



THE FUTURE OF DISASTER RISK POOLING FOR DEVELOPING COUNTRIES: WHERE DO WE GO FROM HERE?

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EXECUTIVE SUMMARY

Highlights

- Developing countries require greater access to finance to respond quickly and effectively to disasters. Multiple tools are available to enable this, including national disaster funds, contingent credit lines, and parametric insurance products.
- This paper analyzes how a portion of the current disaster risk finance architecture is serving developing countries. We focus on the three regional risk pools—CCRIF SPC (formerly the Caribbean Catastrophe Risk Insurance Facility) (referred to throughout as “CCRIF”); African Risk Capacity (ARC); and Pacific Catastrophe Risk Insurance Company (PCRIC)—that offer parametric disaster insurance to developing countries.
- Disaster risk finance instruments, including insurance, should be deployed in combination to address the various “layers” of risk, but few countries appear to be following a “risk-layering” approach.
- Donors and development banks should deploy targeted premium support to assist countries that need it most to access insurance; however, countries should consider the long-term fiscal prudence of using loans to pay for insurance premiums.
- The pools must manage unmet expectations and basis risk more effectively. This will require investing in the quality of models, adopting rules-based processes for managing unmet expectations, and incorporating features (e.g., secondary triggers) to manage basis risk.

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- The pools should scale up investment in product development and roll out sovereign-level parametric cover for additional perils as rapidly as possible, while also exploring new and creative product lines and collaborations.
- Strengthening the risk pools and promoting risk-layering approaches will require new sources of sustained, long-term, concessional finance that go beyond the ad hoc donor support provided to date. We suggest three options to do this; namely, expanding the role of the World Bank's International Development Association (IDA), promoting the role of regional multilateral development banks (MDBs), and creating a new Risk Solutions Incentive Fund.

Context

Protecting communities against disasters, particularly climate-related disasters, is more urgent than ever. Rising mean global temperatures, combined with global population growth, economic development, and urbanization are creating unprecedented patterns of risk to human settlements. Economic and human losses are climbing, and low-income countries are suffering the most on an economy- and population-adjusted basis (CRED and UNISDR 2018). Climate-related events have increased in frequency and severity, and climate change is expected to intensify losses, which will be significant, especially for poor countries (Munich RE 2019; IMF 2017).

There is a growing consensus that developing countries need new ways to finance disaster preparedness, response, recovery, and rebuilding. Numerous international frameworks and political bodies, including the Paris Agreement, Sendai Framework for Disaster Risk Reduction, and the Group of Twenty and Group of Vulnerable Twenty alike, have called for innovative financing mechanisms to assist developing countries cope with disaster. Over the last two decades, financial markets, governments, and the development community have introduced important innovations in disaster risk finance, giving rise to a collection of funding sources to build resilience before disasters happen and to respond, recover, and rebuild after disasters strike. Given the urgency and scale of the challenges developing countries face, pressure to scale up both categories of disaster risk finance is intense.

Developing countries require greater access to finance for early response postdisaster. Postdisaster finance includes long-term finance, which is used for recovery and rebuilding, and short-term finance, which is deployed quickly to limit losses through early response. Mobilizing relief efforts quickly after a disaster can limit long-term economic losses (Cabot Venton et al. 2012), but many developing countries have limited access to finance for early response.

In the last two decades, international institutions and national governments have developed a range of tools to help countries fund early response to disasters. They include national disaster funds, contingent credit lines, parametric disaster risk insurance, catastrophe bonds, and other insurance-linked securities, as well as a range of other postdisaster emergency financing tools. This study focuses primarily on one such tool—parametric disaster risk insurance. Parametric (or index) insurance refers to policies that pay out when modeled losses reach certain predetermined triggers, as opposed to traditional indemnity insurance that pays out based on actual losses. Parametric insurance pays out quickly—typically within a week—as it does not require assessments of actual losses on the ground.

In the last decade, developing country governments and development partners have established three regional risk pools to offer parametric insurance solutions to help governments cope with disasters, ranging from earthquakes and drought to flooding and hurricane-force winds. They are CCRIF, which serves the Caribbean and Central America; ARC, which serves Africa; and PCRIC, which serves Pacific Island countries.

About This Working Paper

The study examines three key questions that aim to provide insight on the regional risk pools and the larger context of disaster risk finance at a key juncture in the evolution of the pools and in the international policy debate.

- **To what extent are countries deploying multiple disaster risk financing instruments to cover the various layers of risk?** While this study primarily focuses on the risk pools themselves, this question provides important context because the long-term success of the risk pools depends on their insurance solutions being deployed alongside other instruments. Theory suggests that disaster risk finance

instruments should not be used in isolation but should be deployed in combination to address risks of varying frequency and severity (Ghesquiere and Mahul 2010). We performed an analysis examining whether countries eligible to purchase insurance from CCRIF, ARC, or PCRIC are deploying multiple instruments in practice.

- **To what extent are governments taking advantage of disaster risk insurance solutions and why?** This question is central to the success of the disaster risk pools, as uptake of insurance products is a clear signal of whether the pools are providing solutions that developing country governments find useful. We analyzed insurance-buying patterns across the three pools and examined possible factors contributing to those patterns.
- **To what extent are disaster risk insurance pools supporting governments in their efforts to protect poor and vulnerable people?** Protecting poor and vulnerable people should be an urgent priority for all governments, particularly in climate-vulnerable developing countries where the challenge is more acute because resources are scarce. We conducted a desk study of the pools' mandates and track records in serving poor and vulnerable people, and of potential ways in which they might better serve these people.

Key Findings

Risk Layering

A simple exercise to examine countries that are eligible to participate in CCRIF, ARC, or PCRIC and that are able to purchase contingent credit lines from MDBs suggests that few countries appear to be following a risk-layering approach. Overall, less than a third (31 percent) of countries in the group we analyzed are deploying two or more tools, and only 9 percent are using all three (we examined national reserve funds, contingent credit lines, and sovereign parametric insurance). Our analysis suggests that countries using more instruments tend to be wealthier, less indebted, and more likely to enjoy higher government capacity than are their peers that deploy fewer tools. They also experience more economic and human losses from disasters and traditionally have received less humanitarian aid per capita than those countries that deploy fewer

instruments. This raises questions on how best to promote risk layering in countries with weaker capacity and lower per capita income.

Insurance Uptake

Sovereign parametric insurance offered by the regional risk pools presents a unique value proposition. In addition to benefits such as rapid payouts, the pools can generate a variety of important cobenefits. For example, tools such as data repositories, risk models, and risk profiles—while initially designed to facilitate the insurance-buying process—can enable governments to better understand and manage the risks they face. These cobenefits do not emerge automatically, however, and all three pools can do more to fulfill their unique value propositions.

The cost of insurance remains a challenge, but the pools are working to improve affordability of their products through a variety of means. These include implementing carefully considered capitalization structures and risk-retention policies; diversifying their risk exposures in terms of geography and peril; facilitating access to concessional premium financing; and, in some cases, achieving economies of scale. Access to concessional finance from IDA has helped some CCRIF and PCRIC countries pay premiums and access insurance.

Cost is not the only barrier to uptake, nor is it always the most significant barrier; other barriers also need to be overcome:

- Managing unmet expectations is critical to avoid dropped coverage. Unmet expectations may result either from technical basis risk, which occurs when modeled losses differ from actual losses, or from instances of nonpayouts, where the catastrophe models worked properly but members still anticipated a payout.
- Promoting a strong understanding of parametric insurance is key to promoting stable uptake, as it helps manage expectations and supports national dialogue around the insurance renewal process.
- Developing and offering new insurance products that help countries address their key risks is essential to attract and retain clients. Inevitably, this requires investments in data collection, modeling capabilities, and marketing.

Supporting Poor and Vulnerable People

The three pools have differing mandates that influence their respective track records as tools for protecting poor and vulnerable people. CCRIF and PCRIC do not have explicit propoor mandates. Governments see flexibility in the use of insurance payouts as a key advantage of the insurance products, and many prefer to maintain discretion over how they use payouts rather than committing in advance to deploy them in ways that directly support poor and vulnerable people. As a result, and because of inadequate tracking, it is difficult to determine how much CCRIF and PCRIC payouts have benefited poor and vulnerable people. In contrast, supporting poor and vulnerable people is an explicit part of ARC’s mandate and design.

Under their current mandates, all three pools could potentially increase support for poor and vulnerable people. In the case of CCRIF and PCRIC, this could mean providing technical or other support to enable countries to prioritize the needs of poor and vulnerable people when deciding how to use payouts. It could also entail designing complementary microinsurance products that directly target poor and vulnerable people. For all three, it could mean helping countries develop scalable social protection systems or partnering with civil society to help them channel resources to poor and vulnerable people more effectively.

Recommendations

The pools and their stakeholders should continually work to improve the “value for money” of membership in the pools. This means limiting costs—both operational costs and the cost of insurance to countries—and passing on price benefits to members where possible and prudent. It also means working to fully achieve the range of cobenefits associated with the risk pools and sovereign parametric insurance. The pools, in partnership with countries, should invest in and provide training for expanded applications of their data platforms and modeling capabilities to ensure they are useable beyond insurance purchases for broader risk management decision-making.

MDBs and bilateral donors should deploy targeted premium support to assist members who need it most. At the same time, countries should consider the long-term fiscal prudence of using loans to pay for insurance premiums. When subsidies are used, countries should continue to cover some portion of the premium, even if minimal, as allocating budgetary funds to pay premiums generates a regular process through which finance and other ministries must review national risk exposure. It also prompts a regular dialogue between ministries and legislatures—which must approve the budget—about disaster risk insurance and disaster risk finance more generally. Donors should consider incorporating an explicit schedule to phase out subsidies over time. Using loans to pay insurance premiums—as is the case with some countries using IDA financing—raises real questions about long-term debt sustainability and about the long-term prudence of linking debt to insurance, which is not designed to generate future returns that can be used to service the debt.

The pools should deploy effective measures to manage unmet expectations and basis risk and share lessons with each other on how to manage this challenge. This will require continual investment to improve model quality, as well as constant education and communication with clients. For instance, updating exposure data underpinning the PCRIC model to ensure continued model accuracy and low levels of basis risk is critically important. PCRIC should also evaluate whether its model accurately reflects the considerable costs to governments of responding to disasters in remote areas, such as distant islands within an archipelago. Pools should adopt rules-based and transparent processes for managing instances of unmet payout expectations. They should consider adopting secondary triggers and features that provide a modicum of resources when policies do not trigger; it is important, however, that these also be rules-based and transparent. CCRIF should evaluate the possibility of deploying a network of ground-based rain gauges for its excess rainfall product, which would help reduce basis risk.

With donor support, the pools should scale up investment in product development. They should roll out sovereign-level parametric cover for additional perils as quickly as possible, while also exploring new and innovative product modalities based on member needs. These could include micro- and meso-level parametric

products or other products customized to the needs of specific members, such as those PCRIC is developing for Fiji; products, such as CCRIF's new fisheries product, that target particular sectors and incorporate predefined mechanisms for transferring resources to specified beneficiaries; or different disaster risk financing tools that complement existing insurance products, such as the regional contingent financing mechanism under consideration by the Asian Development Bank and PCRIC or indemnity-based insurance for public assets.

For countries that want to use sovereign insurance payouts to support poor and vulnerable people, the pools and development partners should help improve their ability to quickly and effectively deliver resources to intended beneficiaries after disasters occur. Governments should develop effective contingency plans with specific elements on how best to identify and reach affected communities. They should also develop the public financial management infrastructure necessary to deliver resources to beneficiaries in an effective and timely manner. One way to channel payouts to poor and vulnerable people is by linking parametric insurance from the pools with disaster-responsive social safety nets. Alternatively, governments could partner with civil society organizations to deliver resources to those most in need, as ARC has begun to do through its ARC Replica product.

Countries that prefer to maintain flexibility and discretion in how they use payouts might consider complementing sovereign parametric coverage with microinsurance products that are expressly designed to target poor and vulnerable people. Where applicable, pools should lend strategic support to microinsurance programs targeting poor and vulnerable people, as CCRIF and PCRIC are beginning to do.

The pools should collaborate with development partners to increase in-country capacity on risk layering. They should study approaches, such as the proposed Asian Development Bank/PCRIC regional contingent disaster financing mechanism and the African Development Bank/ARC Africa Disaster Risks Financing Programme, to more formally link insurance products with other complementary tools. Meanwhile, the pools should continue to educate members on the role and limitations of parametric insurance and encourage them to complement their products with additional disaster risk financing tools.

Finally, all stakeholders should recognize that insurance is not a substitute for enhanced international efforts to raise large-scale funding to help developing countries cope with and adapt to climate change impacts. Parametric insurance is a useful way to secure postdisaster liquidity, but it cannot cover the bulk of losses in any country. Suggesting that insurance is a substitute for these larger climate finance flows could damage long-term political support for the insurance pools and the valuable work they do.

Securing Long-Term Concessional Resources for Disaster Risk Finance

Implementing our recommendations and promoting risk layering will require new sources of long-term concessional financing that go beyond the ad hoc donor support provided to date. Donor resources have often been earmarked to support specific disaster risk financing instruments rather than layered, multi-instrument solutions, and they have typically been provided through sporadic financial commitments by a narrow set of donors. Development partners have launched a number of new entities, including the InsuResilience Solutions Fund and the Global Risk Financing Facility, to provide dedicated concessional resources to support disaster risk finance. These developments, while positive, fall short of what is needed in the longer term.

New approaches that can mobilize large volumes of sustained concessional financing over the long-term are urgently needed to improve the affordability of disaster risk financing tools, develop new ones, and incentivize the adoption of effective, risk-layered strategies. These new approaches must leverage and amplify the strengths of the risk pools, development banks, and other solutions providers. We sketch out three potential options: expanding the role of IDA; leveraging regional development banks; and driving collaboration through a proposed Risk Solutions Incentive Fund. They are not mutually exclusive, and each carries advantages and drawbacks.

1. INTRODUCTION: FINANCING DISASTER RECOVERY IN AN ERA OF CLIMATE CHANGE

Today, protecting communities from disasters—particularly from climate-related disasters, sudden and slow-onset alike—is more urgent than ever. Climate-related disasters include storms, floods, droughts, heat waves, sea level rise, and wildfires. Rising mean global temperatures, combined with global population growth, economic development, and urbanization are creating unprecedented patterns of risk to human settlements (CRED and UNISDR 2018). Economic and human losses are climbing, and low-income countries are suffering the most relative to the size of their economies and populations (CRED and UNISDR 2018).

Securing financial resources to prepare for disasters and to respond, recover, and rebuild after they strike is critical to protect communities. Over the last two decades, financial markets, governments, and the development community have introduced important innovations in disaster risk finance, giving rise to a collection of instruments and funding sources. Given the urgency and scale of the challenge, however, there is an urgent need to scale up disaster risk finance and to improve the affordability and reliability of these instruments and funding sources.

This study focuses on one portion of the disaster risk finance architecture—parametric disaster risk insurance products for developing country governments. In particular, the study focuses on the three regional risk pools created over the last decade to help governments cope with disasters ranging from earthquakes and drought to flooding and hurricane-force winds. These are CCRIF SPC (formerly the Caribbean Catastrophe Risk Insurance Facility) (referred to throughout as “CCRIF”), which serves the Caribbean and Central America; African Risk Capacity (ARC), which serves Africa; and Pacific Catastrophe Risk Insurance Company (PCRIC), which serves countries in the Pacific.

The goal of the paper is to provide—at a key juncture in the global policy debate—insights on these regional risk pools and on disaster risk finance more broadly. Each of the risk pools has reached an important moment in its evolution, making this an opportune time to ask what lessons can be drawn and how the pools can be further strengthened. A fourth regional risk pool, the Southeast Asia Disaster Risk Insurance Facility, is currently under development; some

of the lessons from the existing pools may be relevant to this new initiative. In addition, several governments (e.g., Canada, Germany, Japan, and the United Kingdom, among others) are likely to make significant new financial commitments in disaster risk management (DRM) and climate finance in the coming years. This paper offers insights that should help inform deliberations on how best to deploy scarce concessional finance. Finally, the issue of climate resilience and adaptation will continue to grow in urgency at international climate negotiations. Insights on the effectiveness of insurance and other instruments in promoting resilience and adaptation will be central to this policy and political debate.

1.1 Disaster Finance in a Warming World

Developing countries are sustaining significant economic damage from climate-related disasters. High-income countries have sustained the highest losses in absolute terms from these events, but as a share of their economies, low-income and lower-middle-income countries have experienced losses that are three to four times larger than the losses high-income countries have experienced (CRED and UNISDR 2018). The same is true in terms of population affected. In the 2000–17 period, low- and middle-income countries saw over 3.6 billion people affected by climate-related disasters; low-income countries saw, by far, the largest share of their populations affected relative to wealthier countries (CRED and UNISDR 2018). Within developed and developing countries alike, poor people tend to be more exposed and vulnerable to climate-related risks, including floods and drought, than do nonpoor people (World Bank 2017d).

Climate-related disasters have increased significantly in frequency and severity, and climate change is expected to intensify losses, especially in poor countries. From 1980 to 2018, global climate-related disasters rose steadily from around 200 events a year (with less than US\$50 billion in total losses) to around 800 events (with over \$150 billion in total losses) (Munich RE 2019). Under conservative assumptions, if climate change continues unabated, by the end of the century the average low-income country is projected to be 9 percent poorer than it would be without climate change (IMF 2017). Discounted at the growth-adjusted rate of 1.4 percent, the present value of these losses amounts to more than 100 percent of current gross domestic product (GDP). Under an intermediate emissions scenario, output would fall by 4 percent by the end of the century. The present value of these output

losses—again, discounted at 1.4 percent—amounts to 48 percent of current GDP (IMF 2017). Less conservative approaches suggest that unmitigated climate change would result in much higher losses; it could reduce average global incomes by as much as 23 percent by 2100 (Burke et al. 2015). Because that number is a global average, it masks the fact that losses will be much higher in some parts of the world. These approaches only consider the impacts of temperature increases and do not estimate the potential impacts from climate-related disasters, which are expected to increase in severity and potentially in frequency, particularly in developing countries (IMF 2017).

Over the past decade, an international consensus has emerged—among policymakers and technical experts alike—that developing countries require new financial instruments, including insurance products, to cope with disasters. Group of Twenty (G20) leaders, as early as 2012, recognized “the value of Disaster Risk Management (DRM) tools and strategies to . . . financially manage [disasters’] economic impacts” (Leaders of the G20 2012). The 2015 Sendai Framework for Disaster Risk Reduction called for “mechanisms for disaster risk transfer and insurance, risk-sharing and retention and financial protection, as appropriate, for both public and private investment in order to reduce the financial impact of disasters” (UNISDR 2015). In the Paris Agreement, in the context of the Warsaw International Mechanism for Loss and Damage, there is a reference to “risk insurance facilities, climate risk pooling and other insurance solutions” as areas for cooperation and facilitation (UN 2015). Furthermore, finance ministers of the Group of Vulnerable Twenty (V20) called in its first communiqué for “a trans-regional public-private mechanism, modeled on similar pre-existing regional facilities and featuring index-based risk transferal [*sic*] and other innovative insurance tools,” to address climate-related risks (Finance Ministers of the V20 2015).

Finance to build resilience and protect people and structures before disaster strikes is one category of much-needed finance. Evidence suggests that these investments are highly cost effective (UNICEF and WFP 2015; Hallegatte et al. 2019). The current system of international development assistance in many ways, however, privileges *ex-post* crisis finance—the kind used to recover and rebuild after disasters—over finance for *ex-ante* preparedness. For example, finance for disaster recovery and reconstruction is often available on more concessional terms than finance to prepare for disasters

(Clarke and Dercon 2019). While it is beyond the scope of this paper, this is clearly an issue worthy of urgent attention.

Finance deployed following disaster (or while it is unfolding) can be divided into long-term finance, which is used for recovery and rebuilding, and short-term finance, which is deployed quickly for early response. In this study, we focus on the latter. Evidence is mounting that effective early response can limit long-term economic losses. Cabot Venton et al. (2012), for example, found that an early response to drought could save, per event, between \$292 and \$455 per person in Kenya and between \$236 and \$464 per person in Ethiopia. Similarly, Clarke and Hill (2012) found that an early response to drought could save up to \$1,294 per household. That rapid response is cost effective makes intuitive sense, since the faster food-insecure people receive aid, utilities restore power, and roads and airports reopen, the faster food security can be restored, businesses can renew operations, and people can return to work. This process, in turn, limits lost income and hardship, and lowers the cumulative human and economic cost to a community.

The problem is that most developing countries have limited access to finance for early response. Developing countries often have limited fiscal headroom and find it difficult to reallocate budgetary resources quickly without facing difficult spending tradeoffs. Also, many developing countries have limited ability to borrow large amounts on short notice. Private-insurance penetration rates are generally low in the developing world, so private insurance payouts are of limited help, and in any case, they are often slow to be disbursed. Humanitarian assistance is a critical part of postdisaster funding, but this aid often comes with delays and below pledged amounts (Clarke and Dercon 2016).

Several tools can help countries fund early response to disasters. Some governments have established national disaster funds, “rainy day” reserves set aside from budgetary or other resources and dedicated to disaster-related purposes. Multilateral Development Banks (MDBs), the International Monetary Fund (IMF), and bilateral banks and agencies also have introduced mechanisms that allow countries to put financial resources on standby that can be accessed quickly after disaster strikes. Some countries also have issued catastrophe (cat) bonds and other insurance-linked securities (e.g., catastrophe swaps) that function similarly to insurance con-

tracts, except that they transfer risk to the broader capital markets rather than to reinsurance companies (Artemis.bm 2017; 2018a). Insurance-linked securities represent an alternative to traditional reinsurance and have dramatically increased global risk transfer capacity (Artemis.bm 2018b).

In addition, sovereign parametric insurance has become an important mechanism to help countries manage and reduce losses after disasters strike. Sovereign insurance refers to insurance policies purchased by governments, rather than by private actors, and is used to provide resources for relief, recovery, and sometimes reconstruction. Parametric (or index) insurance has received special attention. These policies provide payouts quickly, typically within a few days of the event. They pay out automatically when modeled losses reach certain predetermined triggers, eliminating the need for time-consuming assessments of actual losses on the ground.

Governments and development partners have created several regional insurance pools to offer sovereign parametric insurance to developing countries. These pools—CCRIF, ARC, and PCRIC—are the central focus of this study. Over the past decade, the pools have benefited member countries in important ways. Thirty-six countries have purchased coverage from the pools at some point, and in the 2018–19 policy year, 27 countries purchased coverage.¹ In the 2017–18 policy year, the pools provided almost \$900 million in coverage while collecting \$42 million in premiums.² Cumulatively, the pools have made over \$180 million to date in payouts to member governments. The reinsurance industry has been a strong partner, with over 30 global reinsurance companies taking some of the risk. Finally, the process of joining the pools and buying coverage has often enabled governments to better understand the risks their communities face and to better manage and plan for them.

1.2 Three Outstanding Questions

Despite these important achievements, three pressing questions remain regarding the future of sovereign parametric disaster risk insurance for developing countries. Most experts now agree that disaster risk finance instruments should not be used in isolation; rather, they should be deployed in combination to address risks of varying frequency and severity (Ghesquiere and Mahul 2010). Different instruments should be applied to the various layers of risk, depending on the financial cost of each instrument.³ The precise

boundary of each different layer of risk is country specific and can shift over time, although, in general, resources that are relatively cheap to raise should be deployed first to cover the lowest layers of risk, representing relatively frequent, lower-severity events. These events require more limited responses than events of higher severity, so they typically demand smaller amounts of finance. Resources that are more expensive to deploy should be used last to cover infrequent but severe events that require extensive financing.

To what extent are countries adopting the prescribed risk-layering approach? Are they deploying multiple tools in a layered fashion; are they relying only on one instrument, or are they using none at all? That is our first question. While this study is primarily focused on parametric insurance, this question matters because insurance can only be successful in the long term if it is deployed alongside other instruments. Insurance is a relatively expensive form of disaster risk finance, and as such, it is more cost effective when employed to cover higher layers of risk (events of lower frequency and higher impact). Using insurance to cover lower layers of risk (e.g., flooding that occurs every two or three years) is less cost effective. Government reserves and contingency funds may be more appropriate to cover these types of risks (World Bank 2017d). This is akin to the difference between low- and high-deductible health insurance policies; the latter has lower premiums and is generally best paired with a savings account to cover recurring out-of-pocket expenses. If insurance is used in isolation, users may develop unrealistic expectations about what insurance can deliver, which, over time, may lead to disappointment with insurance solutions.

The second question focuses on insurance: To what extent are governments taking advantage of parametric, sovereign risk insurance and why? Uptake of insurance products is a clear signal of whether the pool is providing solutions that governments find useful in meeting the disaster risk finance challenge. Uptake is also central to the pools' long-term viability. Pools with high uptake generally enjoy greater risk diversification and greater premium income, which can increase a pool's capital base over time. This allows the pool to offer cheaper insurance, which can attract more buyers. On the other hand, pools with low or falling uptake can enter a negative cycle of lower diversification and lower premium income, which can eventually threaten a pool's financial viability.

The third question concerns the protection of poor and vulnerable people. To what extent are disaster risk insurance pools supporting governments in their efforts to protect these groups? Poor and vulnerable people—often including women and girls, children and the elderly, indigenous peoples, and people with disabilities—are disproportionately impacted by disasters (Hallegatte, Bangalore, et al. 2016). Protecting them should be an urgent priority for all governments. In climate-vulnerable developing countries, the challenge is more acute because resources are scarce. This raises the question of whether and how disaster risk insurance is helping poor and vulnerable people cope with the impacts of disasters.

1.3 Research Approach

To shed light on the three questions outlined above, we used various research approaches. To understand the extent to which countries are adopting multiple disaster risk financing instruments, we tracked the current use of national reserve funds, contingent credit lines, and ARC/CCRIF/PCRIC sovereign parametric insurance by all countries eligible to access these products.

