



Literature Review of Evidence on Disaster Risk Finance

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Global Risk Financing Facility

Supporting Early Action to Climate Shocks, Disasters, and Crises

Table of Contents

Abbreviations	1
Acknowledgments.....	2
Executive summary	3
Background	3
Methods.....	3
Findings	4
1. Introduction	7
2. Methods.....	8
2.1. Identification of documents.....	9
2.2. Limitations and challenges.....	10
2.3. Useful references	11
3. Research Question 1: Constraints preventing uptake of DRF instruments	11
3.1. Cost of DRF instruments	12
3.2. Moral hazard	14
3.3. Basis Risk.....	14
3.4. Observation of others' experiences.....	16
3.5. Institutional and regulatory framework	16
3.6. Psychology, political incentives, trust, and collaboration.....	17
3.7. Technical capacity and financial literacy.....	19
3.8. Previous uptake of DRM tools and experience of catastrophic loss	20
3.9. Supply-side constraints.....	21
3.10. Further observations.....	21
3.11. The need for further lessons on failures.....	22
4. Research Question 2: The impact of technical assistance on response timeliness and effectiveness	23
4.1. The impacts of technical assistance.....	24
4.2. The impact of DRF uptake on DRM.....	26
4.3. The impact of DRF instruments on response.....	27
5. Research Question 3: Combining risk financing instruments	29
5.1. Risk layering	29
5.2. Using DRF to finance shock-responsive components of social safety nets	33
5.3. Bundling DRF tools.....	35



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6.	Research Question 4: Crowding in prearranged financing	37
6.1.	A brief history of factors that have encouraged private sector engagement in prearranged financing to date	38
6.2.	Continued role for public investment and intermediation for risk finance	39
6.3.	Strengthening weak domestic insurance sectors to facilitate participation in prearranged financing	42
6.4.	Continuing need for public sector involvement in DRF	43
6.5.	Risk modeling and actuarially sound pricing	44
7.	Conclusion	45
7.1	Summary of findings	45
7.2	Opportunities for future research	46
	Annex: Examples of DRF instruments	48
	References	52



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Abbreviations

ARC	African Risk Capacity
Cat DDO	Catastrophe Deferred Drawdown Option
CCF	Contingent Credit Facility for Natural Disaster Emergencies
CCL	Contingent Credit Line for Natural Disaster Emergencies
CCRIF	Caribbean Catastrophe Risk Insurance Facility
CDRF	Crisis and Disaster Risk Finance
DRF	Disaster risk finance
DRM	Disaster risk management
FONDEN	Fund for Natural Disasters (Mexico)
FOPREDEN	Fund for the Prevention of Natural Disasters (Mexico)
GFDRR	Global Facility for Disaster Reduction and Recovery
GRiF	Global Risk Financing Facility
HARITA	Horn of Africa Risk Transfer for Adaptation
HSNP	Hunger Safety Net Programme (Kenya)
IBLI	Index-Based Livestock Insurance (Mongolia, Kenya and Ethiopia)
IBRD	International Bank for Reconstruction and Development
IDB	Inter-American Development Bank
ILS	Insurance-linked securities
NAIS	National Agricultural Insurance Scheme (India)
NUSAF3	Northern Uganda Social Action Fund 3
PCRAFI	Pacific Catastrophe Risk Assessment and Financing Initiative
PSNP	Productive Safety Net Programme (Ethiopia)
R4	R4 Rural Resilience Initiative
TCIP	Turkish Catastrophe Insurance Pool
UNFCCC	United Nations Framework Convention on Climate Change



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Executive summary

Background

Over the last two decades, governments and communities have grown more aware of—and increased their demand for—financial planning in preparation for natural disasters and other emergencies. Innovations in data management and modeling have enabled the integration of financial planning and disaster risk management (DRM) programming, leading to the development and uptake of disaster risk finance (DRF) instruments in middle-income countries. However, uptake of such instruments in low-income countries remains limited. Operational experience suggests several reasons for this: low-income countries face immediate demands on scarce budgetary resources, lack political incentives to save for future emergencies, and have limited expertise to design and implement sophisticated DRF solutions. In addition, private financial institutions may doubt the value of investing in DRF in such contexts.

This research note explores the evidence underlying these assumptions. It seeks to better understand four topics: (i) how to boost uptake of DRF instruments, (ii) whether incorporating technical assistance in the design of prearranged financing instruments improves timeliness and effectiveness of disaster response, (iii) whether there are promising examples of combining DRF instruments, and (iv) whether implementing prearranged financing instruments will encourage the private sector to participate more fully. The scope of the review is focused on the following instruments and (where information is available) on the systems/enabling environment of these instruments: regional risk transfer facilities, contingent financing arrangements, alternative risk transfer instruments such as catastrophe bonds and derivatives, and microinsurance schemes. The section on combining DRF instruments also addresses distribution through shock-responsive safety nets. This research was undertaken to inform the theory of change for the World Bank's Global Risk Financing Facility (GRiF). It is also intended as a public good that shares the current state of evidence on these four topics with those interested in DRF. This paper is not intended to make recommendations, only to synthesize the research that currently exists.

Methods

To ensure thorough coverage of the new and rapidly growing DRF sector, the literature review included a wide-net internet search using keywords, a review of articles and documents provided by the GRiF Secretariat, and a snowball sample that reviewed references in papers identified through the other methods. Around 250 documents were identified through this search. About half of the identified documents were policy papers or informal sources, less than half provided a stated methodology, and only 16 percent followed a qualitative, quantitative, or mixed methods approach. While some rigorous evaluations including experimental and quasi-experimental studies have been conducted at the micro level, such techniques are less feasible for macro level instruments. The evidence base for macro level tools consists more of cost-effectiveness studies, scenario analysis, loss modeling, and qualitative approaches drawing on key informant interviews, for example. These results are consistent with observations in the literature indicating a lack of rigorous evidence on DRF and suggesting that most empirical research consists of case studies and success stories. That the field is still new, and that few payout-triggering events have been available for study, help explain the paucity of rigorous evidence.



The limitations in rigorous evidence made it necessary to expand the scope of this literature review. In order to address the objective of the review, which was to provide adequate information to inform the research questions and thus the theory of change, the scope was expanded to incorporate less rigorous works, case studies, and perspectives from policy papers. This review has tried to distinguish between “evidence” and “experience”: the former includes quantitative studies and qualitative studies with clearly outlined methodologies, while the latter includes case studies, works without clear methodologies, and literature reviews.

Findings

Research Question 1: Constraints to the uptake of DRF instruments

The literature shows that the main constraints to uptake of DRF instruments include high premiums, moral hazard, insufficient data and modeling, lack of institutional regulatory structures, and lack of demand in developing countries. Additional inhibiting factors include high start-up costs, basis risk, psychological biases, political disincentives, a lack of trust and willingness to coordinate, and high technical demands, in addition to limited technical capacity and poor financial literacy. Consumers’ demand may also be influenced by observing the positive and negative DRF experiences of others.

Interestingly, the review suggested that there may be a supply-side constraint—that is, potential consumers may actually want to take up risk transfer but have particular needs not covered by the options currently available to them. While the number of DRF options is increasing globally, consumers themselves may have only one or two options to choose between.

Focusing strongly on success stories, the literature shows that many of the countries that have taken up risk finance instruments face frequent natural disasters and were prompted to take up a DRF instrument in the wake of a particularly catastrophic event. These countries also had a strong DRM environment (for example, contingency planning and adaptation interventions) before adopting a DRF tool. More research is needed on and in countries that have not shown interest in taking up DRF instruments.

Research Question 2: Impact of technical assistance on response timeliness and effectiveness

Given the limited availability of evidence on DRF broadly, there is very little research that explores the direct link between technical assistance and the timeliness and delivery of disaster response. There may be an indirect pathway, which can be inferred from policy papers, experience, and the few evaluations that have explored two topics: first, the impact of technical assistance on DRF uptake and sustainability, and second, the impact of uptake and sustainability on the timeliness and effectiveness of responses.

A rare evaluation of technical assistance, carried out for African Risk Capacity (ARC), showed that the facility did build technical capacity but that its depth and sustainability were limited by low starting capacity, limited reach of training, and high turnover of staff.

In assessing timeliness and effectiveness, there is an important distinction to be made between assessing the facility’s payouts and assessing the government’s response. The available information on the impact of technical assistance on timeliness of payouts compares the rapid 10- and 14-day payouts by (respectively) the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) and Caribbean



Catastrophe Risk Insurance Facility (CCRIF) to ARC's 120-day payouts. However, ARC is the only facility that requires countries to specify their response mechanisms and that monitors post-payout distributions. Findings from the first four ARC payouts suggest that even if DRF instruments make rapid payouts, government processes can impede the delivery of funds to the household level. If there is indeed an interest in improving the timeliness and effectiveness of the full response through the use of DRF tools, post-payout distributions should be monitored more closely.

Research Question 3: Promising combinations of risk financing instruments

Three themes emerged prominently from the literature on combinations of risk financing instruments: risk layering, shock-responsive social protection, and bundled services. While there are some empirical evaluations and some scenario and cost-effectiveness analyses addressing these topics, additional research is needed to build the evidence base in this area and to determine the extent to which findings are transferable across contexts and instruments.

The policy literature shows strong conceptual support for implementing risk-layering strategies, in which several types of DRM and DRF instruments are employed to address the country's different hazards, time frames, populations, and levels of risk. A few studies demonstrate that risk layering can be cost-effective, and a few successful case studies are cited in the literature. However, the literature suggests that implementing risk layering can be challenging in practice, requiring policy and planning capacities beyond those already required to implement a single DRF tool. Furthermore, the exact composition of a risk-layering framework needs to be customized for each country and will vary depending on what assets the country prioritizes for protection and on what capacity and funds it has to implement the instruments.

There is growing experience and evidence on using DRF instruments to fund the scale-up of shock-responsive social protection schemes. To date, the scalable social protection systems in Ethiopia and Kenya have been the most well documented, but with more countries adding DRF-funded scalable components to their traditional safety nets, there will soon be much more experience to learn from.

Some programs have begun bundling risk finance tools with various other interventions, although most of the information available on this approach is descriptive. For example, disaster microinsurance has been bundled with microcredit as well as more traditional insurance policies like health insurance. The Rural Resilience Initiative (R4) program bundles microinsurance with DRM interventions. At the macro level, bundling might consist of covering multiple hazards; for instance, Mexico's MultiCat covers both hurricane and earthquake risks.

Research Question 4: Effect of prearranged financing on private sector participation

Given the nature of this research question, the findings on this topic are predominantly informed by information from the policy literature and experience rather than by rigorous evidence.

Private international insurers and investors are already keen to participate in prearranged financing opportunities, in large part thanks to the development and improvement of hazard models and risk financing tools. Opportunities for low-income countries to participate in DRF markets have been greatly facilitated by the formation of risk pools and DRF instruments developed by the World Bank, which



diversify the risk of countries that investors may see as less attractive investments. Although nearly all of the various tools are still relatively new, it is promising that international investors have sustained their interest in DRF instruments despite experiencing some losses.

More work remains to be done at the domestic level, where legal and regulatory frameworks are often lacking, inhibiting domestic private sector engagement in risk finance. Experience in some countries has demonstrated that providing incentives, mandating insurance, and developing governmental (re)insurance programs can work to boost domestic private sector participation.

While experience suggests that the outlook for crowding in the private sector is promising, some studies have warned against pursuing fully market-based solutions, viewing continued engagement of the public sector as essential. The private sector may be keen to support middle-income countries, but it generally remains wary of investing in low-income clients and countries. Still, the continual improvement of risk modeling tools and the development of actuarially sound pricing are likely to continue crowding in the private sector.

Conclusion

Given the limited evidence on DRF in general, and particularly directly addressing these four research questions, this review concludes with a list of suggested topics for future research.



1. Introduction

Disaster risk finance (DRF) instruments were initially developed and used by high- and middle-income countries in the early 1990s to reduce their risk exposure to natural disasters and other hazards. Beginning in the mid-2000s, new financing instruments were developed specifically for low-income countries, but uptake remains low.¹

Over the last five years, the international community has led a push to increase uptake of DRF instruments among low-income countries. This effort has been codified by three international framework agreements adopted in 2015—the 2030 Agenda for Sustainable Development, the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction—which joined in promoting integration of climate and disaster risk management (DRM) with risk finance. Also in 2015, the G7 launched the InsuResilience Initiative to meet its goal of providing insurance for 400 million poor and vulnerable people in developing countries by 2020.²

In response to this effort, low-income countries have increased DRF uptake, though they still lag behind the rest of the world, leaving international humanitarian aid as the modus operandi when disasters occur. In 2019, a very small proportion of losses from natural hazards in Africa and only 25 percent in Asia were covered by insurance, compared with 52 percent in North America and 65 percent in Europe.³ According to a 2017 analysis, humanitarian aid still outpaces insurance payouts in developing countries roughly 2.5 to 1.⁴

New tools for contingent financing and sovereign risk transfer—such as catastrophe (cat) bonds, catastrophe derivatives, and regional sovereign risk pooling facilities—have been piloted. Though uptake remains limited, these tools are gaining traction. Of the sovereign risk pools, only the Caribbean Catastrophe Risk Insurance Facility (CCRIF) has attracted enough participation to date to actualize the benefits of risk pooling, with 19 Caribbean and two Central American members.⁵ According to a recent discussion paper,⁶ 15 countries are eligible for the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI), but only four are currently participating. While 34 countries have signed the African Risk Capacity (ARC) treaty, only 11 are participating in the 2019/20 risk pool. However, five of these countries are new this year, demonstrating increasing interest.⁷ Similarly, uptake in the World Bank’s Catastrophe Deferred Drawdown Option (Cat DDO) contingent financing instrument has increased recently. As of early 2020, 8 of the 18 active Cat DDOs were in low-income, lower-middle-income, or fragile and conflict-affected countries. All but one of these countries had taken out their first Cat DDO

¹ Mechler et al. 2018; Golnaraghi and Khalil 2017.

² Golnaraghi and Khalil 2017; Hillier 2018; European Council 2015 (cited in Schäfer, Warner, and Kreft 2019).

³ Löw 2020.

⁴ ODI and RMS 2017.

⁵ CCRIF 2019; Vyas et al. 2019.

⁶ Vyas et al. 2019.

⁷ African Risk Capacity, “ARC Member States,” <https://www.africanriskcapacity.org/countries/>; African Risk Capacity, “ARC Risk Pools,” <https://www.africanriskcapacity.org/countries/arc-risk-pools/>.



after 2018 (Cat DDOs for International Development Association [IDA] countries were first introduced at the end of 2016).⁸

This literature review was commissioned by the World Bank's Global Risk Financing Facility (GRiF) Secretariat. GRiF provides grants to test, pilot, and scale up prearranged financing instruments in developing countries. The review was designed to serve two purposes: first, to inform the GRiF theory of change, and second, to contribute to the global public knowledge base on DRF. This paper is not intended to provide recommendations but rather to synthesize the existing state of knowledge in the literature.

Based on operational experience at the World Bank, the first pathway of the GRiF theory of change posits that key constraints such as high start-up costs and lack of capacity inhibit uptake of prearranged financing and that GRiF's model of pairing financing with technical assistance will resolve this problem. The first three research questions were designed to explore the evidence underlying these assumptions:

1. What are the key constraints that prevent vulnerable countries (low- and middle-income countries) from the uptake of prearranged financing for disasters?
2. What evidence is there to suggest that including technical assistance as part of prearranged financing will lead to a more timely and effective response?
3. What combinations of risk financing instruments show promise under what circumstances?

The second pathway of the theory of change posits that by providing necessary start-up financing and improving capacity, GRiF will create more options for disaster risk financing, which will in turn lead the private sector to flourish, thereby limiting the need for donor funding. The fourth question was designed to understand whether evidence supports this chain of events, or whether there is a risk of the opposite—that is, donor funding crowding out private sector financing.

4. Is there evidence to suggest that prearranged financing will crowd in rather than crowd out the private sector? Can we provide examples of successes and/or failures in this area to understand a bit more clearly what works and doesn't work?

The review begins by summarizing the research methods used. It then addresses each research question in turn before offering some conclusions. A table of specific DRF instruments frequently cited in the literature and covered in this paper is included as a reference in the annex.

2. Methods

Because the field of risk finance for vulnerable countries is relatively new and rapidly evolving, the approach to the literature review was to conduct a wide-net search for relevant articles, beginning with a set of 21 documents on the topic provided by the GRiF Secretariat⁹ and expanding to a broad internet

⁸ GFDRR 2020.

