁸ See *id.*

⁴⁹ *Id.* at 293.

⁵⁰ Indemnity agreements are:

[A]n obligation by one party to make another whole for a loss that the other party has incurred. . . . Indemnity is a form of compensation in which a first party is liable to pay a second party for a loss or damage which the second party incurs to a third party. Indemnity requires that a common duty be mutually owed to a third party.

41 AM. JUR. 2D, *Indemnity* § 1 (2018).

⁵¹ JOHN T. HARDING, MASSACHUSETTS LIABILITY INSURANCE MANUAL § 6.2 (3d ed. 2017).

⁵² GRAYDON S. STARING & HON. DEAN HANSELL, LAW OF REINSURANCE § 2:7 (2018).

⁵³ See Harding, *supra* note 51, at § 6.3.

⁵⁴ He, *supra* note 47, at 298.

beneficial to programs like the one on the Mesoamerican reef because conservation through maintenance and mitigation of the natural resource protects the ten billion-dollar tourism industry as well as the actual land shoreward of the reef.⁵⁵

III. PAST PARAMETRIC INSURANCE PROGRAMS: THE SUCCESSES AND FAILURES OF PREVIOUS PARAMETRIC REGIMES AND WHAT THEY SUGGEST WOULD BE AN ADEQUATE SOLUTION

Although the Mesoamerican reef is the first parametric insurance plan taken out on a natural resource, there are a growing amount of parametric insurance plans actually in use today. Despite this expanding presence, no parametric insurance claim has been litigated for a determination of legal implications.⁵⁶ As a unique subsector of insurance, it is plausible that claims and issues cannot and would not be handled the same way as the traditional insurance regime. Therefore, a discussion of past projects, successes and failures is useful in determining why regulation for this specific type of industry is necessary.

A. Current Parametric Programs' Approach to Triggers and Payouts

As an example of another parametric program, Swiss Re has a parametric insurance product that protects Japanese corporations and public organizations from tsunamis using the trigger of wave heights.⁵⁷ In this policy, individual Japanese insurance buyers will receive payouts on coverage between 30 and 100 million dollars

⁵⁵ See *Insuring Nature*, *supra* note 3; see also *About Us*, SWISS RE, (2018) http://www.swissre.com/about_us/ (stating that Swiss Re is a reinsurance provider that deals directly with insurance companies, larger corporations, and public sector clients).

⁵⁶ Simon Konsta, *Parametric Insurance has an Important Role in Building Resilience Against Natural Disasters*, CLYDE & CO (Feb. 28, 2018), <https://www.clydeco.com/insight/article/parametric-insurance-has-an-important-role-in-building-resilience-against-n>.

⁵⁷ *Swiss Re Launches Parametric Tsunami Derivative for Japanese Businesses*, ARTEMIS (Aug. 2, 2018), <http://www.artemis.bm/blog/2018/08/02/swiss-re-launches-parametric-tsunami-derivative-for-japanese-businesses/> (explaining that the wave height trigger was established using data validated by the Japan Meteorological Agency).

within 40 days of the tsunami striking the coastline.⁵⁸ The policy was derived after the 2011 Tohoku earthquake precipitated a tsunami that was more than 40 meters high and reached 10 kilometers inland, causing damage around \$210 billion.⁵⁹

Another example is Meteo Protect, which offers a parametric insurance policy to French wine makers using the trigger of cold temperature during the growing period.⁶⁰ The policy was adopted after France saw a severe temperature drop during the critical growing season of 2017 that affected nearly every one of its vineyards.⁶¹ The “prime wine growing region” saw a drop of 40 percent of their output and the country itself saw a drop in 17 percent of its national output.⁶² Meteo Protect incorporates parametric triggers that “account for the financial consequences of frost severely damaging or killing grape buds, and for the decrease in productivity which results from cold temperatures interrupting the vines’ growing cycle.”⁶³ Currently, 15 percent of the vineyards in France are insured; only 10 percent of wine production, however, is threatened and lost to natural circumstances annually.⁶⁴

Yet another example is Beazley’s Weather Guard product, which uses Weather Decision Technologies⁶⁵ that “send[] . . .

⁵⁸ *See id.* (stating that payouts are made once Swiss Re received documentation from the Japan Meteorological Agency that the tsunami height rose above the pre-determined level).

⁵⁹ *See id.*

⁶⁰ *Meteo Protect Signs Up More French Wine Makers to Parametric Insurance*, ARTEMIS (June 11, 2018), <http://www.artemis.bm/blog/2018/06/11/meteo-protect-signs-up-more-french-wine-makers-to-parametric-insurance/>.

⁶¹ *See id.*

⁶² *See id.*

⁶³ Matt Sheehan, *Spring Frost Drives Insurance Demand Among French Winemakers: Meteo Protect*, REINSURANCE NEWS (June 14, 2018), <https://www.reinsurancene.ws/spring-frost-drives-insurance-demand-among-french-winemakers-meteo-protect/>.

⁶⁴ *See id.*

⁶⁵ Weather Decision Technologies is a company that provides extensive weather data to other organizations by offering “specific expertise with big data as it applies to hazardous weather detection and prediction, forecast modeling, decision analytics, GIS, mobile apps and interactive mapping.” *About WDT*, WEATHER OPS, <https://www.weatherops.com/about-us> (last visited Nov. 13, 2018).

weather data to the client and Beazley . . . and if the weather parameters recorded reach or exceed the trigger levels specified in the policy, Beazley will settle the claim automatically.”⁶⁶ This type of weather coverage is beneficial for event organizers and retailers who lose substantial amounts of money in the event of rain or other weather mishaps.⁶⁷ The agency is considering moving to real time weather data to speed up the parametric process, but for now, the process operates as efficiently as it can.⁶⁸

The most prominent example of parametric catastrophe insurance is the Caribbean Catastrophe Risk Insurance Facility (“CCRIF”), which is one of the longest-standing parametric programs.⁶⁹ CCRIF is the first multi-country risk pool that provides parametric catastrophe insurance to government agencies across the countries involved.⁷⁰ The insurance policy is taken out by local governments, not individuals, with the purpose of closing the liquidity gap that is seen when less economically profitable countries are unable to respond to the natural catastrophe.⁷¹ Although, for the most part, CCRIF has been turned to as a model for catastrophe insurance, its ultimate deficiencies are rooted in its established parameters and the inequality between payouts and actual harm experienced.⁷² Understanding the flaws in CCRIF’s parametric nature provides insight into how parametric programs need to develop in the future to be successful.