To analyze patterns of insurance uptake, we mapped the insurance purchases of all countries eligible to buy insurance from CCRIF, ARC, or PCRIC (as well as the World Bank’s Pacific Catastrophe Risk Assessment and Financing Initiative pilot program), starting at the inception year of the pool and extending to the 2018–19 policy year. We then sorted each country into one of the following four categories based on its historical pattern of insurance buying:

- **Loyal buyers:** Countries that have purchased insurance for several consecutive years and that continue to purchase insurance in the current policy year.
- **Dropped coverage:** Countries that purchased insurance from the relevant pool but then stopped buying coverage at some point.
- **Recent arrivals:** Countries that purchased coverage for the first time during either of the past two policy years.
- **Yet-to-buy:** Countries that, as of this writing, have not purchased insurance from the relevant pool.

We then used a range of sources, including relevant literature and stakeholder interviews, to identify possible

drivers of insurance-buying behavior in each category. We do not seek to explain conclusively the insurance-buying behavior of particular countries at particular points in time. Instead, we tried to identify common themes that run through each of the four categories.

Finally, to analyze the extent to which the pools are helping poor and vulnerable people, we conducted a desk study of the pools’ mandates and track records. We complemented this effort with stakeholder interviews to understand the extent and limitations of this role by the pools.

To be sure, the debate over disaster risk insurance is taking place within a larger discourse on climate justice and on who should pay for the damages caused by climate change. Many stakeholders—including some of the governments participating in the insurance pools examined in this study—believe that the largest carbon emitters bear special responsibility for climate change and have an obligation to help vulnerable developing countries cover the financial burdens of climate impacts. Indeed, some countries have argued that the loss and damage mechanism under the United Nations Framework Convention on Climate Change should be expanded to include a financing mechanism. In this vein, a recent analysis argues that the focus on insurance constitutes a “distraction” and “diversion” from the need to channel much larger volumes of finance to developing countries as part of a compensation mechanism for the damages they incur (Richards and Schalatek 2018).

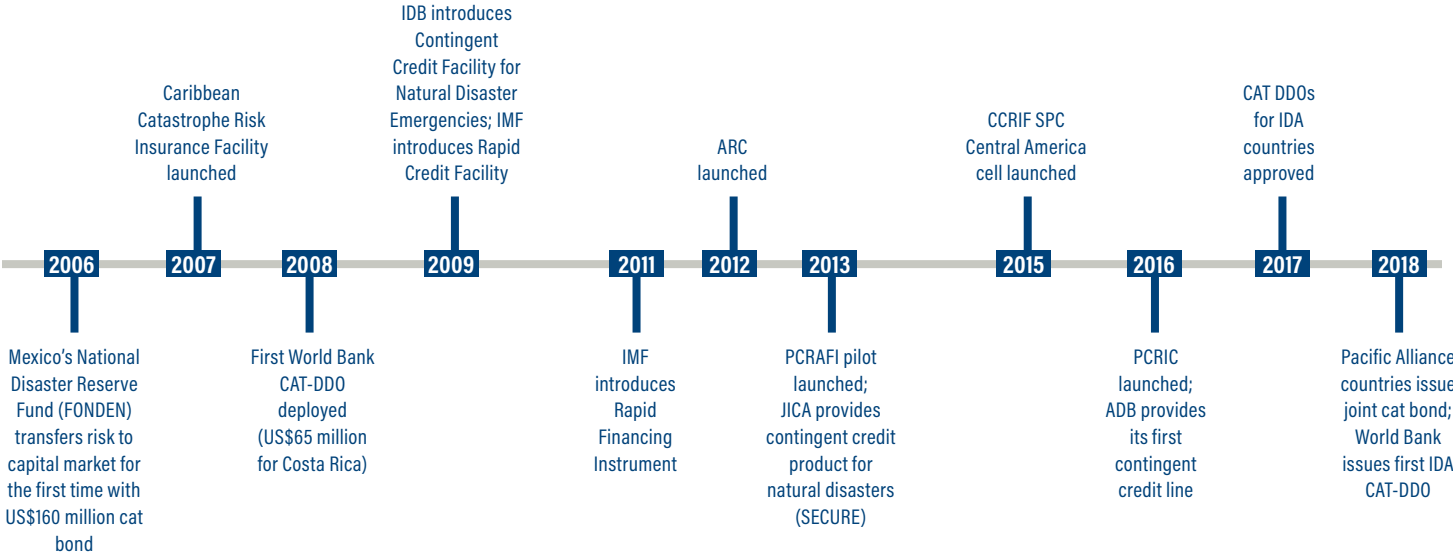
We recognize that the insurance pools reviewed here provide modest volumes of finance relative to total catastrophe losses and that parametric insurance is only a partial solution to the much larger challenge of coping with climate-related disasters. We also are sympathetic to the views of colleagues who have written in favor of a “polluter-pays” approach to climate finance (Waslander and Vallejos 2018). At the same time, we believe that the regional risk pools bring meaningful benefits to developing countries, which extend beyond the payouts alone. Ensuring that these pools live up to their full potential, therefore, is a worthwhile endeavor. Yet, we also recognize that new sources of sustained, long-term concessional finance are needed—sources that significantly scale up funding for disaster risk finance solutions beyond what has been attempted so far. In the last section of this paper, we sketch out some options.

This paper unfolds as follows. We first examine the evolution of disaster risk finance for early response and ask to what extent developing countries are using multiple instruments to manage their disaster risk. We then look closely at the track records of CCRIF, ARC, and PCRIC, respectively, paying special attention to member countries' insurance-buying behavior and the possible drivers of this behavior. Subsequently, we examine the extent to which the risk pools are supporting, directly or indirectly, poor and vulnerable people. We then provide conclusions and recommendations. The last section outlines several options to provide scaled-up support for effective disaster risk finance solutions.

2. EVOLUTION OF SHORT-TERM DISASTER RISK FINANCE

Over the last two decades, international institutions, national governments, and risk pools have developed a range of tools to help countries mobilize short-term finance for disaster response. These tools include national disaster funds, a range of fast-disbursing loans, insurance products, and other insurance-linked securities. Figure 1 illustrates the proliferation of such innovations, and Table 1 gives examples of some of the most common instruments. In parallel, development partners have launched initiatives to coordinate efforts and support progress on disaster risk finance. For instance, in 2017, several G20 countries and the V20 jointly launched the InsuResilience Global Partnership to improve the financial resilience of climate-vulnerable developing countries (GIZ n.d.).

Figure 1 | **Chronology of Selected Innovation in Disaster Risk Finance, 2006–2018**



Notes: Cat bond: catastrophe bond; CAT-DDO: catastrophe deferred drawdown option; IDB: Inter-American Development Bank; IMF: International Monetary Fund; ARC: African Risk Capacity; PCRAFI: Pacific Catastrophe Risk Assessment and Financing Initiative; JICA: Japan International Cooperation Agency; SECURE: Stand-by Emergency Credit for Urgent Recovery; PCRIC: Pacific Catastrophe Risk Insurance Company; ADB: Asian Development Bank; IDA: International Development Association.

Source: Authors.

Table 1 | **Examples of Disaster Risk Finance Instruments**

INSTRUMENT	EXAMPLES
National disaster funds	Mexico's national disaster risk fund (FONDEN); Costa Rica's National Emergency Fund
Contingent credit lines with "soft" triggers	IBRD CAT-DDO; IDA CAT-DDO; JICA Stand-by Emergency Credit for Urgent Recovery
Contingent credit lines with "hard" triggers	IDB Contingent Credit Facility for Natural Disaster Emergencies
Sovereign parametric insurance products	CCRIF policies covering tropical cyclone, excess rainfall, and earthquake risk; PCRIC policies covering tropical cyclone and earthquake risk; ARC policies covering drought risk
Catastrophe bonds	FONDEN catastrophe bond; Pacific Alliance catastrophe bond

Notes: IBRD: International Bank for Reconstruction and Development; CAT-DDO: catastrophe deferred drawdown option; IDA: International Development Association; JICA: Japan International Cooperation Agency; IDB: Inter-American Development Bank; CCRIF: CCRIF SPC; PCRIC: Pacific Catastrophe Risk Insurance Company; ARC: African Risk Capacity.

Source: Authors.

2.1 Different Tools for Different Objectives

The short-term disaster risk financing tools that are currently available differ in terms of certain key characteristics. From the point of view of governments, the primary users, five characteristics are especially important:

- **Financial Cost:** How much will accessing the tool cost in terms of fees, charges, premiums, loan repayments, and/or interest rates?
- **Opportunity Cost:** To what extent does deploying a tool displace resources that could be used for something else?
- **Resource envelope:** Using a particular tool, how much money can the government raise per disaster and over the life of the tool?
- **Control over access:** To what extent can the government access the money at its discretion (on demand)?
- **Time incidence of cost:** Will the government have to disburse money today to cover the financial cost, or is the payment due sometime in the future?

As Table 2 shows, the tools have different financial costs. The precise cost of each tool depends on country- and instrument-specific factors, such as the government's cost of funds and the risk transfer parameters of specific insurance policies or cat bonds.

Varying levels of concessional finance are available for different instruments, which lowers the total cost for some countries. For example, the financial institutions that offer contingent credit lines offer them to various countries on different terms. The International Bank for Reconstruction and Development (IBRD), part of the World Bank Group, offers the IBRD Catastrophe Deferred Drawdown Option (CAT-DDO), which provides credit mostly to middle-income countries. The International Development Association (IDA), also part of the World Bank Group, offers the IDA CAT-DDO, which is almost identical structurally, but made for low-income countries and offered on more concessional terms than the IBRD CAT-DDO. Some countries also have received concessional finance in grant and loan form to help pay insurance premiums. Other things being equal, the availability of concessional finance for one instrument makes that instrument less costly and typically more attractive compared to others.

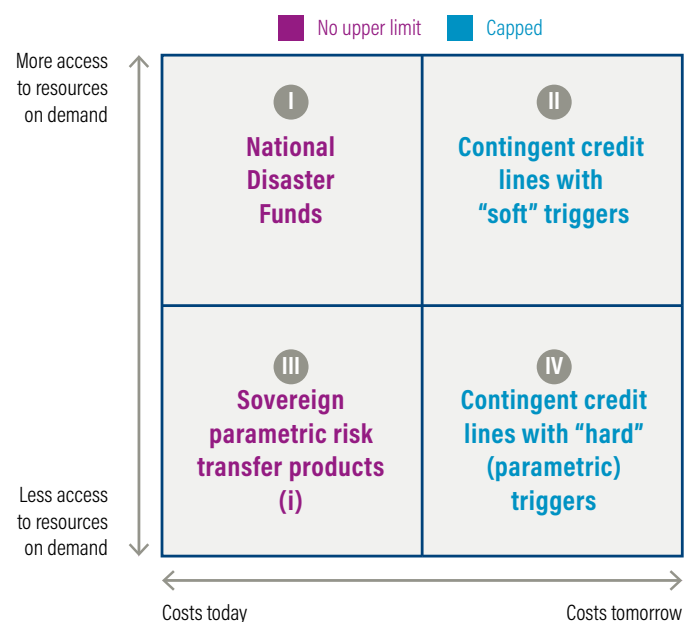
Governments also care about how much money they can raise when needed, how much control they have to access those funds at their discretion, and when they have to pay. Figure 2 plots the tools in a matrix, with the axes representing degree of accessibility (how easily governments can access the funds on demand) and the time incidence of cost (when governments must pay). We use color coding to represent basic facts about the resource envelope (how much money they can raise).

Table 2 | **Disaster Risk Finance Instruments and Their Financial Costs**

INSTRUMENT	COST
National disaster funds	Governments can capitalize reserve funds by using budgetary resources. The cost to the government is the amount budgeted for the reserve fund. Alternatively, governments can borrow money to finance disaster funds, in which case, the cost is the present value of principal and interest payments on the debt. Governments also may incur administrative or legal costs associated with establishing a reserve fund.
Contingent credit lines	There are two elements to the cost of a contingent credit: (i) the present value of principal and interest payments on any drawn-down portion of the credit (multilateral development banks typically offer interest rates that are lower than what the country would pay in the private market); and (ii) fees associated with the transaction.
Sovereign parametric insurance products	The cost is the insurance premium on the policy. The premium level is primarily determined by expected losses (given selected policy parameters). Other factors, including reinsurance and operating costs, also influence premium levels.
Catastrophe bonds	There are two elements to the cost of catastrophe bonds: (i) the present value of the coupon payments that the issuer must pay on an annual basis over the lifetime of the catastrophe bond; and (ii) fees and legal and administrative costs associated with the transaction.

Source: Authors.

Figure 2 | **Disaster Risk Finance Instruments, Organized by Control over Access, Time Incidence of Cost, and Resource Envelope**



Notes: (i) Sovereign parametric risk transfer products include insurance, catastrophe bonds, catastrophe swaps, and other parametric insurance-linked securities.

Source: Authors.

Quadrant I contains instruments, such as national disaster funds, that governments can tap into essentially at will but that carry costs that must be paid in the present. National disaster funds are typically governed by rules to ensure money is used for disaster relief-related purposes, but since the government makes the relevant rules, it retains a high degree of control over access. In terms of resource envelope, there is no formal limit on the potential size of national disaster funds, although, in practice, their size is constrained by the opportunity cost of foregoing use of limited budgetary resources today to grow disaster funds over time. In poor or highly indebted countries, the opportunity cost of these resources can be very high.

Sovereign parametric risk transfer products, including insurance and cat bonds, fall into Quadrant II. These instruments carry costs today, and access to resources on demand is constrained. In the case of sovereign parametric insurance, governments ordinarily must pay insurance premiums up front (although some governments borrow or receive grants to pay their premiums). In the case of a cat bond, costs are spread over the present and near future, since the issuer of the bond must make interest payments to bondholders regularly over a period of several years. Because the

payout will be released only if certain pre-agreed triggers are met, ease of access is low relative to national reserve funds. The resource envelopes available for insurance and cat bonds alike can be large (there is no upper bound, in principle); it ultimately depends on how much the country is willing to pay for these instruments.⁴

Contingent credit lines allow countries to push costs out into the future, but MDBs explicitly cap the size of contingent credit lines. These are loans that are pre-approved and put on “stand-by,” so the borrowing government can draw on the resources immediately following a disaster. Because these are long-term loans from development banks, their costs are typically spread out over many years. This is especially true if the loan is made on concessional terms (for instance, the IDA CAT-DDO involves repayments that are stretched over 30 to 38 years and includes a 5- to 10-year grace period). At the same time, because loanable funds at MDBs are limited, there are caps on the maximum size of a contingent credit line.⁵

The level of discretion countries have to access funds depends on the type of trigger mechanism of the contingent loan. Loans with parametric, or “hard,” triggers fall into Quadrant III. A borrowing country can only access the money if certain pre-agreed parameters, such as sustained wind speeds or modeled economic losses above a certain threshold, are met. Contingent credit lines also can have “soft” triggers; these instruments fall into Quadrant IV. They offer relatively unconstrained access to funds. Borrowing governments can draw down these lines of credit simply by declaring a state of emergency.

Each of these tools has its advantages and its limitations. Tools in Quadrant IV have political economy advantages: policymakers can access resources at will and often incur little or no cost during their time in office. These instruments, however, also have certain limitations. Countries must meet macroeconomic criteria (e.g., sustainable debt loads) to be eligible. Moreover, the loan amounts are capped, as is the number of times the lines of credit may be renewed. For countries with significant disaster risk, instruments in Quadrant IV are unlikely to be sufficient, on their own, to meet their needs. Insurance products are important to cover higher risk layers, but they are at a disadvantage as they limit access to funds and impose costs today.

2.2 Is Risk Layering Happening in Practice?

It is widely accepted that countries ideally should be deploying multiple instruments to cover different layers of risk. How that layering takes place depends on what each tool is best equipped to do and how much it costs relative to the financial protection it affords.

However, very few countries eligible to participate in CCRIF, ARC, and PCRIC appear to be following the risk-layering approach in practice. We examined the 68 countries that are currently eligible, based on MDB membership, to access MDB contingent credit lines and to buy insurance from one of the three risk insurance pools.⁶ We checked whether these countries currently have a national reserve fund, an active or planned contingent credit line, and/or an active insurance policy with one of three pools (during the 2018–19 policy season).

A few caveats are in order here. First, we focused only on a standard set of short-term disaster financing instruments. Some countries may have other, less common instruments in place, such as parametric catastrophe swaps or contingent emergency response components from the World Bank. We also did not analyze the presence of longer-term financing instruments, such as indemnity insurance for public assets. Second, we recognize that macroeconomic constraints may prevent some MDB members from accessing contingent credit lines, so the presence or absence of these instruments is not always a matter of choice. Third, we defined “national reserve fund” narrowly, excluding budget contingencies and other fiscal mechanisms that stop short of reserving funds exclusively for disasters. At the same time, we were not always able to verify whether funds on the books are actually resourced and whether they are being used for their intended purpose. We gave countries the benefit of the doubt when it comes to the effective operation of their national reserve funds.

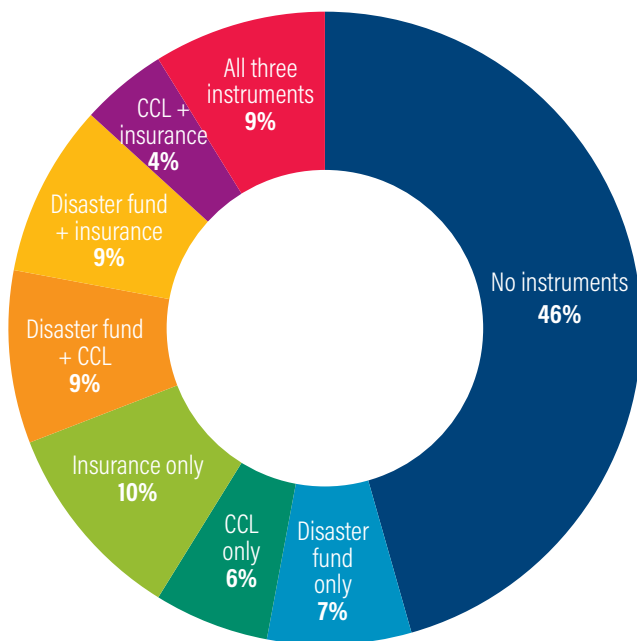
Lastly, in this exercise, we did not evaluate the adequacy of the different instruments applied or the quality of layering strategies deployed. We do not argue that just because a country deploys three disaster risk finance tools, for example, it therefore must have a more effective risk strategy than a country deploying fewer tools. The presence of multiple instruments does not, on its own, guarantee financial resilience. It does demonstrate, however, that a country’s financial authorities have invested time, effort, and money learning about different tools and considering how to manage different layers of risk in a relatively sophisticated way. In that sense, the

number of instruments deployed is a rough proxy for effective disaster risk finance strategies.

This simple exercise shows that almost half (46 percent) of the countries are deploying no disaster risk finance instruments at all (Figure 3 and Table 3). Most of these countries are in Africa, in the membership pool of ARC. Forty percent of PCRIC-eligible countries also are using no tools. On the other hand, all but one country in the Caribbean and all countries in Central America are deploying at least one instrument.

Nearly a quarter (23 percent) of countries use only one instrument. Of Caribbean countries using only one instrument, insurance is the tool of choice. In the Pacific, national reserve funds and contingent credit lines are the most popular among single-tool users. In Africa, there is no clear pattern.

Figure 3 | **Use of Disaster Risk Finance Tools among CCRIF-, ARC-, and PCRIC-Eligible Countries, 2019 (Number of Countries as a Percentage of Total)**



Notes: CCL = contingent credit line. This chart includes the 68 countries that are currently eligible to purchase insurance through CCRIF SPC (CCRIF), Pacific Catastrophe Risk Insurance Company (PCRIC), or African Risk Capacity (ARC), as well as to access multilateral development bank contingent credit lines as members of the Asian Development Bank, Inter-American Development Bank, or World Bank. Although the 55 African Union member states are eligible to purchase ARC insurance, we only include those 33 that have signed the ARC Establishment Agreement, the first required step toward purchasing ARC insurance, as currently eligible to purchase insurance. The analysis includes several contingent credit lines that are not yet finalized and one contingent loan from the Japan International Cooperation Agency.

Source: Authors.

Overall, less than a third of countries (31 percent) are deploying two or more tools, and only 9 percent are using all three.⁷ Central America stands out as the most active user of multiple instruments, with all countries deploying at least two tools. The combination of contingent credit lines and national disaster funds is the most popular combination in that region. In the Caribbean, half of the countries are deploying multiple tools, with nearly a third adding national disaster funds to their CCRIF insurance cover. A few also have contingent credit lines. In the Pacific, about a third of countries are deploying two or more tools, with 13 percent using all three. Many different combinations of instruments are emerging in the Pacific.

In sum, while disaster risk finance instruments have taken root in all four regions, the use of two or more instruments remains the exception rather than the rule. Only a significantly small fraction of countries appear to be adopting the textbook approach of matching layers of risk to specific instruments.

What might explain these varying patterns in the use of disaster risk finance instruments? The question requires further study, but a simple comparison of countries' uses of disaster risk finance tools with country characteristics suggests several possibilities (Table 4). Countries that deploy more instruments tend to have higher per capita income levels, lower public debt burdens as a percentage of their economic output, and higher scores on a popular measure of government effectiveness than the rest of the group of 68 countries. This makes intuitive sense, as countries with those characteristics are in a stronger position to adopt more sophisticated public policy tools, including for DRM. Countries that deploy more tools also tend to experience more disaster damage than their peers and to see more of their populations affected by disasters. At the same time, they receive less humanitarian aid per capita than their peers. This also makes intuitive sense; it suggests these countries are under more pressure to develop alternative disaster risk finance solutions, since they are more vulnerable yet receive less international aid.

We now turn to a closer analysis of the three regional risk pools. We briefly introduce CCRIF, ARC, and PCRIC (for a more detailed factual background, see Appendix B), we analyze insurance-buying patterns in each risk pool, and we explore potential drivers behind these patterns.

Table 3 | **Eligible Countries' Use of Disaster Risk Finance Tools by Risk Pool, 2019 (Number of Countries as a Percentage of Pool Total)**

	ARC	CCRIF CARIBBEAN	CCRIF CENTRAL AMERICA	PCRIC
No instruments	75%	7%	0%	40%
Disaster fund only	9%	0%	0%	13%
Contingent credit only	3%	7%	0%	13%
Insurance only	6%	36%	0%	0%
Disaster fund + contingent credit	3%	0%	57%	7%
Disaster fund + insurance	3%	29%	0%	7%
Contingent credit + insurance	0%	14%	0%	7%
All three instruments	0%	7%	43%	13%

Notes: This chart includes the 68 countries that are currently eligible to purchase insurance through CCRIF SPC (CCRIF), Pacific Catastrophe Risk Insurance Company (PCRIC), or African Risk Capacity (ARC), as well as to access multilateral development bank contingent credit lines as members of the Asian Development Bank, Inter-American Development Bank, or World Bank. Although the 55 African Union member states are eligible to purchase ARC insurance, we only include those 33 that have signed the ARC Establishment Agreement, the first required step toward purchasing ARC insurance, as currently eligible to purchase insurance. The analysis includes several contingent credit lines that are not yet finalized and one contingent loan from the Japan International Cooperation Agency. Columns do not always add up to 100 percent due to rounding.

Source: Authors.

Table 4 | **Relationship between Use of Disaster Risk Finance Tools and Key Economic and Political Variables**

	PERCENT OF COUNTRIES WITH					
	GNI per Capita above Median	Average Annual Humanitarian Aid per Capita below Median	Central Government Debt as a Percentage of GDP below Median	Government Effectiveness above Median	Share of Population Affected Annually by Disasters above Median	Total Annual Disaster Damage per Capita above Median
Countries Using All Three Instruments	83%	67%	83%	83%	83%	100%
Countries Using Two Instruments	80%	67%	53%	80%	60%	80%
Countries Using One Instrument	63%	38%	44%	69%	63%	56%
Countries Using No Instruments	23%	42%	42%	16%	32%	23%

Notes: Gross national income (GNI) per capita data sourced from the World Bank. Humanitarian aid data is sourced from UN OCHA's Financial Tracking Service. We calculated average annual humanitarian aid based on total humanitarian aid received by each country from 2000 to 2019. Population data is sourced from the United States Census Bureau's International Data Base. Central government debt as a percentage of gross domestic product (GDP) is sourced from the International Monetary Fund. Government effectiveness levels are sourced from the World Bank. Population affected by disasters and total disaster damage are sourced from EM-DAT. For each country, we calculated total population affected by and total disaster damage from climatological, geophysical, hydrological, and meteorological disasters from 1950 to 2019.

Sources: Centre for Research on the Epidemiology of Disasters' Emergency Events Database (EM-DAT), United Nations Office for the Coordination of Humanitarian Affairs (UN OCHA), United States Census Bureau, and World Bank, adapted by Authors.

3. CCRIF SPC

CCRIF, the oldest of the three pools, emerged as an effort to protect a region highly vulnerable to earthquakes and hurricanes. In 2004, Hurricane Ivan caused massive losses across the Caribbean, prompting Caribbean Community (CARICOM) countries, in partnership with the World Bank and other development partners, to seek new tools for managing the financial risks associated with disasters.⁸ The eventual result was the launch of the Caribbean Catastrophe Risk Insurance Facility, which enabled governments to access catastrophe insurance by pooling capital and risk. The facility was legally established in May 2007 and launched its first season in June 2007, offering parametric insurance for tropical cyclones and earthquakes to 16 member governments (World Bank 2012a). Today, CCRIF offers members in the Caribbean and Central America insurance cover for tropical cyclone, earthquake, and excess rainfall risk. Additionally, CCRIF is pilot testing a new sovereign-level parametric product for fisheries, and it plans to pilot test a new parametric drought product in the 2019–20 season.