⁹ The GRiF Monitoring, Evaluation, and Learning Specialist provided 17 documents that were policy papers, books, literature reviews, evaluations/methodologies, or journal articles, as well as four Independent Evaluation Group



search using keywords. Given that GRiF focuses on sovereign solutions, the search centered on macro-level instruments. Meso and micro experience and evidence that emerged from the initial articles or internet search were also included.

2.1. Identification of documents

Keywords were selected by pairing the words “evaluation” or “assessment” with the names of programs, initiatives, financing tools, and reinsurers identified through the initial set of documents provided. For example, specific searches were conducted for Cat DDOs, PCRAFI, CCRIF, SEADRIF (Southeast Asia Disaster Risk Insurance Facility), contingent credit lines, catastrophe weather derivatives, and catastrophe (cat) bonds. The first two pages of search results were reviewed for relevance, with a focus on developing countries. Database searches were also conducted and included for the Independent Evaluation Group (IEG) portal, the websites of the sovereign risk pools, the InsuResilience knowledge hub, and the United Nations Framework Convention on Climate Change (UNFCCC) clearinghouse. To ensure the risk financing tools were covered and that both experience and evidence were included, criteria for inclusion were kept broad: the documents had to be relevant to at least one of the four research questions.

The keyword search resulted in over 200 documents in addition to the 21 initially provided. The vast majority (~90 percent) of the compiled documents had been written in the last 10 years, and just under two-thirds had been written in the last five years. The documents were classified by type and methodology (table 1). Nearly half of the documents were policy documents, including various reports, literature reviews, working papers, and conference proceedings. Assessments and evaluations, project reviews, and implementation completion reports comprised about a fifth of the reviewed documents. The remainder were about evenly spread between methodologies and modeled studies, case studies, books and journal articles, and informal sources. About two-thirds of the documents had no stated methodology, and it was difficult to infer what kind of method was used. Of the rest, about half were literature reviews, about a quarter used quantitative methods, about an eighth used other qualitative methods, and the other eighth used mixed methods.

Table 1: Documents provided by the GRiF Secretariat and identified through keyword search

Total number	229
Date	Last 5 years: 62%; last 10 years: 90%
Type	Policy documents (45%); assessments and evaluations (21%); books and journal articles (10%); case studies (9%); methods and other studies (8%); informal sources (7%)
Method	Unknown/not inferred (56%); desk review (19%); case study (9%); quantitative (8%); qualitative (4%); mixed methods (4%)

Given the paucity of rigorous evidence (such as quantitative evaluations and qualitative studies with clearly outlined methodologies identified through the keyword search), the inclusion criteria were kept broad. This made it possible to draw insights from relevant experience, such as case studies, works

(IEG) completion reports for Development Policy Loans (DPLs) with Catastrophe Deferred Draw Down Options (CAT DDOs).

without detailed methodologies, and literature reviews. This paper uses the terms “evidence” and “experience” to distinguish between the types of literature cited. To provide context, policy papers were also included.

About half of the documents identified through the keyword search were selected for detailed review. Documents were selected to ensure adequate background and overview of the DRF landscape, sufficient policy perspectives to demonstrate common themes arising in the policy space, inclusion of various forms of DRF beyond just insurance (which is the most well covered), and coverage of available evidence in the form of evaluations, assessments, and reviews.

Beyond what was necessary to provide background and general support to common themes, the document review excluded certain types of content: material with low relevance to the research questions, repetitions of the most common policy claims or case studies without promotion of new perspectives, descriptions of the DRF landscape, and explanations of how certain tools function. Informal documents were also excluded unless they included important information otherwise unavailable in the selected documents. Of the thoroughly reviewed documents, some were dropped for the reasons just cited.

Finally, a snowball sample, in which additional documents were identified through a review of existing papers’ references, was conducted to ensure that any remaining important evidence was not missed. While many of the documents identified through the snowballing were already included through the keyword search, this step and the review process added several more articles.

While some rigorous evaluations including experimental and quasi-experimental studies have been conducted at the micro level, such techniques are less feasible for macro level instruments. The evidence base for macro level tools consists more of cost-effectiveness studies, scenario analysis, loss modeling, and qualitative approaches drawing on key informant interviews, for example. The experience base is much broader and still holds important lessons.

2.2. Limitations and challenges

The limited rigorous evidence on DRF identified by the search was confirmed by several of the documents. Authors stressed that most empirical DRF research is in the form of case studies focused on success stories, and that the literature suffers from a lack of robust monitoring and evaluation frameworks or counterfactuals.¹⁰ Authors attributed this to the newness of the field and noted that even where DRF has been taken up, relatively few major hazard events have occurred to trigger payouts.¹¹

Two challenges observed during document review and synthesis related to terminology. First, terms such as “disaster risk finance” and “risk transfer” are often used as umbrella terms to refer to various types of instruments, including contingent financing, which is technically a risk retention strategy. This study

¹⁰ Le Quesne 2017; Schäfer, Warner, and Kreft 2019; Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012; Hinds 2013 (cited in Clarke et al. n.d.); IEG 2012 (cited in Clarke et al. n.d.).

¹¹ Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012.



covers a variety of sovereign risk transfer instruments, including insurance, derivatives, and cat bonds as well as contingent financing. Given the lack of clarity in the literature, this study uses “contingent instruments” to refer to both risk transfer and risk retention mechanisms.

Similarly, an important barrier in addressing Research Question 2 is the lack of clarity and consistency around the actual activities referred to by the term “technical assistance.” For example, under the World Bank’s Cat DDO, technical assistance involves developing close working relationships between the World Bank and government counterparts.¹² The ARC risk pool has created a required technical assistance and capacity-building program that requires a contingency plan output.¹³ The CCRIF technical assistance program provides scholarships and professional development, promotes regional strategic knowledge building, and provides grants to local DRM initiatives.¹⁴ That these are all substantially different interventions limits the ability to draw general conclusions and the transferability of findings.

2.3. Useful references

This literature review assumes the reader has a base level of understanding of the DRF landscape. For those interested in reading further, there are many policy papers and documents that provide an overview. “The Stakeholder Landscape in Extreme Events and Climate Risk Management” by Maryam Golnaraghi and Patrick Khalil (2017) is a particularly useful reference. It could be supplemented with *Mechanisms for Financing the Cost of Disasters* by Linnerooth-Bayer, Hochrainer-Stigler, and Mechler (2012); “Best Practices, Challenges, and Lessons Learned from Existing Financial Instruments at All Levels That Address the Risk of Loss and Damage Associated with the Adverse Effects of Climate Change” by the Warsaw International Mechanism for Loss and Damage (2016); “Disaster Risk Financing: Opportunities for Regional Cooperation in Asia and the Pacific” by the UN Economic and Social Commission for Asia and the Pacific (2018); and *The Potential for Scale and Sustainability in Weather Index Insurance for Agriculture and Rural Livelihoods* by P. Hazell et al. (2010).

3. Research Question 1: Constraints preventing uptake of DRF instruments

What are the key constraints that prevent vulnerable countries from taking up prearranged financing for disasters?

The benefits and challenges of taking up DRF instruments are widely discussed in the gray literature, which tends to advocate for or against the use of DRF instruments. However, there is little available robust evidence on the actual constraints that inhibit uptake. Much of the literature explores what does and does not work in the form of case studies. For this reason, this section explores constraints related not only to

¹² IEG 2019a, 2019b; World Bank 2017b, 2017c.

¹³ e-Pact Consortium 2017.

¹⁴ IEG 2019a; CCRIF 2019.



initial uptake but also to sustained uptake of prearranged financing, presenting both evidence and experience inferred from successes and failures.

According to the experience and evidence that exist, many of the constraints observed by Smith in 1996¹⁵ continue to limit uptake of risk transfer instruments today: high premiums, moral hazard, insufficient data and modeling, lack of institutional regulatory structures, and lack of demand in developing countries. Additional inhibiting factors identified by the literature review include high start-up costs, basis risk, psychological biases, political disincentives, a lack of trust and willingness to coordinate, and high technical demands—alongside limited technical capacity and poor financial literacy. Several of these factors are described in further detail below. Uptake may be affected by observing the experiences of others.

One interesting finding, discussed below, was that consumers interested in taking up DRF face a limited supply of instruments that may not suit their particular needs. Importantly, experience shows that many countries that have successfully taken up DRF faced frequent natural hazards and already had strong existing DRM environments. For countries strongly vested in DRF, initial uptake of the instruments was often prompted by a catastrophic event.

3.1. Cost of DRF instruments

Policy papers, experience, and evidence all demonstrate that high start-up, implementation, and capital costs serve as barriers to both the supply of and demand for DRF instruments.¹⁶ An international survey of DRF instruments found that pricing is a fundamental challenge for most types of DRF tools, from insurance to catastrophe bonds.¹⁷

Start-up costs—for gathering data, developing hazard tools, establishing policy and regulatory standards required by insurers, and designing products—can inhibit initial uptake. Additional costs are required to tailor tools to local contexts and educate consumers about the importance of purchasing insurance.¹⁸ For example, expenses associated with issuing Mexico’s first catastrophe bond were about double the roughly 1 percent of cover charged through traditional reinsurance.¹⁹ According to a recent evaluation, costs have prevented insurers from operating in the Caribbean—specifically the high unit cost of developing insurance products on a country-by-country basis and the cost of developing sophisticated actuarial risk profiles. This challenge has led to a long-standing market failure, which CCRIF is attempting to resolve.²⁰

¹⁵ Freman and Kunreuther 2002.

¹⁶ de Janvry, Ramirez Ritchie, and Sadoulet 2016 (cited in Hillier 2018); e-Pact Consortium 2017; Sustainable Finance Center 2018; Linnerooth-Bayer et al. 2009, 2019; Vaughan and Vaughan 2008; UNFCCC 2012; Cummins and Mahul 2009.

¹⁷ OECD 2015.

¹⁸ OVE 2016; Schäfer and Waters 2016; Le Quesne 2017; Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012; Linnerooth-Bayer et al. 2009; Warsaw International Mechanism for Loss and Damage 2016.

¹⁹ Cardenas et al. 2007.

²⁰ OVE 2016.



Some DRF instruments have favorable cost multipliers that make them quite affordable once the initial start-up costs have been met. Other tools, however, involve ongoing costs that may make them less attractive options. For example, high premium prices of some instruments are driven by the requirement to hold enough capital to pay out in a catastrophe, by high levels of uncertainty (which tend to be even higher for reinsurers), and by frictional costs.²¹ Some case studies suggest that small states and developing countries are subject to fluctuations of international insurance prices.²² For microinsurance, the costs of maintaining a distribution network in rural areas of developing countries can lead to higher premiums.²³ A multicriteria cost-effectiveness analysis demonstrated that risk premiums tend to be higher for poor populations because they tend to live in more vulnerable regions.²⁴

Individuals and countries must weigh these high costs against competing budgetary demands, including preparedness and disaster risk reduction. To date, the stand-alone DRF value proposition is in many cases not enough.²⁵ The evaluation mentioned above found that for most governments, the positive signaling effects and rapid distributions of contingency instruments are not worth the associated costs.²⁶ A thorough review of DRF instruments reports that uptake of Cat DDOs is limited by the preference of governments for cash in hand over financed contingency instruments.²⁷ An evaluation of ARC found that its risk pool is shrinking in part because governments find it difficult to justify paying premiums in light of other needs.²⁸ One of the reasons Peru closed its 2015 Cat DDO after a partial disbursement was a financial reassessment of its debts, costs, repayment needs, and other contingent credit lines.²⁹

High insurance costs lead to important trade-offs, which often result in policies that provide only marginal coverage or exclude vulnerable people and countries. Using modeled response costs for six potential member countries, a cost-effectiveness analysis of the ARC risk pool found that its disaster insurance would be cost-effective only for hazards that occur less frequently than once in seven years.³⁰ Participation in the CCRIF risk pool is offered at a low cost, but covers only 20 percent of countries' estimated losses to public infrastructure.³¹ Conversely, ARC covers one-in-five-year events with modeled loss parametric insurance but tends to have higher premiums.³² A review of over 100 microinsurance schemes found coverage is often too low to encourage demand;³³ for example, the 2005 Drought

²¹ Cummins and Mahul 2009; Le Quesne 2017; Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012; Linnerooth-Bayer et al. 2009.

²² Cummins and Mahul 2009.

²³ Hallegatte et al. 2017.

²⁴ Vyas et al. 2019.

²⁵ Hillier 2018; IEG 2019a; Warsaw International Mechanism for Loss and Damage 2016.

²⁶ OVE 2016.

²⁷ Hallegatte et al. 2017.

²⁸ e-Pact Consortium 2017.

²⁹ IEG 2019b.

³⁰ Clarke and Vargas Hill 2012.

³¹ Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012; Vyas et al. 2019.

³² e-Pact Consortium 2017; Hillier 2018; Vyas et al. 2019.

³³ Hillier 2018.



Insurance Program pilot for farmers in Malawi (now defunct) covered only the cost of seeds.³⁴ Alternatively, the poor and vulnerable may be left out, since most vulnerable households cannot afford to pay for insurance, and since few private insurers are keen to provide unsubsidized insurance to low-income clients.³⁵ As a result, household-level insurance schemes like the Turkish Catastrophe Insurance Pool (TCIP), India's National Agricultural Insurance Scheme (NAIS), and India's BASIX tend to focus on high- and middle-income clients. Indeed, an empirical study using a country-year panel data set to examine the impact of disaster risk from flooding, landslides, and windstorms found that demand for insurance coverage peaks at GDP per capita of \$4,000–7,000.³⁶

3.2. Moral hazard

Moral hazard—which occurs when individuals or countries expect someone else to provide emergency relief if needed and so do not seek to mitigate their risk—is a likely factor preventing uptake of DRF tools. Various factors underlie moral hazard. One is cost concerns, in that agents must cover costs associated with DRF but might receive free humanitarian aid ex post. There may also be underlying political incentives, as discussed further below. At the macro level, this issue is cited extensively in the policy literature, with some papers providing examples of moral hazard at work within particular DRF instruments.³⁷ More quantitative evidence is available at the micro level. In a study of 29 economies, many respondents reported moral hazard to be a constraint to individual and business-level uptake of insurance.³⁸ A study of farmers found that demand for crop insurance was markedly lower for those who believed disaster assistance would be made available to them in the event of an emergency.³⁹ Another study that employed a panel data set to estimate moral hazard found that insurance coverage decreases disproportionately as aid increases, at a rate of 6 to 1.⁴⁰ While these studies mostly looked at high-income countries, they have been cited by policy literature on vulnerable countries. Further research would be useful to confirm whether the findings are indeed transferable to such contexts.

3.3. Basis Risk

Basis risk is the risk that the losses estimated by hazard risk models, and therefore the payouts of DRF instruments in the event of an emergency, differ from the actual losses experienced. The DRF literature recognizes that basis risk is an inherent component of all DRF instruments, one that increases where there are limitations in hazard models and the data that underlie them. These limitations underpin DRF suppliers' uncertainty, driving up costs for DRF instruments. Similarly, the literature notes that where

³⁴ Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012.

³⁵ Swiss Re 2014 (cited in Linnerooth-Bayer et al. 2019).

³⁶ Kellenberg and Mobarak 2007 (cited in Le Quesne 2017).

³⁷ Lucas 2015; Dercon and Clarke 2016; Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012; Linnerooth-Bayer et al. 2009; Mechler, Linnerooth-Bayer, and Peppiat 2006; Warsaw International Mechanism for Loss and Damage 2016; Smith 1996 (cited in Freman and Kunreuther 2002); Barriau and Scaillet 2010.

³⁸ OECD 2015.

³⁹ Van Asseldonk, Meuwissen, and Huirne 2003 (cited in Dercon and Clarke 2016).

⁴⁰ Kousky, Michel-Kerjan, and Raschky 2013 (cited in Dercon and Clarke 2016).



models are not well understood or trusted, demand can be constrained.⁴¹ Although great strides have been made in catastrophe risk modeling over the last 20 years,⁴² models continue to suffer from limited historical data and inefficient data management systems. They also require substantial calibration. Once developed, hazard models still include a high degree of uncertainty, and predicting impacts of future events is very difficult.