⁶⁶ A reinsurance agency headquartered in London. *Beazley Speeds Up & Simplifies Parametric Weather Insurance Policies*, ARTEMIS (Apr. 30, 2018), <http://www.artemis.bm/blog/2018/04/30/beazley-speeds-up-simplifies-parametric-weather-insurance-policies/>.

⁶⁷ *See id.*

⁶⁸ *See id.* (stating that “[p]arametric triggers can be sped up even more if real-time data on weather conditions can be used, enabling payouts to be almost instantaneous, once the weather data is delivered to an app or other technology platform,” but acknowledging that this efficiency would require widely accessible technology and “real-time data inputs” that are being developed currently).

⁶⁹ *See* Lauren Brooks, *The Caribbean Catastrophe Risk Insurance Facility: Parametric Insurance Payouts Without Proper Parameters*, 2 ARIZ. J. ENVTL. L. & POL’Y 135, 149 (2011).

⁷⁰ *See id.* at 139.

⁷¹ *See id.*

⁷² *Id.* at 149.

CCRIF's models and parameters in the agreements were based largely on assumptions because "Caribbean exposure data did not exist at the time the parametric equations were developed . . ."⁷³ The parameters were not based on tangible data, so the ability to generate a fair payout was inhibited.⁷⁴ When payouts do not align with the actual harm, two inequalities emerge: first, if the model releases an overpayment for a loss that didn't occur, the other countries in the risk pool suffer; and second, if the model releases a payment below the actual loss, the liquidity gap is not actually reduced and the individual local government whose country is affected must find another way to account for the harm.⁷⁵

The latter concern was seen in 2007, when no payment was issued after Hurricane Dean hit the Lesser Antilles islands and Jamaica, causing hundreds of millions of dollars in damage to agriculture and infrastructure.⁷⁶ Hurricane Dean "failed to surpass wind speeds and other thresholds to prompt payments from the disaster pool[.]" and the affected countries had to bear the burden of recovery without assistance from the insurance policy.⁷⁷ This

⁷³ *Id.* This is markedly different from the newer parametric insurance programs for the Mesoamerican reef, French wine makers, and Japanese businesses where extensive data about the risks and environmental catastrophes has been collected and implemented into the policies. See *Insuring Nature*, *supra* note 3; see also *Meteo Protect Signs Up more French Wine Makers to Parametric Insurance*, *supra* note 60; *Swiss Re Launches Parametric Tsunami Derivative for Japanese Businesses*, *supra* note 57. Further, it is extensively different from the predictions from Beazley that real time weather data could be used for a parametric plan. See *Beazley Speeds Up & Simplifies Parametric Weather Insurance Policies*, *supra* note 66.

⁷⁴ See Brooks, *supra* note 69, at 149–52.

⁷⁵ *Id.*

⁷⁶ *Hurricane Dean: \$3bn In Caribbean Damage and No Money from Its Insurance Policy*, BVIHURRICANE.COM (Aug. 24, 2007), <http://bvihurricane.com/hurricane-dean-3bn-in-caribbean-damage-and-no-money-from-the-world-bank/> ("The banana crop was wiped out on St. Lucia, Martinique, and Dominica, and was 80% destroyed on Guadeloupe. The hardest hit island, Martinique, is estimating storm costs of \$270 million. St. Lucia is reporting \$18 million in total damage, and Dominica is reporting \$98 million in damage to infrastructure (agricultural damage may be another \$100 million).").

⁷⁷ *Id.* (quoting a fund supervisor from CCRIF's Washington office who stated "[h]ad the storm been 30 miles to the north that would have triggered immediate payment in Jamaica").

parameter issue exists because CCRIF requires an objective external party to make the data calculations in pursuit of the fair treatment of all governments in the pool, but the external party did not have the appropriate data that specific individual countries had.⁷⁸ Relying on data aggregated from the individual countries would have proven more effective, which appears to be a concept across many parametric insurance programs.⁷⁹

B. *Addressing Concerns Regarding Current Parametric Programs with Technological Advances and More Data Gathering*

Proposed solutions to assigning the proper parameters include: (1) collecting more data,⁸⁰ (2) encouraging local governments to be in charge of defining the parameters for their individual locations,⁸¹ and (3) developing better parametric models through shared data.⁸² However, these solutions are hard to achieve because little to no regulation of this new sub-sector of insurance exists thus far.

A few agencies and private businesses have begun to address these proposed solutions. The World Bank created the Pacific Catastrophe Risk Assessment and Financing Initiative (“PCRAFI”), which collects data models on a variety of environmental threats in order to provide risk assessment modeling to Pacific Island

⁷⁸ THE CARIBBEAN CATASTROPHE RISK INS. FACILITY, UNDERSTANDING CCRIF: A COLLECTION OF QUESTIONS AND ANSWERS 22 (2015), https://www.ccrif.org/sites/default/files/publications/Understanding_CCRIF_March_2015.pdf.

⁷⁹ *See id.*

⁸⁰ Brooks, *supra* note 69, at 151.

⁸¹ *Id.*

⁸² Nigel Brook, *Parametrics - Building a Better Trigger*, CLYDE & CO (Oct. 26, 2017), <https://www.clydeco.com/blog/insurance-hub/article/building-a-better-trigger> (illustrating the idea of shared data amongst insurance programs with the example that the Global Flood Monitoring System provides satellite data and hydrological runoff as an online resource to use to map actual risk and stating “[t]he more accurate modelling for parametric triggers can become, the lower the basis risk and the more attractive parametric insurance products will be in the long term”).

Countries.⁸³ This data provides more parameter points, including data modeling through satellite imagery, topographic maps, land surveying and fault data, and historical catalogs of tropical cyclones and earthquakes to be used so that payouts more accurately fit the actual harm.⁸⁴ Another party addressing this concern is GEM Foundation,⁸⁵ a public-private partnership that created the OpenQuake Platform, which is “an interactive environment in which users can access, manipulate, share and add data, and explore models and tools for integrated assessment of earthquake risk.”⁸⁶ This collaboration of local and national data facilitates “innovative solutions to inform risk reduction policies” by providing trusted and extensive risk evaluations.⁸⁷

Ultimately, the most technologically robust approach to solving the parametric data issue is predicted to be blockchain technology.⁸⁸ Tech industry leaders have predicted that blockchain technology will eventually be able to increase the efficiency, accuracy, and fairness of parametric insurance.⁸⁹ Blockchain is the platform that fostered the creation of the intangible currency, Bitcoin, and it now functions as a “ledger that registers transactions and the provenance of physical assets, as opposed to assets like cryptocurrencies that are born and transacted only online . . .”⁹⁰ The technology has been described as “a progressively increasing list of records or ‘blocks,’ which are each, in turn, linked to the previous block and secured

⁸³ *Pacific Catastrophe Risk Assessment and Financing Initiative: Better Information for Smarter Investments*, PCRAFI, <http://pcrafi.spc.int/about/> (last visited Sept. 23, 2018).