To support insurance-buying decisions, CCRIF prepares individualized risk profiles for member countries. The profiles provide country-specific hazard and exposure mapping, information on historic losses, and estimated losses to exposed assets for different return period events. CCRIF uses the risk profiles to discuss coverage options with members and to price policies. At present, the profiles are not well suited to support broader DRM planning, although CCRIF stakeholders have indicated that they would like to improve the usability of the profiles (Interview #2, Interview #3). CCRIF also has a relatively small technical assistance program.

CCRIF has just begun its 13th policy season and is approaching an important moment in its evolution. CCRIF is grappling with how to scale up the services it offers members at a time when DRM is becoming more urgent than ever, all while preserving its financial sustainability. Also, insurance uptake in Central America has grown more slowly than expected, although CCRIF's efforts there are beginning to yield results. Furthermore, CCRIF is set to expand its product offerings for the first time since 2014, a process that will bring new challenges and opportunities.

3.1 Historical Insurance Uptake

Uptake of CCRIF insurance has been consistently strong in the Caribbean. In CCRIF's first policy year (2007–08), 16 Caribbean countries purchased coverage. Since then, uptake has remained relatively steady, with only one country—Bermuda—fully dropping coverage. Following the catastrophic 2017 hurricane season, three new Caribbean countries (British Virgin Islands, Montserrat, and Sint Maarten) joined, purchasing coverage for the first time in the 2018–19 season.

Uptake has been slower in Central America but is starting to pick up. Nicaragua joined CCRIF in the 2015–16 policy year and remained the only Central American member until Panama joined in the 2018–19 policy year. Guatemala purchased coverage for the first time in the 2019–20 policy year. Since 2007, CCRIF has made 38 payouts, totaling \$138.8 million, to 13 member countries in Central America and the Caribbean (CCRIF 2019a). Figure 4 provides a comprehensive view of uptake patterns and payouts through the 2018–19 policy year, the most recent year for which we have complete data.

3.2 Factors Influencing Insurance Uptake

Member countries, including countries that are eligible to join but have yet to do so, can be grouped into four categories based on their insurance-buying behavior: loyal buyers, recent arrivals, those that have dropped coverage, and yet-to-buy countries. Of the 28 countries eligible to participate in CCRIF, we categorize 16 as loyal buyers, 15 of which are Caribbean countries.⁹ CCRIF has five recent arrivals and one country that has dropped coverage altogether. Finally, six eligible countries have yet-to-buy CCRIF coverage. Of the six yet-to-buy countries, four are in Central America (Table 5). These groupings raise two key questions: What accounts for CCRIF's success in maintaining so many loyal buyers, and why do several yet-to-buy countries remain, especially in Central America?

Loyal Buyers

A strong focus on affordability, responsiveness to member needs, and effective management of expectations has contributed to the strong uptake and consistent renewal of CCRIF's products.

Table 5 | CCRIF Countries by Insurance-Buying Category

CCRIF CARIBBEAN COUNTRIES			
LOYAL BUYERS	DROPPED COVERAGE	RECENT ARRIVALS	YET-TO-BUY
<ul style="list-style-type: none"> ■ Anguilla ■ Antigua & Barbuda (i) ■ Bahamas, The (i) ■ Barbados ■ Belize (i) ■ Cayman Islands ■ Dominica ■ Grenada ■ Haiti ■ Jamaica ■ St. Kitts and Nevis ■ St. Lucia ■ St. Vincent & the Grenadines ■ Trinidad and Tobago ■ Turks and Caicos Islands 	<ul style="list-style-type: none"> ■ Bermuda 	<ul style="list-style-type: none"> ■ British Virgin Islands ■ Monserrat ■ Sint Maarten 	<ul style="list-style-type: none"> ■ Guyana ■ Suriname
CCRIF CENTRAL AMERICA COUNTRIES			
LOYAL BUYERS	DROPPED COVERAGE	RECENT ARRIVALS	YET-TO-BUY
<ul style="list-style-type: none"> ■ Nicaragua 	<ul style="list-style-type: none"> ■ None 	<ul style="list-style-type: none"> ■ Panama ■ Guatemala (ii) 	<ul style="list-style-type: none"> ■ Costa Rica ■ Dominican Republic ■ El Salvador ■ Honduras

Notes: (i) These countries continue to participate in CCRIF despite having switched products or discontinued coverage for some products. (ii) Guatemala purchased coverage for the first time in the 2019–20 policy year.

Source: CCRIF SPC (CCRIF), adapted by Authors.

AFFORDABILITY

CCRIF has consistently worked to improve the affordability and value for money of its products.

In its first several years of operation, CCRIF lowered its premium multiple, resulting in a cumulative price reduction of around 30 percent. The premium multiple is the multiple of average expected losses that CCRIF charges to cover not only average expected losses but also its operating costs and reserve growth (World Bank 2008). CCRIF also reduced its participation fee (from 100 percent of premium costs to 50 percent) for members with three continuous years of coverage (World Bank 2012a).¹⁰ Lower premiums allowed many members to steadily increase their coverage levels over time (World Bank 2012a).

In addition, CCRIF has provided premium discounts, and some countries have received concessional finance for premium support. On several

occasions, CCRIF has discounted member premiums by 25 percent in years following no-claim years (World Bank 2012a). To encourage members to increase coverage levels for the 2017–18 season, CCRIF also introduced a 35 percent discount for additional coverage purchased over the 2016–17 season (CCRIF 2017). Development partners also have helped ensure the affordability of CCRIF products by providing concessional premium financing, detailed in Appendix B. This financial support has allowed some countries to try out CCRIF products at little up front cost and to eventually incorporate the premium cost into their annual budgeting processes (World Bank 2017d).

Several factors have allowed CCRIF to reduce premiums and offer discounts without jeopardizing its financial stability. First, CCRIF has been able to maintain a healthy level of capitalization thanks to donor grant contributions at inception and

prudent financial management. Second, CCRIF has kept its in-house operating costs low by outsourcing significant portions of its operations, including reinsurance management, asset management, and information technology, to third-party service providers (World Bank 2017d). Third, the facility's large and steady membership has ensured stable premium revenue over time. Finally, CCRIF has positioned itself to take advantage of historically low prices in the reinsurance market and also has explored alternative risk transfer mechanisms in case the reinsurance market hardens.¹¹

Yet, many Caribbean members still buy less coverage than they should. Ideally, countries would purchase enough coverage to fully provide for their immediate, postdisaster liquidity needs, although this may not always be possible given current coverage limits. The IMF has found, however, that many Caribbean countries buy insufficient coverage “mainly because of the perceived high cost and competing developmental needs under fiscal sustainability challenges, and the imperfect correlation between parametric triggers for disbursement and damages” (Guerson and Lissovnikov 2019). CCRIF itself acknowledges the challenge. It characterizes an “adequate” level of coverage to be around 25 percent of overall government exposure to earthquake and hurricane risk, but it found that most member countries' coverage levels are well below this level (Spranger 2019).

In addition, the facility has not been able to take full advantage of the risk diversification benefits of its expanding membership. When CCRIF expanded its insurance offerings to Central America, the pool's leadership considered keeping Caribbean and Central American countries in the same risk pool. Doing so would have increased diversification by adding countries from a different geography and facing different perils. Greater diversification would help CCRIF lower premiums for everyone in the pool. CCRIF, however, opted to keep separate risk pools for Central America and the Caribbean to address concerns that a disaster in Central America could deplete the Caribbean's capital base. Slow growth of new Central American buyers also has hindered diversification.

FLEXIBILITY AND RESPONSIVENESS TO MEMBER NEEDS

Over the years, CCRIF has proved flexible and responsive to member needs. For example, at the request of member countries, CCRIF lowered the minimum attachment point—which functions like a deductible in an ordinary insurance policy—for its tropical cyclone

product. Many members asked CCRIF to provide coverage for lower-intensity, higher-frequency storms to complement the facility's coverage for relatively infrequent and severe events. After CCRIF's first year of operation, its board of directors reduced the minimum attachment point for the tropical cyclone product from a 1-in-20-year return period to a 1-in-15-year return period. The following season, all 16 participating governments renewed their coverage, and 6 lowered their attachment points to the new, lower trigger. CCRIF later reduced the minimum attachment point again to 1 in 10 years (World Bank 2008).

CCRIF also responded to member demand for an excess rainfall product. While many CCRIF countries are exposed to flooding, the tropical cyclone product does not cover flood losses. This gap created situations where member countries suffered significant losses from tropical cyclones but did not receive payouts under their tropical cyclone policies because the losses were predominantly flood-related (Dlugolecki et al. 2013). Members also faced flooding unrelated to tropical cyclones. As a result, member countries called on CCRIF to develop an excess rainfall product to fill the gap. Although this product was somewhat slow to materialize, CCRIF launched an excess rainfall product in 2014, setting the minimum attachment point to cover 1-in-5-year events, a lower attachment point than that of its other products.

At times, CCRIF has worked with countries to customize coverage parameters to better suit their unique circumstances. For instance, it has allowed two countries, The Bahamas and Trinidad and Tobago, to divide their excess rainfall policies for subnational units (CCRIF 2018b). In the 2018–19 policy year, The Bahamas had three separate zones for its excess rainfall and tropical cyclone coverage, and it selected different ceding percentages (i.e., the portion of risk passed on to the risk pool) for each of the three zones. The ceding percentages for its excess rainfall coverage, for example, ranged from 3.5 percent in the northeast to 75 percent in the southeast in 2018–19.

BASIS RISK AND UNMET EXPECTATIONS

To minimize the basis risk of its products, CCRIF has invested in improving its models. Basis risk refers to the risk that index measurements do not match actual on-the-ground losses. In the 2011–12 season, CCRIF introduced a new model that used modeled losses (i.e., estimated economic losses caused by an event) to trigger payouts rather than simply using parameters relating to the magnitude of an event; this change helped

improve the accuracy of the model (Artemis.bm 2010). Since then, CCRIF has continued to invest in research and development to update and improve its models. It introduced an upgraded excess rainfall model for the 2019–20 season that incorporates soil saturation in its loss calculations, improving accuracy when modeling smaller, more localized severe rainfall events (CCRIF 2019d). CCRIF also overhauled the model underpinning its tropical cyclone and earthquake products for the current 2019–20 season. CCRIF now owns its models outright. This allows the facility to update and tailor them more easily than by leasing the models from outside vendors.

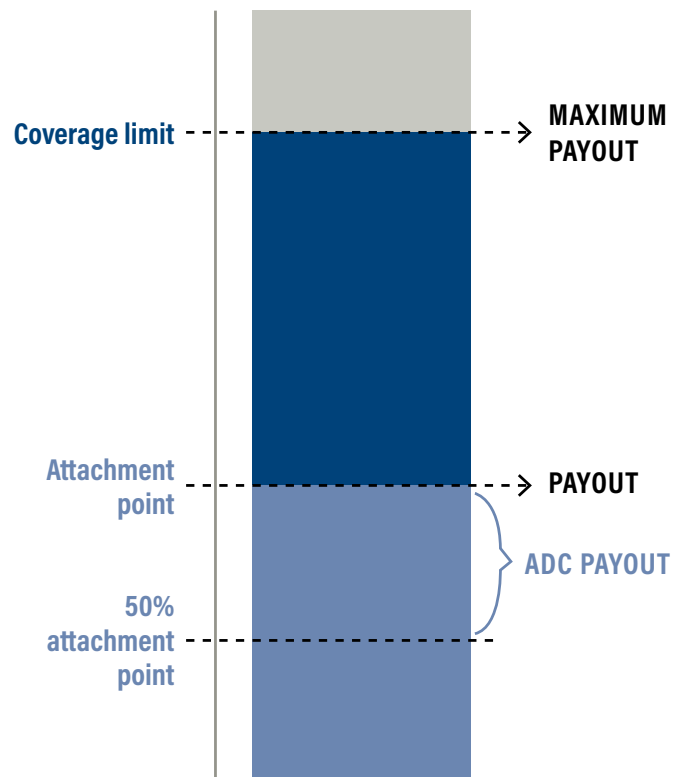
To further reduce the risk that the model fails to capture an event that should trigger coverage, CCRIF has incorporated a “secondary trigger” into its excess rainfall product. The excess rainfall model derives daily rainfall estimates from three separate sources—satellite data and data from two other sources. It uses the satellite data to determine whether an eligible rainfall event has occurred. This is the primary trigger, necessary in all cases, to trigger a payout. If the satellite data and at least one of the other two data sources result in estimates of economic losses above the policy’s threshold, then the policy triggers and a payout is issued. If the satellite data generate losses above the threshold and neither of the other two sources do, then the policy may still be triggered if the United Nations Office for the Coordination of Humanitarian Affairs website, ReliefWeb, also reports a disaster in the area (CCRIF 2019c). This second mechanism, employing a third-party disaster alert, helps to catch events missed by the other data sources.

In addition, CCRIF has introduced a new feature, the Aggregated Deductible Cover (ADC), aimed at managing unmet payout expectations, whether attributable to modeling failures or not. In 2017, CCRIF added the ADC to its tropical cyclone and earthquake policies (CCRIF 2018b). If modeled losses amount to at least 50 percent of the attachment point but fail to trigger the policy, then the country receives a small payout (Figure 5). The maximum amount a country can receive under the ADC is equal to its annual premium for that particular policy. During the 2017–18 season, CCRIF made ADC payments to six countries, and in 2018–19, it made one ADC payment to Haiti for its earthquake policy (CCRIF 2018a).

CCRIF also introduced the Reinstatement of Sum Insured Cover to facilitate coverage for the entire policy period. This addition to the original tropical cyclone and earthquake policies provides access to coverage for the remainder of a policy year, even after the policy has been triggered and the maximum coverage limit reached. The measure prevents a situation in which the insurance cover is exhausted early in the policy year, leaving the country exposed until policy renewal the following year (CCRIF 2018b). In 2017, the maximum payout was made to Antigua and Barbuda following Hurricane Irma. The tropical cyclone policy was immediately reinstated, allowing the policy to trigger a second payout that year after the country was hit by Hurricane Maria.

Finally, CCRIF has provided targeted technical assistance and financial support to governments after disasters that did not result in payouts. For example, it provided small grants (ranging from \$85,000

Figure 5 | CCRIF’s Aggregated Deductible Cover



Source: CCRIF SPC (CCRIF), adapted by Authors.

to \$115,000) to support recovery efforts in Jamaica, Haiti, and The Bahamas (CCRIF n.d.). While the three were affected by Hurricane Sandy, none of their policies triggered a payout. While such measures are modest relative to a full insurance payout, they demonstrate responsiveness to the membership in the aftermath of nonpayout events.

Yet-to-Buy Countries

Despite CCRIF's success maintaining strong and stable uptake, six countries have yet-to-buy coverage. CCRIF management has consistently engaged with stakeholders in these countries, but various factors contribute to their reluctance to join.

CONCERNS ABOUT THE MODELS

Some Central American governments have expressed concern about the appropriateness of CCRIF's excess rainfall model to their regional context. In calculating losses, CCRIF's current excess rainfall model does not account for the movement of water once it hits the ground. Instead, it relies exclusively on the aggregated amount of rainfall over an affected area to estimate losses. Some observers argue that this approach is more appropriate for small islands, which typically have simpler hydrological conditions and topographies than countries with larger accumulation basins, where more sophisticated flood modeling is required (Interview #4). CCRIF is seeking to address this issue by developing a new runoff module for the excess rainfall model. It hopes the addition will make the product more attractive to Central American clients.

Some prospective members have raised concerns about data sources used by CCRIF's models. In El Salvador, for example, stakeholders expressed concern that CCRIF's models rely exclusively on data sources from outside the region, such as the U.S. Geological Survey or U.S. National Hurricane Center. They argue that these sources are not always well suited to capture local risks and have requested that CCRIF supplement the international data with data generated locally. Conversations with CCRIF are ongoing (Interview #5). Some meteorological agencies have more general objections with the modeled-loss approach, expressing a preference for simpler triggers, such as rain volume as measured by their own ground-based rain gauges (Interview #6).

PROTECTION AGAINST HIGHER-FREQUENCY EVENTS

Some countries would like CCRIF to offer coverage for higher-frequency events, particularly for frequent flooding. Lower-intensity but recurring

disasters can generate significant losses, posing economic, fiscal, and political challenges for governments. Some prospective members have requested coverage for more frequent rainfall events (e.g., 1-in-3-year return period events). Such coverage would be costly and could increase basis risk (Interview #3). Consequently, the pool has declined to offer this coverage so far. CCRIF has emphasized that other instruments, such as disaster funds or budget contingencies are more appropriate to deal with higher-frequency events (Interview #3).

AFFORDABILITY

Some Central American countries are operating under significant fiscal constraints that make paying for insurance premiums a challenge. Honduras originally planned to join CCRIF at the same time as Nicaragua, and, in June 2014, the World Bank approved an IDA loan to finance Honduras' membership fee and premiums for seven years (World Bank 2014). The country ran into serious macroeconomic difficulties, however, and that same year found it necessary to undertake a \$189 million stabilization program with the IMF. Honduras has indicated that it would reconsider coverage as macroeconomic conditions stabilize.

PRODUCT AVAILABILITY

Several of the yet-to-buy countries are interested in coverage for different perils. Guyana and Suriname have not yet joined CCRIF because its current product offerings are not as relevant to them, given their specific hazard profiles. Both countries have expressed interest in a river flood model (Interview #2). Also, several Central American countries are interested in drought coverage, but that product is not yet available. CCRIF plans to pilot test the drought product in select countries in 2019–20.

Recent Arrivals

Guatemala purchased excess rainfall coverage for the 2019–20 policy year, making it CCRIF's newest member. While Guatemala had expressed interest in the product for several years, the process of securing legislative approval to buy coverage took nearly two years (Interview #7). Technical experts from Guatemala's meteorological agency also had concerns about CCRIF's model that needed to be addressed (Interview #3). Guatemala's Ministry of Finance is now evaluating the earthquake product and forthcoming drought product (Interview #7).

Three new Caribbean countries, the British Virgin Islands, Montserrat, and Sint Maarten, purchased CCRIF coverage for the first time in the 2018–19 season. The three countries suffered extensive damage

from Hurricane Irma and Hurricane Maria in 2017, and their experiences with those storms prompted them to consider ways, including CCRIF insurance products, to manage future risks. In addition, Sint Maarten was able to secure grant funding from the Government of the Netherlands to pay its participation fee and premiums for two years (World Bank 2018g).

Panama also joined CCRIF and purchased excess rainfall coverage in the 2018–19 season. Strong political will to manage disaster risk more effectively and the government’s growing focus on disaster risk finance were reportedly important factors in its decision to join (Interview #3). Beginning in 2012, Panama developed a comprehensive approach to disaster risk financing that included a reserve fund and two different contingent credit lines (World Bank 2015e). In 2014, Panama adopted a Strategic Framework for the Financial Management of Disaster Risk, which indicated that Panama was studying whether to purchase CCRIF insurance (World Bank 2015e). CCRIF met regularly with government stakeholders in Panama, providing data on historic losses and helping Panamanian officials understand CCRIF products by demonstrating how coverage would have behaved during past disasters (Interview #3). Also, Panama is Central America’s only high-income country, which enabled it to join CCRIF without premium support.

We draw the following conclusions from CCRIF’s experience:

- CCRIF has established itself as a trusted institution and has been able to attract and retain clients by offering frequent and timely payouts, improving the affordability of its products, responding to member demands through new products and customization of existing ones, and innovating to manage unmet expectations.
- CCRIF can do more to fulfill its unique value proposition. At present, its risk models and country risk profiles do not support applications beyond insurance buying, and its technical assistance program is modest.
- Managing the costs of high-frequency events remains a challenge for many countries in the region. Demand for lower attachment points may be indicative of gaps in these countries’ disaster risk financing toolkits. In the Caribbean, for example, very few countries have contingent credits, but macroeconomic conditions may preclude the use of this tool in some Caribbean countries.

4. AFRICAN RISK CAPACITY

ARC began as an effort to respond to recurrent drought-driven food insecurity in Africa. Droughts across the continent, growing awareness of climate-related risks to African countries, and a recognition of CCRIF’s early successes prompted African countries, World Food Programme (WFP) experts, and development partners to develop an African-owned regional risk pool. African Union (AU) officials endorsed the establishment of the African Risk Capacity Agency (ARC Agency) in July 2012, and in November of that year, 18 AU member states signed the ARC Establishment Agreement, establishing the ARC Agency as a specialized agency of the AU. ARC officially launched in 2014, providing insurance for Kenya, Mauritania, Niger, and Senegal. Through the African Risk Capacity Insurance Company Limited (ARC Limited), the entity that underwrites risk transfer products, ARC started offering member countries parametric drought insurance.

ARC is unique among the three pools in that, to purchase insurance, member countries must first complete an extensive preparatory process. They undergo extensive capacity building, which involves the customization of ARC’s Africa RiskView modeling platform (ARV) to capture the country’s particular risk profile, among other things. The ARV incorporates country-specific hazard and vulnerability data to produce the modeled losses that underpin ARC’s insurance product. These modeled losses represent the estimated costs to governments of responding to a drought event. Countries also must develop contingency plans to guide the use of ARC insurance payouts. At the end of the process, countries receive a Certificate of Good Standing from ARC.¹²

ARC’s original aspiration was to indirectly insure 150 million vulnerable African people against disasters through \$1.5 billion in aggregate coverage across 30 African countries by 2020; so far, however, ARC has been unable to reach these targets. Eight countries have purchased insurance from ARC, but the number of countries buying insurance has declined steadily over time. To date, ARC has indirectly insured approximately 50 million people and has provided about \$500 million of aggregate insurance cover. These shortcomings have led stakeholders to engage in intense reflection on the future of the risk pool. ARC intends to soon launch a refreshed strategy.

4.1 Historical Insurance Uptake

Uptake of ARC insurance peaked in 2015–16, when seven countries purchased coverage; it has been declining since. Only three countries signed an insurance policy in the 2018–19 policy year. Only one of those countries, The Gambia, has paid for its policy as of this writing (African Risk Capacity 2019). Figure 6 provides a detailed view of uptake patterns and payouts.

Limited insurance uptake has led to a decline in ARC Limited’s premium income. Net income has decreased from a net gain of approximately \$22 million in 2014 to a net loss of approximately \$6 million in 2018. From 2016–18, ARC Limited’s capital base decreased by approximately \$18 million (African Risk Capacity 2019).

Nonpayment of premiums has exacerbated ARC’s declining income. In some cases, countries have signed insurance policies but have not paid the associated premiums. Historically, ARC Limited has allowed these policies to remain in force despite nonpayment. ARC Limited has written off many of these premiums as unlikely to be paid (African Risk Capacity 2019).

Noncontractual payouts also have hurt ARC’s bottom line. ARC Limited has made two noncontractual payouts—instances where ARC Limited makes a payout to a country even when the drought model fails to trigger a payout. In January 2017, ARC Limited made an \$8.1 million noncontractual payout to Malawi and, in 2018, a \$2.4 million noncontractual payout to Mauritania. ARC Limited makes these payouts to address unmet expectations in countries where drought has occurred, but the model did not trigger a payout because of basis risk or because the modeled response costs were below the policy’s threshold. In instances of noncontractual payouts, ARC Limited cannot generally recoup losses from their reinsurance contracts.

Lack of premium revenue, nonpayment of premiums, and noncontractual payouts could eventually pose financial challenges for ARC. Significant growth in income will be necessary to ensure ARC Limited’s long-term sustainability. At the same time, ARC Agency may need to find a consistent revenue source beyond donor contributions to ensure its ability to consistently operate in the future. Implementing a

Figure 6 | Historical ARC Member Country Insurance Uptake

	BURKINA FASO	KENYA	MALAWI	MALI	MAURITANIA	NIGER	SENEGAL	THE GAMBIA
2014–15	Did not purchase an insurance policy	Purchased an insurance policy	Did not purchase an insurance policy	Did not purchase an insurance policy	6.3	3.3	16.5	Did not purchase an insurance policy
2015–16	Did not purchase an insurance policy	Purchased an insurance policy	8.1 (i)	Did not purchase an insurance policy				
2016–17	Purchased an insurance policy	Did not purchase an insurance policy	Did not purchase an insurance policy	Did not purchase an insurance policy				
2017–18	Purchased an insurance policy	Did not purchase an insurance policy	Did not purchase an insurance policy	Did not purchase an insurance policy	2.4	Did not purchase an insurance policy		
2018–19	(ii)	Did not purchase an insurance policy	Did not purchase an insurance policy	Did not purchase an insurance policy	Did not purchase an insurance policy	Did not purchase an insurance policy	(ii)	Purchased an insurance policy
TOTAL PAYOUTS (Millions \$US)	-	-	8.1	-	8.7	3.3	16.5	-

Notes: In the first few years, some countries may not yet have completed the capacity building program, so red squares may not necessarily represent an active decision not to buy insurance. Numbers represent insurance payouts.

(i) Malawi received a delayed payout for the 2015–16 drought season in January 2017.

(ii) Burkina Faso and Senegal signed insurance policies for the most recent risk pool, although they have not yet paid their associated insurance premiums.

Source: African Risk Capacity (ARC), adapted by Authors.

brokerage fee on premiums could provide revenue, but without sufficient premium income, this revenue stream would not cover ARC Agency’s operations. Doing so may also raise concerns about ARC Agency’s ability to provide impartial advice to African countries.

There are signs, however, that member countries remain interested in what ARC has to offer.

Between 2014 and 2019, the number of member countries with Certificates of Good Standing increased from 5 to 11. This suggests countries remain interested in ARC’s products and capacity building but have declined to purchase insurance due to other factors.

4.2 Factors Influencing Insurance Uptake

ARC currently has 3 loyal buyers, 5 countries that have dropped coverage, and 25 countries that have yet to purchase insurance (Table 6).

