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ACRI

Risk transfer and insurance for disaster risk management: evidence and lessons learned

Review paper for a special session on risk transfer and
insurance at the 5th Global Platform for Disaster Risk
Reduction

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Acronyms

ARC	African Risk Capacity
CAT DDO	Catastrophe Draw Down Option
DRFI	Disaster Risk Financing Instrument
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
CADENA	El Comité de Ayuda a Desastres y Emergencias Nacionales (Mexico)
CCRIF	Caribbean Catastrophe Risk Insurance Facility
FONDEN	El Fondo Nacional para el Desarrollo Nacional (Mexico)
HSNP	Hunger Safety Net Programme (Kenya)
IBLIP	Index-Based Livestock Insurance Project (Mongolia)
IBRD	International Bank for Reconstruction and Development
IPCC	Intergovernmental Panel on Climate Change
PIC	Pacific Island Country
PCRAFI	Pacific Catastrophe Risk Assessment and Financing Initiative
RCT	Randomised Controlled Trial
SST	Sea Surface Temperature

1 Introduction

This paper was commissioned by the Organising Team of a Special Session on Risk Transfer and Insurance to be held at the 5th Global Platform for Disaster Risk Reduction hosted by the Government of Mexico in May 2017. The paper is intended to answer the first of four framing questions for the session, which is “*What have we learned from insurance approaches that today provide lessons learned and good practices?*”

The paper is structured as follows. Section 2 describes the key relevant concepts for the paper. Section 3 discusses evidence on how risk transfer contributes to DRM, focusing on dynamics at the macro economic and political level, and the themes of prevention and preparedness, and response and recovery. Section 3 also covers some of the challenges that may constrain the ability of insurance to contribute to risk management and risk reduction. Section 4 explores factors affecting uptake of insurance from the perspective of insurers, governments and individuals. Section 5 considers the role of insurance within DRM strategies. It discusses risk layering, policy trade-offs and the need to consider the drivers of risk in parallel to the management of risk.

The methodology used for this paper was a desk review. Relevant literature was collected by searches of journal databases and organisational websites, and from direct submissions by the members of the Organising Team. The literature was then analysed and assessed in relation to the main research question and key themes determined in advance.

The typical focus in the literature and in the disaster risk community has been upon the efficacy of risk transfer as a tool for managing residual risk, and supporting response and recovery following a disaster. There is increasing interest, however, in how risk transfer can contribute to risk reduction. It is this latter aspect that is the focus of this paper.

The scope of this review is disaster risk management in general, with a particular focus on climate-related risks. It is acknowledged that lessons from risk transfer in other areas (e.g.: health and credit insurance) could be valuable in addition.

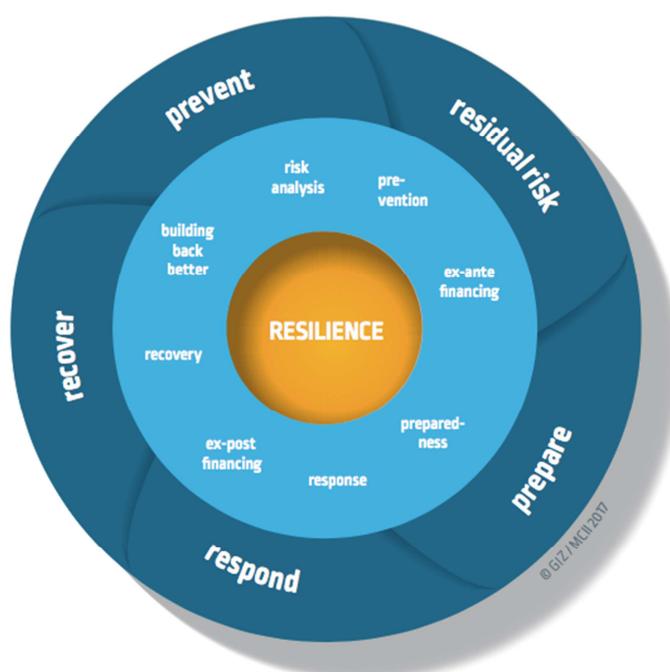
The majority of empirical research relating to the link between insurance and disaster risk management is case-study based and focuses on factors conditioning uptake and impacts on response and recovery, instead of risk reduction. Most available evidence on the management of climate risks relates to the agricultural sector, particularly to agricultural microinsurance schemes. The agricultural microinsurance literature employs a range of methodologies, including experimental design- whereas research relating to other types of product is less varied. For instance, De Janvry (2015) provides the first attempt to undertake an impact evaluation for a sovereign level insurance scheme. The variance in availability of literature, research questions and the methodologies employed means that opportunities to compare and generalise from findings in a rigorous manner are limited. However the lessons from individual cases are instructive for the purpose of this paper, and similar findings between different contexts can help to strengthen conclusions.