⁸⁴ *Id.*

⁸⁵ *About GEM: In Brief*, GEM FOUND., <https://storage.globalquakemodel.org/gem/> (last visited Oct. 13, 2018).

⁸⁶ *The OpenQuake Platform*, GEM FOUND., <https://platform.openquake.org/> (last visited Oct. 13, 2018).

⁸⁷ *What We Do*, GEM FOUND., <https://storage.globalquakemodel.org/what/> (last visited Oct. 13, 2018).

⁸⁸ Carter, *supra* note 25.

⁸⁹ *See id.*

⁹⁰ Magda Ramada Sarasola, *So Maybe You Figured Out What Blockchain Is – But What Can You Do With It?*, WILLIS TOWERS WATSON (June 29, 2018), <https://www.willistowerswatson.com/en/insights/2018/06/emphasis-blockchain-use-in-insurance-from-theory-to-reality>.

using cryptography.”⁹¹ Blockchain creates a platform for efficient data sharing through a “distributed ledger.”⁹² Notably, blockchain technology has allowed for the continued development of smart contracts, which evolve with each transaction subject to the code and parameters established at its creation.⁹³ This growth and never-ending capacity will eventually allow blockchain to develop smart contracts for a wide range of industries.⁹⁴ The benefits extend beyond increased capacity to include an increase in trust among business partners and a lowered business transactional cost.⁹⁵ This is due to the “shared version of the truth” that is visible to everyone through the ledger.⁹⁶

“Parametric insurance coverage is typically used for difficult-to-insure risks,”⁹⁷ and the adoption of blockchain would allow all claims, insurer payouts, adjustments, and trigger data to be collected in one place and automatically performed.⁹⁸ Weather data could be collected consistently and automatically stored in blockchain, which would utilize the smart contracts’ function to adjust rates and risks based on the influx of new data points.⁹⁹ If parametric contracts began to work with blockchain, they would become “immutable, self-executing pieces of code sitting on a transparent and auditable shared ledger.”¹⁰⁰ Not only would this allow for a more accurate policy, but it would make the whole industry more transparent and more responsive to market and environmental pressures.¹⁰¹

⁹¹ Scott A. McKinney, Rachel Landy & Rachel Wilka, *Smart Contracts, Blockchain, and the Next Frontier of Transactional Law*, 13 WASH. J.L. TECH. & ARTS 313, 318 (2018).

⁹² *About Us: What Does Blockchain Do For Us?*, B3I, <https://b3i.tech/about-us.html> (last visited Oct. 13, 2018) [hereinafter *What Does Blockchain Do For Us?*].

⁹³ *Id.*

⁹⁴ *Id.*

⁹⁵ *See id.*

⁹⁶ *See id.*

⁹⁷ Carter, *supra* note 25.

⁹⁸ *Id.*

⁹⁹ *See About Us: What Does Blockchain Do For Us?*, *supra* note 92.

¹⁰⁰ Sarasola, *supra* note 90.

¹⁰¹ *Id.*

C. *Implementation of Blockchain Technology in Insurance Programs as a Way to Increase Efficiency and Transparency*

Already, insurers have begun implementing blockchain technology into the insurance industry.¹⁰² Insurwave was created by blockchain developer Guardtime and uses Microsoft Azure technology and ACORD data standards.¹⁰³ The policy provides \$30 billion-worth of marine insurance¹⁰⁴ to abate the risks of more than 1,000 commercial vessels.¹⁰⁵ The blockchain technology was adopted for this insurance program because it will “support more than half a million automated ledger transactions” and will share data in real time in order to settle transactions “using computer algorithms, with no need for third-party verification.”¹⁰⁶

There is a notable difference between traditional marine insurance and parametric insurance as marine insurance is grounded in the actual losses accrued rather than the conditions requisite of such loss happening.¹⁰⁷ However, the creation of Insurwave shows the industry trend towards adopting new technology as a way to increase efficiency and transparency among parties. This illustrates new benefits for the industry and consumers, but also creates legal challenges that suggest a need to solidify regulation before the industry becomes unmanageable.

¹⁰² Andrew G. Simpson, *First Blockchain for Marine Insurance Now Running*, INS. J. (May 25, 2018), <https://www.insurancejournal.com/news/national/2018/05/25/490345.htm>.

¹⁰³ *See id.* Microsoft Azure is a “set of cloud services” that allows access to a global network of business models, applications, and services. *What is Azure?*, MICROSOFT AZURE, <https://azure.microsoft.com/en-us/overview/what-is-azure/> (last visited Oct. 29, 2018). ACORD carries the objective of enabling “efficient and effective flow of data among all stakeholders across the insurance value chain” and has set standards that “allow industry stakeholders to exchange and use data for their own needs regardless of how it was created or collected.” *Why Standards?*, ACORD, <https://www.acord.org/standards-architecture/why-standards/> (last visited Oct. 29, 2018).

¹⁰⁴ *Marine Insurance*, INT’L RISK MGMT. INST., INC., <https://www.irmi.com/term/insurance-definitions/marine-insurance> (last visited Oct. 13, 2018).

¹⁰⁵ *See Simpson, supra* note 102.

¹⁰⁶ *See id.*

¹⁰⁷ *See generally* ROBERT H. JERRY & DOUGLAS R. RICHMOND, UNDERSTANDING INSURANCE LAW 615–19 (LexisNexis 5th ed. 2012).

One such potential benefit is the simplification of increased data sharing that companies and agencies have already begun to adopt.¹⁰⁸ Concerns that the parametric programs, such as CCRIF, have faced due to lack of information would no longer be an issue because any approved local entity could collect data to be aggregated on blockchain technology. Then parametric insurance contracts would become more effective and more responsive to the actual risks facing the insured entity. For instance, as climate change continues to occur, the likelihood of storm surges or temperature changes is likely to fluctuate inconsistently, especially when compared to historical data.¹⁰⁹ While “traditional” parametric insurance would rely on the historical data to estimate predictions and set parameters, parametric insurance utilizing blockchain would be able to adjust those parameters in real time to account for climate change and to create payouts that are more accurate and consistent with the actual damage.¹¹⁰

Although blockchain technology has the potential to solve problems posed by current parametric regimes, it has inspired discussion among legal scholars because of its rapid growth and lack of regulation.¹¹¹ Strongly debated issues include: liability when blockchain goes wrong; bankruptcy or other insolvency concerns; anonymity and privacy threats; and whether smart contracts are even legally enforceable contracts.¹¹² Further issues involve the actual information that is being used, and the bias that a developer may

¹⁰⁸ See *About Us: What Does Blockchain Do For Us?*, *supra* note 92.