The 55 AU member states are eligible to engage with and purchase insurance through ARC. Table 6 includes only

the 33 countries that have signed the ARC Establishment Agreement, which is the first step toward purchasing an insurance policy. The categorization exercise raises several questions, including what caused five countries to drop coverage; why so many countries remain yet-to-buy countries, despite many that have active engagement with ARC; and what factors have driven the loyal buyers to stay in the pool. We classify Burkina Faso and Senegal as loyal buyers, as they each signed insurance policies in the latest policy year. Both countries, however, have yet to pay for the premiums associated with their policies as of the date of this paper.

Dropped Coverage

Countries that have dropped coverage generally have voiced concerns about unmet expectations relating to the drought model and product and about product affordability. Political risk relating to electoral cycles also has played a role in some cases.

Table 6 | **ARC Countries by Insurance-Buying Categories**

AFRICAN RISK CAPACITY COUNTRIES			
LOYAL BUYERS	DROPPED COVERAGE	RECENT ARRIVALS	YET-TO-BUY
<ul style="list-style-type: none"> ■ Burkina Faso ■ Gambia, The ■ Senegal 	<ul style="list-style-type: none"> ■ Kenya ■ Malawi ■ Mali ■ Mauritania ■ Niger 	None	<ul style="list-style-type: none"> ■ Benin ■ Burundi ■ Central African Republic ■ Chad ■ Comoros ■ Côte d'Ivoire ■ Djibouti ■ Gabon ■ Ghana ■ Guinea ■ Guinea Bissau ■ Liberia ■ Libya ■ Madagascar ■ Mozambique ■ Nigeria ■ Republic of Congo ■ Rwanda ■ Sahrawi Arab Democratic Republic ■ São Tomé and Príncipe ■ Sierra Leone ■ Sudan ■ Togo ■ Zambia ■ Zimbabwe

Notes: Only includes countries that have signed the African Risk Capacity Establishment Agreement. We include Burkina Faso and Senegal as loyal buyers because they each signed insurance policies during the 2018–19 policy year that went into force. We acknowledge that, at the time of this paper, neither country had paid its associated premiums.

Source: African Risk Capacity (ARC), adapted by Authors.

UNMET EXPECTATIONS

Unmet payout expectations have played a key role in Kenya's decision to drop coverage. In two consecutive policy years, Kenya experienced localized droughts, but modeled response costs were too low to trigger payouts. In the 2014–15 policy year, Kenya paid \$9 million in premiums for the maximum ARC drought coverage of \$30 million. Kenya split its coverage into two policies, one for each of its two rainy seasons (e-Pact 2017a). In both rainy seasons, different parts of Kenya experienced below average rains. Despite localized drought conditions that affected populations, the modeled response costs were not sufficient to trigger a payout (ARC 2015b, 2015a).

Kenya again paid \$9 million for \$30 million of coverage in the 2015–16 policy year and split its policy further to account for localized droughts. Kenya split its policy into four smaller policies, covering each rainy season in each of its arid and semi-arid territories. Again, Kenya experienced localized drought. ARV estimated that 1.1 million people were affected by drought in the long rainy season, with response costs below the policy trigger levels (ARC 2016a).

Stakeholders from Kenya have contrasting views of what happened. In each case, ARV anticipated the effects of drought, but the modeled response costs were below the attachment points of Kenya's policies. According to e-Pact (2017a), some Kenyan officials, particularly those involved in the ARV customization process, understood that the model behaved as designed; they were nonetheless disappointed that localized droughts did not trigger a payout. Others, particularly more senior political decision-makers, believed that the ARV model did not accurately calculate the impacts of these droughts. ARC has not publicly stated whether basis risk played a role in the model outcome.

Unmet payout expectations during the 2015–16 policy contributed to Malawi's decision to drop coverage. Malawi paid \$4.7 million for \$30 million of coverage in the 2015–16 policy year. It experienced intense dry spells and high temperatures in the beginning of the rainy season, followed by increased rain toward the end of the season. Early in the season, ARV estimated that a significant number of people would be affected, but by the end of the season, after rains increased, ARV's estimate was revised down (to approximately 20,000 people). ARV's estimated response costs fell well below the threshold to trigger a payout (e-Pact 2017a). Malawi's govern-

ment, on the other hand, estimated 6.7 million people were affected by the drought (Mutharika 2016).

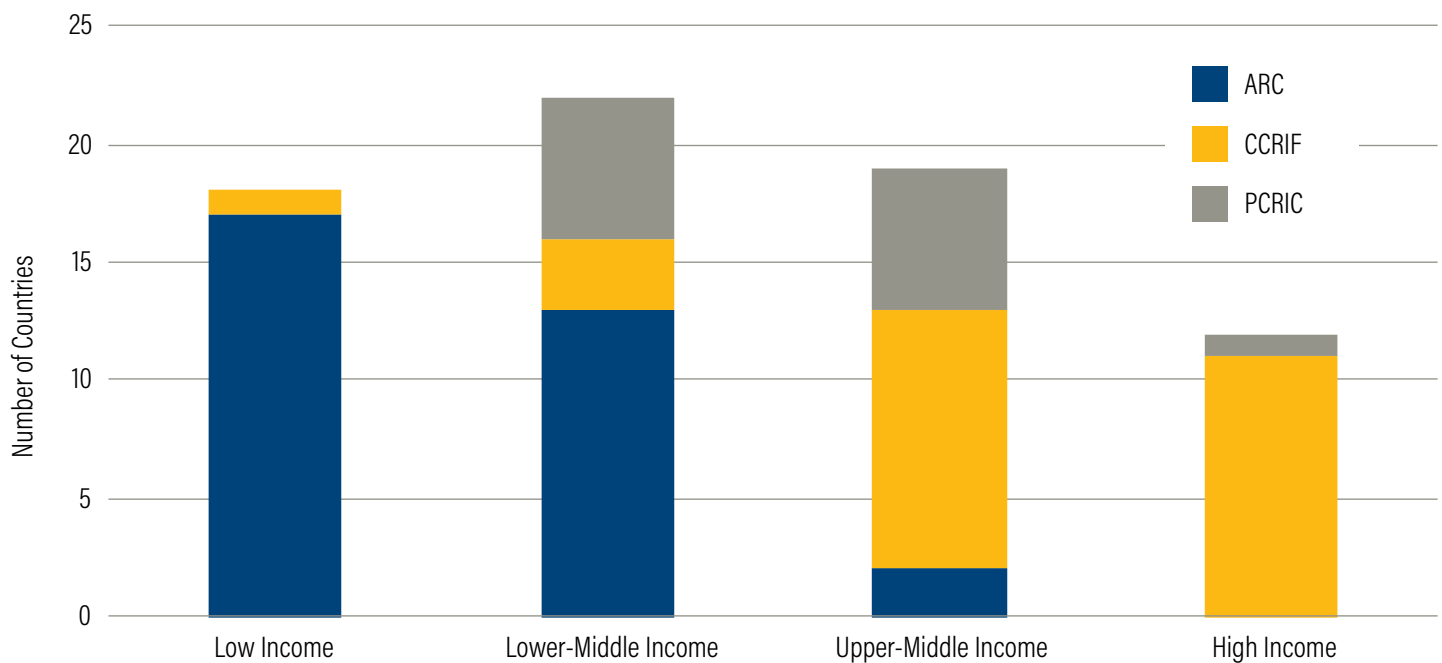
Malawi's government immediately disputed ARV's end-of-season report, which led to a ground-truthing exercise. The exercise found that the ARV model had used a different crop variety than what had actually been planted, but it is unclear whether this variation was the primary cause of discrepancies between modeled estimates and actual conditions, as the report found that both crop varieties were affected by the drought (e-Pact 2017a). In a public statement, ARC attributed the discrepancies to crop varieties and out-of-date farming practices that were used in the model (ARC 2017a). The report, however, also found that higher-than-average temperatures—not included in the drought model parameters at the time—hurt crop yields (e-Pact 2017a). ARC subsequently incorporated temperature and the timing of dry spells into the drought model, although it did not publicly attribute the model failure to a lack of temperature parameters. In January 2017, months after drought had affected Malawi, ARC revised its customization of ARV and provided a retroactive payout of \$8.1 million. This payout came too late to help the country fight the worst effects of drought.

The cases of Kenya and Malawi caused a loss of trust and confidence in ARC's drought model and its product. Groups such as ActionAid and the Heinrich Böll Foundation published reports critical of ARC and its drought product.¹³ Some stakeholders believe that ARC's ARV customization process is flawed and that ARV does not accurately model, or compensate for, localized droughts (e-Pact 2017a). ARC has recently developed and adopted a set of basis risk principles to navigate basis risk events with member countries (Interview #11) although these are not yet publicly available.

AFFORDABILITY

Many African countries are among the poorest in the world. They tend to be poorer than CCRIF and PCRIC members, which heightens the challenge of premium affordability in the case of ARC. Figure 7 compares the World Bank income classifications of countries eligible to join each of the three pools. A complete assessment of the relative affordability of premiums would require comparison of additional factors, including annual budget size relative to premiums; this information, however, is not readily available for all countries. There is widespread sentiment among ARC stakeholders that African countries face particularly severe challenges in paying premiums for ARC's insurance product.

Figure 7 | **ARC-, CCRIF-, and PCRIC-Eligible Countries by World Bank Income Classification**



Notes: Only includes ARC countries that have signed the ARC Establishment Agreement. Excludes five eligible countries that are not members of the World Bank: Anguilla, Cook Islands, Montserrat, Niue, and Sahrawi Arab Democratic Republic. ARC: African Risk Capacity; CCRIF: CCRIF SPC; PCRIC: Pacific Catastrophe Risk Insurance Company.

Source: World Bank, adapted by Authors.

The premium affordability challenge has been exacerbated by the fact that African countries have traditionally relied entirely on their own resources to pay for ARC premiums. Unlike members of the other pools, ARC countries have not received concessional finance, either through IDA or from bilateral donors, to help pay for premiums. This is in part due to the initial design of ARC, which included an explicit decision by stakeholders not to offer direct premium subsidies. It is not clear, however, why African countries—many of which are IDA-eligible—have not used IDA resources to support their premium payments. The World Bank, which is closely involved with CCRIF and PCRIC, has facilitated the use of IDA resources to support premiums in those pools. It is unclear why this has not happened in ARC (Interview #9, Interview #10).

The short return periods of ARC policies also contribute to lower cost effectiveness. ARC currently sells insurance policies that cover relatively frequent events. For example, Senegal’s policy is currently

structured with a 1-in-4-year return period attachment point (Interview #11). Other ARC countries purchasing insurance have designed their policies to cover droughts with a 1-in-5-year return period. Using insurance to cover relatively frequent events generally results in higher premiums per dollar of coverage than using insurance to cover less frequent risks.

Premium affordability is cited as a major factor in some ARC members dropping coverage. Niger, which was an initial participant in ARC’s risk pool and received a \$3.3 million payout in the 2014–15 policy year, dropped insurance coverage in the 2016–17 policy year because it could not secure sufficient money to renew its policy. Niger has reportedly remained out of the risk pool for the same reason, despite its interest in the product (Interview #11). Niger is one of the poorest countries in the world, with a gross national income per capita of \$360 as of 2017. This level falls significantly below many CCRIF and PCRIC countries, many of which have received concessional finance to pay their premiums.

Competing budgetary priorities weigh heavily on ARC’s low-income members, influencing perceptions of premium affordability. Many ARC countries face urgent social needs and find it difficult to set aside money for an insurance policy that could instead go to social protection or risk reduction programs (Interview #12). While the concept of “affordability” ultimately reflects a political choice by governments on how to deploy scarce budgetary resources, it is clear that among low-income ARC countries, those political choices are especially challenging, particularly in the absence of premium support.

To assist countries interested in buying coverage, ARC helped launch the Africa Disaster Risks Financing Programme (ADRFi) in 2018 (ARC 2018b). Developed in close coordination with the African Development Bank (AfDB), the program will provide countries buying ARC insurance cover with direct premium subsidies of up to 50 percent of total premiums over a five-year period. To access ADRFi funds, countries must commit to use their own resources to fund the nonsubsidized portion of premiums and to hold a Certificate of Good Standing with ARC. To pay for their own half of the premium, countries may use funds from their concessional financing envelopes in the AfDB’s African Development Fund (ADF). Finally, countries must sign a five-year commitment to purchase ARC cover using ADRFi support. The subsidy will be phased out over the five years and by the fifth year, countries must pay 100 percent of their premiums.

Multiple countries have expressed interest in the program, but barriers to a widespread rollout remain. Burkina Faso, Chad, The Gambia, Madagascar, Malawi, Mali, Mauritania, Niger, and Senegal have submitted letters of interest to participate; however, many countries have already committed their 2017–19 resource envelopes to other purposes. Now they must wait until more resources become available in 2020 (Interview #26). Also, not all African countries, including Senegal, are eligible to access ADF funds under the ADRFi program.¹⁴ Finally, resources to finance the direct premium subsidies are still modest. To date, only the AfDB and ARC have committed resources to ADRFi, although other donors are expected to make commitments.

POLITICAL RISK

Electoral cycles pose an additional risk to continuity in ARC uptake. The period leading to national elections can lead to shifts in spending priorities, displacing funding originally intended for ARC premiums. Furthermore, discontinuities in government administrations that often accompany shifts in power after elections can interrupt the timely payment of insurance premiums. Two of ARC’s most engaged countries, Mauritania and Senegal, recently went through electoral cycles that reportedly caused difficulties to ARC policy renewal in the 2018–19 policy year. In the case of Senegal, a change in spending priorities appears to have been most important, causing difficulties in paying premiums after signing its insurance policy. In Mauritania, interruptions in administration, associated with a change of government, caused its policy to lapse (Interview #11). Electoral cycles also were reportedly a factor in Kenya’s policy nonrenewal (e-Pact 2017a).

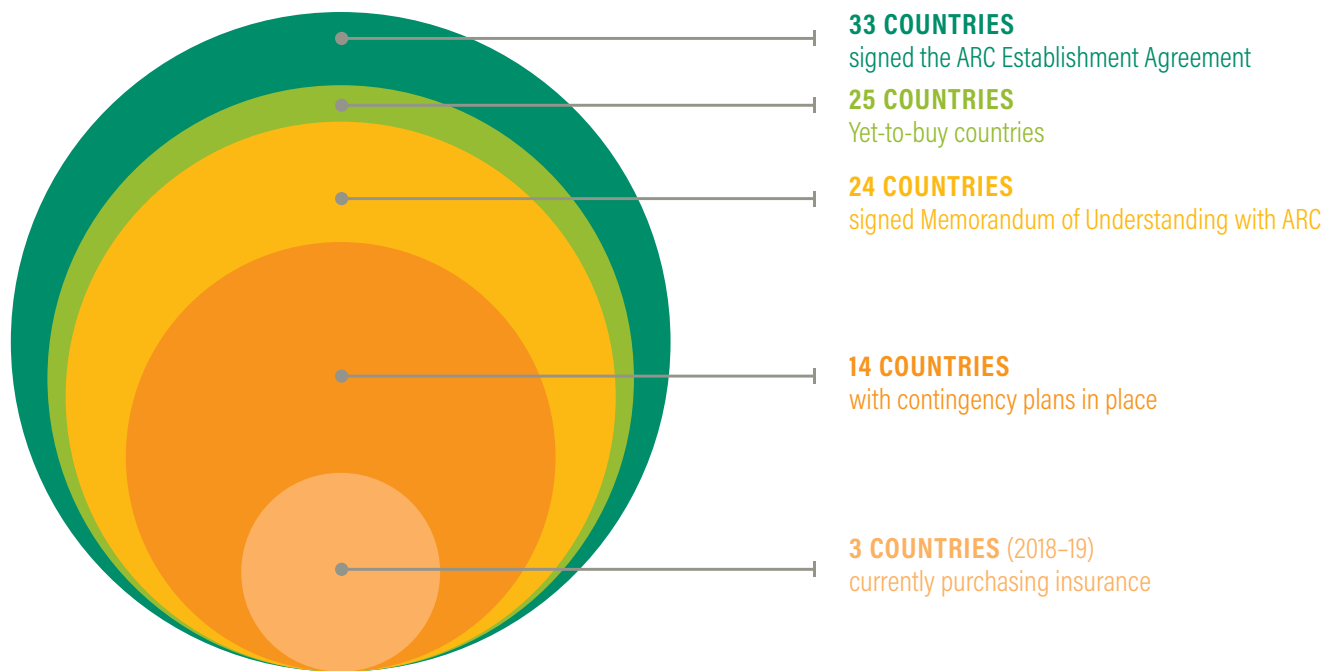
Yet-to-Buy Countries

Countries that have yet-to-buy ARC insurance cover currently represent the overwhelming majority of ARC member states (Figure 8). Of the 55 African Union member states, 33 have signed the ARC Establishment Agreement. As of this writing, 25 of the 33 countries that have signed the ARC Establishment Agreement have yet to purchase ARC insurance. A number of factors appear to drive nonbuying behavior, including limited product offerings, insufficient engagement with finance ministries, and regional politics.

PRODUCT AVAILABILITY

African countries face a wide range of perils, but ARC currently provides insurance only for drought. Other events such as floods, tropical cyclones, outbreaks and epidemics, earthquakes, and volcanic eruptions also are common in some African countries, and some can be costlier than droughts. Several countries have been actively engaged with ARC but either they do not have high exposure to drought risk or are not interested in ARC’s drought product as currently structured. Comoros and Madagascar, for example, have expressed interest in the tropical cyclone product, which is not yet available. Madagascar already has negotiated and developed its participation in ADRFi to facilitate tropical cyclone coverage, but it cannot yet purchase insurance.

Figure 8 | **Current Status of ARC Member States**



Source: African Risk Capacity (ARC), adapted by Authors.

Multiple countries in West Africa have expressed interest in ARC’s river flood product, which is currently being piloted in Côte d’Ivoire, Ghana, The Gambia, and Togo. Côte d’Ivoire and Togo are less exposed to drought risk than to floods; they will likely be more inclined to join the pool when the river flood product becomes available. Ghana has not experienced a significant drought since 1983, so current demand for the drought product there is low. The country is concerned, however, about the risk of urban flooding which is not covered by ARC’s river flood product (Interview #13).

The Democratic Republic of Congo, Guinea, and Uganda have expressed interest in the outbreak and epidemics product (Interview #15). The product, being piloted in Guinea and Uganda, is in the third and final year of development, but it has yet to launch. It will provide insurance cover for Ebola, Lassa Fever, Marburg, or Meningitis outbreaks, which pose risks to over 40 African countries (ARC n.d.c).

Another example is Mozambique, which has concerns that ARC’s products do not fit the country’s needs (Interview #14). Currently, the tropical cyclone model covers wind and storm surge but

not rain. Yet, excess rainfall is a particular concern of Mozambique in the aftermath of the devastating Tropical Cyclone Idai in 2019, which caused over \$2 billion in damage, mostly from the impacts of rain-driven flooding. The tropical cyclone model is currently under review by the World Bank; it will provide a recommendation on whether to incorporate a rainfall element into the model.

Mozambique also is concerned that ARC’s products may overlap with other available tools (Interview #14). For example, Mozambique, in coordination with the United States, developed a pandemic contingency plan in 2014 (USAFRICOM 2014). Developing another contingency plan for ARC’s outbreaks and epidemics product might not provide additional value. Following a drought in 2014, Mozambique received financing from AfDB and post-Idai, it received concessional finance from the World Bank to improve its resilience to disasters, of which \$9 million was made available for immediate disaster relief (World Bank 2019b). Mozambique has stressed the need for ARC and other organizations, such as the World Bank, to better coordinate so that their roles and products are more complementary.

CONSISTENT ENGAGEMENT WITH MINISTRIES OF FINANCE

The role of finance ministries is critical, given that their approval is generally necessary to buy insurance coverage from ARC. Yet, in some countries, they are not sufficiently involved in the capacity building process, making their approval harder to secure than if they were fully engaged from the beginning. ARC's capacity building process generally begins within a country's Technical Working Groups, which bring together professionals from various government agencies to undertake ARV customization, develop contingency plans, and select risk transfer parameters (e-Pact 2017b). Once the process is complete, the insurance proposal is elevated for approval to decision-makers, generally from the finance ministry. Finance ministries are often not actively engaged in the capacity building process (e-Pact 2017c). Additionally, senior officials rarely attend ARC events or engage with ARC employees (ARC 2019). In Ghana, for example, the Ministry of Finance did not actively participate in ARC's capacity building program (Interview #13). ARC undertook these processes through Ghana's National Disaster Management Organisation, which reportedly has had difficulties pitching the idea of purchasing ARC insurance to the Ministry of Finance. To date, this process has not resulted in an insurance purchase.

REGIONAL POLITICS

Some countries have come to regard ARC as a primarily West African entity, which may weaken the sense of continent-wide ownership and may discourage insurance purchases (Interview #16). This could undermine the practice of risk pooling in Africa, which benefits greatly from the participation of countries in various African subregions. In ARC's early policy years, Kenya and Malawi were participants in the risk pools. Kenya, in particular, was a political champion of ARC and its biggest client. Some see the two countries' decisions to drop out of the pool as dragging down ARC engagement with East and Southern African countries. In the past three policy years, the ARC risk pool has consisted entirely of West African countries. The need to foster a sense of Africa-wide ownership will likely come into play as ARC searches for a location for its permanent headquarters.

Loyal Buyers

Since becoming eligible to join, Burkina Faso, Senegal, and The Gambia have purchased insurance from ARC every policy year. Senegal received a \$16.5 million payout in 2014–15, which helped prove ARC's value proposition. Burkina Faso and The Gambia have never received a payout but have remained loyal buyers, suggesting that countries do not necessarily need to receive frequent payouts to maintain participation in the pool. Some stakeholders have suggested that certain characteristics common to these countries help explain their sustained commitment to ARC. The three are located in West Africa, and they tend to receive less postdisaster aid relative to their population sizes than other African countries. This may suggest that the loyal buyers face more intense pressure to find alternative sources of postdisaster financing because they cannot always rely on international aid appeals; the link between access to aid and insurance uptake, however, needs further investigation. In addition, senior-level engagement with ARC, including from finance ministries, may help these loyal buyers make decisions about ARC insurance purchases more efficiently. In Senegal, for example, the ARC engagement team includes senior officials from the Ministry of Economy, Finance, and Planning (Interview #11).

We draw the following conclusions from ARC's experience:

- ARC is the most ambitious of the three risk pools, given the scope of its capacity building and contingency planning program. Its explicit focus on reaching poor and vulnerable people makes it unique among the three pools. The technical challenges involved in modeling and writing policies for drought also set it apart from the other pools, which began with products for nondrought perils.
- ARC has experienced difficulties in attracting new clients and keeping existing ones. Affordability remains a problem for many countries. Unmet expectations, basis risk, and a slow rollout of new products have limited new entrants and led to countries dropping coverage.
- ARC and its supporters must take rapid and decisive action to stop a downward spiral of negative perceptions, declining insurance uptake, and falling premium income. ARC's refreshed strategy, which will be launched within a year, must address these challenges head-on.

5. PACIFIC CATASTROPHE RISK INSURANCE COMPANY

PCRIC traces its origins to a pilot insurance program launched by the World Bank in 2013 under the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI).¹⁵ In 2015, as the PCRAFI pilot program came to a close, finance ministers from the Pacific Region decided to establish a standalone facility to continue the insurance program (World Bank 2018f). The resulting facility consists of two legal entities, PCRIC and the Pacific Catastrophe Risk Insurance Foundation (PCRIF), which owns PCRIC. PCRIC launched its first insurance policies in November 2016 with five participating governments. Today, it offers parametric earthquake and tropical cyclone insurance to Pacific Island countries (PICs). Under the broader PCRAFI program, the World Bank and other partners provide technical assistance and planning support to participating governments.

To assist countries with their disaster risk assessments, the PCRAFI program developed the Pacific Risk Information System (PacRIS) and individualized country risk profiles. PacRIS is a comprehensive geospatial database that compiles the country-specific hazard and exposure data needed to run the risk models underpinning PCRIC products. The country risk profiles are used to estimate direct losses for tropical cyclones and earthquakes of varying severity, as well as average annual losses for each PIC. In addition to supporting insurance purchases, these tools are meant to support broader DRM, financial planning, and other functions, including postdisaster damage assessments to help countries make response decisions rapidly and effectively. Despite being open source, use of PacRIS outside the context of insurance has been limited. Also, some of the PacRIS data are now out of date (World Bank 2018a). The Secretariat of the Pacific Community (SPC) has been engaged to update PacRIS; SPC is considering how to improve usability and applicability of the data repository to local DRM decision-making (Interview #17).

PCRIC is now in its third season and at a critical point in its development. After a successful postpilot launch and insurance purchases by several countries, the facility has encountered several challenges, including slower-than-expected growth and difficulty recruiting talent to fill its permanent board and chief executive

officer positions. The steps PCRIC takes in the next two years will be critical to demonstrate its long-term sustainability and to cement support from a critical mass of PICs.

5.1 Historical Insurance Uptake

Of the 14 countries that are currently eligible to purchase PCRIC products, 6 have purchased coverage from the PCRAFI pilot program and/or PCRIC. Five countries—the Marshall Islands, Samoa, Solomon Islands, Tonga, and Vanuatu—participated in the first policy year of the PCRAFI pilot program. The Cook Islands joined in the second policy year (2013–14), and the Solomon Islands declined to renew its policies in the third. Membership remained constant for several years, until the current (2018–19) policy year, when Vanuatu withdrew. In addition, Fiji joined PCRIF to pursue development of two nonsovereign-level products but did not purchase PCRIC’s existing products.

