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RESILIENCE BONDS: A BUSINESS-MODEL FOR RESILIENT INFRASTRUCTURE

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Before starting re:focus partners, Shalini Vaijhala served as Special Representative in the Office of Administrator Lisa Jackson at the U.S. Environmental Protection Agency. In this position, she led the U.S.-Brazil Joint Initiative on Urban Sustainability (JIUS) announced in March 2011 by presidents Obama and Rousseff. Shalini received her Ph.D. in Engineering and Public Policy and B.Arch in Architecture from Carnegie Mellon University.

James (Jamie) Rhodes joined re:focus partners as a Senior Fellow in 2014 to co-lead the RE.bound Program and develop a new portfolio of insurance-linked finance projects. He is an entrepreneur who holds multiple patents and has founded and built several successful enterprises across diverse industry segments. Jamie earned a Ph.D. in Engineering and Public Policy from Carnegie Mellon University, and worked as a Post-Doctoral Researcher at Scripps Institution of Oceanography and then as a Staff Researcher at U.C. Davis.

KEYWORDS

- RESILIENCE BONDS
- CATASTROPHE BONDS
- BUSINESS MODEL

When natural disasters occur, governments are often considered as “insurers of last resort” and are expected to help with losses not covered by traditional insurance and to coordinate and fund reconstruction efforts.

As the frequency and severity of natural disasters (storms, floods, wildfires) increase, this becomes financially unsustainable for budget-constrained governments. Catastrophe bonds are one mechanism designed to transfer these types of risks to the capital market. They work as an insurance policy in which the holder of the policy receives a pay-out when a disaster reaches a predetermined threshold. re:focus partners came up with the idea of Resilience Bonds to complement catastrophe bonds. Resilience Bonds create incentives for cities to invest in resilience so as to reduce the human and financial cost of catastrophes when they strike. Resilience Bonds are designed to fund risk reduction projects via a resilience rebate that turns avoided losses in to a revenue stream.

INTRODUCTION

As the frequency and intensity of extreme weather events increase due to climate change, local and national governments are increasingly expected to step up to cover the damages and pay for reconstruction. Often considered as “insurers of last resort” public authorities are more and more often being called upon as the first resort, and they need to find sustainable business models to fund resilience. Still, it remains difficult for a public authority to pay for something when the cost is high, the benefits are diffuse, and the probability of extreme losses is low. To find financial resources and transfer the risks of such catastrophic events to financial markets, cities and utilities are investigating new financial and insurance mechanisms such as Catastrophe Bonds and Resilience Bonds.

re:focus developed the mechanism of Resilience Bonds in 2015 with the ambition of building more integrated resilience solutions and innovative public-private partnerships for vulnerable communities. Based on the same financial modeling as Catastrophe Bonds, Resilience Bonds are designed to fund both proactive risk reduction projects and reactive disaster recovery actions.

1. THE MAIN ISSUE UNTIL NOW: FINANCING RESILIENCE IS NEITHER POLITICALLY NOR FINANCIALLY REWARDING

When a disaster strikes, communities generally expect governments to pay for the losses not covered by traditional insurance and to coordinate and fund reconstruction efforts. As the frequency and severity of natural disasters (storms, floods, wildfires) increase this becomes financially unbearable for budget-constrained governments. Even more so as the gap between insured losses and total losses is increasing. Between 2005 and 2015, the United Nations counted 335 climate related disasters every year, twice as many as between 1985 and 1994¹. And the cost of each catastrophe grew six-fold from around \$30 billion per year to \$182 billion². Moreover, in 2016, only 26% of economic losses due to natural disasters were insured³.

In heavily urbanized areas of developed countries, additional challenges arise and increase the cost of each weather-related disaster. For example, older cities have to factor in aging infrastructure systems that are increasingly vulnerable and at risk of cascading failure. A storm can damage a power system and cut production for weeks, dramatically increasing the cost of an extreme event. In developing countries, municipalities are also struggling to keep up with informal urbanization and the extreme vulnerability of their inhabitants.