¹⁰⁹ See *Global Warming and Hurricanes: An Overview of Current Research Results*, GEOPHYSICAL FLUID DYNAMICS LAB., <https://www.gfdl.noaa.gov/global-warming-and-hurricanes/> (last visited Oct. 14, 2018) (stating that cycling rainfall will increase as well as the intensities of storms and concluding that there will be an increase in “very intense (category 4 and 5) tropical cyclones”).

¹¹⁰ This serves both the insured and the insurer, as it was noted that one limitation on the CCRIF policy was that payouts had at times been more than the damage actually caused. See Brooks, *supra* note 69, at 149.

¹¹¹ Bryce Suzuki, Todd Taylor & Gary Marchant, *Blockchain: How It Will Change Your Legal Practice*, ARIZ. ATT’Y, Feb. 2018, at 18 (“Regulatory issues will be important for blockchain—to provide adequate oversight without stifling or unduly constraining innovative new uses of the technology. Premature or unduly rigid regulation could hamper the development of blockchain.”).

¹¹² See *id.*

bring to the program.¹¹³ Technology such as blockchain and programs such as PCRAFI and OpenQuake solve the lack of data issue, which fosters a space for accurate parametric insurance to thrive.¹¹⁴ However, because of the lack of clear legal standards, government regulatory oversight beyond what is already at play in the traditional insurance regime will be needed to ensure that all parties are protected and to detail who will be liable when something eventually goes wrong.

IV. HOW THE TRADITIONAL INSURANCE REGIME PRESENTS CHALLENGES FOR PARAMETRIC INSURANCE: SIGNALING THAT A PRIVATE AND PUBLIC REGULATORY STANDARD MIGHT SERVE BEST

Because parametric insurance is a sub-sector of the insurance field, only private activities have guided its development.¹¹⁵ Further, as stated earlier, no cases have been litigated involving parametric insurance, especially in relation to insuring natural assets.¹¹⁶ The insurance industry faces its own regulations, but those regulations operate with the assumption that the indemnification process will occur creating significant discord in advancing policies and traditional law.¹¹⁷

The insurance industry is regulated largely by states with limited oversight by the federal government.¹¹⁸ Although the industry originally faced regulation through state corporate charters and accompanying corporate laws, the McCarran-Ferguson Act¹¹⁹ formally established the state-federal relationship saying that “[n]o person shall engage in the business of insurance in a State as principal or agent unless such person is licensed as required by the appropriate insurance regulator of such State in accordance with the

¹¹³ See Carla L. Reyes, *Conceptualizing Cryptolaw*, 96 NEB. L. REV. 384, 387 (2017).

¹¹⁴ See *supra* notes 83–87 and accompanying text.

¹¹⁵ See Konsta, *supra* note 56.

¹¹⁶ See *id.*

¹¹⁷ See JERRY & RICHMOND, *supra* note 107, at 60–65.

¹¹⁸ See *id.* at 61.

¹¹⁹ 15 U.S.C. § 6701 (2017).

relevant State insurance law”¹²⁰ Further, the Act provided that, subject to a few exceptions, no State shall act to invalidate or impair the business of insurance.¹²¹ Essentially, insurance companies must abide by state law with federal oversight unless insurers are not within the business of insurance,¹²² in which case those companies would have federal oversight due to the commerce clause.¹²³

In an attempt to serve the public interest, state regulation of the insurance industry covers rate regulation, insurer solvency, unfair practices, and insurer overreaching.¹²⁴ The objectives given to state legislatures are to ensure fair and reasonable prices, to protect the industry from insolvency, and to guarantee public access to coverage.¹²⁵ Although states predominantly govern the regulation of insurance, The National Association of Insurance Commissioners has created model rules and regulations for states to adopt or courts to assess when making decisions.¹²⁶

Most insurance claims are ground in basic contract and tort law where certain doctrines pervade, but these doctrines do not effectively translate to technology-based insurance policies.¹²⁷ The doctrine of reasonable expectations, for example, states that “courts have to determine what the weaker contracting party could legitimately expect by way of services according to the enterpriser’s ‘calling,’ and to what extent the stronger party disappointed reasonable expectations based on the typical life situation.”¹²⁸

¹²⁰ *Id.* § 6701(b).

¹²¹ *Id.* § 6701(d)(1).

¹²² See Richard Cordero, Annotation, *Exemption or Immunity from Federal Antitrust Liability Under McCarran-Ferguson Act (15 U.S.C.A. §§ 1011-1013) and State Action and Noerr-Pennington Doctrines For Business of Insurance and Persons Engaged in It*, 116 A.L.R. Fed. 163, § 3 (1993) (“[T]hat term is most naturally read to refer to mercantile transactions, buying and selling, and traffic, so that it does not mean a commercial or industrial establishment, enterprise, or single entity . . . the core of ‘the business of insurance’ [is] the relationship between an insurer and its insured, the type of policy that can be issued and the liability under it, as well as the policy’s interpretation and enforcement.”).

¹²³ See JERRY & RICHMOND, *supra* note 107, at 68.

¹²⁴ See *id.* at 90–94.

¹²⁵ See *id.* at 89.

¹²⁶ See *id.* at 101.

¹²⁷ See *id.* at 143.

¹²⁸ *Id.* (emphasis omitted) (citation omitted).

Traditionally, this doctrine would analyze the power balance of the two contracting parties and the document agreed upon, which would completely describe the indemnification process and the outcome would be concrete enough to put in words. In parametric insurance plans, however, the outcome is much less concrete and determinate upon weather patterns. This can affect what reasonable parties assume the outcome to be and might frustrate the common law application of that doctrine. Further, many more parties are indirectly involved in carrying out the parametric insurance that could substantially affect the power balance and reasonable expectations.