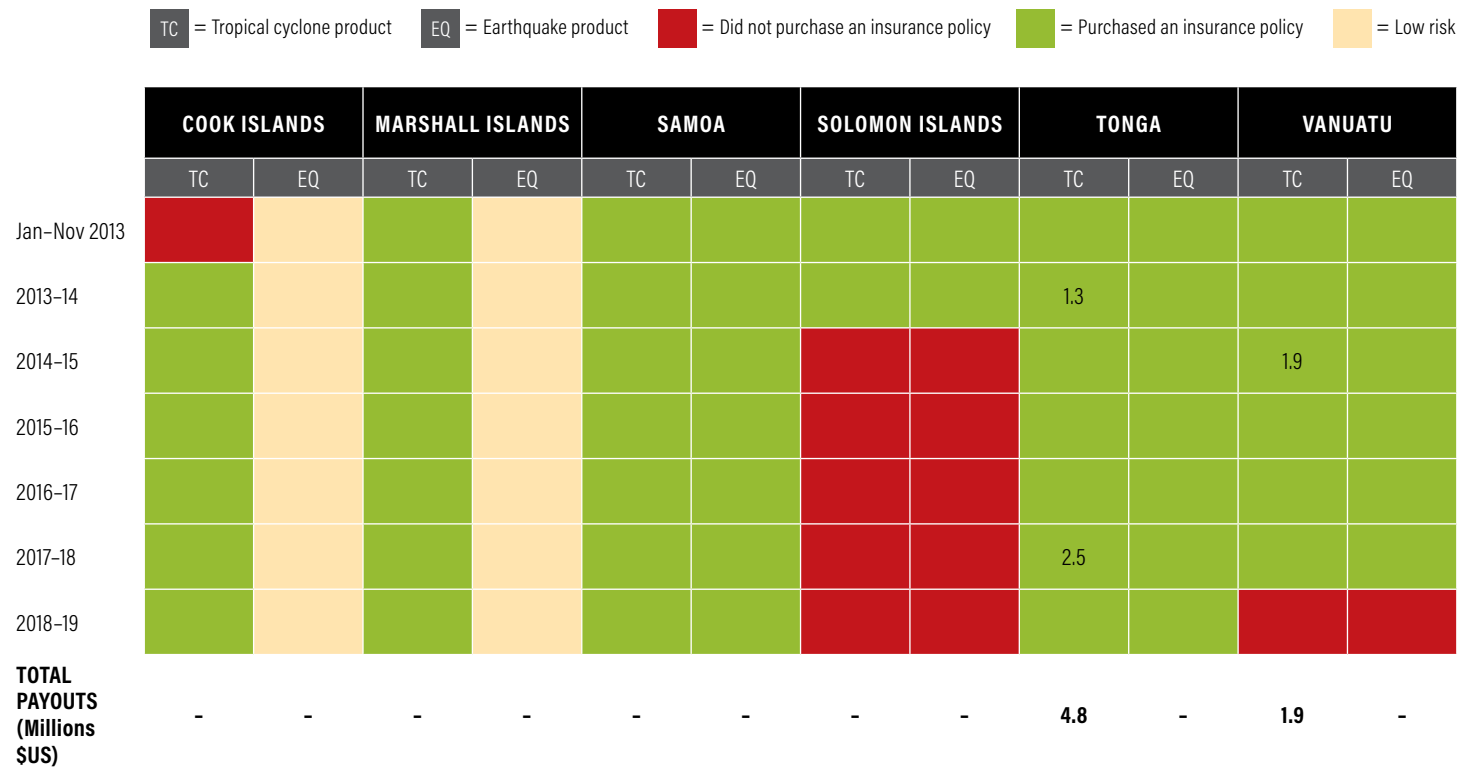
Uptake has been slower than anticipated, which could pose financial challenges for the facility. A \$3.5 million payout to Tonga in 2018 partially depleted PCRIC’s capital, and some observers fear that without premium income above \$3 million, PCRIC’s capital will continue to decline (premium income was \$2.34 million in the 2017–18 season) (DFID 2018). Figure 9 provides a comprehensive view of uptake patterns and payouts.

The PCRAFI pilot program and PCRIC have made three payouts to two countries. Tonga received a \$1.3 million payout in January 2014, following Tropical Cyclone Ian. Vanuatu received a \$1.9 million payout in March 2015, following Tropical Cyclone Pam. Tonga, in February 2018, received a \$3.5 million payout following Tropical Cyclone Gita (World Bank 2018f).

5.2 Factors Influencing Insurance Uptake

Of the 14 countries currently eligible to participate, 8 have yet-to-buy PCRIC products. Even though Fiji recently joined PCRIF, it falls in the yet-to-buy category, as it has not yet purchased any PCRIC products. Four countries are loyal buyers, and two countries have dropped coverage. At present, PCRIC does not have any recent arrivals (Table 7).

Figure 9 | Historical PCRIC Member Country Insurance Uptake



Notes: Numbers represent insurance payouts.

Source: Pacific Catastrophe Risk Insurance Company (PCRIC), adapted by Authors.

Table 7 | PCRIC Countries by Insurance-Buying Category

PACIFIC CATASTROPHE RISK INSURANCE COMPANY COUNTRIES			
LOYAL BUYERS	DROPPED COVERAGE	RECENT ARRIVALS	YET-TO-BUY
<ul style="list-style-type: none"> ■ Cook Islands ■ Marshall Islands ■ Samoa ■ Tonga 	<ul style="list-style-type: none"> ■ Solomon Islands ■ Vanuatu 	None	<ul style="list-style-type: none"> ■ Fiji ■ Kiribati ■ Micronesia, Federated States of ■ Nauru ■ Niue ■ Palau ■ Papua New Guinea ■ Tuvalu

Source: Pacific Catastrophe Risk Insurance Company (PCRIC), adapted by Authors.

These groupings raise several questions with important implications for PCRIC's future. Why have many PICs chosen not to purchase coverage so far, and why did the Solomon Islands and Vanuatu drop theirs? Also, what has kept the facility's four loyal buyers in the pool?

Yet-to-Buy Countries

The eight countries that have yet-to-buy PCRIC products are diverse, and their reasons for not buying PCRIC coverage vary. Cost relative to the size of payouts, product availability, and reliance on postdisaster aid from other sources appear to be the most prominent issues.

AFFORDABILITY AND SIZE OF PAYOUTS

Cost appears to be an important reason some eligible PICs have chosen not to participate. As with ARC countries, the concept of affordability ultimately reflects a political choice about budget tradeoffs. Many PICs run tight budgets because their small populations and economies mean their governments have relatively narrow revenue bases (SPC 2015b). As a result, setting aside adequate resources for disaster risk finance is challenging, requiring very difficult tradeoffs, particularly in the context of extremely high vulnerability to climate-related disasters.

Most of the countries that have participated so far have relied on premium subsidies and concessional premium financing. As detailed in Appendix B, several of the countries that participated in the PCRAFI pilot program received direct premium subsidies from the Government of Japan. In consultations conducted after the pilot program, four countries suggested that they would not have been able to participate without premium subsidies. They indicated that they would “seriously evaluate their ongoing participation if the premium ceases to be subsidised” (SPC 2015b). For the last several years, the same four countries have used concessional finance from IDA to pay their premiums.

Similar support may not be available for new entrants. Premium subsidies, such as those offered during the pilot program, may not be available to new members, and several of the yet-to-buy countries, including Palau, Nauru, and Niue, are not eligible to access IDA resources. Fiji only recently secured access to IDA under the small-island economies exception (ReliefWeb 2019). Moreover, although the issue of climate justice resonates in all the regions covered in this paper, it does so especially strongly in the Pacific. As some of the most

climate-vulnerable countries in the world, some PICs are understandably averse to paying premiums for climate-related risks, arguing instead that major carbon emitters should shoulder much of or all the burden.

At the same time, some PICs question whether the small size of PCRIC payouts relative to the devastation they routinely face justifies the premium expense. The expected average annual payout for countries in the pool was \$1.7 million in 2017–18, and the average size of payouts to date has been \$2.2 million (World Bank 2016a; DFID 2018). This has led some countries to question the cost-effectiveness of PCRIC products (Interview #18). For instance, the size of potential payouts is an important reason Fiji has decided against buying PCRIC's sovereign-level products (Interview #19; Interview #20). Although payouts are only meant to cover immediate liquidity needs, some governments compare the modest size of potential payouts to the scale of losses following events in recent memory, and they question the value of PCRIC products (Interview #20). Countries could increase payouts by increasing the level of coverage they purchase, of course, but doing so would increase premiums.

PRODUCT AVAILABILITY AND ACCESS TO CLIMATE CHANGE FUNDING

Some countries appear to be hesitant to join because PCRIC does not currently offer products for some of the perils that most concern them. Slow-moving tropical depressions and other excess rainfall events are often cited among their most pressing concerns, while other countries suffer from severe drought (Interview #25). PCRIC does not yet offer coverage for either, but it is working to develop a rainfall product that covers excess rainfall and drought (World Bank 2018e). A preliminary study confirmed the product's feasibility but found an unacceptable level of basis risk for excess rainfall events (DFID 2018). Additional work is needed to refine the model.

Some PICs are looking for alternatives to what PCRIC is offering. Since 2017, Tuvalu has sought to establish a Pacific Islands Climate Change Insurance Facility (PICCIF). The PICCIF would address the region's climate change insurance needs and generate sufficient financing for climate change insurance (PSFS 2019). The concept has yet to be fully developed, but PIC economic and finance ministers have approved of the initiative and support its continued development (PSFS 2019). Support for the initiative speaks to regional demand for products covering a broader range of perils, including sudden and

slow-onset events. It also speaks to a desire to make the link to climate change more explicit to improve access to climate change funding facilities and international and bilateral sources of financial support for climate-related impacts (PSFS 2017).

RELIANCE ON POSTDISASTER CONCESSIONAL FINANCE

Some countries decline to purchase PCRIC products because they prefer to rely on other disaster risk financing mechanisms, including international assistance. For example, while Micronesia has engaged with PCRAFI, it does not currently purchase PCRIC coverage because it can access emergency relief and reconstruction assistance from the United States under the Compact of Free Association (Interview #21). U.S. financial assistance can be slow to materialize, so Micronesia is considering a contingent credit line from the Asian Development Bank (ADB) to cover its immediate liquidity needs. Also, the agreement with the United States is set to expire in 2024, and if that assistance ends, Micronesia will have to reevaluate its postdisaster funding strategy (Interview #21). Even without a formal arrangement like Micronesia's, countries' disaster risk finance decisions may be influenced by the support they expect to receive from bilateral and development partners after a disaster. Many PICs have access to postdisaster concessional financing from different sources, including the MDBs and the IMF (Tierney 2018).

Dropped Coverage

UNMET EXPECTATIONS

Unmet payout expectations were a significant factor in the Solomon Islands' decision to withdraw from the pool. The Solomon Islands purchased PCRIC tropical cyclone and earthquake coverage during the first two policy years of the pilot program but did not renew its policies after two nonpayout events. In February 2013, a magnitude 8.0 earthquake and tsunami affected the country's Santa Cruz Islands. The event generated losses, but the modeled losses fell below the attachment point specified in the country's earthquake policy. According to the World Bank, the "earthquake occurred far from the economic center of the Solomon Islands, which meant that the impact on core government services and the economy of Solomon Islands and its future economic development was limited" (World Bank 2016a). Then, in April 2014, a slow-moving tropical depression caused extensive flooding, causing over \$100 million in losses, or around 9 percent of GDP. As a tropical depression, the storm did not qualify as an eligible event

under the Solomon Islands' tropical cyclone policy. Both events contributed to the country's decision to drop coverage the following season.

Unmet payout expectations contributed to Vanuatu's decision to drop its PCRIC coverage after the 2017–18 policy year. Vanuatu purchased tropical cyclone and earthquake coverage for six consecutive policy years before withdrawing. In March 2015, Tropical Cyclone Pam hit Vanuatu. Estimated losses were \$450 million, equivalent to nearly two-thirds of Vanuatu's GDP (GIZ 2017a). Within ten days, Vanuatu received a \$1.9 million payout from PCRIC. While the assistance was welcome, Vanuatu expected the payout to be larger (SPC 2015b). Nonetheless, Vanuatu maintained its coverage for the next three seasons. Then, in March 2018, Tropical Cyclone Hola hit Vanuatu but did not trigger a payout, despite significant impacts. With Vanuatu already suffering from the recent eruption of the Manaro Voui Volcano, the cyclone "exacerbated the Manaro situation when dense ash fall mixed with tropical cyclone rains, resulting in acid rain that severely impacted the southern part of the island" (World Bank 2018h). Together, the events multiplied the damage on communities, affecting small-scale farmers, export-oriented agriculture, livestock, and critical water sources. After that experience, Vanuatu dropped PCRIC coverage. It is currently working to secure a \$10 million CAT-DDO from the World Bank (World Bank 2019a).

The gap between low modeled losses and high costs of disaster response in remote affected areas has contributed to unmet expectations. Like the 2013 earthquake and tsunami in Solomon Islands, Cyclone Pam and Cyclone Hola hit Vanuatu outside of major economic centers. The PCRIC model estimates government emergency losses—the costs to governments of providing necessary relief and undertaking recovery efforts—as a percentage of total "ground-up" losses. While asset losses tend to be lower for disasters that occur outside of major economic centers, a government's response cost for these events still may be quite high. Because PICs are geographically dispersed across large ocean areas, the cost of transporting goods and personnel to remote disaster-affected locations can be significant (World Bank 2015c), but the extent to which these costs are factored into the PCRIC loss module is not clear (SPC 2015b).

Unmet expectations can reflect gaps in disaster risk financing strategies that leave frequent, less severe hazard events without adequate coverage.

Although some PICs have budget contingencies or dedicated reserve funds, these are often small, typically covering up to 1-in-3-year return period events. This leaves a financing gap between risks covered by these tools and those covered by disaster risk insurance, which typically covers events with return periods of 1 in 10 years and above (ADB 2019a, 2019b). A handful of PICs have secured contingent credit lines to help fill this gap, and the ADB is developing a new multicountry contingent financing mechanism that would further increase the number of countries with protection for frequent events (ADB 2019a).

However, there is a pressing need to find ways to more formally link parametric insurance products and contingent credits. For this reason, ADB is considering establishing the above-mentioned multicountry contingent financing mechanism as a cell within PCRIC itself (ADB 2019a). In theory, ADB would disburse funds that countries would then deposit in a segregated cell within PCRIC. PCRIC could hold a portion of the pooled funds in liquid form in case of disaster and invest the remainder. Creating a mechanism to allow PCRIC to extend contingent credit lines to its members also could allow it to sell parametric insurance products and contingent loans in coordinated packages. Linking products in this way could strengthen the complementarity of the tools and institutionalize greater collaboration and coherence across the tool providers.

Loyal Buyers

PCRIC's four loyal buyers likely have their own unique reasons for continually renewing their PCRIC coverage. Yet, they share certain characteristics that help explain their insurance-buying behavior, namely stable ways to pay their premiums and a strong understanding of the need to combine disaster risk finance instruments.

STABLE PREMIUM FINANCING MECHANISMS

All four loyal buyers have found stable ways to finance their premiums. As explained in greater detail in Appendix B, the Marshall Islands, Samoa, and Tonga have arranged to use IDA resources to finance their premiums through 2023. The Cook Islands is not a member of the World Bank, and consequently, does not have access to IDA resources. However, the government has reached an agreement with its state-owned enterprises to share

premium costs. In exchange, state-owned enterprises receive a pro rata share of any payout the Cook Islands receives. This arrangement is attractive to the companies because they face difficulties accessing private insurance to cover their infrastructure (Cook and Bailey 2015). To keep premium costs down, the Cook Islands has selected the lowest level of cover available, so its maximum payout is only about \$2.9 million (ADB 2016). Ideally, the Cook Islands (and others considering a similar approach) would find a way to finance higher premiums for an adequate level of coverage.

STRONG UNDERSTANDING OF THE NEED FOR MULTIPLE INSTRUMENTS

Several of the loyal buyers demonstrate a strong commitment to disaster risk finance and understanding of the need to deploy multiple financial tools alongside parametric insurance. Samoa, for example, recognizes that PCRIC offers valuable tools but that its products are just one small piece of a broader strategy incorporating not only a variety of disaster risk financing tools but also resources to improve physical resilience and relocate vulnerable communities (Interview #22). Samoa does not currently have a dedicated disaster fund, but it has a small contingent budget for unforeseen expenditures, and it has secured a contingent credit line from the ADB (ADB 2017).

Similarly, the Marshall Islands uses a number of disaster risk financing instruments in addition to its PCRIC tropical cyclone policy. The country contributes between \$230,000 and \$245,000 annually to a Disaster Assistance Emergency Fund, and its contributions are matched, one-to-one, by the United States Government (Interview #23). Where additional resources are required for disaster response and reconstruction, the Marshall Islands can request additional support from the United States under the Compact of Free Association (Interview #23). Additionally, Phase II of the Pacific Resilience Program includes a Contingency Emergency Response Component that allows the Marshall Islands to quickly access \$500,000 (and uncommitted national IDA funds, if more funds are needed) following a disaster declaration (World Bank 2017c). The Marshall Islands also may participate in the proposed ADB multicountry contingent financing mechanism, mentioned above (ADB 2019a). The Marshall Islands views the various instruments as complementary, because the different tools provide protection for different kinds of risk and are accessible under varying conditions (Interview #23).

The Cook Islands also has embraced the need for a multi-instrument approach to disaster risk finance. After Tropical Cyclone Pat in 2010, the Cook Islands struggled to access the disaster relief funding it needed. This experience prompted the government to undertake more comprehensive planning and to place a stronger emphasis on self-reliance (GoCI 2018). In 2011, the Cook Islands established the Disaster Emergency Trust Fund with a balance of around NZ\$1.7 million (\$1.1 million) (GoCI 2018). Furthermore, the Cook Islands secured a \$10 million contingent credit line in 2016 from the ADB. The government has deployed these instruments alongside its PCRIC tropical cyclone policy. Participation in PCRIC has allowed the Cook Islands to benefit from the World Bank's technical expertise, even though it is not a World Bank member.

We draw the following conclusions from PCRIC's experience:

- Transitioning the PCRAFI pilot program to a regionally owned, independent entity was an important step to scale up and institutionalize the regional risk pool.
- Premium subsidies and concessional IDA financing have been key for attracting and retaining member countries. Yet, cost and inability to access similar premium financing support may be keeping some new entrants from joining the pool. Moreover, as some of the most climate-vulnerable countries in the world, some PICs are averse to paying premiums for climate-related risks. They also compare unfavorably the size of potential PCRIC payouts to the large losses they have sustained from disaster events in recent memory.
- Unmet payout expectations remain a significant challenge and have contributed to two countries' decisions to drop coverage.
- PacRIS and country risk profiles have been used outside the context of insurance but only in limited ways.

6. PROTECTING POOR AND VULNERABLE PEOPLE

Poor people are disproportionately exposed to disasters, are more vulnerable to disasters when they occur, and have fewer resources and less support to cope with the impacts of disasters.

As a result, they tend to experience greater losses relative to income, and they have less capacity to cope and recover (Hallegatte, Bangalore, et al. 2016; Hallegatte, Vogt-Schilb, et al. 2016). These effects can keep people in poverty and push those just above the poverty line into poverty (Hallegatte, Bangalore, et al. 2016). More generally, demographic groups that are most vulnerable vary from country to country; they often include indigenous peoples, children, the elderly, people with disabilities, and women.

Protecting poor and vulnerable people is an urgent priority and critical to achieving development objectives in most countries, especially in developing countries increasingly exposed to the impacts of climate change. How does this imperative relate to disaster risk insurance? Observers of the regional risk pools are increasingly asking about the extent to which sovereign parametric risk insurance is enabling and could better enable governments to protect poor and vulnerable people.

6.1 Risk Pools and Poor and Vulnerable People Mandate

Neither CCRIF nor PCRIC has an explicit mandate to address poor and vulnerable people. Both facilities focus on providing governments with rapid, general budget support in the aftermath of disasters. While not their primary objective, the World Bank project launching CCRIF and the PCRAFI program refer to potential positive effects on poverty. The PCRAFI pilot program, for example, was “expected to have an indirect positive impact on poverty” by contributing to improving postdisaster response (World Bank 2012b). Similarly, the project supporting CCRIF's Central America expansion indicated that the “proposed Project is expected to have positive indirect poverty reduction and social impacts by enhancing the ability of the countries participating in CCRIF to meet the needs of their most vulnerable populations in the aftermath of major disasters” (World Bank 2015b).

In contrast, ARC has an explicit mandate to protect the food security and livelihoods of Africa's most vulnerable people. These people, many of whom are farmers, are often disproportionately affected by disasters. ARC was founded on the premise that distributing contingent financing quickly can provide greater economic benefits to affected populations than traditional disaster relief channels. A cost-benefit analysis commissioned by ARC found that an investment in early intervention through ARC produces 4.4 times the economic gains produced by an investment later on in the evolution of a crisis (ARC n.d.b).

Track Record

Because CCRIF and PCRIC provide general budget support and place no restrictions on the use of payouts, member countries may opt to use these resources in ways that support poor and vulnerable people, directly or indirectly.

For instance, a country could use payouts to scale up cash transfers to affected populations, providing direct support to poor and vulnerable people. Countries also may prioritize other objectives, such as repairing critical infrastructure or restoring basic social services. Such uses may indirectly benefit poor and vulnerable people, along with many others. In addition, poor and vulnerable people may indirectly benefit if the insurance payout frees up government resources for social protection measures.

However, there is currently no formal system in place at CCRIF or PCRIC to track or measure direct or indirect benefits to poor and vulnerable people.

Neither pool has historically required countries to report on the use of payouts; the pools request that members provide such information voluntarily. Many members do; however, the information is often not complete, uniform, or sufficiently detailed to allow for a comprehensive quantification of benefits. For example, we know from information provided voluntarily by CCRIF countries that payouts have been used to clear debris and reopen major roadways; provide food and shelter; replace roofs of schools and churches; repair homes and disaster shelters; and purchase basic supplies for affected families, such as medication and tarpaulins for houses (CCRIF 2019a). From World Bank reporting, we also know, for example, that Tonga used payout money to purchase fuel for boats to bring emergency goods to the affected islands, and that Vanuatu used part of its payout to transport nurses to affected areas to provide emergency care (World Bank 2016a). Yet, from this information, it is not possible to assess the number and characteristics of beneficiaries or the economic and social impact of the assistance.

In contrast, ARC requires participating governments to develop contingency plans that lay out how they will use ARC payouts. This planning process helps ensure that payouts reach vulnerable people quickly and effectively, protecting lives and livelihoods (ARC n.d.a). A country's final implementation plan provides information on how the payout will be used given specific circumstances, including affected populations and intended beneficiaries. Contingency plans must be approved by the ARC Agency Governing Board. This process ensures that contingency plans are developed in line with ARC's pro-poor mandate (ARC 2015c).

ARC also has reporting and auditing requirements to ensure that payouts reach the most vulnerable people quickly, effectively, and in a transparent way. Since its inception, ARC has paid out over \$36 million to four countries, reportedly benefiting over 2.1 million people and over 900,000 livestock from food distribution, cash transfers, and livestock feed subsidies (ARC 2018a). To ensure it can track the resources, ARC has instituted reporting requirements as part of its monitoring and evaluation framework. After a country receives a payout, it must immediately begin a reporting process, which includes regular discussions with ARC, monthly reports, and a final implementation report, which provides financial and operational details. Separately, ARC commissions independent, third-party financial and process audits of payout implementation. These audits provide an opinion on the extent to which payouts were implemented in line with a country's final implementation plan and report. These reporting requirements ensure that countries track and disclose detailed information on payout beneficiaries.

Several analyses have documented areas for improvement at ARC. Some payouts have failed to reach their ultimate beneficiaries in a timely way. In Niger and Senegal, ARC payouts flowed to the countries' national treasury accounts, but budgeting and accounting rules caused significant delays in the transfer of funds to implementing partners (ARC 2017b). As mentioned in Section 4, basis risk caused a nine-month delay in ARC's payout to Malawi (Hillier 2018). Additionally, country self-reporting can sometimes be inaccurate and difficult to obtain.¹⁶ External auditors also have encountered challenges, including the inability to access sufficiently detailed information and insufficient time to complete complicated audits, among others (ARC 2016b).

6.2 Coupling Parametric Insurance with Other Tools

Many member countries across the three pools will require additional support to successfully channel payouts to intended beneficiaries. Some members' public financial management systems may not lend themselves to quickly and accurately deliver payouts from government coffers to affected communities. For member countries with well-functioning social safety nets, channeling payouts through these mechanisms is one possible way to improve outcomes for poor and vulnerable people. An alternative approach is to work with civil society and other organizations with established networks on the ground to more effectively channel payouts to those most in need of support.

Some CCRIF and PCRIC members may prefer to maintain flexibility in the use of payouts from their sovereign-level products. In this case, complementing sovereign-level coverage with microlevel products expressly designed to target poor and vulnerable people may be a better approach. CCRIF and PCRIC already are beginning to engage in new initiatives to develop microinsurance products. Microinsurance products, however, have certain limitations, and research on the impact of microinsurance postdisaster is limited. As such, standalone microinsurance should not be the only available solution to meet the needs of poor and vulnerable people, and strong monitoring and evaluation frameworks are needed to assess the value of these initiatives as they progress.

Using Payouts to Scale Up Shock-Responsive Social Safety Nets

Disaster-responsive social protection programs offer a potential avenue to more effectively channel payouts to poor and vulnerable people. Although very few are operational to date, these programs are designed to quickly scale up after disasters to target additional beneficiaries and/or increase support to existing beneficiaries (World Bank 2017d). A good example is Kenya's Hunger Safety Net Programme (HSNP), which provides periodic and emergency cash transfers to chronically food insecure households in four northern counties. The HSNP has an index-based mechanism to provide emergency cash transfers to additional households during drought events (NDMA 2013). Programs such as the HSNP improve the resilience of covered populations by

providing resources to cover immediate response costs, supplementing income, and averting coping measures that could otherwise have long-lasting negative effects on well-being (Hallegatte and Rentschler 2018). Other countries that have used social protection programs to respond to disasters include Ethiopia, Fiji, Pakistan, and the Philippines (Hallegatte and Rentschler 2018; O'Brien, Scott, et al. 2018).

However, operationalizing disaster-responsive social safety nets requires investment in sophisticated financial management infrastructure and access to resources secured ex ante to scale up payments after a disaster.