Planning ahead could dramatically reduce the cost of each extreme weather event. But cities are often budget constrained and faced with stretching limited funding to address many competing priorities. It is difficult to pay for something when up-front costs are high, benefits are diffuse and extend far into the future, and the

probability of extreme losses is low. On top of that, success in well-designed resilient infrastructure is often invisible. In other words, success happens when nothing happens. While investing early in resilience saves lives and money, it is often neither politically nor financially rewarding. To create incentives for cities to invest in resilience, re: focus created Resilience Bonds to transform avoided losses into revenue flows, and to make invisible successes visible and economically capturable.

2. THE MODEL OF RESILIENCE BONDS: FUNDING BOTH PROACTIVE RISK REDUCTION AND REACTIVE RECOVERY ACTIONS

2.1. GENESIS OF CATASTROPHE BONDS: TRANSFERRING RISKS TO CAPITAL MARKETS

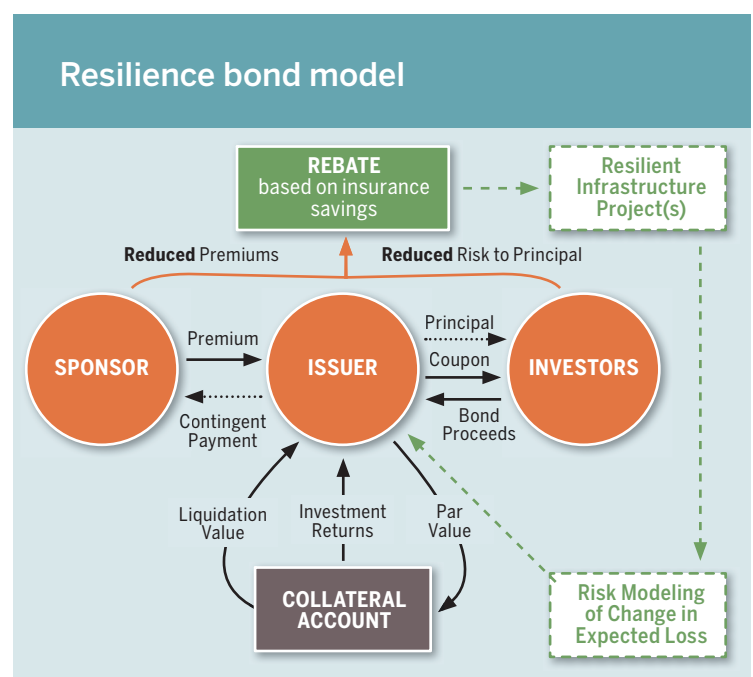
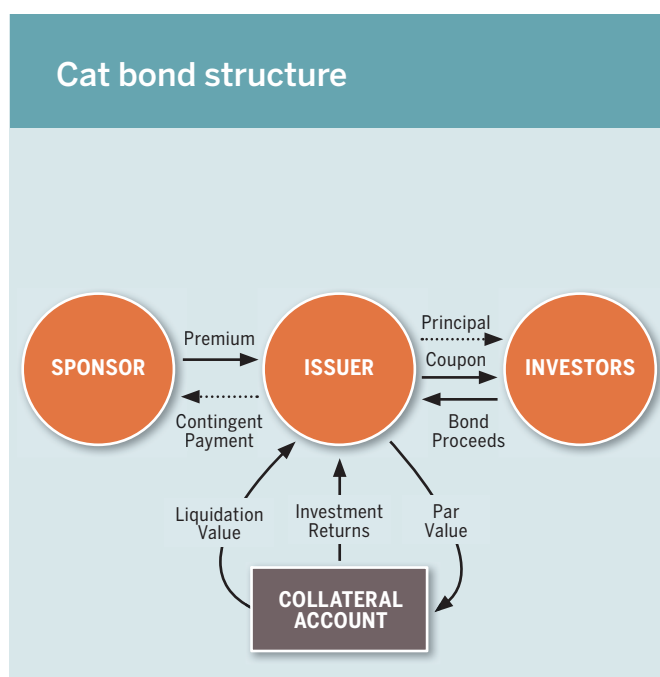
Catastrophe Bonds (also called Cat Bonds) emerged in the 1990s after Hurricane Andrew hit the State of Florida in the United States⁴. There was tremendous financial devastation because of the large real estate market and major tourism industry. The insurance industry came together to create an instrument to protect itself against extreme losses: Catastrophe Bonds. These instruments are insurance policies and *not* traditional municipal bonds that you use to build a road or a seawall. Each policy typically has a short term, between three and five years. What makes