The way that smart technology, like that used in parametric insurance, is programmed can have an extensive influence on the result because all programs inherently contain the bias of those who developed it.¹²⁹ This concept alone throws a wrench in the way that traditional insurance doctrines apply to parametric insurance. For example, if technology used to measure aggregated wind speed and future weather predictions contains the bias of the developer, an insured might or might not still have a reasonable expectation of services that could shape a claim against the insurer who hired the developer or even the developer itself. As technology becomes more present and the understanding behind data creation becomes more well known, it might or might not be reasonable to assume that the technology will provide a near accurate read out of the actual conditions present. There might not be a regulatory answer to the situations posed, but more direct and specific principles and enforceable regulation will allow for disputes like this to be taken into contracting decisions.¹³⁰

¹²⁹ See Reyes, *supra* note 113, at 387 (stating “scholars voice concern over the potential for technology to spread and institutionalize the bias of its developers,” while discussing whether it is possible for lawmaking to increase efficiency and write out systemic bias); see also Danielle Keats Citron & Frank Pasquale, *The Scored Society: Due Process for Automated Predictions*, 89 WASH. L. REV. 1, 4–5 (2014) (explaining that “[b]ecause human beings program predictive algorithms, their biases and values are embedded into the software’s instructions, known as the source code and predictive algorithms” and for this reason, no programming can truly be unbiased).

¹³⁰ See Reyes, *supra* note 113, at 426 (“As cryptolaw begins to take shape, processes for rooting out such bias and increasing protections for individual rights

The doctrine of liability for bad faith is also relevant to traditional insurance law because “insurers can be held liable in tort for bad faith performance of their duties to insureds.”¹³¹ Insurance law adopted doctrines from torts because contract law doesn’t allow compensation for anything outside the four corners of the contract, including emotional distress that could arise from the emotional and personal nature of insurance.¹³² Although the doctrine of bad faith provides a way for the court to regulate the insurer’s performance on the contract, it doesn’t provide assurance before a bad act or catastrophe occurs, and it’s often left up to a court’s discretion rather than the plain text enforcement of a regulation.¹³³ The concept of bad faith is complex in traditional application, and it only becomes more complicated when multiple parties, technology, and weather data are involved.

This is not to say that traditional insurance regimes could not be applied to parametric insurance; in fact, they likely will be because the concepts of fraud, mistake, and contractual penalties will pervade.¹³⁴ Rather, this is to say that challenges posed by the parametric insurance field will require the development of more specific regulation because of complexities such as technology, power hierarchies between the massive insurance or reinsurance agencies and the localized insureds, and uncertainty regarding disproportionate pay-out related disputes.¹³⁵

could be developed to prevent similar outcomes from infecting crypto-legal structures by choosing the mix of DLT services best suited for that purpose.”).

¹³¹ See JERRY & RICHMOND, *supra* note 107, at 156.

¹³² See *id.* at 161.

¹³³ See *id.* at 156.

¹³⁴ See *id.* at 172.

¹³⁵ See Reyes, *supra* note 113, at 427 (“Over time,[] an aggregation of interacting crypto-legal structures with varying levels of autonomy will result in the simplification and reconfiguration of substantive law and reconstitute the makeup of legal actors in the administrative process.”).

V. THE GREEN BOND REGULATORY SCHEME: A PRIVATE AND PUBLIC REGULATORY STRUCTURE FOR ENVIRONMENTAL ECONOMICS COULD BE THE PROPER MODEL FOR PARAMETRIC INSURANCE REGULATION

A lack of certainty about how parametric insurance plans will play out in the long term has caused concern within the industry as well as within the legal field.¹³⁶ Although parametric triggers have been used for more than 20 years, “legal and regulatory considerations have slowed their adoption by the insurance sector.”¹³⁷ The hesitation in the industry revolves around the basis of risk, what the insurable interest actually is, and how parametric contracts work with the traditional indemnity principle.¹³⁸ The first two concerns are likely to be resolved through case law and extensive data collection, because the way courts and regulators interpret these seemingly broad topics will be solidified to a recognizable pattern.¹³⁹ The third concern provides an important regulatory issue that will need to be addressed for parametric insurance to be adequately implemented. Currently, most governments require proof of loss and an insurable interest in the loss in order to receive a payout.¹⁴⁰ This is the indemnity principle.

¹³⁶ See *Parametrics to Grow in 2018 as Re/Insurers Look to Resilience: Clyde & Co.*, ARTEMIS (Jan. 11, 2018), <http://www.artemis.bm/blog/2018/01/11/parametrics-to-grow-in-2018-as-reinsurers-look-to-resilience-clyde-co/> (stating that there are “hurdles that the industry must overcome” because the industry could be the critical solution to support the “desire and belief amongst the risk transfer industry, and global development and resilience organisations [sic], to provide those in need with protection against the world’s perils, many of which are believed to be increasing in both severity and frequency as a result of climate change.”).

¹³⁷ Konsta, *supra* note 56.

¹³⁸ See *id.*

¹³⁹ See *id.* (“Although the way parametric products are treated in the law and by regulators will evolve and become clearer as case law and precedent develops, the level of support being given by governments around the world at present, together with demand from buyers and the proven success of parametric products to date, suggests regulators and law-makers will support and encourage the responsible roll-out of parametric insurance in 2018 rather than attempting to hold it back.”).

¹⁴⁰ Simon Konsta, *Parametric Insurance: Closing the Protection Gap – Legal Considerations*, CLYDE & CO (Apr. 20, 2018), <https://resilience.clydeco.com/articles/closing-protection-gap>.

However, application of this principle inhibits the efficiency of parametric insurance, and when the new technology-based insurance is required to fit the common law rule of insurance, all benefits of the program are overturned.¹⁴¹ Although some governments, like South Africa, have adapted and allowed insureds to “merely [] prove that some loss has been suffered,” rather than prove the extent of loss necessary for the traditional indemnification process, the full benefit of parametric insurance—immediacy—cannot not be actualized.¹⁴² Progressive regulatory standards would allow this type of industry to grow into an innovative solution rather than struggle to conform into an older industry’s way of working.

The paramount issue at hand is that parametric insurance uses technology designed and programed by outside parties and often aggregates extensive amounts of data in an attempt to make the payout as tailored and fair as possible. This lends well to a deregulated market. When advanced ledgers like blockchain enter the playing field, this is even more relevant.¹⁴³ However, the seriousness of insurance, especially when the insurable asset is contributing to multi-billion-dollar industries, requires that certain parameters and guidelines must be developed in order to ensure adequate application. If parametric insurance were to be considered in the realm of green bonds and were to be regulated in a similar fashion, the industry would be able to flourish at its outset while companies and individuals would be held accountable.

¹⁴¹ See *id.* (“[T]he indemnity principle can potentially create regulatory and legal challenges in jurisdictions where codified insurance law does not traditionally permit ‘contingent contracts’, requiring instead that any losses are subject to valuation.”)