Making those systems shock-responsive requires significant investment and planning, including collecting ample exposure and vulnerability data and developing reliable and transparent delivery mechanisms. Moreover, shock-responsive social protection programs require governments to secure adequate financing to cover the cost of scaling up protection after a disaster. For these programs to work, funds must be readily available when a disaster occurs, since the timeliness of transfers is critical. Governments could draw on a variety of tools for this purpose, including dedicated reserve funds, contingent credit lines, and parametric insurance (Hallegatte, Vogt-Schilb, et al. 2016).

Some ARC members have used insurance payouts to scale up social safety nets, and others have developed plans to do so. Malawi used a portion of its \$8.1 million payout in 2017 to scale up its Social Cash Transfer Programme (ARC 2018a). Mali discusses the possibility of using ARC payouts to scale up its Jigisèmèjiri cash transfer program during drought in its operational plan (Government of Mali 2015; O'Brien, Congrave, et al. 2018). Kenya also considered using ARC payouts to support the scale up of HSNP payments and had started to develop the necessary processes before dropping ARC coverage after the 2015–16 drought season (Farhat et al. 2017).

Working with Humanitarian Organizations

Governments also could coordinate with civil society organizations, including humanitarian actors, to establish more effective delivery mechanisms for insurance payouts. For countries lacking the financial and/or operational capacity to coordinate an effective postdisaster response, humanitarian actors can help provide scaled and coordinated execution (WFP 2018).

ARC Replica, an innovative new pilot program, offers a potential model for this approach. As initially designed, ARC Replica allows humanitarian organizations to purchase ARC policies that mirror the policies held by the member countries in which they operate. If the country's ARC policy triggers and pays out, the policy held by the humanitarian organization in the same country pays out simultaneously. A more detailed overview of ARC Replica is provided in Appendix B.

ARC Replica offers several potential benefits. It scales up the parametric insurance coverage available to African countries by allowing them access to coverage beyond ARC's current \$30 million coverage limit. Also, it provides a coordinated and timely payout execution mechanism, as ARC Replica partners must develop their own contingency plans in coordination with country governments (Start Network 2017). The initiative also gives African governments and ARC a partner with whom to undertake and refine ARC's technical processes. This could help strengthen ARV customization, the development of countries' contingency plans, and other technical aspects of ARC, such as its monitoring and evaluation framework. Finally, the program could provide a model for moving away from a traditional, ex post humanitarian response toward a more proactive ex ante risk management approach to humanitarian response (WFP 2018).

To deliver on these potential benefits, ARC Replica must first overcome two significant challenges.

To be able to purchase ARC insurance, the humanitarian organizations involved in the pilot phase had to undertake time-consuming legal and institutional changes (Interview #27). In addition, the program must secure a long-term, sustainable financing source for insurance premiums. The Government of Germany committed funds to pay for ARC Replica policies in 2018, but it is not clear whether this is sustainable. Asking humanitarian organizations to leverage their own funding sources—which include public and private sector donors—to purchase insurance would likely be difficult.

Microinsurance Products

While CCRIF's sovereign-level products do not explicitly target poor and vulnerable people, CCRIF is supporting two microinsurance initiatives that seek to do so more directly. CCRIF has supported the implementation of the Livelihood Protection Policy (LPP), an index-based microinsurance product designed to protect the livelihoods of vulnerable, low-income individuals in the Caribbean by providing

wind and excess rainfall coverage (MCII 2013). CCRIF's role in LPP has been limited; the Munich Climate Insurance Initiative (MCII) developed and launched the product, and CCRIF supported its implementation by helping to connect MCII with government contacts and supporting LPP training for government agencies (Interview #24). CCRIF also is developing a microinsurance product for the fisheries sector under the Caribbean Oceans and Aquaculture Sustainability Facility (COAST). The product would provide fisherfolk and fisher cooperatives with coverage for business interruption losses caused by inclement weather. It also would offer incentives to reduce overall risk and adopt preparedness measures. If deployed, the product would rely on CCRIF's risk modeling; CCRIF would adapt its existing risk models to include exposure and vulnerability data specific to the fisheries sector (CCRIF 2019d).

PCRIC is supporting microinsurance initiatives that directly target poor and vulnerable individuals. The company is currently supporting World Bank and International Finance Corporation projects to develop two microinsurance products for low-income households in Fiji. The first would provide cyclone coverage for houses of low-build quality, so long as owners first implement some basic reinforcements, such as roof strapping. The second is a livelihoods protection product for low-income households whose homes are deemed uninsurable. Rather than insuring a specific asset, the product would provide a small payout to the policyholder whenever a predefined event occurs. It would initially cover wind damage but could eventually cover excess rainfall as well. If developed, the products would use PCRIC modeling, and PCRIC would secure reinsurance. The livelihoods protection product is expressly designed for low-income individuals. The Fijian government would subsidize the product, and although the targeted beneficiaries have not been decided, the International Finance Corporation proposes to offer coverage to nearly 39,000 low-income households, including welfare recipients and farmers.

While these targeted products may help CCRIF and PCRIC increase their impact on poor and vulnerable people, three limitations of microinsurance should be recognized. Microinsurance products may not be appropriate for the lowest-income groups. These groups may not be able to afford insurance and have few insurable assets in the first place (Hillier 2018). For instance, LPP coverage proved too costly for some vulnerable people in Jamaica (World Bank 2017a). Similarly,

a review of Kenya’s index-based livestock insurance (IBLI) scheme found that the people that benefited the most were “the vulnerable-but-non-poor” rather than the very poor (GIZ 2017b). An evaluation of Mongolia’s IBLI scheme found that the scheme was successful but only for middle-size herders, leaving the poorer herders vulnerable and increasing inequality (Taylor 2016).

Second, establishing sales and distribution channels from scratch for new microinsurance products can be time-consuming and expensive, and the resulting premium volumes may not justify the expense. Playing a direct role in marketing and distributing microinsurance products could divert too many resources away from the core business of the risk pools. Instead, the pools could lend other strategic support to microinsurance initiatives seeking to fill gaps in existing coverage. For example, they could lend their risk modeling expertise to assist in developing microinsurance products or help secure reinsurance for microlevel products.

Finally, research on the effectiveness and impact of post-disaster microinsurance is limited. There is evidence of positive impacts of microinsurance after disasters (Janzen and Carter 2019); however, more is needed on the impact of index-based microinsurance products on the ability of poor and vulnerable households to cope with shocks. As CCRIF and PCRIC continue to develop these and other microinsurance products, it will be important that they include strong monitoring and evaluation systems to assess the efficacy of the initiatives.

We draw the following conclusions on the pools’ support for poor and vulnerable people:

- CCRIF and PCRIC provide general budget support and do not have explicit propoor mandates. Because of inadequate tracking and reporting, it is very difficult to determine beyond anecdotal evidence the extent to which CCRIF and PCRIC payouts have benefited poor and vulnerable people. However, both pools can do more to support poor and vulnerable people.
- Where supporting poor and vulnerable people is an explicit part of the pool’s mandate and design, as is the case with ARC, reaching the ultimate beneficiaries through central government payouts requires careful planning and sophisticated public financial management infrastructure.
- Products or systems that complement sovereign parametric insurance—such as microinsurance products, shock-responsive social safety nets that use insurance payouts to scale up cash transfers, and programs that use civil society organizations to channel and potentially scale up insurance payouts—are worth exploring further.

7. CONCLUSIONS AND RECOMMENDATIONS

Sovereign-level parametric insurance, offered through regional pools, brings a unique value proposition to the disaster risk finance toolkit. In addition to payouts, the pools can generate important cobenefits, as follows:

- Tools such as data repositories, risk models, and risk profiles, while initially designed to facilitate the insurance-buying process, can enable governments to better understand and manage the risks they face.
- A regular process within national governments that can help push key ministries, including finance ministries and disaster management agencies, to develop shared understandings of national disaster risk and cultivate staff with relevant technical skills and knowledge.
- A regular dialogue between ministries and national legislatures, which must appropriate budgetary resources to pay the insurance premium, about disaster risk and how to manage it.
- Regional platforms anchored in regional political institutions that can provide a space for dialogue on DRM at the technical and political levels, as well as a platform to develop and launch new products and solutions.

These cobenefits, however, do not emerge automatically. They need targeted investments in technology, people, and political engagement. For example, the tools developed to facilitate the design of insurance policies—ARC’s Africa RiskView tool, PCRAFI’s Pacific Risk Information System, and CCRIF’s country risk profiles—have the potential to better support countries’ DRM and financial planning beyond insurance buying. Some of these tools, however, need updated data, more user-friendly interfaces, or training for the users.

The cost of insurance remains a challenge, but cost is not the only barrier to uptake, and sometimes it is not the most significant barrier. Other barriers need to be managed as well, including the following:

- Managing unmet expectations is critical for avoiding dropped coverage. Unmet expectations may result either from technical basis risk or from instances of nonpayouts where the catastrophe models worked properly but members still anticipated a payout.
- Promoting a strong understanding of parametric insurance is key for promoting stable uptake, as it helps manage expectations and supports national dialogue around the insurance renewal process. This understanding is necessary not only among politically appointed government officials but also among others involved in the decision to purchase insurance, including civil servants, legislators, civil society leaders, and the disaster-response community.
- Developing and offering new insurance products that help countries address their key risks is essential for the pools to attract and retain clients. Inevitably, this requires investments in data, data collection, modeling capabilities, and marketing.

7.1 General Recommendations

The pools and their stakeholders should continually work to improve the value for money of membership in the pools. This means limiting costs and passing on price benefits to members, where possible and prudent. It also means working to fully achieve the cobenefits described above. The pools, in partnership with countries, should invest in and provide training for expanded applications of their data platforms and modeling capabilities to ensure they are useable beyond insurance purchases for broader risk management decision-making. They also should consider expanding their roles as conveners of government officials and other stakeholders and hold regular dialogues, workshops, and knowledge exchange sessions on key issues of DRM and finance, thus leveraging the pools' own information and data capabilities. Such changes may be costly. The pools should explore ways to cover these costs without increasing member country premiums, as will be discussed in Section 8.

MDBs and bilateral donors should deploy targeted premium support to help members who most need it to access insurance. They should make

resources available for direct premium subsidies where a clear and compelling case can be made for them. Even when premiums are heavily subsidized, countries should cover a portion of the premium—even if minimal—from their own resources. Allocating budgetary funds to pay premiums generates a regular process through which finance and other ministries must review national risk exposure. It also prompts a regular and constructive dialogue between ministries and legislatures. Where appropriate, donors should consider the gradual total or partial phaseout of the subsidies. Maintaining transparency on total premium levels, with and without subsidies, is essential as it allows governments and the public to see the underlying price signal.

At the same time, governments and MDBs should consider the long-term fiscal prudence of using loans to pay for insurance premiums. Doing so raises real questions about debt sustainability and about the prudence of linking debt to insurance, which is not designed to generate future returns that can be used to service debt.

The pools should deploy effective measures to manage unmet expectations and basis risk, as well as share lessons with each other on how to manage this challenge. This will require continual investments to improve model quality, as well as constant education and communication with clients. The pools should adopt rules-based and transparent processes for managing instances of unmet payout expectations. They also should consider adopting secondary triggers and features that provide a modicum of resources when policies fail to trigger; however, it is important that these also be rules-based and transparent.

With donor support, the pools should scale up investment in product development. They should roll out sovereign-level parametric cover for additional perils as quickly as possible, while also exploring new and innovative product modalities and collaborations. These could include micro- and meso-level parametric products or other products customized to the needs of specific members, such as those PCRIC is developing for Fiji. They could include products, such as CCRIF's new fisheries product, that target particular sectors and incorporate predefined mechanisms for transferring resources to specified beneficiaries. New collaborations, such as the proposed ADB/PCRIC regional contingent financing mechanism or a potential partnership with the V20 to support its proposed Sustainable Insurance Facility, could

provide members with access to a wider range of tools. Developing new products is time- and resource-intensive, but doing so could help attract new entrants to the pools while adding value for existing members.

Finally, stakeholders should recognize that insurance is not a substitute for enhanced international efforts to increase large-scale funding to help developing countries cope with and adapt to climate change impacts. Sovereign parametric insurance is a useful way to secure postdisaster liquidity, but it cannot cover the bulk of losses in any country. Suggesting that insurance is a substitute for these larger climate finance flows could damage long-term political support for the insurance pools and the valuable work they do.

7.2 Recommendations on CCRIF

CCRIF should take steps to ensure that its members can take full advantage of CCRIF's risk models and country risk profiles. It should consult its members to identify priority applications for its risk assessment and financing tools outside the insurance-buying context. Following stakeholder consultations, it should invest in making the tools more user friendly while also improving their functionality for wider use. It should provide complementary training on use of the tools.

CCRIF should evaluate the possibility of deploying a network of ground-based rain gauges for its excess rainfall product. If cost effective, incorporating ground-based measures into the excess rainfall product trigger could address the modeling concerns of some potential new entrants, while also helping to reduce the product's basis risk.

The pool should promote the use of contingency planning and offer support to member countries wishing to adopt contingency plans. Doing so could help interested countries improve the efficiency and effectiveness of decision-making on the use of payouts. Contingency planning for sudden-onset events, such as tropical cyclones, likely differs in significant respects from contingency planning for drought events, although there still may be important lessons CCRIF could draw from ARC's extensive experience with contingency planning. CCRIF also could potentially learn from PCRAFI's recent experience developing contingency plans for PICs.

CCRIF should continue to educate members on the role of parametric insurance and its limitations and encourage members to complement CCRIF products with additional disaster risk financing tools. CCRIF should find ways to collaborate with institutions such as the World Bank, IDB, Caribbean Development Bank (CDB), and Central American Bank for Economic Integration to increase in-country capacity on risk layering. One such example is the joint CCRIF/CDB Integrated Sovereign Risk Management program that is exploring the possibility of embedding country risk officers or coordinators in national governments.

7.3 Recommendations on ARC

Donors should contribute to the ADRiFi program, which can help restore ARC uptake. While the program does not currently act as a source of long-term concessional finance, it can help jumpstart the risk pool and reestablish ARC's value proposition with member countries. Nine African countries have expressed initial interest in ADRiFi. Providing these nine countries with premium subsidies of, for example, 50 percent of total premiums over ADRiFi's initial five-year term would require approximately \$50 million of donor support (ARC 2019). These resources should be administered by the AfDB so that they align with ADRiFi's five-year financing window. If, at the end of the program, the capacity of countries to pay premiums without subsidies has not meaningfully improved, donors should reconsider before renewing the program and explore other options.

In addition to ADRiFi, ARC and its member countries should consider other sources of concessional finance for premium support. These may include financing from the Global Risk Financing Facility (GRiF), a World Bank-administered trust fund. ARC countries also should explore using IDA financing, which has helped countries in the Caribbean and the Pacific regions purchase insurance coverage. When possible, countries should use IDA grants rather than credits. Using loans to finance premium payments should only be considered when pure grant financing is not available, when countries have a plan to transition away from using IDA credits to finance premiums, and when debt sustainability is not a major concern.

ARC should continue to work with the World Bank, AfDB, and bilateral aid agencies to promote education on the use of noninsurance disaster risk financing instruments as a complement to insurance.

ARC countries have generally adopted few disaster risk financing tools compared to countries in CCRIF and PCRIC. Stakeholders should promote a risk-layering approach and avoid relying too heavily on parametric insurance. Particular attention should be given to instruments designed to cover higher-frequency events, such as reserve funds and contingent credit lines. ARC should leverage the ADRiFi program—designed not only to provide premium subsidies but also to help countries develop and adopt layered disaster risk finance strategies—to facilitate this process.

If and when countries adopt strategies that employ multiple tools to cover different layers of risk, ARC should reconsider the attachment points of its policies with the aim of improving cost effectiveness. Because many ARC countries lack the suite of disaster risk financing instruments to cover their entire range of risks, ARC products are currently being used to cover frequent risks. As adoption of other instruments improves, ARC should ensure that its products are used in the most cost-effective way. This may entail raising the attachment points on its policies to cover more infrequent disasters, such as 1-in-15- or 1-in-20-year return periods. Setting up national disaster funds is undoubtedly difficult. Nevertheless, stakeholders should not assume that their development is impossible or that ARC policies always will be needed as a substitute financing mechanism.

ARC should roll out new products as soon as possible, as long as they are of adequate integrity and quality. This may require adding an excess rainfall element to the tropical cyclone model. Additionally, ARC should engage more deeply with countries to ensure that the products they develop fit those countries' needs.

ARC should consider adopting transparent, rules-based mechanisms to help manage unmet payout expectations. Doing so will help avoid instances such as Malawi's delayed payout, which significantly undermined ARC's reputation. These mechanisms could take similar forms to CCRIF's Aggregated Deductible Cover and secondary triggers.

7.4 Recommendations on PCRIC

Where needed, bilateral donors should provide targeted premium financing to potential new members. In some cases, targeted premium subsidies may be appropriate, although subsidies should be phased out, partially or totally, over time. Where debt sustainability is a significant concern, loans for insurance premiums are not appropriate. Development partners, together with PCRIC, will need to evaluate alternative ways to improve product affordability.

PCRIC should expand its product offerings as soon as possible. In continuing to develop a rainfall product, PCRIC should learn as much as possible from CCRIF's experience. If basis risk associated with excess rainfall events continues to remain high, it should explore the possibility of offering a standalone drought product as it continues to refine the excess rainfall model.

PCRIC and the World Bank must address issues underlying unmet payout expectations. Updating exposure data underpinning the PCRIC model to ensure continued model accuracy and low levels of basis risk is critically important. PCRIC also should evaluate whether its model accurately reflects the considerable costs to governments of responding to disasters in remote areas, such as distant islands within an archipelago. In parallel, PCRIC should consider adopting rules-based mechanisms, such as CCRIF's Aggregated Deductible Cover, to reduce potential backlash when policies do not trigger following disasters. Technical assistance partners should continually engage with members to ensure they fully understand the limitations of the policies they purchase.

PCRIC and stakeholders—including the World Bank, ADB, and bilateral donors—should increase collaborative efforts to improve in-country capacity on risk layering. They should study approaches, such as the proposed ADB/PCRIC regional contingent financing mechanism, to more formally link PCRIC products with other, complementary tools. Meanwhile, they should continue to educate members on the role and limitations of parametric insurance and encourage members to adopt other, complementary tools.

Development partners should also invest in improving the usability and broader applicability of PacRIS. SPC should study ways that the data repository and risk modeling, developed for the PCRAFI

pilot program, could help countries plan and prepare for disasters, while also reducing their overall disaster risk. Using these tools for broader applications may require collection of additional, more granular data, in which case, SPC should work with countries to identify priorities and with donors to finance their efforts.

7.5 Recommendations on Support for Poor and Vulnerable People

While not required under their current mandates, CCRIF and PCRIC should encourage countries to deploy payouts from their sovereign-level products in propoor ways. They could provide governments with information, analyses, and lessons learned from other parts of the world on the long-term social and economic benefits of targeting payout resources more narrowly to benefit poor and vulnerable people, and they could help countries develop contingency plans with specific propoor elements.

Countries should improve their ability to quickly and effectively deliver resources from insurance payouts to intended affected populations after disasters occur. They should develop effective contingency plans, drawing on lessons from ARC, with specific elements on how to best identify and reach affected communities. They can also link parametric insurance from the pools with social safety nets, using insurance payouts to scale up support for poor and vulnerable people affected by disasters. An alternative approach is to work with humanitarian organizations, leveraging their resources and capacity to channel payouts. All stakeholders should draw lessons from the continued development of the ARC Replica product.

Countries should also consider complementing sovereign parametric coverage with microinsurance products that are expressly designed to target poor and vulnerable people. Where applicable, pools should lend strategic support to microinsurance programs targeting poor and vulnerable people, as CCRIF and PCRIC are beginning to do. While the pools likely should not play a role in marketing and distributing microinsurance products, they could, for example, lend their risk modeling expertise to help develop microinsurance products or help to secure reinsurance. Importantly, they should lend strategic support to initiatives seeking to fill existing gaps in coverage, to avoid crowding out existing private sector micro-level schemes.

8. THE NEXT FRONTIER: SECURING LONG-TERM CONCESSIONAL RESOURCES FOR BETTER RISK MANAGEMENT

So far, donor resources dedicated to supporting disaster risk finance solutions have been limited in two key ways. First, they have traditionally been earmarked for particular instruments, such as parametric insurance from the sovereign risk pools or contingent credit lines, instead of focusing on mobilizing the full spectrum of tools in a coordinated way to help countries develop layered approaches to disaster risk finance. Second, much of the support earmarked for the risk pools has been provided through one-time financial commitments by a handful of donor governments. These funds have been instrumental in establishing the risk pools and supporting their early operations; however, they cannot sustain, on an ongoing, long-term basis, the key priorities outlined in this paper.

Implementing our recommendations on the risk pools and promoting risk-layering approaches will require new sources of sustained, long-term concessional financing that go beyond the ad hoc support provided to date. Developing, pilot testing, and scaling up new products will require substantial new investments. Likewise, unlocking additional value from the pools' existing databases, models, and risk profiles will require additional resources. While the pools have some resources in the form of premium and investment income and ongoing donor support, this money alone is not sufficient—especially given the imperative to keep costs down. In addition, uptake of risk layering is not likely to grow significantly unless concessional financing is scaled up to improve the affordability of different instruments and deployed to ensure that those instruments are available on roughly comparable terms. Concessional finance will likely be needed on a long-term basis to ensure that the lowest-income countries can benefit from the full range of disaster risk finance instruments.

Development partners have launched several entities to provide dedicated concessional finance to support disaster risk finance. Launched in 2018 with initial funds of €15 million from the Government of Germany, the InsuResilience Solutions Fund (ISF) provides grants of up to €2.5 million to support the development of new climate risk insurance products, bring existing pilots to scale, and scale up insurance operations (ISF n.d.). Another example is the GRiF, a trust fund for

which resources of \$145 million have been announced, most of which derive from the Government of Germany and the Government of the United Kingdom. The GRiF supports activities such as financing the capitalization of insurance risk pools, financing the start-up costs of national disaster funds, and lowering the cost of risk financing mechanisms by subsidizing insurance premiums or buying down interest rates (World Bank 2018c). The ADRiFi program, also launched in 2018, will provide African countries with direct premium subsidies and facilitate the development and adoption of other climate risk management solutions.

These entities are welcome additions to the disaster risk finance architecture, but the resources at their disposal fall short given the scale of the challenge. For example, if the ADRiFi program were to subsidize 50 percent of annual premiums, as it is currently proposing to do, for the seven countries that purchased ARC coverage in the 2015–16 policy year, it would likely need annual donor contributions of approximately \$10 million to \$15 million, based on historical premium levels. ADRiFi cannot sustain this level of support over a multiyear timeframe with currently committed funds. If the GRiF were to provide the necessary financing, the operation would exhaust half of the GRiF's current resources in just over five years, assuming no growth in ARC's membership beyond the seven countries that purchased insurance during the 2015–16 policy year.

Moreover, these entities receive funding from a relatively narrow base of donors. Germany and the United Kingdom have been the leading contributors so far. To mobilize larger volumes of finance, sustained contributions from a much wider base of countries and institutions, including the Green Climate Fund (GCF), will be needed. The GCF is a major provider of concessional climate finance, including for climate adaptation and, as such, could be an important source of support for disaster risk finance. In addition, some of these entities provide financing earmarked for specific instruments and not for sets of complementary tools. The ISF and ADRiFi, for example, provide concessional finance only for insurance solutions and not for other disaster risk finance instruments.¹⁷

In view of these limitations, new structures that can provide large volumes of sustained financing over the long term are urgently needed.

Three options are worth considering as a start to the conversation. They are not mutually exclusive, and each carries advantages and drawbacks.

Option 1: Expanding IDA's Role

One possibility is to encourage IDA to play a much larger role in ex ante disaster risk finance. Currently, IDA can provide concessional finance to 75 eligible countries to fund development priorities. Each eligible member country has a limited resource envelope. In total, IDA currently has available resources of \$75 billion over the 2018–20 period based on the most recent replenishment, known as IDA18. IDA raises the bulk of its resources from donor-country contributions and by issuing debt in the capital markets. IDA has a large existing donor base of 52 countries that have pledged resources to IDA18.

IDA already provides significant amounts of disaster financing to member countries, although its support for ex ante, or prearranged, disaster risk finance is limited. For example, IDA's Crisis Response Window (CRW) primarily provides ex post disaster assistance. IDA also offers governments the ability to reallocate portions of their IDA envelopes to support postdisaster crisis response. These sources of finance, however, take time to materialize. The CRW's average time, for example, from crisis to financial commitment is 216 days (Spearing 2019). IDA currently offers only one ex ante disaster risk financing tool, the IDA CAT-DDO (Clarke and Dercon 2019); as of October 2018, however, only one had been finalized (World Bank 2018d).

Given its large resource base, IDA could significantly expand its resources dedicated to ex ante disaster risk finance. At each replenishment, IDA's members—especially those contributing resources—set the general framework for how IDA resources are to be used. So far, donors have not given IDA the same ambitious mandate to provide concessional finance for disaster preparedness and early response activities as they have for ex post disaster finance. For that reason, a recent analysis proposes that IDA scale up concessional finance for crisis preparedness and early response. At the same time, IDA could help countries acquire insurance products with explicit development objectives, which the risk pools could provide while also financing complementary precrisis expenditures, including funds for disaster prevention, preparation, and risk information (Clarke and Dercon 2019).

IDA could help support risk layering by providing concessional finance that facilitates the adoption of various instruments (Figure 10). These resources would be used to ensure that the different disaster risk financing tools are available on roughly equal levels of concessionality and are combined in tailored, cost-effective ways to cover countries’ full range of risks. Grants (rather than loans) will be especially important for insurance solutions; as mentioned earlier, we do not believe that providing loans to pay for insurance premiums—even with concessional finance—is a fiscally prudent long-term solution for many countries.