Basis risk and “near misses” are key challenges for uptake of DRF instruments, particularly index-based tools like standard derivatives and many microinsurance products.⁴³ A good example is the 2015/16 ARC experience in Malawi. In this case, an issue with the hazard model resulted in the model failing to trigger during a drought. The resulting lack of a payout led to a huge outcry, a technical review, and a revision to the hazard model and data. To resolve the issue, ARC made a delayed payout of over \$8 million, but Malawi still ultimately withdrew from the risk pool. Stakeholders felt that ARC handled the situation poorly overall.⁴⁴ In a few cases, CCRIF and PCRAFI policies did not trigger because the event just missed falling within the policy parameters. This kind of “near miss” has in some cases created extensive controversy with political implications.⁴⁵ While Jamaica and Haiti are still part of the CCRIF risk pool despite these experiences, the Solomon Islands withdrew from PCRAFI because of them.⁴⁶ The sovereign risk pools have been responsive to these incidents. For instance, CCRIF has added new and upgraded models and introduced a secondary payout trigger, and ARC recently adopted a new set of principles for managing basis risk with member countries.⁴⁷

Examples of basis risk or near misses have also occurred in microinsurance programs. The BASIX DHAN scheme in India failed to trigger during a drought in 2005, when one-third of the scheme’s customers were first-time enrollees who had joined after seeing the high payouts of the previous season.⁴⁸ Some schemes, such as ACRE in Rwanda and an Oxfam-SANASA program in Sri Lanka, have opted or been pressured to offer ex gratia payments. For ACRE, such payments led to the withdrawal of one of the providers.⁴⁹ The most extreme example is the scheme in Ethiopia designed by the World Food Programme and reinsured by AXA Re, which was not renewed after it failed to trigger in 2006.⁵⁰

⁴¹ Warsaw International Mechanism for Loss and Damage 2016; Bennett and Smyth 2016; Le Quesne 2017; Rogers and Tsirkunov 2013 (cited in Hallegatte et al. 2017); Schäfer, Warner, and Kreft 2019; Cummins and Mahul 2009; UNFCCC 2008, 4, ¶1; Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012; GFDRR 2011a, 2012b; Schäfer et al. 2016; OECD 2015; DRFIP 2012.

⁴² Golnaraghi and Khalil 2017.

⁴³ Le Quesne 2017; e-Pact Consortium 2017; Sustainable Finance Center 2018; Vyas et al. 2019; Hillier 2018; Hallegatte et al. 2017; Brown, Zelesnka, and Mobarak 2013 (cited in Hallegatte et al. 2017); Cole et al. 2012, 2013 (cited in Hallegatte et al. 2017); Karlan et al. 2012 (cited in Hallegatte et al. 2017); Mobarak and Rosenzweig 2013 (cited in Hallegatte et al. 2017); Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012.

⁴⁴ e-Pact Consortium 2017; Vyas et al. 2019; Hillier 2018.

⁴⁵ Vyas et al. 2019.

⁴⁶ Vyas et al. 2019; Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012; Hillier 2018.

⁴⁷ Martinez-Diaz, Sidner, and McClamrock 2019.

⁴⁸ Kande 2005 (cited in Mechler, Linnerooth-Bayer, and Peppiat 2006).

⁴⁹ Hillier 2018.

⁵⁰ Wiseman and Hess 2007 (cited in Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012).



3.4. Observation of others' experiences

Observational experience suggests that countries that have not yet taken up DRF instruments are watching those that have. Positive experiences in one country tend to generate new uptake by others, but poor experiences in a country can make other countries wary. Observational experience suggests that the examples of DRF leaders like Mexico, Colombia, and the Philippines have inspired other countries to pursue DRF mechanisms. At the micro level, TCIP's widespread uptake is partially credited to its strong record of claims paying.⁵¹ Similarly, as indicated above, much of the unanticipated high uptake of BASIX DHAN microinsurance occurred after policyholders were known to have received substantial and generous claims during a previous year's drought.⁵²

Conversely, poor experiences may have a deleterious effect, and negative views may become self-fulfilling prophecies. Of ARC's first four payouts, only one was made within the 120-day disbursement window.⁵³ This is likely one factor explaining low risk pool participation in ARC's early years. The ARC evaluation found evidence that high-profile issues, notably the payout issue in Malawi, inhibited uptake among other countries, even though ARC made an \$8.1 million noncontractual payout. The evaluation also found that the pool's lack of growth led many stakeholders to doubt ARC's sustainability.⁵⁴

Still, implementers of some instruments are trying to find new ways to address the concerns around unmet expectations, and hopefully their efforts will make potential customers more comfortable. For example, CCRIF has provided targeted technical assistance and some financial support to countries that have experienced losses when their policies have not triggered. It has also added an Aggregated Deductible Cover (ADC) that provides small payouts in cases where there are modeled losses but the policy is not triggered. Another example is offered by the Asian Development Bank, which is considering adding a multi-country contingent financing mechanism to PCRAFI to provide financing support for less severe hazards.⁵⁵

3.5. Institutional and regulatory framework

Policy papers, literature reviews, case studies, and an insurance feasibility study cite several significant market barriers: weak institutional and legal capacity, institutional instability, and market and regulatory imperfections.⁵⁶ Competent regulatory frameworks and bodies are important in providing assurance to both clients and insurers; they also help establish legal frameworks, protect clients in the

⁵¹ GFDRR 2011b.

⁵² Mechler, Linnerooth-Bayer, and Peppiat 2006.

⁵³ Clarke and Vargas Hill 2012; Vyas et al. 2019.

⁵⁴ e-Pact Consortium 2017; Martinez-Diaz, Sidner, and McClamrock 2019.

⁵⁵ Martinez-Diaz, Sidner, and McClamrock 2019.

⁵⁶ IDF n.d. (cited in Le Quesne 2017); Schäfer et al. 2016; Charpentier and Le Maux 2014; Hallegatte et al. 2017; OVE 2016; Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012; Warsaw International Mechanism for Loss and Damage 2016; Linnerooth-Bayer et al. 2009; Le Quesne 2017; Mechler, Linnerooth-Bayer, and Peppiat 2006; GFDRR 2013.



event insurers default, and regulate corporate governance, reinsurance, and intermediaries.⁵⁷ Without adequate frameworks and bodies, insurance systems may be exposed to high risks of insolvency.⁵⁸ A review of 19 existing DRF instruments found that successful implementation depends on strong existing policy and institutional environments.⁵⁹ A similar conclusion was reached by a prospective study that explored which insurance mechanisms could be adopted by developing countries in the next 10 years; it found that expanding the insurance market depended on effective regulation of domestic insurance markets to promote insurers' financial stability and consumers' confidence.⁶⁰ A review of the Philippine Cat DDO cited weak institutional and legal capacity as the main constraint to the Cat DDO's implementation,⁶¹ and a case study of microinsurance in Malawi blamed the program's failure on these same weaknesses.⁶² Comparatively, strong institutional and legal frameworks have been cited to explain the successes of Mongolia's Index-Based Livestock Insurance (IBLI),⁶³ Mexico's MultiCat bond,⁶⁴ and Costa Rica's Cat DDO, the last of which maintained the commitment of the government despite three regime changes.⁶⁵

3.6. Psychology, political incentives, trust, and collaboration

Lessons from the fields of psychology and political science are applicable to DRF uptake. The field of psychology, applied through the policy literature to DRF, suggests that people (i) tend to underestimate the probability of disaster risk, (ii) find decision-making before disasters difficult, (iii) are prone to procrastination, and (iv) are biased toward the present at the expense of the future.⁶⁶ DRF policy papers suggest that while political commitment is a prerequisite for success,⁶⁷ uptake is inhibited by political disincentives: (i) politicians apply short-term mindsets against long-term value propositions; (ii) voters punish politicians when natural disasters occur, but disaster relief buys votes; (iii) voters prefer cash payouts that they observe to benefit them personally, and (iv) limited public demand reduces pressure on politicians.⁶⁸ The recent ARC evaluation found that such disincentives were affecting decision making.⁶⁹ Furthermore, governments may be wary of giving up decision-making power and may be skeptical of supranational entities managing the financing.⁷⁰ According to another evaluation, the stigma attached to

⁵⁷ IDF n.d. (cited in Le Quesne 2017); Warsaw International Mechanism for Loss and Damage 2016.

⁵⁸ Charpentier and Le Maux 2014; Linnerooth-Bayer et al. 2009; Mechler, Linnerooth-Bayer, and Peppiat 2006.

⁵⁹ Warsaw International Mechanism for Loss and Damage 2016.

⁶⁰ ODI and RMS 2017.

⁶¹ World Bank 2017c.

⁶² GFDRR 2012b.

⁶³ GFDRR 2011a.

⁶⁴ GFDRR 2013.

⁶⁵ IEG 2019a.

⁶⁶ Hertwig et al. 2004 (cited Schäfer, Warner, and Kreft 2019); Gaurav, Cole, and Tobacman 2011; Schäfer, Warner, and Kreft 2019; Dercon and Clarke 2016; IEG 2019a.

⁶⁷ World Bank 2017d.

⁶⁸ Dercon and Clarke 2016; InsuResilience Global Partnership Secretariat n.d.; Clarke and Dercon 2019; Fuchs and Rodriguez-Chamussy 2014 (cited in Le Quesne 2017).

⁶⁹ e-Pact Consortium 2017.

⁷⁰ Dornan and Cain 2014 (cited in Le Quesne 2017).



a government that demonstrates vulnerability to future uncertainties was one of the top two reasons for poor uptake of contingency financing instruments.⁷¹

There is evidence and experience to suggest that a lack of trust and parties' willingness to collaborate are also barriers to the formation of DRF markets. On the demand side, several studies have shown that countries, people, and local banks may distrust or be skeptical of insurance providers, implementers, and hazard data.⁷² Others have found that individuals and governments do not trust that they will get payouts.⁷³ Interestingly, one reason Kenya opted out of ARC was lack of trust, but had it remained one more year, it would have likely received a payout.⁷⁴ On the supply side, insurers may be wary of subscribers fraudulently manipulating the system to receive payouts,⁷⁵ defaulting on premiums, or making late payments.⁷⁶ Policy papers and evidence point to the necessity of strong coordination across multiple actors for successful implementation, but collaborating across bureaucrats, financiers, implementers, technical modelers, and government agencies is challenging.⁷⁷ Reports highlight a lack of willingness to be coordinated by others, a lack of trust in others' intentions, a lack of belief that partners will fulfill their responsibilities, and a collective action problem that leads to procrastination.⁷⁸ Sovereign risk pooling is by nature even more challenging, requiring sovereign governments to trust one another.⁷⁹

Experience shows that uptake can be facilitated by working with the right government counterpart and engaging in participatory processes to develop the instruments.⁸⁰ Experience from the World Bank's Cat DDOs showed the importance of shifting the World Bank's government counterpart from civil protection or other agencies, where the emphasis was on post-disaster recovery, reconstruction, and infrastructure, to the Ministry of Finance.⁸¹ In Colombia in particular, this move was heralded as a game changer that opened the door to more discussions on pre-disaster planning, DRM, and public finance.⁸² In addition, the close collaborations between the World Bank teams and the implementing governments were necessary to get the Cat DDOs off the ground.⁸³ Similarly, part of the success of Ethiopia's Horn of Africa Risk Transfer for Adaptation (HARITA), which has now scaled up to become the R4 Rural Resilience Initiative (R4), is

⁷¹ OVE 2016.

⁷² e-Pact Consortium 2017; Hallegatte et al. 2017; Linnerooth-Bayer et al. 2009; Suarez, Linnerooth-Bayer, and Mechler 2007 (cited in Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012); Schäfer et al. 2016.

⁷³ Cai 2016 (cited in Le Quesne 2017); Cole, Stein, and Tobacman 2014 (cited in Le Quesne 2017); e-Pact Consortium 2017; Vyas et al. 2019.

⁷⁴ Vyas et al. 2019.

⁷⁵ Dercon and Clarke 2016.

⁷⁶ e-Pact Consortium 2017.

⁷⁷ Le Quesne 2017; Dercon and Clarke 2016; Warsaw International Mechanism for Loss and Damage 2016; OECD 2015.

⁷⁸ Le Quesne 2017; Dercon and Clarke 2016.

⁷⁹ Le Quesne 2017; Warsaw International Mechanism for Loss and Damage 2016.

⁸⁰ Warsaw International Mechanism for Loss and Damage 2016.

⁸¹ GFDRR 2014; World Bank 2017b.

⁸² World Bank 2017b.

⁸³ World Bank 2017c; IEG 2019a.



attributed to its participatory approach, which educates farmers about the product and creates a package that they find attractive.⁸⁴

3.7. Technical capacity and financial literacy

The technical capacity demands of implementing DRF are high on both the supply and demand sides, neither of which typically have the necessary capacity to implement DRF instruments on their own. Two studies, one review, and one survey of DRF instruments—each covering numerous projects across the world—found that the complexity and highly technical qualities of risk transfer schemes, including insurance and cat bonds, can be a constraint in the face of limited technical capacity of governments.⁸⁵ On the demand side, there is a lack of robust methodology to help institutions, governments, and programs compare the various financing options in a consistent, comprehensive way,⁸⁶ and many countries lack the financial experts needed to implement these options once chosen. Even in Peru, where existing DRM capacity is relatively high, it was only after six years of unsuccessful efforts that the government managed to institute an agricultural insurance scheme.⁸⁷ On the supply side, domestic insurers and providers in developing countries tend to have very little starting capacity.⁸⁸ This was demonstrated when Swiss Re began the design of its Climate Adaptation Development Program in Kenya, Mali, and Ethiopia. The program was inhibited by the lack of analytical capacity in the domestic financial markets and therefore relied heavily on donor funding to develop its weather derivative contracts.⁸⁹ Finally, experience has shown that most macro-level DRF instruments have relied heavily on technical assistance for instrument design,⁹⁰ and both policy papers and evaluations have found that developing countries tend to lack skilled professionals who can design, negotiate, and implement DRF instruments.⁹¹ This issue is further discussed under Research Question 2.

Policy papers, experience, and evidence all highlight that few developing countries have a culture of insurance and that most have low levels of financial literacy.⁹² These limitations result in (i) low risk awareness, (ii) a lack of understanding of the benefits of insurance, and (iii) challenges in understanding the nature of the products being offered and making the best decisions about them. For example, the ARC evaluation found that some respondents understood the risk pool to be a savings scheme, resulting in

⁸⁴ Kebede 2012 (cited in Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012).

⁸⁵ Mahul and Boudreau 2010 (cited in Clarke et al. n.d.); OECD 2015.

⁸⁶ Clarke et al. 2017.

⁸⁷ Solana 2015.

⁸⁸ Schäfer et al. 2016; Warsaw International Mechanism for Loss and Damage 2016; OECD 2015.

⁸⁹ UNFCCC 2008.

⁹⁰ IEG 2019a.

⁹¹ International Financial Consulting 2014.

⁹² GFDRR 2011a, 2011b; Gaurav, Cole, and Tobacman 2011; Karlan et al. 2012 (cited in Hallegatte et al. 2017); Cole et al. 2012, 2013 (cited in Hallegatte et al. 2017); e-Pact Consortium 2017; Dercon and Clarke 2016; CCRIF 2015 (cited in InsuResilience Global Partnership Secretariat n.d.); Narube 2015; Schäfer et al. 2016; Hallegatte et al. 2017; Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012; Warsaw International Mechanism for Loss and Damage 2016; Clarke et al. 2017 (cited in Bennett and Smyth 2016).



distrust when they did not receive payouts in this way.⁹³ Some of the “near misses” described above might not have generated such upset if the claimants had better understood the product’s technical details. At the micro level, evidence from a desk review of DRF instruments and a case study shows that many farmers in Malawi did not fully understand the microinsurance program’s indexing system (despite outreach efforts), and that this misunderstanding led to dissatisfaction and resistance to further purchase of insurance.⁹⁴

Importantly, initial research on the impacts of raising financial literacy on insurance demand is promising. For example, a field experiment in India found that microinsurance demand increased by 5.3 percent as a result of a communications intervention that focused on personal financial and risk management.⁹⁵ Similarly, in Ethiopia, researchers found that providing farmers with experimental simulation games increased their financial literacy, particularly with respect to index-based insurance, and led to increased demand for such products.⁹⁶

3.8. Previous uptake of DRM tools and experience of catastrophic loss

Experience suggests that countries that have successfully taken up DRF tend to have already had a strong history of and capacity in DRM. In certain cases where DRF measures have been implemented without strong DRM systems or treated as one-off solutions, there have been challenges. Reviews of Cat DDOs in Costa Rica, Peru, and Colombia suggested that they were successful because of the countries’ strong DRM histories,⁹⁷ and a literature review made similar claims about the ASEAN (Association of Southeast Asian Nations) and Philippine DRF successes.⁹⁸ However, many developing countries still lack established DRM strategies or budgets, have contingency funds that remain empty, or have no established risk transfer mechanisms and no institutions responsible for them.⁹⁹ An evaluation of ARC identified weak starting capacity: half of the countries studied had no national DRM policy and another half had no DRM institution in the country. The ARC evaluation also found that the drought management authorities in many member countries completed just the technical assistance that was required and were not interested in additional capacity building that was offered to help countries build a holistic DRM strategy.¹⁰⁰ In Malawi, which has neither a DRM budget nor emergency reserves, two drought insurance policies have been discontinued, and promising microinsurance schemes have folded.¹⁰¹ While a lack of DRM infrastructure does not necessarily preclude a country from taking up a DRF instrument, it appears to be a relevant factor.