¹⁴² See *id.* (explaining that while there is significant tension between indemnification contracts that pervade across the insurance industry and typically require proof as to the extent of the loss, countries that are attempting to promote parametric insurance programs have begun to lessen their traditional insurance law requirements to allow for the parametric structure to exist).

¹⁴³ See Suzuki, Taylor & Merchant, *supra* note 111, at 18 (stating “[p]remature or unduly rigid regulation could hamper the development,” but “[b]lockchain . . . will continue to evolve at a feverish pace, with much of the work being behind-the-scenes investment by large corporations”).

A. *How Green Bonds Are Currently Regulated Through Private and Public Regulatory Structures*

A green bond is widely defined as “a debt instrument for which the proceeds are used to finance environmentally-friendly projects.”¹⁴⁴ Like parametric insurance policies, green bonds have the potential to make environmental conservation economically feasible, but rather than being led by environmental enthusiasts, they have been promulgated by mutual funds and insurers.¹⁴⁵ Fixed income investors support these funds, which can go towards the mitigation of climate change¹⁴⁶ or the creation of renewable energy facilities.¹⁴⁷

Similar to parametric insurance, green bonds began as a market function without any regulation.¹⁴⁸ However, since they first made their entry into the market, industry has attempted to control their impact in order to ensure effectiveness.¹⁴⁹ Today, green bonds are “predominantly regulated through private mandates”¹⁵⁰ that were created through private business frameworks and function in correlation to government regulation.¹⁵¹ Private industry has set the standards originally, but as green bonds develop into a more recognized regime, some governments have begun to adopt and

¹⁴⁴ Kevin M. Talbot, Comment, *What Does “Green” Really Mean?: How Increased Transparency and Standardization Can Grow the Green Bond Market*, 28 VILL. ENVTL. L.J. 127, 128 (2017).

¹⁴⁵ See Stephen Kim Park, *Investors as Regulators: Green Bonds and the Governance Challenges of the Sustainable Finance Revolution*, 54 STAN. J. INT’L L. 1, 4–5 (2018).

¹⁴⁶ See *Green Bonds*, IBRD FUNDING PROGRAM: THE WORLD BANK, <http://treasury.worldbank.org/en/about/unit/treasury/ibrd/ibrd-green-bonds> (last visited Sept. 23, 2018).

¹⁴⁷ See Kerry Hannon, *Should You Invest In ‘Green Bonds?’*, FORBES (June 29, 2017), <https://www.forbes.com/sites/nextavenue/2017/06/29/should-you-invest-in-green-bonds/#5b1034e348a4>.

¹⁴⁸ See Echo Kaixi Wang, *Financing Green: Reforming Green Bond Regulation in the United States*, 12 BROOK. J. CORP., FIN., & COM. L. 467, 486 (2018).

¹⁴⁹ See *id.*

¹⁵⁰ Park, *supra* note 145, at 6.

¹⁵¹ See *id.* at 18.

enforce the privately created standards.¹⁵² The structure of green bond regulation has been described as:

[P]rivate governance regimes whose members are exclusively drawn from the investors, issuers, ratings agencies, assurance providers, and other participants and financial intermediaries in the green bond market. These purely private regimes tend to reflect the interests of the entities that control them. At the other end are private governance regimes that take into account the interests of stakeholders such as government agencies, social and environmental advocacy groups, local community organizations, and other members of civil society.¹⁵³

These industry standards are not considered black letter law, but they have authority among consumers and private entities, and most green bond issuers abide by the standards created.¹⁵⁴ This type of flexible authority, known as the private governance regime, is driven by investor choices and competition for perceived credibility in the market.¹⁵⁵ Private governance is not all self-regulation, instead, “it consists of an amalgam of private frameworks that operate both independently and sometimes in conjunction with domestic regulation and multilateral initiatives.”¹⁵⁶

According to the UN Development Programme, the International Capital Market Association’s Green Bond Principles (“GBP”) and the Climate Bond’s Initiatives (“CBI”) Climate Bond Standards are the predominant regulatory standards enforced upon green bonds.¹⁵⁷ The GBP are voluntary guidelines that increase transparency in the green bond issuance process and they include the four elements: (1) use of proceeds, (2) process for project evaluation and selection, (3) management of proceeds, and (4) reporting.¹⁵⁸ CBI has similar elements, but their regulatory approval

¹⁵² *See id.* at 16–18.

¹⁵³ *Id.* at 19.

¹⁵⁴ *See id.* at 20.

¹⁵⁵ *See id.* at 19.

¹⁵⁶ *Id.* at 18.

¹⁵⁷ *Green Bonds*, U.N. DEV. PROGRAMME <http://www.undp.org/content/sdfinance/en/home/solutions/green-bonds.html> (last visited Sept. 23, 2018).

¹⁵⁸ INT’L CAPITAL MKT. ASS’N, GREEN BOND PRINCIPLES: VOLUNTARY PROCESS GUIDELINES FOR ISSUING GREEN BONDS 3 (2018), <https://www.icmagroup.org/green-social-and-sustainability-bonds/green-bond-principles-gbp/>.

requires independent review of the qualifying project and implications before the board will endorse the green bond.¹⁵⁹

The standards are facially voluntary; however, industry pressure as well as increased awareness of the product have demanded their self-enforcement.¹⁶⁰ These standards allow for green bond issuers to ensure credibility to their investors, but there is no legal enforcer of the guidelines.¹⁶¹ Rather, the industry formed the standards because they saw a possibility of exploitation and recognized that a single fraudulent issuer could ruin the credibility of the whole industry.¹⁶²

Although private governance regimes are the most common form of green bond regulation, the private standards have begun to merge with public regulation to create a more forceful governance structure.¹⁶³ Public regulation is administered by a governmental body, but is less strict than typical command-and-control statutes and regulations.¹⁶⁴ Public regulation is typically still “[d]ecentralized, flexible, and collaborative,”¹⁶⁵ but it often provides a coercive pressure on the private standards through agency enforcement of quasi-regulatory activities, incentivizing compliance, and threatening “that the government agency will enforce private standards”¹⁶⁶

One such example of public regulation is China’s green bond market where the People’s Bank of China regulates green bond

¹⁵⁹ *Overview: Climate Bonds Standard*, CLIMATE BONDS INITIATIVE, <https://www.climatebonds.net/standard/about> (last visited Sept. 23, 2018).

¹⁶⁰ *See* Talbot, *supra* note 144, at 143–44.