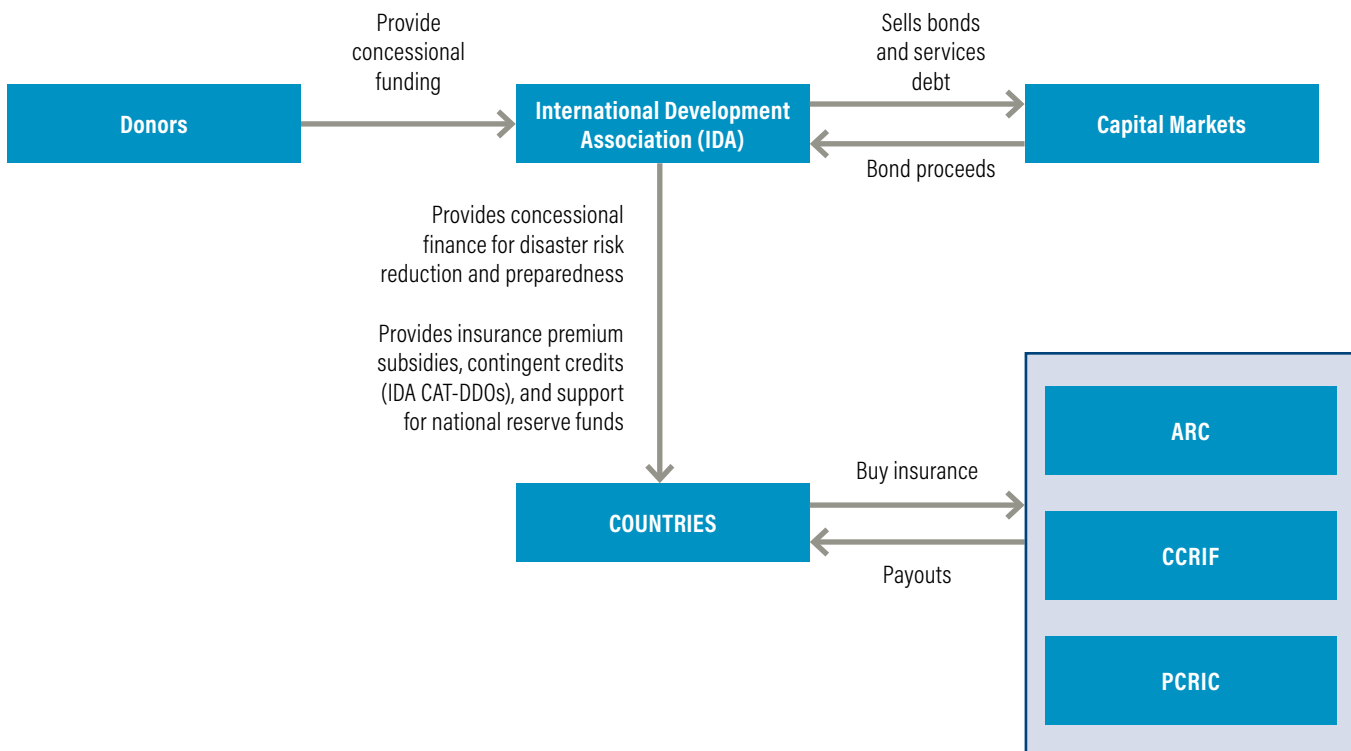
Advantages: IDA already exists. It has a large resource base and the capacity to attract regular new funding. Its focus on the poorest countries helps address some of those in greatest need. IDA already supports countries through contingent lines of credit, and the CRW and other IDA resources can provide complementary finance for resilience, predisaster preparedness, and postdisaster assistance.

Drawbacks: IDA does not cover all climate-vulnerable developing countries, including middle-income countries and non-World Bank members. Furthermore, disaster risk finance must compete with many other development priorities. IDA, in its present form, would likely not be able to support the risk pools directly, as primary client relationships are with national governments. This approach would centralize solutions in the World Bank, which may be inclined to favor its own solutions rather than those from other actors.

Option 2: Leveraging Regional Multilateral Development Banks

Another option looks to regional MDBs to promote integrated disaster risk finance strategies within their respective regions and to promote synergies between those banks and the relevant risk pools. All of the regional banks already have some form of disaster risk reduction and finance program, and some of them already are collaborating with the risk pools.

Figure 10 | Option 1: Expanding the Role of the International Development Association

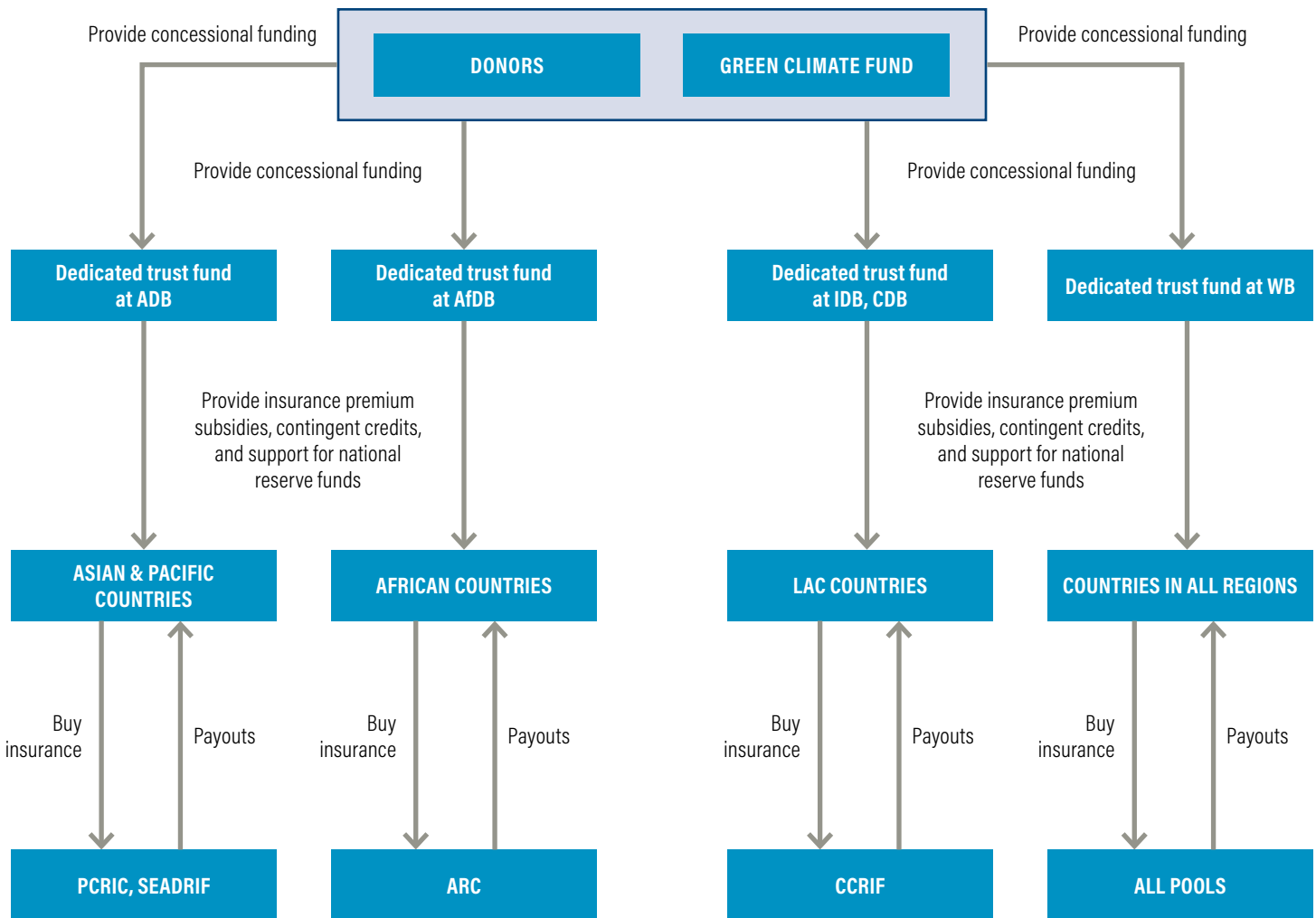


Notes: CAT-DDO: catastrophe deferred drawdown option; ARC: African Risk Capacity; CCRIF: CCRIF SPC; PCRIC: Pacific Catastrophe Risk Insurance Company.
Source: Authors.

The AfDB and the ADB, for example, are forming closer ties to ARC and PCRIC, respectively, and are providing technical and financial support. The ADB’s multicountry contingent credit program, which could potentially be housed in a PCRIC cell—discussed in Section 5—offers a creative way for the pools and development banks to integrate their efforts. Encouraging this trend and enhancing the role of the regional banks would complement the cross-regional work of the World Bank. For example, the GRiF could focus primarily on supporting countries that currently fall outside the regional risk pools.

Under this approach, donors would contribute directly and on a recurring basis to dedicated trust funds in each regional bank, in addition to the World Bank, where the GRiF already exists. Regional banks enjoy strong ties to their respective regions, so a regional approach could help attract donors from within those regions. In addition to bilateral donors, the GCF also could provide concessional funding; most of the regional MDBs are already accredited to receive funding from the GCF.

Figure 11 | **Option 2: Leveraging Regional Multilateral Development Banks**



Notes: ADB: Asian Development Bank; AfDB: African Development Bank; IDB: Inter-American Development Bank; CDB: Caribbean Development Bank; WB: World Bank; LAC: Latin America and the Caribbean; PCRIC: Pacific Catastrophe Risk Insurance Company; SEADRIF: Southeast Asia Disaster Risk Insurance Facility; ARC: African Risk Capacity; and CCRIF: CCRIF SPC.
Source: Authors.

The regional banks would then use trust fund resources to incentivize adoption of risk-layering approaches in particular countries.

As with the IDA approach, the regional banks would use trust fund resources to ensure that disaster risk financing tools are available on broadly equal terms and are combined in cost-effective ways to cover countries' full range of risks. For example, they could provide concessional finance to subsidize insurance premiums where appropriate, reduce the costs of acquiring contingent credit lines, and defray the costs of setting up and financing national disaster funds (Figure 11).

Advantages: The regional banks are well positioned to engage client countries and to develop synergies with regional risk pools. A regional approach may encourage innovations well suited to the local political and institutional context. Most regional MDBs are already eligible to receive GCF funds and could more easily attract financing from donors within their regions.

Drawbacks: Technical capacity among the regional MDBs is uneven. In addition, creating and contributing to multiple trust funds would carry additional transaction costs for donors and increase complexity. Regional banks may be inclined to favor the solutions they provide over those from other entities. As with IDA, regional banks may find it difficult to support the pools directly for activities such as product development.

Option 3: Driving Collaboration through an Incentive Fund

A third option envisions the creation of a new Risk Solutions Incentive Fund that could provide financing to governments, the risk pools, and MDBs (Figure 12). The fund would promote collaboration among all the disaster risk finance providers to develop cost-effective, customized, risk-layered solutions for countries. These packages would deploy multiple instruments in combination, regardless of the provider. A

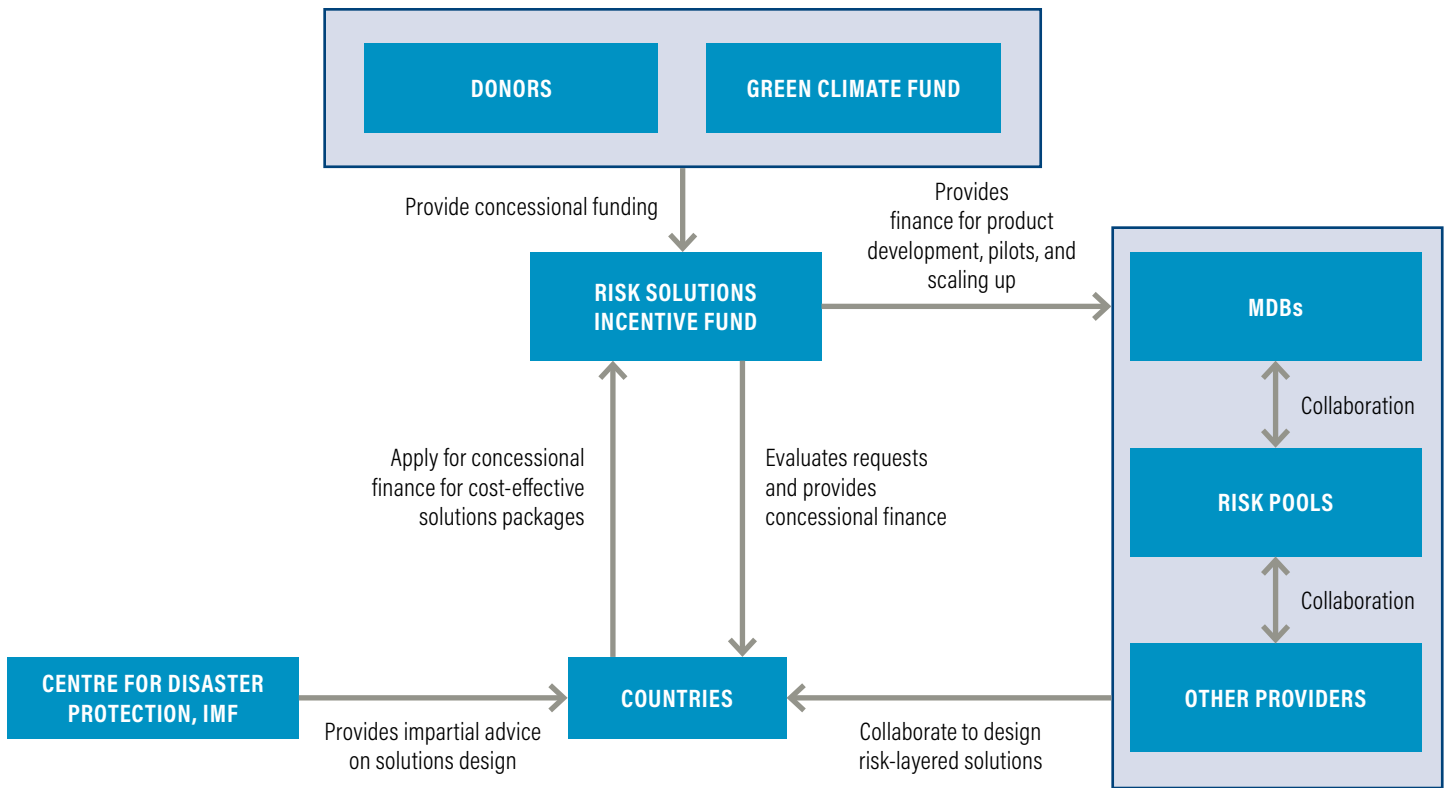
country would develop a solutions package in partnership with MDBs, risk pools, and other providers. It would also benefit from impartial advice from entities such as the IMF and the UK Centre for Disaster Protection. The country would then apply to the Incentive Fund for concessional finance to implement the package. In addition, the Incentive Fund would be able to directly support the risk pools and MDBs with resources for product development, pilot testing, and scaling up existing programs.

The Incentive Fund would be independent from other solutions providers and would not offer products of its own. This would allow the Incentive Fund to evaluate solutions and to allocate funding objectively, based solely on technical merit and cost effectiveness. The Incentive Fund would be housed and managed, for example, by a private or nonprofit financial institution. Its activities would be guided by a board representing key stakeholders, and it would have to coordinate closely with other actors to avoid duplication and maximize synergies.

Importantly, the Incentive Fund would need to attract sustained and significant concessional funding from a diverse set of contributors. The Incentive Fund would operate on the basis of multiyear plans and with an established replenishment cycle to ensure regular and predictable resource mobilization. It could potentially attract a wider range of donors, including new bilateral donors and the GCF, since it offers a more strategic way to support disaster risk finance than contributing relatively small sums to a variety of product-specific initiatives. The Incentive Fund could be nested and managed by an institution already accredited or soon to be accredited to receive GCF funding; the institution could apply for GCF money on behalf of the Incentive Fund and use the money to finance investments selected by the Incentive Fund. Another advantage of the Incentive Fund, relative to other options, is that some donors may prefer to support a single fund, as doing so would reduce their transaction, governance, and oversight costs.

Advantages: Donors would find it easier and more cost effective to contribute to a single fund that can assist any developing country, regardless of income level. Separation from providers would give the fund the independence necessary to evaluate, encourage, and support a suite of innovative solutions, regardless of their proponent.

Figure 12 | Option 3: Driving Collaboration through a Risk Solutions Incentive Fund



Notes: MDB: multilateral development bank; IMF: International Monetary Fund.
Source: Authors.

The fund would be able to support the pools and MDBs directly, not only national governments.

Drawbacks: The Incentive Fund would have to be established, and a suitable hosting and managing institution would have to be identified.

New structures that can provide long-term concessional resources for disaster risk finance need to be put in place in the near future. These new structures can leverage and greatly amplify the strengths of the risk pools, development banks, and other solutions providers. This ambitious initiative is needed to match the scale of the challenge as a warming world causes more and more damage to vulnerable countries and people.

Given the urgency of the challenge, major donors and development partners should convene and discuss options such as those presented above.

The InsuResilience Global Partnership, with its large and diverse membership base, would be a good forum to host these conversations. At the same time, it is critical that any lessons emerging from the ISF, GRiF, ADRiFi, and other relevant funds are documented and used to inform this important policy debate.

ABBREVIATIONS

ADB	Asian Development Bank	GRiF	Global Risk Financing Facility
ADC	Aggregated Deductible Cover	HSNP	Hunger Safety Net Programme
ADF	African Development Fund	IBLI	index-based livestock insurance
ADRFi	Africa Disaster Risks Financing Programme	IBRD	International Bank for Reconstruction and Development
AfDB	African Development Bank	IDA	International Development Association
ARC	African Risk Capacity	IDB	Inter-American Development Bank
ARC Limited	African Risk Capacity Insurance Company Limited	IMF	International Monetary Fund
ARV	Africa RiskView	ISF	InsuResilience Solutions Fund
AU	African Union	LPP	Livelihood Protection Policy
CARICOM	Caribbean Community	MCII	Munich Climate Insurance Initiative
Cat bonds	catastrophe bonds	MDB	multilateral development bank
CAT-DDO	catastrophe deferred drawdown option	PacRIS	Pacific Risk Information System
CCRIF	CCRIF SPC	PCRAFI	Pacific Catastrophe Risk Assessment and Financing Initiative
CDB	Caribbean Development Bank	PCRIC	Pacific Catastrophe Risk Insurance Company
COAST	Caribbean Oceans and Aquaculture Sustainability Facility	PCRIF	Pacific Catastrophe Risk Insurance Foundation
COSEFIN	Council of Ministers of Finance of Central America, Panama, and the Dominican Republic	PIC	Pacific Island country
CRW	Crisis Response Window	PICCIF	Pacific Islands Climate Change Insurance Facility
DRM	disaster risk management	SPC	Secretariat of the Pacific Community
G20	Group of Twenty	V20	Group of Vulnerable Twenty
GCF	Green Climate Fund	WFP	World Food Programme
GDP	gross domestic product		

APPENDIX A: LIST OF INTERVIEWS AND OTHER CONSULTATIONS

Our work has benefited from formal interviews, informal consultations, and group workshops with many stakeholders in the disaster risk finance space. To ensure frank feedback, we have anonymized the stakeholder consultations cited in this report, including numbered interviews rather than individuals to maintain confidentiality while still tracking consultations in a methodical way.

We spoke with 75 stakeholders, including 22 representatives from 9 international organizations; 18 from 14 national governments; 10 from the 3 regional risk pools; 10 from 5 donor governments; 8 from 3 private sector companies; 6 from 4 NGOs; and 3 from academic institutions. Table A1 includes a complete list of organizations we consulted in the process of our research.

Table A1 | **List of Organizations That Participated in Formal Interviews, Informal Consultations, or Group Workshops**

ACADEMIC INSTITUTIONS	
Grantham Research Institute	University of Oxford
The Wharton School	
NATIONAL GOVERNMENTS	
Cook Islands	Democratic Republic of Congo
El Salvador	Fiji
Gambia, The	Ghana
Guatemala	Marshall Islands
Mexico	Micronesia
Mozambique	Samoa
Solomon Islands	Vanuatu
BILATERAL AID AGENCIES	
German Federal Ministry for Economic Cooperation and Development	Global Affairs Canada
KfW	UK Department for International Development
United States Agency for International Development	
INTERNATIONAL/REGIONAL ORGANIZATIONS	
African Development Bank	Asian Development Bank
Council of Ministers of Finance of Central America, Panama, and the Dominican Republic	Inter-American Development Bank
Pacific Islands Forum Secretariat	Secretariat of the InsuResilience Global Partnership
Secretariat of the Pacific Community	World Bank
World Food Programme	
NGOs	
Munich Climate Insurance Initiative	Oxfam
Start Network	UK Centre for Disaster Protection
PRIVATE SECTOR COMPANIES	
AXA	Swiss Re
Willis Towers Watson	
REGIONAL RISK POOLS	
African Risk Capacity Agency	CCRIF SPC
Pacific Catastrophe Risk Insurance Company	African Risk Capacity Insurance Company Limited

Source: Authors.

APPENDIX B: BACKGROUND INFORMATION ON THE REGIONAL RISK POOLS

Establishment and Structural Overview

CCRIF SPC

The Caribbean Catastrophic Risk Insurance Facility was established initially in 2007. Its legal structure has evolved over time. It was originally established as a captive insurer, owned by a purpose trust domiciled in the Cayman Islands.¹⁶ In 2014, it restructured itself as a segregated portfolio company (becoming CCRIF SPC) to allow for expansion of the risk pool into Central America and to offer new products (e.g., for excess rainfall in 2014). As a segregated portfolio company, CCRIF maintains separate underwriting pools with differentiated capital for various lines of business. It has established segregated portfolios (or segregated cells) for CARICOM countries and countries under the Council of Ministers of Finance of Central America, Panama and the Dominican Republic (Secretario Ejecutivo del Consejo de Ministros de Hacienda o Finanzas de Centroamérica, Panamá y República Dominicana, COSEFIN).¹⁹ While its segregated cells for the Caribbean and Central America reduce the potential risk diversification benefits of expanding into Central America, it has addressed member concerns that disasters in Central America would quickly deplete the Caribbean's capital base.

African Risk Capacity

ARC consists of two affiliated entities, ARC Agency and ARC Limited. African countries, WFP experts, and other development partners established ARC Agency, ARC's capacity building arm, in 2012. ARC Agency is governed by a Conference of Parties, consisting of the AU member states that have formally signed the ARC Establishment Agreement. ARC Limited is the commercial arm that writes insurance; it launched the first risk pool in 2014.

Pacific Catastrophe Risk Insurance Company

At the conclusion of the PCRAFI pilot insurance program in 2015, Pacific Island countries and development partners launched a standalone facility to continue the insurance program. That facility consists of two legal entities, PCRIC and PCRIF. PCRIC is a captive insurance company domiciled in the Cook Islands. PCRIC is owned by PCRIF, which is governed by a council of members comprising PCRIC member countries and donors (GoCI 2016). The council appoints the members of the PCRIC board of directors, and the board appoints PCRIC's chief executive officer. After some delays, the permanent board of directors was recently confirmed and, as of May 2019, PCRIC was in the process of searching for a new chief executive officer as its first one resigned. These delays have slowed the adoption of necessary internal policy documents, such as an investment strategy (DFID 2018).

Capitalization

CCRIF

CCRIF's capitalization was made possible by an early injection of grants by international partners. Bermuda, Canada, France, Ireland, United Kingdom, Caribbean Development Bank, European Commission, and IBRD contributed funds—nearly \$70 million in total—to support CCRIF's initial startup and early operations (World Bank 2012a). These funds indirectly supported CCRIF's

capitalization by reimbursing operating costs, including claims and reinsurance premiums, for the first five years of CCRIF's operation (World Bank 2012a). Donor funds again reimbursed operating costs for an additional four years following CCRIF's expansion into Central America (World Bank 2015a). With donor support covering payouts and reinsurance premiums, CCRIF was able to retain member country premiums and participation fees, as well as build up its capital more quickly (World Bank 2012a). In this way, donor support has allowed CCRIF to build up a pooled reserve so that it can retain some of its risk.

CCRIF has maintained an ongoing engagement with donors and has continued to receive donor support in recent years. For example, in 2017, Mexico and the Caribbean Development Bank approved a \$14 million grant to CCRIF; in 2018, KfW committed €15 million to CCRIF (CCRIF 2018b, World Bank 2018b), and the Government of Ireland contributed €1 million in January 2019. Such funds further support CCRIF's financial sustainability by enabling it to increase its reserves while also supporting the development of new products.

ARC

In March 2014, the UK Department for International Development and KfW contributed \$98 million in the form of a 20-year noninterest-bearing loan to directly capitalize ARC Limited. It must repay the loan by 2034. To do so, ARC Limited charges small surcharges on top of country premium payments to gradually repay the loan (Interview #8). Any profits can be used to accumulate capital over time so that ARC Limited can continue to operate after repaying its initial capital.

Donor resources fund ARC Agency's daily operations. Donors including AfDB, Canadian International Development Agency, French Development Agency, KfW, Swedish International Development Cooperation Agency, Swiss Development Corporation, The Rockefeller Foundation, UK Department for International Development, and United States Agency for International Development have provided grant financing, often on a recurring basis, to fund ARC Agency's operations. Currently, ARC Agency has no other revenue stream.

PCRIC

Donors provided direct seed capital to PCRIC. Funds have been provided in a phased manner, with an initial disbursement of \$6 million (World Bank 2016b). PCRIC received an additional \$12 million in 2017. These funds were intended to allow PCRIC to "earn investment income and in extreme years support insurance payouts as they fall due" and "to retain and manage a portion of the risk" (World Bank 2016b).