⁹³ e-Pact Consortium 2017.

⁹⁴ Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012; GFDRR 2012d.

⁹⁵ Gaurav, Cole, and Tobacman 2011.

⁹⁶ Norton et al. 2012 (cited in UNFCCC 2012); Patt, Suarez, and Hess 2010 (cited in Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012); Patt, Suarez, and Gwata 2005 (cited in Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012).

⁹⁷ IEG 2019a; IEG 2019b; World Bank 2017b.

⁹⁸ Hillier 2018.

⁹⁹ Hillier 2018; UNFCCC 2012.

¹⁰⁰ e-Pact Consortium 2017.

¹⁰¹ Hillier 2018.



As further discussed below under Research Question 2, experiences from the use of Cat DDOs and other DRF tools, along with other evidence, suggest that DRF uptake may also facilitate additional interest in DRM.

Experience also shows that countries prone to frequent natural disasters tend to have better uptake than those with less exposure, and that many of the countries at the fore of DRM and DRF did not take up those approaches until they experienced catastrophic loss. Prompted by disasters, countries like Mexico and the Philippines improved their DRM and DRF at the macro level; Turkey and Mongolia implemented widespread household-level insurance schemes; Fiji developed new insurance standards; Honduras insured its public infrastructure; and private or nonprofit organizations in Bangladesh and India implemented microinsurance.¹⁰² Interestingly, Chile took an early interest in cat bond discussions alongside Mexico in the mid-2000s but decided not to pursue one in 2008; it regained interest in DRF, however, after the 2010 earthquake struck and a new administration was elected.¹⁰³ At the micro level, disasters have also prompted some microfinance schemes to incorporate coverage for disaster losses.¹⁰⁴ Conversely, the ARC evaluation observed that countries are less likely to buy insurance if they experience a good year.¹⁰⁵

3.9. Supply-side constraints

A couple of evaluations indicate that supply-side constraints also exist, but these findings have not yet been sufficiently explored and do not receive adequate coverage in the policy literature. Evaluations of the CCRIF and ARC risk pools found that the instruments' designs constrained uptake. For instance, in the words of a World Bank review,¹⁰⁶ CCRIF was “supply driven in the sense that the insurance solution was the modality on offer.” Similarly, the ARC evaluation pointed out that several Sub-Saharan countries are not affected by droughts—the only hazard currently covered by the pool—but rather by floods.¹⁰⁷

3.10. Further observations

At the micro level, compulsory insurance leads to increased though still not particularly widespread uptake, but the requirement to purchase insurance may not be popular with consumers. A review of 117 countries found that when insurance is not mandatory, uptake rates remain low, even in high-income countries.¹⁰⁸ In Turkey, the number of earthquake policies increased by a multiple of six between 1999 and 2010 after it was made compulsory in urban areas.¹⁰⁹ However, by the end of 2020, only 56 percent

¹⁰² Dercon and Clarke 2016; World Bank 2017c; GFDRR 2011b; Freman and Kunreuther 2002; Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012; Mechler, Linnerooth-Bayer, and Peppiat 2006; Cardenas et al. 2007.

¹⁰³ Michel-Kerjan et al. 2011.

¹⁰⁴ Mechler, Linnerooth-Bayer, and Peppiat 2006.

¹⁰⁵ e-Pact Consortium 2017.

¹⁰⁶ IEG 2012.

¹⁰⁷ e-Pact Consortium 2017.

¹⁰⁸ Hallegatte et al. 2017.

¹⁰⁹ GFDRR 2011b; Smyth et al. 2004 (cited in Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012).

of dwellings in the country were insured.¹¹⁰ In Mongolia, where insurance for herders is required, less than 15 percent of those in the covered area had joined as of 2011, six years after the program was implemented.¹¹¹ VimoSEWA in India experienced a backlash from customers when it required them to bundle their health, property, and life insurances with disaster coverage, and the disaster coverage was quickly made voluntary again.¹¹²

3.11. The need for further lessons on failures

To adequately address the question on *constraints* to uptake, there is a need for more research in countries that have not taken up DRF and for more extensive exploration of instruments that have had limited uptake or have failed. In a fairly rare example pointing to challenges, a technical note covering the approach of the Inter-American Development Bank (IDB) to catastrophe risk financing¹¹³ points to previously popular instruments whose use has been in decline. As discussed in box 1, the IDB has had little success with its DRF instruments. Aside from the few sources cited here, the lessons learned through the implementation of these instruments received remarkably little coverage in the literature. Other instruments that have been introduced but failed to gain traction include sidecars and standardized derivatives linked to catastrophe risk.¹¹⁴

Box 1: Case Study: The Inter-American Development Bank’s Contingent Credit Facility and Contingent Credit Line

Two macro DRF instruments that have been covered relatively little in the literature are the IDB’s Contingent Credit Facility for Natural Disaster Emergencies (CCF) and Contingent Credit Line for Natural Disaster Emergencies (CCL), both of which have had limited uptake. Implemented in 2009, the CCF is an investment loan designed to provide rapid liquidity in the event of a disaster. It uses parametric triggers and requires countries to have an established integrated DRM program. In 2012, the IDB added an additional contingent product, the CCL, to cover a broader set of disasters. The CCL has a simpler trigger, as it can be disbursed based on the declaration of a state of emergency. Only seven CCFs were approved in the loan’s first five years, followed by a slump in which no new countries signed up, and for several years, none of the CCFs were used in the event of a disaster. No countries ever signed up for the CCL.

Two studies, carried out in 2014 and 2016, found that uptake of the two products was hampered by design issues, such as high standby fees, requirements inhibiting rapid disbursement, and risk-based access restriction.¹¹⁵ Countries were concerned because eligibility was dependent on positive results of a macroeconomic forecast, a requirement that in effect undermined uptake. Collectively, these challenges led to (i) a lack of clarity on whether borrowers were eligible, (ii) less support for the instrument as a whole, and (iii) stigma regarding asymmetric information about country risk. The

¹¹⁰ Middle East Insurance Review 2020.

¹¹¹ Hallegatte et al. 2017.

¹¹² Mechler, Linnerooth-Bayer, and Peppiat 2006.

¹¹³ Andersen et al. 2010.

¹¹⁴ Andersen et al. 2010; Barriou and Scaillet 2010.

¹¹⁵ OVE 2016; Gonzalez Diez et al. 2014.



studies also found that countries were afraid of the stigma of appearing vulnerable by taking up the instrument, had limited understanding of the tools, were uncertain whether resources were actually available, and felt that the triggers were too rigid and difficult to meet. The last two years have seen renewed interest in the CCF, with five new countries participating, though this review did not find evidence as to what had inspired this shift.¹¹⁶

4. Research Question 2: The impact of technical assistance on response timeliness and effectiveness

What evidence is there to suggest that prearranged financing paired with technical assistance will lead to a more timely and effective response?

Given the limited availability of evidence on the topic of DRF in general, very little research has been done that explores this particular question in full. As discussed in section 2.2, one challenge is that in practice, “technical assistance” involves a wide variety of different interventions, varying substantially across DRF instruments. It does not appear that these have been thoroughly outlined and compared by any documents to date. As a result, the information provided on technical assistance in this section should be viewed as anecdotal, and therefore may not be transferable to other contexts.

In exploring the timeliness question, this review included experience and evidence related to the speed of response to triggering events, encompassing both the rapidity of payout by the instrument itself and duration in reaching the intended beneficiaries. The review of effectiveness focused on whether the instrument successfully improved the welfare of beneficiaries compared to an alternative situation without the instrument. Effectiveness could look different for various DRF tools, depending on how payouts are intended to be used. For example, it could entail reducing the impact of the disaster event on households, accelerating recovery of businesses, and facilitating “build back better” for infrastructure and homes.

Policy papers, experience, and a few evaluations that have looked at technical assistance tend to focus on its role in DRF uptake and sustainability. Uptake and sustainability are then said to improve the timeliness and effectiveness of responses. It is therefore unclear whether technical assistance directly impacts timeliness and effectiveness. Some other literature suggests that providing technical assistance during uptake can encourage improved DRM, risk reduction, and adaptation, again indirectly impacting effectiveness. A rare evaluation of technical assistance, carried out for African Risk Capacity, showed that the facility did build capacity but that its depth and sustainability were limited by low starting capacity, limited reach of training, and high turnover of staff.

While a few papers clearly suggest a direct, positive link between technical assistance and response timeliness, the literature mostly addresses timeliness and effectiveness of DRF instruments in general. It tends not to explore links with any specific attributes of the instruments, including technical assistance.

¹¹⁶ IDB 2019, 2020.



Importantly, there is a distinction between timeliness of the facility in processing payments to governments and timeliness of the implementation of the governments' responses. The former is discussed fairly frequently in the literature, which highlights 10- and 14-day disbursements by (respectively) PCRAFI and CCRIF. Evidence collected under ARC, the only facility that requires countries to complete a capacity-building program and to specify their response mechanisms through approved contingency plans, shows that government bureaucracy and other factors can still delay delivery of funds to the ground level. Some evidence-based research has been carried out on the effectiveness of micro-level DRF tools, but there is minimal experience and evidence of DRF tools' effectiveness at the macro level—a result of limited requirements for contingency planning for fund disbursement and monitoring of payout use. If there is indeed an interest in understanding and improving the timeliness and effectiveness of the full response through the use of DRF tools, outcomes and impacts should be more closely monitored by DRF instruments.

Given the dearth of literature, there is a great deal of room for future research to further explore these topics.

4.1. The impacts of technical assistance

As discussed in section 2.2 on limitations, the exact form of technical assistance provided can vary dramatically across different instruments. “Technical assistance” can refer to developing close advisory relationships with government counterparts, as is done by the World Bank; providing specific trainings, as is done by ARC; or providing scholarships, professional development, grants, and regional workshops, as is done by CCRIF. While these descriptions simplify the range of activities being implemented by each organization, the point is that the content of technical assistance varies markedly and findings are not necessarily transferable.

A limited number of papers and evaluations suggest that technical assistance leads to timelier payouts, but there remains little information on whether technical assistance helps improve the timeliness and effectiveness of the full response. One of the most thorough assessments of this topic was carried out for the ARC project, the findings from which are highlighted in box 2. One evaluation suggests a direct link between technical assistance and timeliness in CCRIF and PCRAFI,¹¹⁷ both of which have paid out all of their disbursements rapidly (14 days for CCRIF and 10 days for PCRAFI).¹¹⁸ PCRAFI has specifically received technical assistance to work on the link between receipt of insurance and deployment of funds, which has led to the development of post-disaster budget execution manuals for participating countries.¹¹⁹ The fact that Costa Rica was able to effectively draw down and use all three of its Cat DDO disbursements within two to five business days was credited to the World Bank's excellent communications and strong rapport with the government.¹²⁰ A review of Peru's Cat DDO points out that the World Bank was involved in providing critical technical support in the aftermath of the March 2017 El Niño Costero event,¹²¹ although

¹¹⁷ OVE 2016.

¹¹⁸ Vyas et al. 2019.

¹¹⁹ IEG 2019a.

¹²⁰ IEG 2019a.

¹²¹ IEG 2019a.



the report does not detail the exact components of technical assistance provided or delineate its impact on the recovery effort.

Despite the fact that the precise definition of technical assistance seems to vary across instruments, experience and evidence broadly point to technical assistance as a critical input in uptake and sustainability of DRF instruments. These, in turn, may improve the timeliness and effectiveness of the response, suggesting that the causal link between technical assistance and response may be mostly indirect. The causal links in this chain are well discussed in the policy literature, but with limited robust evidence. Technical assistance that involves developing working relationships with government counterparts can facilitate a strong DRM enabling environment, which, as discussed under Research Question 1, is essential for the uptake of DRF.¹²² In Colombia and Peru, for example, both of which have Cat DDOs, the World Bank provided substantial knowledge and financial support long before the countries were ready to take up DRF.¹²³

Of the available policy, experiential, and evaluative literature on all types of DRF instruments, technical assistance and capacity building, the vast majority—from the World Bank, other international institutions, and the private sector—are considered as having been essential for successful DRF uptake and implementation, including tool development, facilitation of supply and demand, development of financial structures, compilation of risk data, and development of hazard models.¹²⁴ For example, to issue the first cat bond, Mexico relied extensively on technical assistance from outside consultants.¹²⁵ On the hazard modeling front, technical assistance helped the PCRAFI platform become the most developed historical disaster archive and one of the most comprehensive collections of geospatial data for the region.¹²⁶ One Cat DDO implementation completion report finds that the development of hazard models has fed back into increased attention to DRM and DRF among participating countries.¹²⁷ For those interested, a list of initiatives working to enhance risk knowledge and risk assessment capacities is available in Golnaraghi and Khalil’s (2017) “Stakeholder Landscape in Extreme Events and Climate Risk Management.”

Box 2: Evaluating technical assistance

ARC has been praised for requiring governments to receive technical assistance and participate in capacity-building activities. While experiences from implementing technical assistance have been documented under many of the other DRF instruments, ARC is one of the only programs that has carried out a close assessment of its technical assistance component, which consists of required training on risk transfer and insurance, customization and validation of the hazard model for each country, and support with contingency planning.¹²⁸

¹²² Warsaw International Mechanism for Loss and Damage 2016; UNFCCC 2012.

¹²³ World Bank 2017b.

¹²⁴ Le Quesne 2017; IEG 2019a; Warsaw International Mechanism for Loss and Damage 2016; Clarke et al. n.d.; Linnerooth-Bayer et al. 2019; OVE 2016.

¹²⁵ Cardenas et al. 2007.

¹²⁶ UNESCAP 2015 (cited in Le Quesne 2017).

¹²⁷ IEG 2019a.

¹²⁸ e-Pact Consortium 2017.



Overall, the ARC evaluation found that (i) international experts viewed the requirement of technical assistance positively, (ii) governments and stakeholders reported valuing the technical assistance provided, and (iii) capacity had indeed been built through the program. The evaluation also noted where challenges common to many technical assistance interventions (such as low starting capacity, limited reach of the trainings, and high turnover of trained staff) have undermined its effectiveness. Interviewees expressed some concerns that the capacity building took longer than anticipated, relied on traditional methods rather than innovative approaches despite being a component of an innovative risk finance mechanism, and did not account for different levels of knowledge between and within countries. ARC staff expressed mixed views about the use of embedded government coordinators: some suggested that this approach overstretches the coordinators, while others saw it as an essential component of ARC's sustainability. ARC is now working to further develop its technical assistance approach in light of these findings.

The facility has several other technical assistance components: it promotes the concept of disaster risk insurance in order to build political support, coordinates among government stakeholders, and supports decision-making around uptake of particular instruments. It also offers participating governments the option for further technical assistance and capacity building on DRM more broadly. Importantly, the evaluation found that these multiple components were somewhat at odds: country governments were hesitant to pursue the offer of additional technical assistance because ARC's promotional efforts called its neutrality into question. Country governments were also unclear on how ARC's technical assistance would complement their existing DRM strategies, often being implemented with other partners.

The evaluation concluded that while ARC's technical assistance component is a promising start, so far only superficial technical assistance has taken hold rather than broader institutionalization. Countries will require ongoing support and assistance beyond the official program.

4.2. The impact of DRF uptake on DRM

Section 3.8 suggested that a strong DRM environment can enable DRF uptake. There is also some experience and evidence to suggest that taking up DRF instruments can generate interest in improving DRM and adaptation, though the evidence base is not yet as strong given some counter-examples.¹²⁹

These perspectives are not necessarily at odds with one another, as they may be mutually reinforcing. Reviews and evaluations of completed Cat DDOs in Costa Rica, Peru, the Philippines, and Colombia also reported that the uptake of the instrument and associated technical assistance improved dialogue on DRM among government agencies, supported DRM reforms, and led to concrete DRM plans. These improvements were reportedly facilitated by the fact that government counterparts for the Cat DDOs are Ministries of Finance, enabling the World Bank to engage in higher-level strategic conversations about DRM than under previous arrangements with different counterparts.¹³⁰

¹²⁹ Schäfer et al. 2016; Warsaw International Mechanism for Loss and Damage 2016.