¹⁶¹ *See id.* at 144.

¹⁶² *See id.*; *see also* Mariana Santibanez, Abhinav Ramnarayan & Daniel Stanton, *Transparency the Key for Burgeoning Green Bond Market*, REUTERS (Mar. 30, 2015), <https://www.reuters.com/article/green-bonds-idUSL6N0WW16120150330> (stating “the [green bond] market would lose its credibility if there were to be one incident where a corporate was deliberately misleading investors with a bond that was not green” as a justification for universally adopted industry standards).

¹⁶³ Park, *supra* note 145, at 16, 18–19.

¹⁶⁴ *See id.* at 21 (“In many instances, soft law norms of business conduct become interwoven with traditional hard law-based government regulatory schemes over time.”).

¹⁶⁵ *Id.* at 40.

¹⁶⁶ *Id.* at 41.

issuance, listing, and other criteria.¹⁶⁷ The transition to public regulation was established to allow international practice of private principles.¹⁶⁸ The public regulation details a working definition of green bond as well as selected green projects and categories that qualify as green assets.¹⁶⁹

As China adopts public regulation, recent studies have suggested that the United States should issue command-and-control regulation through the Securities and Exchange Commission (“SEC”) because guidelines made “by a federal regulator will be difficult to ignore” and would be able to force companies to comply with third party verification steps and the other guidelines.¹⁷⁰ China has adopted formal regulation accompanying public regulation through their version of the SEC, the China Securities Regulatory Commission (“CSRC”).¹⁷¹ China, the first government to develop these regulatory standards, now imposes penalties upon green bonds verifiers who do not comply with the proposed standards.¹⁷² The guidelines require a third-party verifier to have “professional expertise in assurance, accounting and auditing[;]” liability insurance; established procedures for quality control; and a standardized verification report.¹⁷³ The final requirement, the verification report, must be made public to investors.¹⁷⁴ If an issuer fails to meet these standards, it will be forced to take corrective

¹⁶⁷ *See id.* at 35.

¹⁶⁸ WEIHUI DAI, SEAN KIDNEY & BEATE SONERUD, CLIMATE BONDS INITIATIVE & INT’L INST. FOR SUSTAINABLE DEV., ROADMAP FOR CHINA: GREEN BOND GUIDELINES FOR THE NEXT STAGE OF MARKET GROWTH 3 (2016), https://www.climatebonds.net/files/files/CBI-IISD-Paper1-Final-01C_A4.pdf.

¹⁶⁹ *See id.* at 8–9.

¹⁷⁰ Wang, *supra* note 148, at 486.

¹⁷¹ Andrew Whiley, *Chinese Regulators Introduce Supervisory Scheme for Green Bond Verifiers – Further Step in Building Market Frameworks*, CLIMATE BONDS INITIATIVE (Jan. 15, 2018), <https://www.climatebonds.net/2018/01/chinese-regulators-introduce-supervisory-scheme-green-bond-verifiers-further-step-building>.

¹⁷² *See id.*

¹⁷³ *Id.*

¹⁷⁴ *See id.*

action, and if the failure continues, it will lose the green label for the remaining time to maturity.¹⁷⁵

The United States has not adopted green bond regulation like China.¹⁷⁶ As the green bond industry continues to grow, however, it is likely that the SEC will have to take part in regulation or else threats to the credibility of projects and verifiers could inhibit market development.¹⁷⁷ Without fixed regulation, legal issues may arise that could be avoided through the enforcement of the private guidelines already in existence. One such issue is that issuers are not required to disclose whether their green bond actually fits the standards or not.¹⁷⁸ Another is that enforcement of green bond standards are not something that is easily litigated because it would be difficult for a party to establish actual damages if the bond turned out to not be sufficiently “green.”¹⁷⁹ No action has been filed over green bond outcomes because of the standing issue¹⁸⁰ associated

¹⁷⁵ *See id.*

¹⁷⁶ *See id.* (“This is the first time a government has developed regulatory supervision.”)

¹⁷⁷ Wang, *supra* note 148, at 486 (“Without clarification, problems can ensue whereby issuers may obtain second-party opinions from a consultant that belongs to the same company or organization that is issuing the bond, and subsequently claim that the opinion is independent and professional.”).

¹⁷⁸ Scott Breen & Catherine Campbell, *Legal Considerations for a Skyrocketing Green Bond Market*, NAT. RESOURCES & ENV’T, Winter 2017, at 16, 19.

¹⁷⁹ *See id.* at 20. “Sufficiently green” in this context means that the green bond is actually contributing to the climate or environmental projects that it says that it is. *See id.* at 16.

¹⁸⁰ In order to bring a case in front of a court, parties are constitutionally required to establish “standing,” meaning the party must show they have the constitutional right to bring the claim and are the proper party to do so. *See* Warth v. Seldin, 422 U.S. 490, 498 (1975) (“In essence the question of standing is whether the litigant is entitled to have the court decide the merits of the dispute or of particular issues. This inquiry involves both constitutional limitations on federal-court jurisdiction and prudential limitations on its exercise.”). Courts have repeatedly held that establishing standing requires the satisfaction of three elements: (1) the party suffered an injury “in fact” that was concrete and actual, rather than hypothetical; (2) there was a “causal connection” between the injury and the defendant’s action; and (3) it must be “likely” that the injury will be “redressed by a favorable decision.” *Lujan v. Defs. of Wildlife*, 504 U.S. 555, 560–61 (1992). The standing issue presented by green bonds is that it is difficult to show the first element, actual damages, when the bond purchased was not going

with lack of actual damages. This only increases the need for government oversight because the courts are unable to hear the cases.¹⁸¹ A third issue is that U.S. Securities law grants a private right of action to those who suffer material harm from untrue statements, but if the green bond holder isn't the one designed to experience the effects of the green bond, she would be unable to establish standing.¹⁸² These legal implications are what has led China to adopt a nationally mandated enforcement of the private sector standards and it's likely that the United States will do the same in the near future.¹⁸³

B. *How Parametric Insurance Regulation Could Learn from Green Bonds and Model Itself After the Green Bond Regulatory Scheme*

Although a congressional act delegated to the SEC would ultimately solidify the concerns with private standards across the market-based product,¹⁸⁴ similar to the outset of green bonds, parametric insurance needs time to grow in the open market before pure command-and-control regulation would prove beneficial. Industry leaders are still debating how to best implement parametric insurance programs across the globe,¹⁸⁵ so while the goal ultimately should be a formal regulation structure, private industry standards should be adopted first. This would foster accountable market

to be used to benefit the purchaser, but rather a third party, the climate. *See* Breen & Campbell, *supra* note 178, at 20. Obviously, the climate as an intangible party cannot bring suit, but it is in fact the one experiencing the damage. While it might be possible that those impacted by climate change would be able to establish actual damages, they are not the parties involved in the sale of the green bond and would therefore have an issue establishing the second element of cause. *See id.* This is the standing issue presented by green bonds: without regulation or case law setting precedent, there is no sure way to hold issuers accountable other than market functions. *See id.*

¹⁸¹ *Id.* at 16, 20.