2 Linking risk transfer with DRM: conceptual framework

Modern DRM demands a focus on managing risks, instead of managing disasters per se. It is widely accepted that the risk management process should be continuous and embedded within broader development policymaking and activities (GIZ GmbH 2016; Taylor 2016; UNISDR 2015). The IPCC (2012) traces the emergence of this integrated notion of DRM over the last two decades, during which time it came to replace the notion of ‘disaster and emergency management’ which focused management of disaster events rather than risk.

Figure 1 presents a conceptualisation of the various stages involved in risk management: **preventing** risks from turning into disasters, **managing residual risk**¹, **preparing** for disasters, **responding** to disasters and **recovering** from disasters. The process is cyclical, though the components in the second and third layers do not necessarily occur in the indicated order, and may overlap. Further, recovery ideally results not just in returning to the state prior to the disaster occurrence, but to a state that is more resilient (“building back better”).

Figure 1: A framework for DRM (GIZ / MCII 2017)



There are different terminologies used to express the different components of DRM², but their meaning is similar. Disaster Risk Reduction (DRR) is understood to be the ultimate goal of DRM, and is a cross-cutting element throughout the process, i.e.: there are opportunities to achieve risk reduction through prevention, preparedness, response and recovery. DRM will always entail the management of residual risk, though this category is dynamic and may

¹ Residual risk is influenced by ‘objective’ conditions such as technological capacity, and also by ‘subjective’ decisions relating to what is an acceptable level and type of risk for a society to face. The UN has defined ‘acceptable risk’ as ‘the extent to which a disaster risk is deemed acceptable or tolerable depends on existing social, economic, political, cultural, technical and environmental conditions’ (UN GA 2016). Residual risk relates closely to the terminology of loss and damage adopted by the UN Framework Convention on Climate Change.

² For example, UNISDR (2015) refers to prospective risk management, corrective risk management and compensatory risk management.

be reduced by risk reduction efforts as well as a number of other factors, such as technological innovation, policy frameworks and an overall enabling environment.

There are various options for financing disaster risk management, known as Disaster Risk Financing Instruments (DRFIs). DRFI measures are commonly classified as ex post (eg: budget re-allocations, loan conversations, borrowing) or ex ante (accumulated reserves, precautionary savings, contingent credit, risk transfer/insurance). Insurance is a type of ex ante financing, in which an at-risk party cedes all or some of its risk exposure to a third party in return for a premium payment.

Individuals, or other entities, typically do not rely on just one type of DRFI- which is appropriate given that they be more or less appropriate given the type of disaster faced and other circumstantial considerations (see discussion in Section 5 on risk layering). However, in general, ex ante mechanisms are recognised to have a distinct advantage over ex post financing measures in that they can support disaster risk reduction and prevention, as opposed to just recovery and response (UNISDR 2015b). As Dercon and Clarke (2016) observe, in the case of sovereign disaster risk insurance, it is not necessarily the insurance products themselves that catalyse improvements in DRM but rather the associated requirement for the insured government to accord with the principles and processes of insurance. Public finance and public policy are critical to effective risk reduction and risk management, beyond the financing instruments themselves.

A positive link between risk transfer and risk reduction is in the interests of policyholders and insurers. Risk reduction can help to make insurance more accessible, affordable and viable in the long run (UNISDR 2015b). This is in the interest of both policyholders and insurers- as is the effect of risk reduction on limiting the likelihood of unexpected losses. However there is scarce comparative literature available which could help to assess the success of different mechanisms for linking risk transfer with DRM.

Key concepts

Annex 1 describes the main types of insurance product that are relevant to DRM. Each type of product has advantages and disadvantages, and are more or less appropriate given the issue at hand and the context.

The section below highlights some of the main concepts that distinguish insurance products from one another, which bear significantly upon the relationship with risk reduction, as will be discussed in Section 3.

As discussed in Section 5, the selection of the tool is not an either/or decision as different instruments fulfil different needs and can be complementary (Baur and Parker 2014). The performance of individual instruments should be assessed in relation to the integrated risk management system of which they are (ideally) part. Their individual performance will vary according to the system and context that they operate in.

- **Structure for the pay-out**

The main types of structure are indemnity-based, index-based, hybrid and alternative risk transfer tools. Each is more or less appropriate given a particular context.