¹³⁰ IEG 2019a; IEG 2019b; World Bank 2017b, 2017c.



Financing tools can be designed to encourage DRM by requiring risk reduction activities, incentivizing risk prevention and adaptation, or promoting activities that result in long-term reduction in losses.¹³¹ **At the same time, experience at the micro level warns that implementers must be careful not to incentivize maladaptation.** A recent evidence review found that although highly dependent on context and tool design, insurance can contribute to DRM, and the effects are maximized when there is already an existing DRM framework in place.¹³² According to a World Bank report, the Cat DDO requirement that countries develop integrated DRM strategies leads to advancements in national policy frameworks and DRM investment.¹³³ In general, the sovereign risk pools do not offer incentives or financing for member countries to engage in DRM.¹³⁴ At the micro level, the literature cites case studies of programs that include DRM elements. In some cases, such as R4 and HARITA, there is evidence of success, but several other programs have since failed.¹³⁵ Critics argue that insurance has the potential to undermine DRM and incentivize maladaptation. For example, microinsurance programs that insure cash crops but not staple crops (as in India, Mali, Mexico, Malawi, and China) may encourage farmers to decrease the diversity of their food crop portfolios and move toward monoculture, resulting in soil degradation, reduction in biodiversity, and decreased resilience to natural disasters.¹³⁶ Similarly, in one example in Mexico, insurance that covered agricultural production only on non-irrigated land reduced investment in irrigation.¹³⁷

4.3. The impact of DRF instruments on response

Effective response goes beyond timely delivery of financing to governments and is also judged by the strength of the response efforts. But few macro-level DRF instruments require that response mechanisms be defined before a payout or incorporate robust evaluation of the full response. Drawing on the case of ARC, a comparative analysis of monitoring and evaluation tools for risk financing programs¹³⁸ identified three key questions for assessing operational success and impact of DRF: (i) did the DRF instrument release funds on schedule and in line with predefined timelines; (ii) did the country spend the payout in line with the timelines and activities set forth in its contingency plans; and (iii) has the instrument made a difference in the lives of targeted beneficiaries? The analysis raises an important question for consideration in the design of DRF tools: where does the responsibility of the DRF instrument stop?

Timeliness of DRF instrument disbursement—referred to in question (i) above—tends to be well monitored, and as discussed in section 4.1, most sovereign-level tools have released their funds in a timely

¹³¹ Le Quesne 2017; Linnerooth-Bayer et al. 2009.

¹³² Le Quesne et al. 2017.

¹³³ World Bank Group 2018.

¹³⁴ Le Quesne 2017; Linnerooth-Bayer et al. 2019.

¹³⁵ Suarez, Linnerooth-Bayer, and Mechler 2007 (cited in Linnerooth-Bayer et al. 2009); Kunreuther 1998; Mechler, Linnerooth-Bayer, and Peppiat 2006.

¹³⁶ Solana 2015; Isakson 2015 (cited in Hillier 2018); Müller, Johnson, and Kreuer 2017; Fuchs and Wolff 2011 (cited in Hillier 2018).

¹³⁷ GFDRR 2012b.

¹³⁸ Kimetrica 2016.



fashion. One exception is ARC, which made an ex gratia payout to Malawi after the hazard tool failed to trigger, but otherwise has distributed funds to governments smoothly during payouts.¹³⁹ With respect to question (ii), some DRF instruments (such as ARC) require contingency plans to specify distribution mechanisms beyond the initial payout, whereas others (such as CCRIF, PCRAFI, the World Bank's Cat DDOs, cat bonds, and derivatives) have no requirements about how their funding will get to beneficiaries.¹⁴⁰ As a result, ARC is one of the few macro level tools that monitors post-payout spending closely. Examples from its experience can shed light on factors that can enable or constrain the flow of post-payout funds from other tools as well. The ARC payout in Mauritania went smoothly, with ARC funds channeled directly to the National Drought Management Authority in line with and significantly supported by the contingency plan. This enabled the ARC-financed food distribution began two months earlier than normal government food distributions. In Senegal and Niger, however, the flow of payout funds from ARC to beneficiaries was held up by bureaucracy at the national level, resulting in delays in food distributions.¹⁴¹ In response to question (iii), the ARC case study generally found that ARC financing supported household-level resilience. Additional studies on the post-payout use of funds and meso- and micro-level impacts of macro tools are greatly needed to fill this important gap in the literature.

There have been several promising rigorous studies exploring effectiveness at the micro level. To date, several mixed method evaluations, incorporating quasi-experimental methods, have been carried out for the HARITA/R4 program, which incorporates both DRM activities and insurance. Focusing on Ethiopia and Senegal over a series of both drought and non-drought years, the studies found evidence that the program helps reduce, though not eliminate, the hardships caused by drought, and that program participants maintained better food security, engaged in less severe coping strategies, and maintained more of their productive assets than nonparticipants. Interestingly, the qualitative results suggest that farmers do not perceive insurance to be the most impactful component of the programs. However, the quantitative results in Senegal demonstrate that including insurance in the service bundle does contribute to improved outcomes.¹⁴² A review of several longitudinal evaluations of the IBLI product in Kenya and Ethiopia found that the insurance positively impacts farmers' subjective, economic, and health-related welfare, particularly during droughts.¹⁴³ Finally, an evaluation of the Goat Trust in India found that the program dramatically reduced livestock mortality.¹⁴⁴

Several authors have suggested that timeliness and effectiveness of delivery could be improved by funneling macro-level payouts through existing organizations or programs that have established distribution systems in developing countries, most notably social protection programs.¹⁴⁵ This approach is discussed in further detail in section 5.2.

¹³⁹ e-Pact Consortium 2017; Clarke and Vargas Hill 2012; Kimetrica 2016; Shah 2016.

¹⁴⁰ Geneva Association 2018 (cited in Hillier 2018); World Bank 2017b.

¹⁴¹ e-Pact Consortium 2017; Clarke and Vargas Hill 2012; Kimetrica 2016; Shah 2016.

¹⁴² Madajewicz, Tsegay, and Norton 2013; Madajewicz, Tsegay, and Lee 2017; Oxfam and World Food Programme 2015.

¹⁴³ Jensen, Barrett, and Mude 2015.

¹⁴⁴ Thomas et al. 2017 (cited in Hillier 2018).

¹⁴⁵ Solana 2015; Hallegatte et al. 2017; Schäfer et al. 2016.



5. Research Question 3: Combining risk financing instruments

What combinations of risk financing instruments show promise under what circumstances?

The hazards countries face vary in kind and in severity, and they can have far-reaching, geographically diverse, and varied impacts on populations, businesses, and infrastructure. DRF instruments are typically designed to address just a subset of the full range of risks a country faces and to be paid out to specific groups. By its nature, a single instrument cannot appropriately hedge against all the risks a country faces. Operational experience suggests that multiple DRF instruments can be combined to provide greater coverage of overall risk.

The review found that the literature prominently features several approaches to combining DRF instruments: risk layering, DRF-financed shock-responsive (or scalable) social protection schemes, and bundled instruments. While some evidence has been generated, additional studies would be useful to build out the evidence base and confirm whether findings from the initial studies are transferable across contexts and instruments.

The policy literature shows strong support for combining multiple types of risk financing instruments (and, in some cases, risk management approaches), each of which is designed to address different hazards, time frames, populations, and levels of risk under a risk-layering framework. A few studies have shown that risk layering can be a cost-effective way of managing risk. There is general agreement that the exact set-up of the risk-layering framework should be customized for each situation.

There are increasing efforts to integrate DRF and social protection systems such that DRF instruments finance shock-responsive components of social protection schemes. With more such instruments being implemented, there should be much more experience to learn from soon. To date, the greatest amount of evidence for such approaches has been generated in Ethiopia and Kenya.

Some programs have begun bundling risk finance tools in various ways, but most of the information available on this approach is descriptive. For instance, at the micro level, disaster microinsurance has been bundled with more traditional insurance policies like health insurance and with microcredit schemes. Notably, R4 bundles microinsurance with DRM interventions.

Bundling can also involve using risk finance instruments to cover multiple hazards. For example, Mexico's MultiCat covers hurricane and earthquake risks, CCRIF and PCRAFI offer earthquake and tropical cyclone coverage, and CCRIF has recently added protection against excess rainfall.

5.1. Risk layering

Risk layering involves implementing a full suite of tools that collectively address multiple layers of risk, from high-frequency/low-impact hazards to low-frequency/high-impact hazards, across all population



subsets.¹⁴⁶ While some of the literature focuses on risk layering using DRF tools exclusively, some also includes DRM interventions. In line with its overall approach of inclusivity, this paper takes the broader definition. From this perspective, risk layering can be viewed as a stepwise approach that reduces risks where possible and then implements DRF instruments as risk increases and where the associated costs are justified.

Either way, there is consensus in the literature that a strong DRF strategy does not rely on just one tool but ideally involves layering multiple instruments and/or interventions.¹⁴⁷ Both definitions agree that DRF instruments for rapid response at the macro level might include sovereign risk transfer for low-frequency/high-severity risks, contingency financing for mid-to-high risks, contingent emergency response components for middle-level risks, and budgetary instruments for high-frequency/low-severity risks. The broader perspective is that these would be integrated with DRM-related interventions that focus on, for example, promoting and incentivizing risk reduction and adaptation strategies; ex-ante managing and planning for risk; and implementing social protection instruments like national and regional safety nets, social insurance and labor interventions, and informal social protection such as savings groups.¹⁴⁸

A couple of studies have shown that risk layering can be more cost-effective than implementing a standalone instrument. As previously discussed, tools like disaster risk insurance are cost-effective only for hazards that occur infrequently, for instance less often than once in five, or once in seven, years. One empirical study in Mozambique found that a DRM strategy of improving irrigation could reduce insurance costs by at least 30 percent.¹⁴⁹ To cite a more illustrative example: a cost-benefit analysis of DRM and DRF approaches in a drought-prone region of India assessed 30 different interventions, including infrastructure investments, adaptive farm management techniques, and risk transfer instruments. The authors found that certain adaptive DRM interventions, such as implementing drainage systems and drip irrigation and improving soil techniques, actually had negative cost-benefit ratios, as they save costs over the long run. Implementing such measures could help the region avert roughly 20 percent of the \$360–570 million in expected losses over the next 20 years. Interventions such as crop engineering, integrated pest management, sprinkler irrigation, and watershed management had slightly higher cost-benefit ratios, around 0.1, but could avert roughly another 25 percent of the loss. The authors' proposed risk-layering portfolio suggested that 30 percent of the remaining expected loss, which would occur as a result of high-impact/low-frequency events and could not be mitigated through DRM measures, would be covered by crop and index-based insurance and that the remaining 20 percent would be residual loss. While this study

¹⁴⁶ Miller and Keipi 2005; Hallegatte et al. 2017; IEG 2019a; GFDRR 2012a.

¹⁴⁷ Baur and Parker 2015; Le Quesne 2017; Dercon and Clarke 2016; Vaananen et al. 2019; Vyas et al. 2019; Hillier 2018; Schäfer, Warner, and Kreft 2019; Linnerooth-Bayer et al. 2009, 2019; World Bank 2017d; IEG 2019a; GFDRR 2011a, 2012a; Hochrainer-Stigler and Pflug 2012 (cited in Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012); Benson et al. 2012 (cited in Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012); Cummins and Mahul 2009; Warsaw International Mechanism for Loss and Damage 2016; UNFCCC 2012; DRFIP 2012.

¹⁴⁸ IEG 2019a; Le Quesne 2017; Vaananen et al. 2019; Vyas et al. 2019; Warsaw International Mechanism for Loss and Damage 2016; UNFCCC 2012.

¹⁴⁹ Biffis and Chavez 2017 (cited in Hillier 2018).



represents an important start in assessing the potential and ideal structure of risk layering frameworks, one weakness was that, due to the many potential insurance alternatives, the authors selected to use an illustrative cost-benefit ratio of 1 for the insurance component. This assumes that risk transfer benefits are equal to the social costs.¹⁵⁰ Further research could build on this study, investigating the actual cost-benefit ratios of various forms of insurance. Box 3 highlights a scenario analysis that estimated the potential impacts of risk layering across 117 countries.

Box 3: A study on risk layering and bundling

Using their resilience model, Hallegatte et al. found that implementing risk layering through a bundled package of DRM and DRF instruments could increase average resilience by 1.6 percent, equivalent to a \$13 billion improvement in well-being across all countries.¹⁵¹ The DRM components of the bundled package they modeled included a preparation and contingency plan that outlined a budgetary process, a registry, and a delivery process to rapidly provide a cash transfer to all victims; these transfers would cover 80 percent of the losses suffered by the bottom 20 percent. This social protection scheme would be rapidly funded by DRF instruments such as a reserve fund, contingent finance, or risk-sharing instrument in the event of an emergency. The authors found that in absolute terms, the impacts would be greatest in China, Peru, the Philippines, Colombia, and Thailand (each avoiding at least \$700 million in well-being losses). They found that in relative terms, the impacts would be greatest in Angola, the Democratic Republic of Congo, Benin, and Gabon (each avoiding at least 10 percent of well-being losses). The findings emphasize the potential value of implementing risk layering that incorporates both social protection and financial risk management instruments.

While there is a need for additional scenario analysis and modeling to test alternative risk layering approaches, there is also a need for further implementation and empirical evaluation of this experience to assess how risk layering actually works in practice.

Some of the most successful and cited DRF case studies incorporate risk layering. Mexico, a favorite case study in the literature, incorporates relief and recovery funded through federal budget reserves as well as catastrophe bonds and insurance for higher-layer risks in its Fund for Natural Disasters (FONDEN) contingency fund. It also provides funding for DRM through the federal Fund for the Prevention of Natural Disasters (FOPREDEN) and incentivizes insurance uptake and “build back better” risk mitigation. The first time an uninsured asset is damaged, the fund will cover the full cost of reconstruction; but if the asset remains uninsured and is subsequently damaged again, the fund will pay only part of the reconstruction costs.¹⁵² IBLI in Mongolia is another often-cited example that incorporates a risk retention layer, such that herders bear costs of small losses while larger losses are transferred to private insurers, who are reinsured by the government and international reinsurers in the case of catastrophic losses. The government also offers a social safety net.¹⁵³ IBLI’s risk-layering design makes it particularly affordable and feasible for

¹⁵⁰ Economics of Climate Adaptation Working Group 2009.

¹⁵¹ Hallegatte et al. 2017.

¹⁵² World Bank 2017a (cited in Hillier 2018); Hallegatte et al. 2017.

¹⁵³ Schäfer et al. 2016; Mahul and Skees 2006 (cited in Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012); GFDRR 2011a.



insurers.¹⁵⁴ Other examples of risk layering can be found in the Philippines,¹⁵⁵ Vanuatu,¹⁵⁶ Mexico's CADENA program, and R4.¹⁵⁷

Though experience is limited and evidence unavailable to date, a novel approach advocates for pooling various risk layers, as is done by CCRIF. The idea is that the countries' risk would be pooled, and then each layer of pooled risk would be covered by the appropriate instrument. For example, the bottom low-frequency/low-intensity layer of pooled risk would be retained, the middle layer could be reinsured, and the top level could be covered by cat bonds.¹⁵⁸

There is agreement across the literature that there is no one-size-fits-all approach to risk layering. A review of disaster risk and risk finance in 117 countries highlights that the ideal combination of instruments is country-specific, and that the decision about how to layer should consider both costs and benefits of the available tools.¹⁵⁹

While risk layering is conceptually promising, experience shows that it can be difficult to implement in practice. Despite relying on a fairly crude methodology, a recent working paper found that only a third of eligible countries are using at least two of the three DRF tools covered by the study, and 9 percent are using all three.¹⁶⁰ The paper suggests that risk layering may be positively associated with income, government effectiveness, and prevalence of disaster damage, and may be negatively associated with receipt of humanitarian aid. Importantly, it also suggests strong regional trends. For instance, of the 46 percent of countries that have not adopted any of the instruments covered by the study, most are in Africa, while all Central American countries have adopted at least two instruments. The paper does note that the study's design and definitions are fairly limited, so further investigation into the prevalence of risk layering would be useful. Based on their findings, the authors suggest that increasing the availability of concessional financing would lead to more widespread uptake of risk layering. An earlier policy paper also suggests that the challenges inherent in actualizing the uptake of stand-alone DRF instruments are multiplied with risk layering, which involves uptake of multiple instruments and introduces added complexity. Risk layering requires even greater technical capacity to implement than a single instrument, and to date there does not exist any standard approach to help governments make the necessary decisions.¹⁶¹ This is where additional scenario analysis and modeling could greatly support

¹⁵⁴ Linnerooth-Bayer et al. 2019.