¹⁸² *Id.*

¹⁸³ *See* Wang, *supra* note 148, at 486.

¹⁸⁴ An act similar to that proposed for green bonds could eventually be productive for the industry, but the industry would need to remain deregulated as the industry grows. *See* Breen & Campbell, *supra* note 178, at 20.

¹⁸⁵ *See* Konsta, *supra* note 56.

growth without stifling innovative solutions to the insecurities of the industry.

For example, one element of the voluntary GBPs used in regulating green bonds is the “Process for Project Evaluation and Selection.”¹⁸⁶ The ICMA recommends that within this element, green bond issuers should be encouraged to communicate to investors “the environmental sustainability objectives; the process by which the issuer determines how the projects fit within the eligible Green Projects categories . . . ; [and] the related eligibility criteria, including, if applicable, exclusion criteria or any other process applied to identify and manage potentially material environmental and social risks associated”¹⁸⁷ The purpose of these standards is to increase transparency so that the bond holder understands what they are purchasing and what the effects are.¹⁸⁸

In the realm of parametric insurance, this standard around increased transparency would be vital to ensure that that policy holders understand the details that have gone into building the parameters and how exactly the payment will occur. A lack of transparency could result in abuse of power by the insurance agency in setting parameters that aren’t in accordance with the harm the policy is ensuring against.¹⁸⁹ Information regarding the technology that records the trigger and historical data that has been collected to set fair standards should also be released to the contracting parties for the same reason. Further, if efforts are made to combat the lack of data sharing, either through the allowance of local parties inputting the own data, which was suggested for CCRIF, or through the implementation of blockchain, information will have to be

¹⁸⁶ See INT’L CAPITAL MKT. ASS’N, *supra* note 158, at 4.

¹⁸⁷ *Id.*

¹⁸⁸ See *id.*

¹⁸⁹ See generally Brooks, *supra* note 69 (discussing the full limitations of CCRIF during its offset including that the individual governments that were insured could not provide the information shaping the parameters in the policy, instead relying on an outside third-party to provide such information, and that this led to inadequately informed payouts, making vulnerable populations even more vulnerable).

provided regarding how the data was gathered and recorded to educate and combat inherent bias.¹⁹⁰

While private standards should be adopted by a regulatory body so that individuals are protected, third-party verifiers like those sources aggregating the data for the parametric plan should be approved through an agency like China's CSRC.¹⁹¹ This would ensure that verifiers are held to standards of transparency and honesty, and the insureds have something to challenge if the data is not implemented correctly.¹⁹²

The discussion above is only one example of a standard translated from green bonds that might yield proper benefits; however, because cases involving parametric insurance have not been litigated, there is still a level of uncertainty that these concerns are what regulation should focus on.¹⁹³ Past programs have suggested that these issues should be targeted at the outset of regulation, but emerging technology and the vast amount of parametric programs that have come into existence suggest that industry and larger regulatory bodies need to be flexible in their standards.¹⁹⁴ Ultimately, parametric insurance programs are posed to be more affordable and efficient than traditional insurance and they lend themselves well to covering natural assets that need immediate and constant conservation.¹⁹⁵ If the programs are able to follow standards like that in green bonds, more parametric programs can be established for environmental assets providing incentives for local governments, policy leaders, and advocates to preserve natural resources for the future.

¹⁹⁰ See generally Reyes, *supra* note 113, at 425–27 (explaining that programmers leave their own inherent bias when developing technology software).

¹⁹¹ See generally Whiley, *supra* note 171 (explaining that China now enforces penalties on verifiers that do not comply with the previously voluntary standards).

¹⁹² See *id.*

¹⁹³ See Konsta, *supra* note 56.

¹⁹⁴ See *Pacific Catastrophe Risk Assessment*, *supra* note 83 (discussing information sharing programs that provide adequate measures of risk assessment through shared data). See generally Brooks, *supra* note 69 (discussing the need for data sharing in order for parametric insurance programs to be most efficient).

¹⁹⁵ See *Insuring Nature*, *supra* note 3.

VI. CONCLUSION

Programs like CCRIF and other catastrophe insurance regimes have been evaluated for efficiency, and like the field of green bonds, most of the issues could be solved with a uniform system of standards, adequate data collection, and both private and public enforcement.¹⁹⁶

Private insurance groups have abided by the industry standards that reinsurers have adopted where third parties assess risks and parameters for the insurance policies, but, as seen in the CCRIF, this can lead to a lack of localized data and ineffective payout mechanisms.¹⁹⁷ Instead of having one global verifier like a federal agency such as NOAA, if risk assessors and verifiers had to meet standards similar to that of the CSRC, then localized groups could collect data, assess risk, and report parameters for insurance companies to use. This would alleviate the concern about objectivity because the assessors would be held to the nationally required standards. It would also alleviate the stress of a national agency deciding proper payouts for a small local area for which data might not be readily available.

Today, few jurisdictions have adopted regulation of parametric insurance into their governing structures, and those that have are dealing with the conflict between this new regime and traditional insurance policies.¹⁹⁸ As the world begins to feel the effects of climate change through stronger storms and permanent damage to natural resources, parametric insurance plans on natural assets can incentivize local governments to protect rather than repair the environment. Private industry has the financial resources to make environmental conservation economically feasible, as seen by the introduction of green bonds. However, in order to ensure fair and appropriate use of those resources, regulation should be adopted. This regulation should primarily mirror that of the private standards in green bonds, which are self-enforcing standards of behavior.

¹⁹⁶ See Brooks, *supra* note 69, at 151–52; see also Brook, *supra* note 82.

¹⁹⁷ See Brooks, *supra* note 69, at 151–52.

¹⁹⁸ See *Parametric Disaster Insurance*, NAT'L ASS'N OF INS. COMM'RS (July 25, 2018), https://www.naic.org/cipr_topics/topic_parametric_disaster_insurance.htm.

Eventually, to utilize the full potential of this tech driven industry, regulation through a national standard like the CSRC should be adopted.