1 United Nations Office for Disaster Risk Reduction.

2 Swiss Re, *Closing the protection gap. Disaster smart solutions for the public sector*, 2016.

3 Aon, *Impact Forecasting. Annual global climate and catastrophe report*, 2017.

4 Michael Lewis, *In Nature's Casino*, The New York Times, 2007.



“CAT BONDS ARE SIMILAR TO LIFE INSURANCE POLICIES THAT ONLY PAY OUT WHEN THE WORST DISASTERS STRIKE. RESILIENCE BONDS ARE MORE LIKE PROGRESSIVE HEALTH INSURANCE THAT PROVIDE INCENTIVES TO MAKE HEALTHY CHOICES THAT REDUCE LONG-TERM RISKS.”

them unique is that when a disaster reaches a predetermined threshold, the holder of the policy receives a pay-out, the same way a life insurance holder would, and investors lose part or all of their principal invested. The purpose of Catastrophe Bonds (and Resilience Bonds) is to transfer risk to capital market. Nowadays the market for Cat Bonds is around \$30 billion and growing rapidly.

2.2. THE DIFFERENCE BETWEEN CAT BONDS AND RESILIENCE BONDS

Resilience Bonds are a form of Catastrophe Bond that link insurance premiums to resilience projects in order to monetize avoided losses through a rebate structure. The “resilience rebate” is a source of funding for measurable risk reduction projects. If Catastrophe Bonds are similar to life insurance policies that only pay out when the worst disasters strike, then Resilience Bonds are more like progressive health insurance programs that provide incentives to make healthy choices—quitting smoking or exercising regularly—that reduce long-term risks and the cost of care.

The difference between a Resilience Bond and a Catastrophe Bond is that it uses the same financial modeling as in a Catastrophe Bond, but it models two scenarios: business-as-usual and a world with a protective infrastructure project. It estimates the difference in the expected losses when the catastrophe happens with and without the project. That difference is captured as a resilience rebate and this rebate can be used to fund the project itself.

There are two main advantages of a Resilience Bond.

(1) The first is that it expands financial protections for communities vulnerable to a catastrophic event. When the predefined threshold is hit, the sponsor receives a rapid payout, which makes post-disaster reaction quicker.

(2) The second advantage is to leverage new project finance for resilient infrastructure that offers a measurable risk reduction. Resilience bonds are therefore designed to fund proactive risk reduction projects and reactive disaster recovery actions.

The major innovation is that it initiates infrastructure projects with resilience in mind. It helps cities design new solutions instead of building more of the same, because resilience is about systems, not just one-off projects.

2.3. AN ECOSYSTEM OF MULTIPLE SPONSORS

The process of designing and issuing a Resilience Bond generally involves an ecosystem of players ranging from local and state government officials who are responsible for disaster prevention, to insurers who will pay for the losses, utility operators who are at risk, and the engineering and construction companies that can reduce risk as part of their businesses.