¹⁵⁵ Mahul 2018, 2019.

¹⁵⁶ Cook 2017.

¹⁵⁷ Madajewicz, Tsegay, and Norton 2013; de Janvry, Ramirez Ritchie, and Sadoulet 2016.

¹⁵⁸ Vyas et al. 2019.

¹⁵⁹ Hallegatte et al. 2017.

¹⁶⁰ Martinez-Diaz, Sidner, and McClamrock 2019. Countries included in the study were those eligible to participate in one of the three regional risk pools (CCRIF, ARC, and PCRIF) and those able to purchase multi-lateral contingent credit lines. The DRF instruments included in the study were limited to national reserve funds, contingent credit lines, and sovereign parametric insurance.

¹⁶¹ Le Quesne 2017.



implementation. Ideally, results from such exercises should be broadly shared as public goods to build the global knowledge base and support other countries in making similar decisions.

While risk layering may be a tough sell initially, experience so far suggests that countries that take up one DRF tool may be more likely to add additional tools later on. Most of the countries lauded for implementing risk layering did not implement the full strategy all at once. Rather, uptake appears to be stepwise and incremental. While more research is needed, it is notable that in the working paper cited above, more than half of the 54 percent of countries employing at least one DRF instrument currently use two or more instruments.¹⁶² Indeed, a 2016 review of best practices and lessons learned in DRF suggests while risk layering is optimal, stand-alone instruments can be useful in generating the initial traction and high-level interest needed to build support for broader strategic discussions.¹⁶³

5.2. Using DRF to finance shock-responsive components of social safety nets

In some instances, ad hoc safety nets have been rapidly implemented in the aftermath of disasters, but this approach is not ideal. Ex post systems have been attempted in several situations, for example for tsunami recovery in Maldives and Sri Lanka and earthquake recovery in Pakistan and Turkey. While many of these interventions did provide critical recovery assistance to affected populations, they demonstrate that trying to implement such a system in a post-disaster context can result in imprecise targeting, in some cases missing the most vulnerable groups, and slow delivery of funds to beneficiaries.¹⁶⁴

Standard social protection schemes can provide critical coverage for the poorest, and they are becoming more common.¹⁶⁵ The number of countries with conditional cash transfer programs more than doubled between 2008 and 2014, reaching 64 in total. The number with public works programs grew 50 percent between 2011 and 2014, reaching 94.¹⁶⁶ There have been several positive evaluations of stand-alone social protection programs.¹⁶⁷

Using DRF to fund the scale-up of existing scalable social safety nets in the event of an emergency has the potential to rapidly deliver relief funding to the household level. While implementation of such mechanisms is increasing, experience and evidence are limited because they are so new. Advocated by several authors,¹⁶⁸ shock-responsive, or scalable, social protection schemes have faced difficulty financing emergency scale-ups. Some authors have suggested that linking them with DRF instruments may improve

¹⁶² Martinez-Diaz, Sidner, and McClamrock 2019.

¹⁶³ Warsaw International Mechanism for Loss and Damage 2016.

¹⁶⁴ Sanghi et al. 2010.

¹⁶⁵ Hallegatte et al. 2017; Warsaw International Mechanism for Loss and Damage 2016; Hillier 2018.

¹⁶⁶ World Bank 2015 (cited in Hallegatte et al. 2017).

¹⁶⁷ Kenward, Cordier, and Islam 2012 (cited in Hallegatte et al. 2017); de Janvry et al. 2006 (cited in Hallegatte et al. 2017); Fiszbein, Schady and Ferreira 2009 (cited in Hallegatte et al. 2017); Gertler 2004 (cited in Hallegatte et al. 2017); White and Porter 2016 (cited in Hallegatte et al. 2017).

¹⁶⁸ Dercon and Clarke 2016; Hillier 2018; Pelham, Clay, and Braunholz 2011; Sanghi et al. 2010; Wiseman and Hess 2007 (cited in Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012); Warsaw International Mechanism for Loss and Damage 2016; O'Brien et al. 2018.



the efficiency and cost-effectiveness of both instruments while promoting economic inclusion and adaptive capacity of the poor.¹⁶⁹ Scalable social protection systems have been rolled out in East Africa (Kenya, Uganda, and Ethiopia; see box 4) and the Sahel (Mali, Mauritania, Niger), as well as Lesotho and the Philippines.¹⁷⁰ While there haven't been opportunities to test all of them in practice, many of the ARC countries' contingency plans suggest integrating their existing social protection plans as distribution networks.¹⁷¹

Box 4: Examples of DRF-financed scalable social safety nets in East Africa

One broadly cited example of a DRF-integrated scalable social safety net is Ethiopia's Productive Safety Net Programme (PSNP). It uses contingent financing mechanisms and insurance to scale up during extreme events and make payments to beneficiaries before they resort to negative coping strategies. A case study of the scale-up components of the PSNP and Kenya's Hunger Safety Net Programme (HSNP) reported that during Phase 1 of the PSNP, the contingency funds were often used to augment the regular caseload rather than to respond to shocks; because of constrained funding, the program could not otherwise meet the regular caseload's needs. In response, a Risk Financing Mechanism was introduced in 2009 to fund scale-up in the event of a crisis.¹⁷² In response to the 2011 drought, \$134 million was drawn down from the mechanism to cover over 3 million additional beneficiaries and to extend the duration of transfers for 6.5 million existing beneficiaries for an additional three months.¹⁷³ The Risk Financing Mechanism disbursed its funds much more rapidly than the parallel humanitarian appeal. In comparison, Kenya's HSNP scale-up was much more limited, doubling the amount transferred to existing beneficiaries during the 2011 drought but not increasing the number of beneficiaries.¹⁷⁴

A newer example of a DRF-funded scalable social protection mechanism is Uganda's Northern Uganda Social Action Fund 3 (NUSAF3), which has been piloted to mitigate the impact of droughts in Karamoja. According to the government's mid-term review of the project, the scalable component was triggered three years in a row, saving the government what would have amounted to roughly half of its allotted emergency fund. The study found that the DRF mechanism was responsive and successfully enabled households to access enough food to cushion themselves from the impacts of the drought, reducing the amount of emergency food aid required from the government.¹⁷⁵

¹⁶⁹ Warsaw International Mechanism for Loss and Damage 2016; Costella et al. 2017a; Costella et al. 2017b (cited in Vaananen et al. 2019); Peters and Pichon 2017; Vaananen et al. 2019.

¹⁷⁰ Ulrichs and Slater n.d.; Hillier 2018.

¹⁷¹ Republic of Mali 2015 (cited in Vaananen et al. 2019); O'Brien et al. 2018.

¹⁷² Slater and Bhuvanendra n.d.

¹⁷³ Slater and Bhuvanendra n.d.; Schäfer and Waters 2016; Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012; IEG 2019a.

¹⁷⁴ Slater and Bhuvanendra n.d.

¹⁷⁵ Government of Uganda 2019 (cited in World Bank Group 2020).



Mexico's CADENA program also offers a scalable distribution mechanism. Unlike the programs mentioned above, it does not provide continuous coverage to any one group. Rather it is exclusively used in the event of a disaster. The program is based around government-funded macro-level catastrophe insurance that, when triggered, provides payouts to small-scale farmers who fit specific, predetermined criteria. Evaluations of CADENA have found that while delivery speed could be improved and eligibility criteria need to be continually reviewed, the program benefits those in moderate poverty. It found further that cultivated land area, expenditures, and income tend to increase in the years following shocks.¹⁷⁶

One study compared two safety net models: a scalable social safety net partially funded by beneficiaries and a publicly funded in-kind safety net. It found that the former had a greater impact on economic growth and poverty reduction, though part of the impact was attributed to the self-financing by beneficiaries rather than to the linking of the two policy instruments.¹⁷⁷

Research on alternative delivery systems is needed. Despite the enthusiasm around DRF-funded shock-responsive safety nets, these are not necessarily the best delivery system in every situation and may not be feasible in every context. As one study on the use of safety nets for disaster preparedness and recovery found, in order to be effective, safety nets must work together with other programs and policies and are not necessarily well suited for all natural hazards. Drawing from case studies, the paper outlines a typology of contexts to help determine when safety nets are appropriate relative to alternatives.¹⁷⁸ This review highlights safety nets specifically because they featured prominently in the literature. It also highlights a gap in evidence on other forms of delivery systems.

5.3. Bundling DRF tools

Some programs have bundled microinsurance with other micro products, but most of the literature on the programs is descriptive. One initiative that integrates bundling and has been rigorously evaluated is the R4 program, highlighted in box 5. A recent paper¹⁷⁹ reviewed several experiences from various initiatives that have bundled credit and crop insurance, offering a useful update to a 2006 paper on the same topic.¹⁸⁰ The most recent review presents a nuanced view on the causal linkages, advantages, and limitations of each approach. It found that past programs in which publicly funded crop insurance was used to underwrite farm loans were generally expensive and did not tend to be successful, but suggested that more recent programs that involve private, index-based insurance appeared promising. It further suggested that including insurance coverage has several potential advantages: it can reduce default risks, reduce the costs associated with and improve the efficiency of risk management techniques, reduce interest rates, attract more clients, and reach a poorer client segment, among other benefits. However, implementing the bundled solution involves costs and management challenges associated with training staff to introduce farmers to the intricacies of insurance products. As discussed in section 3.7, experience has shown that understanding complex insurance topics like basis risk and the payout process can be

¹⁷⁶ de Janvry, Ramirez Ritchie, and Sadoulet 2016.

¹⁷⁷ Carter and Janzen 2015.

¹⁷⁸ Pelham, Clay, and Braunholz 2011.

¹⁷⁹ Meyer, Hazell, and Varangis 2017.

¹⁸⁰ Mechler, Linnerooth-Bayer, and Peppiat 2006



challenging for governments, let alone poor smallholder farmers. The paper’s findings suggest that insurance can be particularly useful in promoting the use of credit in contexts where credit is constrained, farmers have minimal collateral, and defaults tend to result from systemic risks. Some of the interventions this review covers include BASIX, the Weather-Based Crop Insurance Scheme, and PepsiCo’s potato program, all in India; the Sygenta Foundation, UAP insurance, and Safaricom’s Kilimo Salama in Kenya; PlaNet Guarantee in Burkina Faso; and the Zambia Lima Credit Scheme, among others. It also cites studies conducted on programs in Malawi, Ghana, and India. Other interventions are described as well. For example, in Vietnam, the Vietnam Bank for Agricultural and Rural Development acts as the country’s agricultural insurer through its lending; it pools risk at the national level by charging flat interest rates throughout the country and either rescheduling or forgiving loans in the event of a natural disaster.¹⁸¹

Disaster insurance has also been bundled with other more traditional insurance coverage. For example, SANASA in Sri Lanka found that bundling disaster insurance with its other insurance products (such as accidental death and hospitalization coverage) led to increased product acceptance among clients.¹⁸² In India, VimoSEWA bundles disaster insurance with health, property, and life insurance as well as microcredit. Though not yet commercially viable at the time the referenced articles were published, this product has been demonstrated to be flexible and resilient to triggering events and has generally proven effective, enabling earthquake and flood victims to rapidly restore their livelihoods and return to income-generating activities.¹⁸³

Experience with bundling coverage for multiple hazards is growing, and this approach could be further expanded. Many countries experience multiple hazards, which tend to cluster in common ways. For instance, earthquakes and volcanoes are often found along mountainous faults, while floods, cyclones, and landslides often affect continents’ eastern coastlines.¹⁸⁴ Multiple hazards that tend to come together can be bundled under a single policy or loan.¹⁸⁵ Such an approach follows the evolution of disaster risk insurance in developed countries, where insurance was hazard-specific until the 1930s, when all-peril insurance became more common.¹⁸⁶ Examples of DRF instruments that currently offer coverage for multiple hazards include Mexico’s MultiCat bonds, which provide coverage for hurricane and earthquake risks; PCRAFI, which offers coverage for earthquake and tropical cyclone risks; and CCRIF, which also covers earthquakes and tropical cyclones and recently added coverage for excess rainfall. ARC is currently exploring the addition of insurance products for floods, cyclones, and Ebola in order to diversify its risk pool.¹⁸⁷ As coverage for more perils is offered, such programs should build in monitoring and evaluation components and record their experiences so that others in the DRF space can learn from them.

Box 5: Bundling in the R4 Program

¹⁸¹ Skees, Hartell, and Murphy 2007.

¹⁸² Prashad and Herath n.d. (cited in Schäfer, Warner, and Kreft 2019); Schäfer et al. 2016.

¹⁸³ Mechler, Linnerooth-Bayer, and Peppiat 2006.

¹⁸⁴ Sanghi et al. 2010.

¹⁸⁵ Hillier 2018.

¹⁸⁶ Sanghi et al. 2010.

¹⁸⁷ e-Pact Consortium 2017.



R4, funded by Oxfam and the World Food Programme, is a micro program offering “integrated risk management.” The initiative provides microinsurance for droughts and promotes DRM through resource management via asset creation, livelihoods diversification, microcredit, savings, and capacity building. The program is praised throughout the literature.¹⁸⁸ For instance, one article stresses that R4’s policy of informing clients of hazards and advising them on activities for risk reduction is rare. It also points to its insurance for assets plan as a unique feature, and notes that the insurance can serve as collateral for loans.¹⁸⁹ R4 grew out of the HARITA program in Ethiopia, which itself was based on the country’s well-known PSNP, and under which the program’s rainfall index insurance package was designed. An early impact evaluation of HARITA found that insured farmers were able to save more than twice as much as noninsured farmers, leading them to invest more in farming inputs and productive assets.¹⁹⁰ A more recent evaluation found that being part of the program limited the impact of the 2015 drought on farmers’ food security and prevented many from selling off productive assets as a coping strategy.¹⁹¹ In 2012, the program transitioned to become R4 and expanded to Senegal, Malawi, Zambia, Kenya, and Zimbabwe.¹⁹² An impact evaluation in Senegal found strong results that the integrated, or bundled, nature of the program reduced the adverse impact of shocks on food security.¹⁹³ Unlike other farmers in the same area, program participants were able to maintain their food security levels across two consecutive bad harvests, and those with insurance spent more on agricultural inputs than those without.

For other initiatives that promote an integrated approach to disaster and climate risk management, see “The Stakeholder Landscape in Extreme Events and Climate Risk Management” by Golnaraghi and Khalil (2017).

6. Research Question 4: Crowding in prearranged financing

Is there evidence to suggest that prearranged financing will crowd in rather than crowd out the private sector? Can we provide examples of successes and/or failures in this area to understand a bit more clearly what works and doesn’t work?

Experience shows that the development of catastrophe risk models and the introduction of new risk financing tools by public institutions has already led to interest and positive response from private insurers and investors. To date, intermediaries such as risk pools and the World Bank have been instrumental in

¹⁸⁸ Oxfam and World Food Programme 2015; Schäfer et al. 2016; Schäfer, Warner, and Kreft 2019; Linnerooth-Bayer et al. 2019; Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012; UNESCAP 2018.

¹⁸⁹ Linnerooth-Bayer et al. 2019.

¹⁹⁰ Madajewicz, Tsegay, and Norton 2013.

¹⁹¹ Madajewicz, Tsegay, and Lee 2017.

¹⁹² Vyas et al. 2019.

¹⁹³ Dalberg Global Development Advisers 2016; Madajewicz, Tsegay, and Norton 2013.



making a DRF market by introducing creative ways to diversify risk and link low- and medium-income countries with international reinsurers and capital market investors. Although experience with each tool has been limited, and although international investors have sustained losses in some cases, there still appears to be enthusiasm for DRF instruments.

At the domestic level, further private sector engagement will require improvements in legal and regulatory frameworks. Experience in several countries has shown that providing incentives and developing governmental (re)insurance programs have worked to encourage private sector participation. Building demand, for instance through mandating insurance, can also lead to a more robust domestic insurance market.