Products

CCRIF

CCRIF's current products share certain key features. First, CCRIF's products are parametric, meaning they pay out when pre-established trigger event loss occurs based on the intensity of a hazard event. Second, the products are designed to cover relatively infrequent, high-severity events; as a result, CCRIF policies have relatively high deductibles (or attachment points). Under CCRIF's current policy parameters, the attachment point cannot be more frequent than 1-in-20-year events for earthquakes, 1-in-10-year events for

tropical cyclones, and 1-in-5-year events for excess rainfall. Third, payouts from CCRIF products provide short-term liquidity to help governments begin relief efforts immediately following a disaster. CCRIF policies pay out quickly—within (and often in less than) 14 days of an event occurring. To ensure speedy disbursement, payouts are based on estimated losses, calculated by a risk model using specific hazard inputs applied to predefined government exposure, rather than on-the-ground damage assessments. Payouts are meant only to cover immediate response and recovery needs, so the coverage limits in CCRIF policies are relatively modest. Members can obtain a maximum coverage of \$100 million per peril per annum (World Bank 2008).

Since its inception, CCRIF has offered parametric products for earthquake and tropical cyclone. The tropical cyclone product covers direct losses to governments for wind and storm surge damage caused by eligible tropical cyclone events. The model uses data from the U.S. National Hurricane Center to determine the level of wind and storm surge hazards, along with data on the value and distribution of government exposures to those hazards, to estimate government losses. The earthquake product is linked to ground-shaking intensity. In particular, the model underpinning the earthquake product uses U.S. Geological Survey data on the source, magnitude, and hypocenter of an earthquake to calculate ground-shaking intensity across the affected country. It then estimates government losses based on what assets are exposed to what level of intensity.

Responding to member demand, CCRIF launched an excess rainfall product in 2014. The product covers direct losses from rainfall and is designed to trigger if modeled losses due to the amount of rainfall exceed the specified policy trigger (or attachment point). It can be triggered by rainfall associated with tropical cyclones or noncyclonic systems.

Under the COAST, an initiative funded by the U.S. State Department and World Bank, CCRIF is beginning to provide a parametric insurance product to promote resilience in the Caribbean fisheries and aquaculture sectors. In July 2019, CCRIF issued COAST insurance policies to two member governments, Saint Lucia and Grenada (CRIFF 2019b). The product covers losses sustained by the fisheries and aquaculture sectors from hurricanes and excess rainfall (CCRIF 2019d). Like CCRIF's other products, the COAST product is a sovereign-level product, meaning the policyholders are governments and the product channels payouts to member country finance ministries. Unlike its other products, the COAST product includes a livelihood protection component, whereby policyholders commit, in advance, to transfer payouts to fisherfolk and other affected individuals in the fisheries sector (CCRIF 2019b).

In the 2019–20 season, CCRIF also plans to pilot test a new product for agricultural losses due to drought. The new product will cover two types of drought event: “the dry spell event (i.e., a short but very intense drought that causes acute crop stress) and the yield reduction event (i.e., a longer but milder drought that causes a reduction of crop yield)” (CCRIF 2019d). These and other proposed products are summarized in Table B1.

Table B1 | CCRIF Models and Products under Development

RISK MODEL/PRODUCT	SPECIFIC RISK(S) COVERED	STATUS
Drought	Drought (dry-spell events and yield reduction events)	CCRIF is finalizing the product and plans to pilot test it in select countries in 2019–20.
Fisheries and Aquaculture	Losses, including business interruption, from excess rainfall and winds	CCRIF is pilot testing a sovereign-level product in 2019–20. CCRIF also is exploring the possibility of developing a microinsurance product for fisherfolk and fisher cooperatives.
Agriculture (farming activities and related processes)	Extreme rainfall, tropical cyclone-induced wind and coastal flooding, and drought	CCRIF is in discussions with development partners and member governments about a possible agriculture product.
Public Utilities	Unspecified	CCRIF is engaged with public utility stakeholders about a possible product for public assets.

Source: CCRIF SPC (CCRIF), adapted by Authors.

ARC

ARC currently offers parametric drought insurance coverage of up to \$30 million per country. Like CCRIF's products, the drought product is a modeled-loss-type parametric insurance policy. The drought model is incorporated into the ARV platform, ARC's software engine that includes country vulnerability data and will house future hazard models as well. ARV combines rainfall and crop-based drought models with vulnerability data to identify affected food-insecure and vulnerable households and calculate estimated drought response costs. The model uses these response costs to trigger payouts. Attachment points on ARC's drought product are currently as low as one in four years (Interview #11).

Like CCRIF and PCRIC, ARC is designed as an early response financing mechanism; it does not provide countries with comprehensive financial protection from drought impacts. The drought product provides up to \$30 million to combat the worst effects of food insecurity before they occur, which can help mitigate future losses if payouts are received quickly and distributed effectively. ARC's coverage limit may represent only a fraction of total drought-related losses. In Malawi, for example, the World Bank estimated that the total response costs for the 2015–16 drought amounted to \$500 million, for which Malawi received a payout from ARC of \$8.1 million (Government of Malawi 2016).

ARC Agency is working to develop and launch a number of new products. These include models for tropical cyclones, floods, and outbreaks and epidemics, as well as a five-year financing mechanism, the Extreme Climate Facility (Table B2).

PCRIC

PCRIC currently offers parametric products for tropical cyclone and earthquake. It too offers modeled-loss-type parametric products. The tropical cyclone product covers impacts from cyclone-induced wind and flooding (from storm surge and precipitation), while the earthquake product covers impacts caused by ground shaking and tsunami. As with CCRIF's products, PCRIC's policies are designed to cover relatively infrequent and severe events and thus have relatively high deductibles; the policy attachment points cannot fall below 1 in 10 years. They are designed to provide member countries with an immediate but limited cash injection following a major cyclone or earthquake to help begin relief efforts, so they pay out quickly within 10 working days. Policy triggers are based on modeled losses, rather than on-the-ground loss assessments. AIR Worldwide, a risk modeling firm, developed PCRIC's risk models. These are proprietary and are rented out to PCRIC, which owns the model output, but not the model itself.

PCRIC is developing new products, including a rainfall product and two household-level cyclone products for Fiji. Many PICs are exposed to substantial damage and disruption due to excess rainfall. Although PCRIC's tropical cyclone product covers flooding arising from qualifying cyclone events, it does not cover flooding linked to weather systems, such as tropical depressions or convective storms. Similarly, many PICs face significant drought risk, but PCRIC does not currently offer insurance coverage for drought. As a result, in 2017, PICs asked the World Bank to evaluate the feasibility of a rainfall product that covers excess rainfall and drought (World Bank 2018e). A preliminary study confirmed the product's feasibility, but when testing the index using historic data, it found an unacceptable level of basis risk for

Table B2 | **ARC Models and Products under Development**

RISK MODEL/PRODUCT	SPECIFIC RISK(S) COVERED	STATUS
Tropical Cyclone	Wind, storm surge, and wave damage	Initial model for nonrain elements of tropical cyclone completed in collaboration with Kinetic Analysis Corporation. ARC approved the commissioning of a model review by the World Bank in February 2019.
Flood	Large river floods	Model is being piloted in four countries: Côte d'Ivoire, Ghana, The Gambia, and Togo. ARC expects insurance product will be available in 2020.
Outbreak & Epidemic	Ebola, Lassa Fever, Marburg, Meningitis	Model is in third and final year of development with piloting in Guinea and Uganda. Developed in consultation with the World Bank and designed to be complementary to its Pandemic Emergency Financing Facility.
Extreme Climate Facility	Extreme climate events potentially including drought, heatwaves, floods, tropical cyclones, among others	Still in development. ARC expects product to be a five-year financing mechanism that allows member countries that are actively purchasing insurance to access additional financing if extreme weather events increase in magnitude and/or frequency over the five-year period. Payouts will be used to build climate resilience and undertake adaptation efforts for disaster risks.

Source: African Risk Capacity (ARC) and e-Pact (2017c), adapted by Authors.

excess rainfall events (DFID 2018). Additional work is needed to refine the model. PCRIC also is developing two microinsurance products that would provide cyclone coverage for households in Fiji.

At the request of Vanuatu, PCRIC evaluated the possibility of developing an insurance product to protect against volcanic activity (World Bank 2018h). A feasibility study for this purpose evaluated two potential triggers: a pre-eruption trigger based on forecasts and a posteruption trigger (e.g., an evacuation order) to assist with recovery (DFID 2018). The findings of that study are not publicly available and, since Vanuatu withdrew from PCRIC in October 2018, it is unclear whether PCRIC will continue to develop this product.

Technical Assistance

CCRIF

In addition to insurance, CCRIF offers member countries technical assistance and planning support on DRM and finance. In 2009, CCRIF launched a technical assistance program with three main components: scholarship and professional development, regional knowledge building, and support for local disaster risk reduction initiatives. Overall, the program is quite small. CCRIF can allocate up to 50 percent of earned investment income to its technical assistance program (Interview #1); however, since 2009, it consistently has allocated significantly less. CCRIF member countries also receive technical support on DRM and finance from donors and development partners. For example, after CCRIF's Central America expansion, donor funds supported technical assistance to enhance disaster risk finance and insurance capacities of participating countries and public financial management of disasters (World Bank 2015b).

CCRIF also prepares individualized risk profiles for member countries each time it modifies the risk models underlying its products. These provide an overview of hazard characteristics and risks in a country, along with economic loss information used by CCRIF models. The profiles provide hazard and exposure mapping, information on historic losses, and estimated losses to exposed assets for different return period events. CCRIF uses the risk profiles to discuss coverage options with members and to price policies. At present, the profiles are not designed to support broader risk management planning, but CCRIF stakeholders have indicated that they would like to improve usability of the profiles (Interview #2, Interview #3).

ARC

ARC has an extensive capacity building program, through which ARC Agency helps countries develop early warning systems and contingency plans, as well as customize ARV. The capacity building program begins with a scoping mission to identify the most appropriate ministries, relevant technical experts, and senior officials to engage with ARC. Technical experts receive training on ARV and customize the drought model. Customization includes, for example, choosing country-appropriate rainfall datasets, crop types, and growing season dates. Once countries have completed ARV customization, they build contingency plans to guide the use of insurance payouts. Contingency plans include broader operational and final implementation plans, which are submitted shortly before an imminent payout and include detailed information given the specific situation. Finally, ARC helps guide countries

in the selection of their risk transfer parameters, including insurance policy return periods, ceding percentages, coverage levels, and premium amounts.

ARC's contingency planning process is unique among the three pools. Governed by the ARC Agency Governing Board and guided by ARV customization, contingency plans must identify how insurance payouts will be used, in combination with existing country systems, to reach and protect a country's most poor and vulnerable people. In general, stakeholders, including donors, the humanitarian community, and member countries find this approach innovative and useful (Interview #9).

ARC spends considerable resources on its country engagement process and capacity building program. As of October 2017, ARC Agency had approximately 50 employees, including 19 full-time salaried positions (e-Pact 2017c). Its budget for 2019 is over \$15 million, which includes research and development, capacity building, and business development (ARC 2019).

PCRIC

Under the broader PCRAFI program, the World Bank and other partners provide technical assistance to participating governments. During the pilot program, the World Bank provided technical assistance to ministries of finance on disaster risk finance and public financial management, and it provided guidance on the product offerings and different insurance parameters to enable countries to select appropriate insurance coverage (World Bank 2013). As part of these activities, the SPC assisted each of the participating governments to develop postdisaster budget execution guidelines to facilitate the rapid mobilization of resources in the aftermath of an event (SPC 2015a).

The project establishing PCRIC also includes an institutional capacity building component. It allocates \$2.3 million in donor funds to capacity building for PCRIC, national and regional organizations, and PIC government ministries on disaster risk financing and insurance (World Bank 2016b). Unlike ARC, PCRIC does not include a standalone capacity building entity. Instead, the World Bank currently administers the related technical assistance and will gradually shift responsibility for these activities to national and regional entities.

Unlike ARC, contingency plans are not a mandatory precondition to buy PCRIC coverage, but member countries recently drafted contingency plans with the support of PCRAFI technical assistance. Though the plans are not publicly available, they reportedly "provide an overview of the legislative environment of disaster response, identify likely expenditures for the PCRIC payout as well as negative expenditures and detail the financial tracking and reporting procedures that will be used" (DFID 2018).

As explained in Section 5, the PCRAFI program also has developed PacRIS and individualized country risk profiles to assist with disaster risk assessment. SPC compiled much of the data included in PacRIS. Some of that data is now out of date and "must be updated as soon as possible for the [PCRIC] model to accurately protect household, business and government assets that face exposure to disaster related risks" (World Bank 2018a). PCRAFI technical assistance funds will support necessary updates to the PacRIS database, and SPC has been engaged to carry out this work. In updating the PacRIS data sets, SPC is considering how to improve usability and applicability to local DRM decision-making (Interview #17).

Premium Financing

CCRIF

While most CCRIF members pay premiums out of their own national budgets without assistance, several have benefited from premium support. For example, Haiti, which is the poorest country in the region, receives help paying its CCRIF premium. In recent years, CDB has funded significant portions of Haiti's premiums. For the 2017–18 season, CDB provided a \$3.5 million grant to Haiti to cover premiums for its tropical cyclone, earthquake, and excess rainfall coverage (CDB 2017). For the 2018–19 season, CDB provided \$3 million, and Haiti contributed \$1.8 million (CDB 2018). Another example is Sint Maarten, which purchased tropical cyclone, earthquake, and excess rainfall coverage for the first time in the 2018–19 season. Under the Sint Maarten Emergency Recovery Project, the Government of the Netherlands provided grant funding to support Sint Maarten's participation fee and premiums for two years (World Bank 2018g).

Several participating countries have used IDA credit to fund their insurance premiums and CCRIF participation fees. Dominica, Grenada, St. Lucia, and St. Vincent and the Grenadines used IDA credits to finance their participation fees (World Bank 2011). More recently, under the Nicaragua Catastrophe Risk Insurance Project, Nicaragua secured IDA credit to fund its CCRIF participation fee, 100 percent of its premiums for its first four years of CCRIF participation, and half of its premiums in the fifth and sixth years (World Bank 2017b).

ARC

ARC countries have historically paid for their insurance policies using their own budgetary resources. Many ARC countries are IDA-eligible; however, to date, none have used IDA allocations to fund ARC premium payments. The reason is unclear, although it appears that the World Bank's close involvement in CCRIF and PCRIC has helped ensure more active use of IDA financing in those pools (Interview #9, Interview #10).

In an effort to improve the affordability of its products and improve uptake rates, ARC recently helped launch ADRiFi with AfDB. See Section 4 for additional details on this program.

PCRIC

With the exception of the Cook Islands, participating governments benefited from premium subsidies throughout the PCRAFI pilot program and from concessional premium financing since PCRIC's inception. The Government of Japan provided premium subsidies to member countries other than the Cook Islands during the pilot program.²⁰ Japan fully subsidized premiums in the first year of the pilot. In the second pilot season, participating countries each contributed \$20,000 to the cost of premiums and, in the third season, they increased their national contributions to \$40,000 (World Bank 2015c).

Since the 2015–16 policy year, Samoa, the Marshall Islands, Tonga, and Vanuatu have used IDA resources combined with small but growing contributions from their own national budgets to finance their premiums. Under the Pacific Resilience Program, the four countries secured IDA resources to finance their

premiums for three years, through the 2017–18 season (World Bank 2015d). The Marshall Islands and Samoa used grant funds from their IDA envelopes, Tonga used an IDA credit with a small grant component, and Vanuatu used an IDA credit. At the same time, all four countries agreed to contribute on their own at least \$40,000 in the 2015–16 season, \$50,000 the following policy year, and \$60,000 the year after that (World Bank 2015d).

The Marshall Islands, Samoa, and Tonga subsequently secured IDA resources for an additional five years' worth of premiums, through the 2022–23 season. The Marshall Islands and Samoa again secured grant funding to pay their premiums, and Tonga amended its financing agreement to include only grant funding. The three countries agreed to contribute a portion of the premium from their own resources in gradually escalating intervals, culminating in \$100,000 during the 2022–23 policy year (World Bank 2015d).

ARC Replica

ARC Replica is a recently developed program that provides a matching insurance policy to humanitarian partners working in African countries. As initially designed, a humanitarian organization would purchase an insurance policy from ARC that would mirror the sovereign coverage purchased by the country in which the organization operates. When the country's ARC policy triggers and pays out, the policy held by the humanitarian organization would pay out simultaneously, effectively doubling the total resource envelope available to the country, even if the payouts are disbursed to different entities.

In 2018, Mali, Mauritania, and Senegal piloted the program, along with two humanitarian organizations, Start Network and WFP. ARC offered an insurance policy to WFP that mirrored those signed by the governments of Mali and Mauritania. The same was done with the Start Network, whose policy mirrored that of the Government of Senegal. The premium for the humanitarian organizations was covered fully by the Government of Germany. WFP and the Start Network developed their own contingency plans, in close coordination with authorities in Mali, Mauritania, and Senegal. To access ARC Replica, countries must have participated in ARC's previous two risk pools and must not have any unpaid premiums.

In 2018, ARC Replica policies were voided because Mali, Mauritania, and Senegal did not meet the conditions needed to activate the policies. To activate an ARC Replica policy, member countries must sign their own policy and pay for at least 70 percent of that policy's premiums. In 2018, Mali and Mauritania did not sign their policies and Senegal did not pay the premiums for their signed policy. In 2019, after much negotiation with ARC Replica's partners and the donor, ARC delinked ARC Replica policies and member country policies, so that humanitarian organizations now may obtain ARC Replica coverage even if the governments of the countries in which they operate do not purchase ARC coverage.

ENDNOTES

1. Numbers include Burkina Faso and Senegal, which signed insurance policies for the 2018–19 policy year but have not paid the premiums associated with these policies as of the date of this paper.
2. Data on insurance premiums and coverage levels in the 2018–19 policy year are not available for all three pools.
3. What instruments are best suited for which layers of risk has been a matter of some debate. For example, in cases where creating operational national disaster funds has been too financially or politically costly, using insurance or contingent credit lines to cover relatively high-frequency, low-severity events may make sense. Despite these debates over the costs of specific tools, the overall principle—that the lower costs should be matched to lower layers of risk—is widely accepted.
4. Compared to national disaster funds, it is easier to raise a larger resource envelope from insurance (or from a cat bond) because insurance is risk-based and only pays out when a covered event produces modeled losses about specified levels. Generally speaking, this means that, in most years, the insured can expect not to receive a payout. When a sufficiently large covered event does occur, however, the insured can generally expect to receive a multiple of annual premiums in its insurance payout. With reserve funds, for every dollar put into the fund, only one dollar can be taken out.
5. The Contingent Credit Facility for Natural Disaster Emergencies, offered by the Inter-American Development Bank (IDB), is capped at the lower of \$100 million and 1 percent of the borrowing country's GDP. A country signing up for an IDA CAT-DDO can borrow up to \$250 million, or 0.5 percent of GDP, whichever is lower. The limit for an IBRD CAT-DDO is the lower of \$500 million and 0.25 percent of GDP. The World Bank also limits the number of times countries can renew CAT-DDOs.
6. Seventy-six countries are currently eligible to purchase insurance through CCRIF, PCRIC, or ARC. Although all 55 African Union member states are technically eligible to purchase ARC insurance, we only include those 33 that have signed the ARC Establishment Agreement, the first required step toward purchasing ARC insurance. Eight of these 76 countries (Anguilla, Bermuda, British Virgin Islands, Cayman Islands, Montserrat, Sahrawi Arab Democratic Republic, Sint Maarten, and Turks and Caicos Islands) are not eligible to access MDB contingent credit lines because they are not members of the ADB, IDB, or World Bank. This analysis excludes those 8 and covers the remaining 68 countries.
7. Six countries currently deploy all three instruments. These countries are the Cook Islands, Guatemala, Jamaica, Nicaragua, Panama, and Tonga.
8. CARICOM is an organization of Caribbean states (plus Belize, Guyana, and Suriname) that aims to promote economic integration and cooperation throughout the region (CARICOM n.d.).
9. While eligibility to join CCRIF is loosely based on geography, eligibility is neither strictly defined in the facility's founding documents nor is there an official list of eligible countries. Although the trust deed establishing CCRIF does not specifically require it, CCRIF leadership has established a precedence of seeking a no objection letter from CARICOM for new entrants that are not full or associate CARICOM members. For instance, CCRIF sought and received no objection letters from CARICOM for its expansion into Central America and for Sint Maarten to join.
10. Members are required to pay one-time participation fees to enter the program. This discount allowed members of three years standing to draw on their deposited participation fees to defray part of their premium costs.
11. In 2014, CCRIF complemented its reinsurance program with a \$30 million cat bond that the World Bank issued on its behalf. The bond provided three years of annual protection for hurricanes and earthquakes affecting CCRIF's Caribbean members, enabling CCRIF to buy less reinsurance. The cat bond experiment was not renewed because reinsurance prices remained sufficiently low over the following years to make the cost gains from the cat bond marginal, but the experience could be useful in the future.
12. ARC issues Certificates of Good Standing to countries that have signed the ARC Establishment Agreement, have contingency plans in place, and have completed customization of ARV, ARC's proprietary software and modeling engine.
13. ActionAid published a report in May 2017 entitled "The Wrong Model for Resilience: How G7-Backed Drought Insurance Failed Malawi, and What We Must Learn from It," while the Heinrich Böll Foundation published a report in August 2018 entitled "Not a Silver Bullet: Why the Focus on Insurance to Address Loss and Damage Is a Distraction from Real Solutions" (Reeves 2017; Richards and Schalatek 2018).
14. The ADF is the primary concessional financing arm of the AfDB and comprises 38 least developed African countries (AfDB n.d.a). The ADF classifies countries into four categories, ADF-Only, ADF-GAP, Blend, and Graduating to AfDB, based on per capita income and creditworthiness. Senegal is a blend country, Mauritania is an ADF-Gap country, and the other seven countries that have expressed interest in ADRiFi are ADF-Only countries (AfDB n.d.b).

15. PCRAFI is a joint initiative of the World Bank, Secretariat of the Pacific Community, and Asian Development Bank, launched in 2007, to provide financing and disaster risk management tools to Pacific Island countries.
16. ARC has stated that it often relies on “simple reports from sentinels/ field stations of figures with no accompanying analysis, performance/ impact indicators or reasons for discrepancies in planned versus actual service delivery” (ARC 2017b).
17. The ADRIFi program will provide support for other climate risk management solutions (e.g., risk profiles and contingency plans) and disaster risk finance strategies, although it will not provide support for disaster risk finance instruments other than insurance.
18. “Captive insurer” refers to an insurance company that is established for the purpose of insuring the risks to which its owners are exposed (Clarke and Dercon 2016).
19. COSEFIN, which was established in 2006, is the forum of Finance Ministers under the broader Central American Integration System (SICA). SICA is the institutional framework for economic and political collaboration among Central American states (CAIS n.d.).
20. Contributions from the Government of Japan were channeled through a World Bank-administered trust fund. Because the Cook Islands is not a World Bank member, it was not eligible for subsidies during the pilot program.

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INTERVIEWS

Interview #1. Nov. 2018. Interview by L. Sidner and J. McClamrock. Written.

Interview #2. Oct. 2018. Interview by L. Sidner and J. McClamrock. Telephone.

Interview #3. May 2019. Interview by L. Martinez-Diaz and L. Sidner. Telephone.

Interview #4. Apr. 2019. Interview by L. Martinez-Diaz. In Person.

Interview #5. May 2019. Interview by L. Martinez-Diaz and L. Sidner. Telephone.

Interview #6. Sept. 2018. Interview by L. Martinez-Diaz. In Person.

Interview #7. Apr. 2019. Interview by L. Martinez-Diaz. In Person.

Interview #8. Oct. 2018. Interview by L. Martinez-Diaz, J. McClamrock, and L. Sidner. Telephone.

Interview #9. Oct. 2018. Interview by J. McClamrock and L. Sidner. Telephone.

Interview #10. Apr. 2019. Interview by L. Martinez-Diaz and J. McClamrock. Telephone.

Interview #11. Feb. 2019. Interview by L. Martinez-Diaz and J. McClamrock. Telephone.

Interview #12. Apr. 2019. Interview by L. Martinez-Diaz and J. McClamrock. Telephone.

Interview #13. Apr. 2019. Interview by L. Martinez-Diaz and J. McClamrock. In Person.

Interview #14. Mar. 2019. Interview by J. McClamrock. In Person.

Interview #15. Apr. 2019. Interview by L. Martinez-Diaz and J. McClamrock. In Person.

Interview #16. Apr. 2019. Interview by L. Martinez-Diaz and J. McClamrock. In Person.

Interview #17. May 2019. Interview by L. Sidner. Telephone.

Interview #18. Apr. 2019. Interview by L. Martinez-Diaz. In Person.

Interview #19. May 2019. Interview by L. Sidner. In Person.

Interview #20. May 2019. Interview by L. Sidner. In Person.

Interview #21. May 2019. Interview by L. Sidner. In Person.

Interview #22. May 2019. Interview by L. Sidner. In Person.

Interview #23. May 2019. Interview by L. Martinez-Diaz. Written.

Interview #24. May 2019. Interview by L. Sidner. Telephone.

Interview #25. Jun. 2019. Interview by L. Martinez-Diaz, L. Sidner, and J. McClamrock. Telephone.

Interview #26. Feb. 2019. Interview by J. McClamrock and L. Sidner. Telephone.

Interview #27. Dec. 2018. Interview by L. Martinez-Diaz. In Person.

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ABOUT WRI

World Resources Institute is a global research organization that turns big ideas into action at the nexus of environment, economic opportunity, and human well-being.

Our Challenge

Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth's resources at rates that are not sustainable, endangering economies and people's lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

Our Vision

We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

Our Approach

COUNT IT

We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

CHANGE IT

We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

SCALE IT

We don't think small. Once tested, we work with partners to adopt and expand our efforts regionally and globally. We engage with decision-makers to carry out our ideas and elevate our impact. We measure success through government and business actions that improve people's lives and sustain a healthy environment.



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