In most cases, a city government is rarely the largest asset-holder affected by a catastrophe. If you take the case of Norfolk, Virginia, the city does not hold most of the assets at risk, even though it has the ability to build comprehensive coastal protections and the responsibility to do so in specific areas. This is the reason why Resilience Bonds were designed to engage multiple sponsors⁵, the same way you would have a cooperative or homeowners association in a building in order to have all the affected players in the scheme.

re:focus collaborates with many engineering and construction companies, which reduce risk as part of their business to offer a wide range of technical solutions to a given problem encountered in one place. In some cases, operating engineering firms are able to see more sides of a client’s exposure to risk than a client itself, and these firms have the best vantage point to design comprehensive and cost-effective system solutions rather than one-off projects that are limited by a single agency or department’s authority or budget.

2.4. A FINANCIAL TOOL FOR RESILIENCE PROJECTS

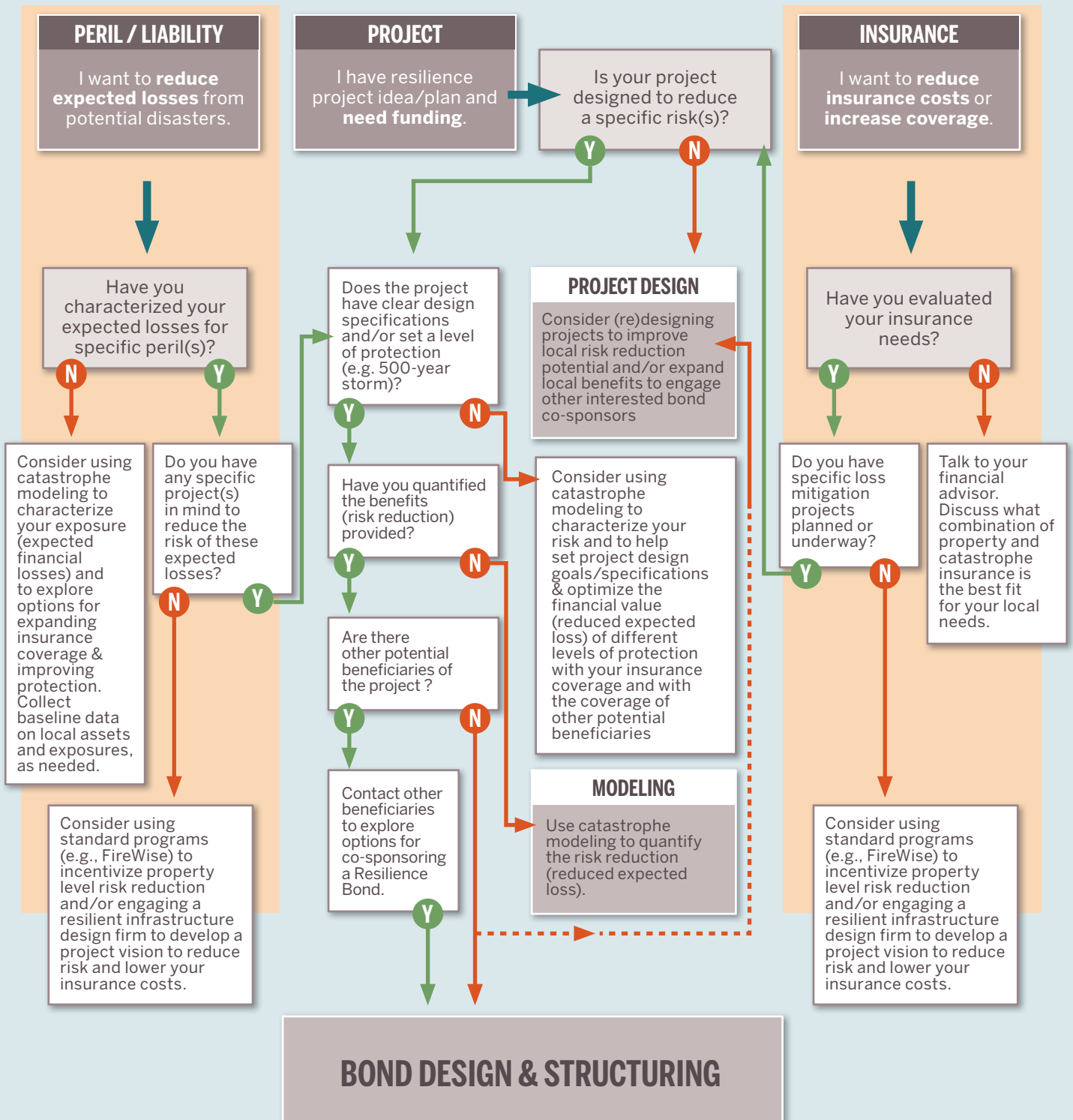
re:focus serves as an agent for loss mitigation, aligning risk reduction projects with insurance benefits on behalf of both public and private entities.