Some authors are wary about viewing fully market-based solutions as a panacea and suggest that continued engagement of the public sector is essential. In particular, while the private sector has expressed substantial interest in DRF in general, it has not been particularly keen to invest in low-income clients or countries. Still, the improvement of risk modeling tools and the development of actuarially sound pricing are likely to continue crowding in the private sector.

Due to the nature of this research question and the recent growth in the DRF space, the bulk of the information in this section draws from recent history, limited operational experiences and policy literature rather than from rigorous evaluations. Findings here are based on recent examples and are not necessarily robust or indicative of future trends or performance.

6.1. A brief history of factors that have encouraged private sector engagement in prearranged financing to date

Several factors have already begun to crowd in private sector participation in DRF, namely an increase in environmental disasters and associated economic losses in the 1980s and 1990s, the development of catastrophe risk models, an increased international focus on DRF, and macroeconomic trends. According to a study of the effectiveness of cat bonds,¹⁹⁴ the economic losses due to natural disasters have persisted despite the rise in catastrophe insurance, and this situation has led to the development of the market for catastrophe-linked securities, which transfer risk to capital markets. Severe natural disasters have also led to the development of catastrophe risk models in the same time period. These models have enabled (re)insurers to better price and underwrite disaster risk coverage, facilitating growth of the market for DRF instruments.¹⁹⁵ As a result, the capacity of the reinsurance market more than quadrupled between 1994 and 2011.¹⁹⁶ The growth of the catastrophe-linked securities markets was also facilitated by the second generation of catastrophe risk models as well as by US credit rating agencies.¹⁹⁷ A more recent surge in private sector engagement has been led by the three international framework agreements—The 2030 Agenda for Sustainable Development, the Paris Agreement, and the Sendai

¹⁹⁴ Mariani and Amoruso 2016.

¹⁹⁵ Golnaraghi and Khalil 2017; UNESCAP 2018; OECD 2009.

¹⁹⁶ Guy Carpenter 2011 (cited in Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012).

¹⁹⁷ OECD 2009.



Framework for Disaster Risk Reduction.¹⁹⁸ It has also been facilitated by macroeconomic trends. For example, the good financial performance of cat bonds before and during the 2008 recession validated the claim that they are uncorrelated with commercial risk and led to a surge in the volume of global cat bonds. Investors included hedge funds, dedicated insurance-linked securities (ILS) funds, money managers, pension funds, insurance companies, and mutual funds.¹⁹⁹

In the last 15 years, new disaster risk financing instruments have been developed and tested, with generally positive responses from insurers and investors. While they are based on instruments long used in private markets to protect against catastrophe risk, it is important to note that their application to low-income countries is in general relatively new, that they have had limited subscription to date, and that they have been triggered even fewer times. Every time a payout triggers, additional experience is gained, and more arguments are made for risk transfer to private markets. For example, Chile and its domestic insurance market were well protected after the 2010 Chilean earthquake, when 95 percent of the \$8 billion in insured losses was transferred onto international reinsurers.²⁰⁰ Participants in the cat-linked securities markets foresee continued and increased demand from developing countries in the future.²⁰¹ However, experience shows that the extent of loss from catastrophes can drive some participants out of the market when payouts are triggered, and there is concern that in the long run, many will have to leave the market or risk bankruptcy when a major hazard occurs in a high-risk area.²⁰² Still, experience remains limited, and concrete evidence is lacking.

6.2. Continued role for public investment and intermediation for risk finance

Risk pools, established by public sector institutions, contribute to the international DRF market by enabling low-income and at-risk countries to access international reinsurance and capital markets, and by making it cost-effective for these markets to serve these countries. Furthermore, by pooling risk across governments, opportunities will be opened for the creation of new financial products.²⁰³ As of 2016/17, the sovereign catastrophe risk pools had collectively purchased coverage for a total of \$870 million, with a premium volume of \$56.6 million, and were backed by over 30 reinsurance companies.²⁰⁴ CCRIF is reinsured through a panel of traditional reinsurers and accesses the capital market via a World Bank cat bond,²⁰⁵ which was enabled through the first cat swap—a transaction that took place between the World Bank and CCRIF.²⁰⁶ The use of the capital markets helps protect CCRIF against insolvency and helps ensure that payouts are rapid.²⁰⁷ PCRAFI is insured by five private sector reinsurers, and ARC by

¹⁹⁸ Golnaraghi and Khalil 2017; Navarro-Martin 2017.

¹⁹⁹ Andersen et al. 2010; Michel-Kerjan et al. 2011; OECD 2009.

²⁰⁰ Hallegatte et al. 2017.

²⁰¹ OECD 2009.

²⁰² Barrieu and Louberge 2009.

²⁰³ Cummins and Mahul 2009; Le Quesne 2017.

²⁰⁴ World Bank 2017d.

²⁰⁵ GFDRR 2012a; Dercon and Clarke 2016; Bennett and Smyth 2016.

²⁰⁶ Ghesquiere and Mahul 2007 (cited in Le Quesne 2017).

²⁰⁷ Bennett and Smyth 2016; Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012.



24.²⁰⁸ In fact, ARC's first four risk pools were oversubscribed with competitive pricing, demonstrating the reinsurance industry's positive interest in the product. An independent evaluation conducted three years after ARC enacted its first policies found that the insurance industry still viewed it favorably, though there were some doubts about the organization's flexibility toward premium payment deadlines.²⁰⁹

In 2006, the World Bank began helping governments access catastrophe bonds, which transfer disaster risks to financial markets. While issuances to sovereign governments have been limited to date, the cat bond market in developing countries has potential for growth. Implementation of cat bonds in developing countries is fairly new, but these bonds have historically been attractive to investors because catastrophe risk is uncorrelated with financial markets.²¹⁰ A 2008 study looking at the application of cat bonds in low-income countries specifically used simulated empirical data to show that investing in cat bonds in low-income countries could significantly reduce the level of risk in a portfolio, indicating potential for demand among investors.²¹¹ On the other hand, catastrophe bonds have been attractive to countries and risk pools because, like insurance, they can disburse funds rapidly. Cat bonds can also enable access to larger capital pools and more competitive pricing than reinsurance markets.²¹²

Limited experience in developing countries to date suggests that the World Bank and others have played an important intermediation role in customizing and arranging cat bond transactions, and have thus made investors more comfortable about purchasing the risk of low-income countries.²¹³ In 2006, the World Food Programme pre-financed emergency operations with a cat bond, though this was not renewed in 2007, due to moral hazard. Also in 2006, Mexico issued the World Bank's first cat bond, more details on which are provided in box 6. The World Bank provided a cat swap for CCRIF for 2007–14, and in 2014 issued CCRIF a three-year cat bond.²¹⁴ In 2016, the Pacific Alliance, formed by Peru, Chile, Colombia, and Mexico, sponsored a World Bank cat bond of \$1.36 billion,²¹⁵ representing the first simultaneous cat bond issuance for four sovereign entities and the largest earthquake cat bond ever issued.²¹⁶ The diversification of risk to four different geographical areas helped to attract more than \$2.5 billion in investment orders from 45 international investors.²¹⁷

²⁰⁸ GFDRR 2012a; World Bank Group 2018.

²⁰⁹ e-Pact Consortium 2017.

²¹⁰ World Bank 2017e; OECD 2009, 2015; Executive Committee of the Warsaw International Mechanism for Loss and Damage 2017; Andersen et al. 2010; Hermann, Köferl, and Mairhöfer 2016; GFDRR 2013; Michel-Kerjan et al. 2011.

²¹¹ Martina and Teh 2008.

²¹² World Bank 2017e; OECD 2009, 2015; Executive Committee of the Warsaw International Mechanism for Loss and Damage 2017; Andersen et al. 2010; Hermann, Köferl, and Mairhöfer 2016; GFDRR 2013; Michel-Kerjan et al. 2011.

²¹³ Executive Committee of the Warsaw International Mechanism for Loss and Damage 2017.

²¹⁴ World Bank 2019b.

²¹⁵ IEG 2019b.

²¹⁶ World Bank 2019b.

²¹⁷ World Bank, 2017e, 2019b.



The World Bank has also played an intermediation role with respect to weather derivatives, but again, given that these instruments are relatively new, experience is limited. While developed countries have been using weather derivatives since the 1960s, they were not used in low-income countries until 2002 (in South Africa).²¹⁸ In 2007, Swiss Re launched the Climate Adaptation Development Program, which used a weather derivative based on a climate index to protect village clusters in Ethiopia, Kenya, and Mali.²¹⁹ Unlike some other experiences highlighted above, this project failed to garner as much insurance coverage as it sought, and later had to be scaled down to match available funding.²²⁰ In 2008, the World Bank introduced weather derivatives to its portfolio. Malawi was the first to purchase one. The product was structured such that when a drought triggered the derivative, the payout would lock in the price of maize imports, preventing market price hikes.²²¹ The United Kingdom's Department for International Development financed the first three years of premiums. In 2011, the government financed the premiums through a World Bank loan but did not renew.²²² Another often-cited example of a weather derivative is that taken out by Uruguay and executed by the World Bank in 2013 to cover risk of drought and high oil prices.²²³ In 2014, however, the market-based transaction was not renewed, and the government instead used a World Bank contingent lending product to achieve the same objectives.²²⁴ More recently, the World Bank carried out a cat swap to support PCRAFI in placing five derivative contracts on the international reinsurance market as a single diversified portfolio.²²⁵

There are other examples of individual developing countries or organizations buying insurance on international markets, in some cases directly but in others through public sector institutions.²²⁶ TCIP is underwritten by roughly 30 international (re)insurers.²²⁷ WINCROP, which insures Caribbean banana farmers against windstorms, reinsures 85 percent of its portfolio internationally at favorable rates, thanks to its good reputation.²²⁸ In 2006, AXA underwrote a \$7 million World Bank drought insurance policy for Ethiopia, though this was not renewed.²²⁹

Box 6: Mexico's Cat Bond Experience

The first of the World Bank's cat bonds was Mexico's CatMex, a \$160 million cat-in-a-box issued in 2006 and guaranteed by Swiss Re, which provided security to FONDEN.²³⁰ While Mexico was the first to use

²¹⁸ Singh 2005 (cited in Hermann, Köferl, and Mairhöfer 2016).

²¹⁹ Hermann, Köferl, and Mairhöfer 2016; UNFCCC 2008.

²²⁰ UNFCCC 2008.

²²¹ DRFIP 2012.

²²² Syroka and Nucifora 2010 (cited in Clarke and Vargas Hill 2012); Hermann, Köferl, and Mairhöfer 2016; OVE 2016.

²²³ OVE 2016; Le Quesne 2017; Navarro-Martin 2017.

²²⁴ World Bank Treasury, n.d.; World Bank 2014.

²²⁵ OECD 2015.

²²⁶ Dercon and Clarke 2016.

²²⁷ GFDRR 2011b.

²²⁸ Mechler, Linnerooth-Bayer, and Peppiat 2006.

²²⁹ Dercon and Clarke 2016.

²³⁰ Linnerooth-Bayer, Hochrainer-Stigler, and Mechler 2012; Clarke et al. 2017; Navarro-Martin 2017; OVE 2016; Andersen et al. 2010; Hermann, Köferl, and Mairhöfer 2016; GFDRR 2013; Michel-Kerjan et al. 2011.



a World Bank cat bond, the World Bank's cat bond issuance platform was designed to be scalable and customizable for each country.²³¹ When in 2009 Mexico issued its second cat bond, which covered multiple hazards, it was 2.5 times oversubscribed by a broad set of different investors.²³² Specialist ILS managers and reinsurers were the main investors, with the remainder comprising banks, hedge funds, money managers, reinsurer cat funds, and endowment pension funds. These were predominantly headquartered in the United States and Bermuda, though European and Japanese investors were also involved.²³³ These investors lost half their principle when Hurricane Patricia struck in 2015, triggering payment,²³⁴ but this has not put off investors. In 2014 and 2015, use of cat bonds in developing countries was predicted to rise.²³⁵

6.3. Strengthening weak domestic insurance sectors to facilitate participation in prearranged financing

In order to see growth in the domestic private sector, legal and regulatory frameworks need to be improved. An assessment of potential insurance development scenarios in developing countries found that significant insurance market growth will depend on effective regulation of domestic insurance markets to enable insurers' financial stability and consumers' confidence in claims payment.²³⁶

Providing incentives, mandating insurance, and developing governmental (re)insurance programs have led to the participation of domestic insurers in several countries. For example, there are government-owned insurers for agricultural insurance in India, Iran, Turkey, and the Philippines. In Mexico, private insurers are offered tax breaks if they provide catastrophic coverage. In Panama, Peru, and Colombia, government buildings must be insured. Turkey and Taiwan have set up institutions that provide mandatory property catastrophe insurance for homeowners and businesses. In some countries, such as Thailand and Mongolia, the government acts as a reinsurer.²³⁷ However, according to a survey of countries employing DRF instruments, countries that provide public support through premium subsidies or reinsurance find it very difficult to remove as the domestic insurance market expands.²³⁸

Being mandated to serve low-income clients, or seeing examples where this requirement is profitable, may make domestic insurers more inclined to offer catastrophic coverage to poor clients. When mandated to provide insurance to low-income people, domestic insurers in India discovered that this can be a potentially profitable segment.²³⁹ Similarly, domestic insurance companies were highly doubtful

²³¹ Michel-Kerjan et al. 2011.

²³² OVE 2016; GFDRR 2014; Executive Committee of the Warsaw International Mechanism for Loss and Damage 2017; Andersen et al. 2010; GFDRR 2013; Michel-Kerjan et al. 2011.

²³³ Michel-Kerjan et al. 2011.

²³⁴ Navarro-Martin 2017.

²³⁵ Phillips 2014 (cited in Hermann, Köferl, and Mairhöfer 2016); Artemis 2015 (cited in Hermann, Köferl, and Mairhöfer 2016).

²³⁶ ODI and RMS 2017.

²³⁷ Dercon and Clarke 2016; OECD 2015.

²³⁸ OECD 2015.

²³⁹ Krishna 2005 (cited in Mechler, Linnerooth-Bayer, and Peppiat 2006).



when Oxfam initially started offering microinsurance to poor populations, but once the program became successful, the insurers began approaching nongovernmental and community-based organizations directly.²⁴⁰

6.4. Continuing need for public sector involvement in DRF

Some authors have raised concerns about viewing market-based solutions as a panacea. A primary concern is the private sector's profit motivation, which may sideline development goals such as protecting well-being and promoting DRM.²⁴¹ There is evidence that private insurers invest less in preventive DRM than public insurers.²⁴² One policy paper goes so far as to propose the need for a new form of institution—development insurers—which would seek to balance well-being impact and profit.²⁴³ The pure focus on economics is evident in the literature on damage and loss estimation and on insurance pricing, which does not account for the impacts on well-being that concern the development sector.²⁴⁴ Some authors advise caution in viewing risk transfer as a silver bullet; they point out that risk transfer does not eliminate risks and (writing in 2012) suggest skepticism toward new financial instruments in light of the global financial crisis.²⁴⁵

Experience demonstrates that engagement from the public sector can spur on the private sector. One paper finds that while the private sector excels in product design, the public sector is needed to help products reach scale and to encourage innovation by the private sector.²⁴⁶ It cites all three sovereign risk pools as well as the Mexico catastrophe bond as examples where these roles have played out. Similarly, when the World Bank, BASIX microfinance, and ICICI Lombard, a Mumbai-based insurance company, implemented a weather derivative in India, many farmers who initially took out contracts through the microfinance channel ended up buying it directly from the insurer within a span of three years.²⁴⁷

In most cases, private insurers are not enthusiastic about offering unsubsidized insurance to poor clients, so the public sector will likely need to continue to engage, particularly in vulnerable countries and with poor clients.²⁴⁸ At the macro level, there has been concern about the size of the ARC risk pool, which will need to continue to rely on donor investment if more countries are not brought on board.²⁴⁹ Similarly, the PCRAFI pool is not yet large enough to be self-sustaining. Both of these pools have been supported by donor funding. At the micro level, unsubsidized microinsurance programs have in general not been particularly successful, but there have been some good experiences with programs that are

²⁴⁰ H. Krishna, personal communication, 2005 (cited in Mechler, Linnerooth-Bayer, and Peppiat 2006).

²⁴¹ Clarke and Dercon 2019; Linnerooth-Bayer et al. 2019.

²⁴² Schwarze and Croonenbroeck 2017 (cited in Linnerooth-Bayer et al. 2019); von Ungern-Sternberg 1996 (cited in Linnerooth-Bayer et al. 2019); Chambwera et al. 2014 (cited in Linnerooth-Bayer et al. 2019).