To serve the best interest of all of these entities, it is important to make very clear where Resilience Bonds can be appropriate and where they are not the right tool. Not all projects are a good fit for a Resilience Bond approach. Some projects are too difficult to model, and some are too small to create quantifiable or meaningful risk reductions. Some projects are too diffuse, such as capacity building programs or emergency preparedness plans, and some projects have high operational uncertainty which makes benefits hard to estimate. It is worth noting that Resilience Bonds are designed for catastrophic events not chronic stress like water scarcity. re:focus works with clients and partners on alternative insurance-linked project finance solutions for these other types of hazards as well.

Timing is also very important. Public entities often need technical assistance to go from where they are now to where they need to be to start a Resilience Bond project (cf. figure below). For example, if a city has a concept for coastal protection but does not know what level of protection it needs, it means that there is still preliminary design work that needs to be completed before exploring if and to what extent a Resilience Bond can help finance the project.

⁵ The sponsor is the one who pays the premium and receives the payout in the event of a disaster.

Bond design & structuring





3. ACHIEVEMENTS AND REMAINING CHALLENGES FOR RESILIENCE BONDS

3.1. ACHIEVEMENTS AND MAIN PROSPECTS FOR THE UPCOMING YEARS

re:focus released a framework for Resilience Bonds in December 2015. The mechanism has since been validated by multiple partners in the insurance industry and capital markets over the course of 2016 and 2017 to set the stage for the first wave of transactions. Since then, re:focus has been working with both private partners and public sector entities toward the first Resilience Bond issuance. The process of developing public-interest Resilience Bonds is slower than issuing a conventional Catastrophe Bond because it is necessary to align the timing of a Resilience Bond issuance with the timing of major infrastructure projects. A Resilience Bond is designed to be issued when a resilience project comes into effect. In the case of a seawall, it can be up to a decade from design going through construction. Public sector Resilience Bond projects will mainly be driven by project design timelines not insurance industry timelines.

So far, the priority has been large public infrastructure projects in North America, largely because this is where the Catastrophe Bond market has sparked the greatest interest. For example, the New York Subway System and

Amtrak both issued their own Catastrophe Bonds after Hurricane Sandy in 2013. There is also a straightforward path between high value assets and major resilience projects in cities like San Francisco, Houston, and Miami.

Another line of work is being investigated in collaboration with major insurance players as part of the Center for Global Disaster Protection. This work focuses on extending the Resilience Bond model to developing countries. In these countries, when a disaster strikes damages are often more devastating to people and homes than large assets or commercial industries. As part of a collaboration with Risk Management Solutions (RMS) and Vivid Economics, DfID, and Lloyds of London through a new Innovation Lab⁶, re:focus has been developing variations of Resilience Bonds that can better leverage humanitarian aid and international development funding for disaster risk reduction projects around the world.

Overall, both private and public actors are enthusiastic about the possibilities offered by Resilience Bonds. But public-sector projects are much harder to develop. Unlike private actors that can mitigate losses for their own covered assets, public sector projects are often far broader. Private actors have specific expectations; the asset owner is the one at risk, and the one able to implement the project and enjoy the benefits of the investments. Therefore, it is a much more contained conversation and resilience projects are easier to move forward. In the public sector, the conversation requires many more stakeholders, they move at a slower pace and the stakeholder with the authority to implement a large infrastructure project is not always the greatest beneficiary even though they are responsible for the process.

⁶ RMS, *Enter the Center*, 2018.

“NOT ALL PROJECTS ARE A GOOD FIT FOR A RESILIENCE BOND. SOME PROJECTS ARE TOO DIFFICULT TO MODEL, OTHERS ARE TOO SMALL OR DIFFUSE TO CREATE QUANTIFIABLE RISK REDUCTIONS.”

3.2. REMAINING CHALLENGES AND THE NEXT FRONTIER

Designing major resilient infrastructure projects and systems is time-consuming and complex work. Making sure the design process generates meaningful and measurable risk reductions adds another layer of complexity. However, this is essential for avoided losses to be monetized. That can mean considering different technologies, construction methods, or other design solutions to increase the level of protection and create greater financial value. This is counterintuitive for most designers and engineers who are typically presented with a scope of work and/or budget at the outset of a project. They then work to design the best solution at the lowest cost.

The first challenge is engaging and collaborating with design and engineering firms that are willing to shift from this very narrow path to a more flexible and innovative approach. This allows both designers and clients to zoom out and identify where projects can be scaled up to capture greater financial value rather than downsized to match currently available funds. Most infrastructure projects are generally imagined based on what an agency can buy and not necessarily based on the desirable level of protection. Or ideas are too abstract. Enormous resilience solutions are envisioned, but without any practical path to implementation. A middle ground of a project pipeline of large scale and pragmatic risk reduction projects is essential for creating meaningful change.

The second element is to find the right point of intervention in a project design so that the financing can inform the design and the design can integrate the financing solution. Both in the private and public sectors, people who manage risk and insurance and understand how resilience projects could be translated into financial rebates are not the same as the staff who do capital planning for infrastructure or project implementation. This lack of communication or a common language or approach means that project opportunities to reduce risk are sometimes missed altogether. Risk managers need to understand how projects in their city or utility's capital and strategic plans can reduce overall system risk and project-level people need to understand the potential insurance benefits (and funding sources) created by their project. To put it differently, if your life insurance company does not know that you quit smoking, you will not see a change in your rates. Sometimes it is difficult to reach that alignment. Framing the discussion to engage departments with complementary priorities can also help build broader support with communities and local stakeholders so that they also understand the benefits from such projects.

Finally, our next frontier is to meaningfully model risk reduction and price the value of these reductions for a wider variety of infrastructure project types and perils. Resilience Bonds work very well for some projects and not for others. For example, modeling the risk reduction from a coastal protection project is very straightforward, but doing the same for a city-wide green stormwater infrastructure system is not. The real value of our work will be in extending models to more diffuse resilience projects and capturing benefits that are harder to model and spread across more beneficiaries over time. This is the case of housing reconstruction in Nepal after recent earthquakes or in the Caribbean following Hurricanes Irma and Maria. There are dramatic socio-economic consequences of disasters and great interest in resilient reconstruction, but a lot of challenges remain in aligning cost and benefits between international development project funding agencies and the insurance industry.

CONCLUSION

Resilience Bonds have been designed with the conviction that planning ahead of catastrophes is more cost-effective than post-disaster reconstruction. Resilience Bonds are designed to monetize avoided losses to help governments invest in proactive risk reduction infrastructure projects. The potential for local governments to fund resilience projects, to share the burden with other stakeholders and to transfer the risk of a catastrophe to capital markets using this mechanism are significant. While today Resilience Bonds only work for some projects where risk reductions are readily measurable and targeted, the ultimate objective is to extend the types of projects for which Resilience Bonds can work and serve a broader range of vulnerable communities around the world.