²⁴³ Clarke and Dercon 2019.

²⁴⁴ Hallegatte et al. 2017.

²⁴⁵ Byrne and Grannis 2012 (cited in Bennett and Smyth 2016).

²⁴⁶ Hallegatte et al. 2017.

²⁴⁷ Barriau and Scaillet 2010.

²⁴⁸ Swiss Re 2014 (cited in Linnerooth-Bayer et al. 2019).

²⁴⁹ e-Pact Consortium 2017.

subsidized by governments.²⁵⁰ One study found that 85 percent of flood insurance schemes in developing countries involved both public and private sectors.²⁵¹ A policy paper attributes the public sector's high level of involvement to its role in making insurance commercially viable.²⁵² According to a study from the Financial Innovations for Social and Climate Resilience Initiative, as the private sector provides disaster cover to a greater proportion of the nonpoor and near poor who can afford premiums, the burden on the public sector to support resilience and recovery for the whole population will be lifted, allowing public funds to focus more specifically on the poor.²⁵³

6.5. Risk modeling and actuarially sound pricing

The development and improvement of risk models may help to further encourage private sector engagement. All three sovereign risk pools have developed advanced risk models of interest to the private sector, including local insurers, which could precipitate the expansion of further insurance options in these regions. The Pacific Risk Information System, underpinning PCRAFI, has been used in the underwriting and pricing of domestic insurers and brokers to investigate the potential for crop insurance in some Pacific Island countries and to inform catastrophe risk insurance policies for hotels and resorts in Fiji.²⁵⁴ Similarly, beginning in 2010, the CCRIF hazard risk data and platform were used by international partners and local insurers and financial institutions to provide catastrophe risk coverage for low-income individuals. CCRIF data have also been used as the foundation for a loan portfolio hedge to promote investment in risky areas.²⁵⁵ Finally, through its new Licensing for Development initiative, ARC is aiming to facilitate private sector adoption of parametric insurance products. The initiative allows private sector actors with risk exposure in Africa to use ARC's hazard tool, Africa Risk View, and associated vulnerability and drought profiles to assess potential impacts of weather volatility on crop production, supply chains, and business forecasting.²⁵⁶

Development of actuarially sound pricing may also enhance the interest of the private sector. For example, when India's NAIS program restructured from a social crop insurance scheme to a market-based program with commercial weather-based crop insurance products, private insurers decided to participate because the pricing scheme—developed with the support of technical assistance from the World Bank—was actuarially sound.²⁵⁷

²⁵⁰ Dercon and Clarke 2016; Mechler, Linnerooth-Bayer, and Peppiat 2006; Schäfer et al 2016.

²⁵¹ Surminski and Oramas-Dorta 2014 (cited in Le Quesne 2017).

²⁵² Le Quesne 2017.

²⁵³ Benson et al. 2012.

²⁵⁴ Pacific Islands Forum Secretariat 2014 (cited in Le Quesne 2017); World Bank 2017d; IEG 2019a.

²⁵⁵ World Bank 2017d; IEG 2019a.

²⁵⁶ e-Pact Consortium 2017; World Bank 2017d; IEG 2019a.

²⁵⁷ GFDRR 2012c.



7. Conclusion

This review was undertaken primarily to support the development of the GRiF theory of change, and secondarily to share the current state of evidence around four key questions with a broad audience. While there is a growing evidence base, much of the literature to date, particularly for macro-level instruments, is based on inference from existing success stories and failures rather than on robust evaluation. As the sector evolves and grows, there is a need for more comprehensive evaluations of key programs as well as simulation models and cost-effectiveness analyses comparing alternative program designs. Still, as this review has demonstrated, many important lessons can be gleaned from the experiences to date.

7.1 Summary of findings

With respect to Research Question 1 regarding constraints to DRF instrument uptake, this review found that many of the constraints observed in the 1990s—notably high premiums, lack of data and modeling, moral hazard, lack of regulatory frameworks, and a lack of demand—remain today. These constraints inhibit uptake of DRF instruments in vulnerable countries on both the supply and demand sides. Further well-known inhibiting factors include high start-up costs, basis risk, psychological biases, a lack of trust and willingness to coordinate, political disincentives, high technical demands (alongside limited technical capacity), and poor financial literacy. One interesting finding was that continued limited supply restricts the options available to governments and consumers, who may be interested in taking up instruments that are not yet available. Another interesting finding is that uptake by countries and individuals may be affected by observing the experiences of others. Finally, many of the successful cases of uptake were countries that face frequent natural disasters, have developed a strong existing DRM environment, and were initially prompted to take up DRF instruments by the experience of a catastrophic event. In the future, the understanding of constraints to uptake would greatly benefit from evaluations of countries that have *not* yet taken up DRF.

With respect to Research Question 2, the review found that while the policy literature and experience emphasize the importance of technical assistance for the uptake of DRF instruments, very little research has been done to explore the direct link between technical assistance and the timeliness and effectiveness of post-hazard responses. One challenge is that the type of technical assistance offered varies substantially across DRF instruments, and it does not appear that the different types have been thoroughly outlined and compared by any documents to date. Given that rigorous monitoring and evaluation of disaster response is uncommon in general, it is not particularly surprising that evaluation of these particular components of interventions is even more limited. However, there are a few notable pieces of evidence on the topic. Notably, the ARC evaluation highlights that while the facility's technical assistance requirement did indeed result in greater capacity, several challenges remained, including low starting capacity, limited reach of the trainings, and high turnover of trained staff. Both the role of technical assistance and the factors contributing to timeliness and effectiveness of response would be excellent areas for future research.

The evidence on Research Question 3 showed that while risk layering and integration of DRF tools with social safety nets are interesting propositions, far too little experience exists to draw broad conclusions. As they are further tested in new contexts, it will be important to incorporate strong monitoring and evaluation frameworks to learn from these experiences.



Finally, with respect to Research Question 4 regarding the potential of DRF to crowd the private sector in or out, this literature review found more experience of DRF tools encouraging the participation of the private sector than was initially expected. Crowding in has already been largely facilitated by the development of catastrophe risk models and strong international attention to DRF, and further honing of risk models and continued attention can help to maintain this momentum. New tools developed and implemented by intermediaries have facilitated private sector participation and interest in sovereign risk pools, which have garnered the support of many reinsurers, as well as in catastrophe bonds (some of which have been repeatedly oversubscribed). Still, experience is limited, and further uptake is needed to demonstrate that these findings are generalizable rather than the result of a few early cases. To encourage this increase in uptake, the public sector will need to continue to play a central role in “making the market,” or eliminating barriers to participation on both the supply and demand sides. Continual improvement of risk models will also be necessary to further crowd in the private sector. Finally, while some countries’ domestic private sectors have been crowded in through the insurance program design, most countries’ legal and regulatory frameworks still require significant strengthening to improve the financial and insurance enabling environments.

7.2 Opportunities for future research

Several avenues for further research were identified in the process of drafting this review and in the peer review process. Since the field is relatively new and rapidly evolving, there is a great opportunity and need for new research to inform implementation. Overall, given the scope of this paper, a detailed discussion of each research question at the macro, meso, and micro levels was not possible. A follow-on study that details the relevance and applicability of these findings for agents at each level would help to make this research actionable for various actors.

Of the four research questions, Research Question 1 is the most extensively covered by the literature. Still, there are several gaps and opportunities in this area that could be addressed by future studies. First, much of the existing literature is focused on success stories and highlights factors enabling uptake. A qualitative study incorporating interviews with officials in countries that have not yet taken up DRF instruments, or in countries where traction has been lost, would perhaps provide a more direct answer to this question. Second, a bulk of the literature focuses on demand-side constraints. Further exploring supply-side constraints would provide valuable insights for the development and rollout of future DRF solutions. Such a study might survey countries that have taken up DRF instruments, as well as those that have not, to learn whether the options available to them suit their needs. While there may be a chicken-and-the-egg problem with this inquiry—countries cannot request instruments without first thoroughly understanding how insurance works and what the possibilities might be—it may also reveal surprising limitations and opportunities for new instruments. Such a study may even help to generate interest and discussions in countries that have expressed minimal interest to date, or where DRF discussions have tapered off. Countries that have already adopted DRF tools may have new ideas for modifying instruments based on their growing experience. Third, while this research question is well covered broadly, there is room for deeper analysis of each of the various constraints. For example, value for money assessments on various instruments would add a necessary level of depth to the cost discussion. This topic in particular could also be designed to inform some of the other research questions, such as those addressing effectiveness, risk layering, and bundling. Finally, to make this research more actionable, a follow-on study



could be done to explore how various agents have managed to overcome the constraints identified.

Given the minimal experience available for addressing Research Question 2, there is a great deal of room for additional research—not only on the connection between technical assistance and response timeliness and effectiveness, but also on each of these topics independently. According to the literature, the experiences of implementers indicate that technical assistance is critical, but more detailed accounts of these experiences would improve and broaden this understanding. They could shed light on the composition and evolution of technical assistance within given programs, successes, nuances and challenges in delivery, conditions under which various approaches are useful, and impacts on the program. Once more detailed accounts are available, it would be useful to classify and compare the various forms of technical assistance on offer. Such research could inform the composition of technical assistance programs and contribute to building a better knowledge base around the causal chain, which is really what this research question is addressing. In addition, while there have been some robust evaluations of response effectiveness at the micro level, there is still a great deal of opportunity for research to explore the timeliness and effectiveness portion of the question—for DRF instruments in general, but also for macro level and various components of the instruments, such as technical assistance, in particular. Given that many macro tools require limited planning for, as well as monitoring and evaluation of, the full response, such research is important from both the accountability and learning standpoints.

In line with this challenge, while Research Question 3 found notable interest in and growing evidence around using DRF instruments to finance shock-responsive components of safety nets, other delivery systems need more coverage in the literature. Additional information on the pros and cons of various approaches to delivery should help countries make educated decisions about delivery in their contingency planning processes and will ultimately also facilitate more complete, end-to-end monitoring and evaluation of payouts, thus further contributing to the learning cycle. Similarly, further research around pairing DRF tools with financial inclusion interventions would be useful. Further evaluations on value for money and effectiveness, both mentioned above, would improve understanding of the various trade-offs involved under risk-layering approaches.

The work on Research Question 4 was primarily based on recent examples and limited operational experiences. A deeper dive into the experiences of private sector engagement, including constraints, solutions, and enabling factors, would be useful. In addition, more extensive, evidence-driven research is needed in this area, in particular assessments of the value for money of bringing in the private sector.



Annex: Examples of DRF instruments

This table is intended to summarize the DRF instruments commonly cited in the literature and referred to in this paper. It is not intended to be a complete review of all instruments. For those interested in a detailed review of microinsurance programs in particular, Hillier’s (2018) “Facing Risk” is an excellent resource.

Instrument type	Instrument name	Launch date	Participating countries
Regional risk transfer facilities	African Risk Capacity (ARC)	2014	34 member states, though most have not participated in the risk pool. Past risk pool participants: Kenya (risk pools 1, 2), Malawi (2). Current risk pool participants that had previously participated: Niger (1–3, 6), Mauritania (1–4, 6), Senegal (1–6), Mali (2–4, 6), The Gambia (2–6), Burkina Faso (3–6). New risk pool participants (pool 6 only): Côte D'Ivoire, Chad, Zimbabwe, Madagascar, Togo.
	Caribbean Catastrophe Risk Insurance Facility (CCRIF) ^a	2007	Anguilla, Antigua and Barbuda, The Bahamas, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Dominica, Grenada, Haiti, Jamaica, Montserrat, Nicaragua, Panama, St. Kitts and Nevis, St. Lucia, St. Martin, St. Vincent and the Grenadines, Trinidad and Tobago, Turks and Caicos Islands.
	Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI)	2012	PCRAFI provides disaster risk assessment tools to 15 countries, though not all have taken out insurance. Past risk pool participants: Solomon Islands (pools 1–2), Vanuatu (1–6). Current risk pool participants: Cook Islands (2–7), Marshall Islands, Samoa, Tonga (1–7).
	Southeast Asia Disaster Risk Insurance Facility (SEADRIF)	Insurance provision forthcoming	Expected to cover Myanmar, Lao PDR, and Cambodia first.

Instrument type	Instrument name	Launch date	Participating countries
International contingent financing	World Bank Catastrophe Deferred Drawdown Option (Cat DDO)	2008	Costa Rica (2009), Guatemala (2009 and 2019), Colombia (2009 and 2013), Peru (2011 and 2015), El Salvador (2011), Panama (2012), Philippines ^a (2012 and 2016), Sri Lanka (2014), Seychelles (2015), Serbia (2017), Dominican Republic (2018), Kenya (2018), Romania (2018), Cabo Verde (2019), Malawi (2019), Samoa (2019), Tuvalu (2020), Maldives (2020), Madagascar (2020), Morocco (2020), Vanuatu ^a (2020), Grenada (2020).
	Inter-American Development Bank (IDB) Contingent Credit Facility for Natural Disaster Emergencies (CCF)	2009	Dominican Republic (2009–20), Honduras (2011–17), Costa Rica (2012, cancelled), Panama (2012–17), Peru (2013–19), Nicaragua (2013–19), Ecuador (2014–20), Bahamas (2018–), Jamaica (2018–), Argentina (2019–), Belize (2019–), and Suriname (2019–).
	IDB Contingent Credit Line for Natural Disasters (CCL)	2012	None.
Alternative risk transfer	Cat bonds	Introduced in mid-1990s; uptake increased around 2007	Hundreds issued to cover pandemics, terrorism, and natural disasters. Relatively new among developing countries. Notable examples: first cat bond issued by Hannover Re to cover worldwide property catastrophe losses (1994), World Food Programme (2006), Mexico/FONDEN (2006, 2009, 2012), first World Bank cat bond (for CCRIF, 2014), Pacific Alliance (Peru, Chile, Colombia, Mexico) (2016), Peru (2018), Philippines (2019).
	Cat derivatives, cat swaps, weather derivatives	1990s	Examples of Cat swaps: CCRIF, PCRAFI, Philippines (2017). Examples of weather derivatives: South Africa (2002); CRMG, BASIX, and ICICI Lombard with the World Bank to scale up weather insurance for smallholder farmers in India (initiated in 2003); World Food Programme parametric weather derivative to Ethiopia (2006); Climate Adaptation Program in Kenya, Mali, and Ethiopia (piloted in 2007); Malawi smallholders weather derivative (2008–11); Uruguay (2014).



Instrument type	Instrument name	Launch date	Participating countries
National contingent financing	Fund for Natural Disasters (FONDEN) ^a (works with federal Fund for the Prevention of Natural Disasters [FOPREDEN], which is for risk recovery)	Budgetary tool for disaster relief and reconstruction: 1996 Contingency fund: 2005	Mexico.
International microinsurance schemes	R4 Rural Resilience Initiative (R4) ^a (piloted as Horn of Africa Risk Transfer for Adaptation [HARITA] in Ethiopia)	HARITA: 2009 R4: 2011	Ethiopia, Senegal, Malawi, Zambia, Kenya, Zimbabwe.
National and subnational microinsurance schemes	Turkish Catastrophe Insurance Pool (TCIP)	2000	Turkey.
	Index-Based Livestock Insurance (IBLI) ^a	2006	Mongolia.
	Index-Based Livestock Insurance (IBLI)	2010	Kenya, Ethiopia.
	CADENA (provides a safety net only during an emergency)	2013	Mexico.
	National Agricultural Insurance Scheme (NAIS)	1999	India.
	ACRE Africa	2009	Rwanda, Kenya, Tanzania.
Bundled microinsurance	VimoSEWA	Trade union: 1982 Integrated insurance scheme: 1992	India.
	SANASA	Weather-based insurance: 2010	Sri Lanka.
	BASIX	Livelihood promotion: 1996 Weather-based insurance: 2003	India.

Instrument type	Instrument name	Launch date	Participating countries
	Malawi Weather Index Insurance	2005–14	Malawi.
Scalable safety nets	Productive Safety Net Programme (PSNP)	Safety net: 2010 Shock-responsive component: 2009	Ethiopia.
	Hunger Safety Net Programme (HSNP)	Safety net: 2009 Shock-responsive component: 2014	Kenya.
	Northern Uganda Social Action Fund 3 (NUSAF3)	Safety net: 2003 Shock-responsive component: 2016	Uganda.
	Other shock-responsive safety nets of note		Mali, Lesotho, Niger, Mauritania, Philippines.

a. The literature highlights this instrument as being part of a notable risk-layering framework.

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