For index insurance, the selection of the index is a key variable determining impact. It could be a direct index, such as a livestock mortality index, or an indirect index, such as a weather or area-yield index. Two of the largest index insurance schemes in the world, the Chinese

Agricultural Scheme and India's National Agricultural Insurance Scheme (covering around 160 million and 15.9 million policyholders respectively), are both based upon area-yield indexes (Hess and Hazell 2016).

Index insurance is particularly prominent in developing countries- mainly for flood, drought and earthquake risk, and rainfall variability risk, at the meso and macro level, but increasingly at the micro level too (Hess and Hazell 2016; Mahul and Stutley 2016). The characteristics of index insurance make it particularly suitable for contexts where technical capacity is limited and where there are scarce alternatives for mitigating the impacts of disasters. Compared to indemnity-based schemes, index based insurance can have lower transaction costs and quicker payments. This is due to the fact that pay-outs are no longer based on individual loss assessments but can be disbursed based on a trigger signal which is provided by a certain predefined risk overcoming a predefined threshold.

However index insurance suffers from the problem of basis risk, discussed further in the following sections.

- **Type of insured party**

One way to categorise types of insured party is to focus on geographical scale. The following is adapted from Schaefer et al (2016), drawing also on ACT (2016), UNFCCC (2008) and Warner et al (2013).

Micro level insurance is provided to individuals, households and SMEs. Policies are bought at the local level from a variety of types of institution, and pay-outs are received directly by policyholders. Microinsurance schemes are extremely diverse- indeed, one of the purported advantages of microinsurance is the potential to tailor insurance products to meet the needs of individuals, including the poor. Compared to other disaster response mechanisms operating at the micro level, a key distinguishing feature of microinsurance is that individual policy holders are legally entitled to compensation instead of being suppliants. Uptake of micro level schemes is conditioned by a variety of factors described in Section 4- including the extent to which people appreciate the basic principles of insurance, including risk pooling and premium payments.

Meso level insurance operates through meso level institutions including local authorities, regional financial institutions, associations and cooperatives. It typically involves a reinsurer making pay-outs to these institutions, who then go on to distribute services to individuals. Meso level institutions are able to aggregate risk, whereby the diversification of risk profiles and economies of scale allows for reduced premium costs. For insurance companies, this approach provides them with access to a pre-established network- and from the perspective of beneficiaries, the established presence of the policyholder in the local area improves their chances of receiving pay-outs relatively quickly. However for success operation, meso-insurance schemes demand significant capacity from the policyholders - particularly in terms of financial literacy and operational ability.

Macro level insurance is provided to governments, either as sovereign entities or through multi-national risk pools. A potential advantage of macro level schemes is that they can reach a large number of people within a short period of time, depending on the mechanism used for translating the pay-out to the final beneficiaries. The design of this mechanism, as well as the insurance tool, is critical in determining the efficiency of the payment. Transparency and accountability are critical in avoiding the mis-use of funds (Schaefer and Waters 2016).

Multi-national risk pools can help governments who otherwise would struggle to access re-insurance to do so by packaging their risk with that of others, hence presenting a more appealing offering to the private sector. This could open up opportunities for innovative financial products that might not be available otherwise – for instance, the US\$20 million swap between the IBRD and CCRIF which was the first transaction to enable developing countries to use a derivative transaction to access the capital market to insure against natural disasters (Ghesquiere 2007). However risk pools come with substantial technical demands, and substantial capacity building is likely to be necessary with governments and other key stakeholders in many vulnerable countries. Particularly given the effort required, it is important to bear in mind that financial transactions at this scale are certainly not always the most appropriate solution for managing and reducing risk.

They also reduce the size of the premium costs paid by individual members for reasons discussed earlier. UN ESCAP (2015) shows that risk pooling reduces the sum of 200-year probability maximum losses for 10 ASEAN countries by almost half what it would be without risk pooling.

- **What is being insured**

There is a wide variety of items that can be insured against climate risk, and an insurance scheme may cover a single or multiple perils. Agricultural microinsurance schemes, for instance, can apply to crops, livestock, credit, inputs, revenue, bloodstock, forestry and greenhouses (Hess and Hazell 2016). At the other end of the scale, multi-national risk pools are most commonly associated with weather insurance (e.g. droughts, typhoons, floods) but not exclusively- for instance, the African Risk Capacity is intending to market outbreak and epidemic insurance from 2018³ (these types of insurance products have been developed outside of multi-national risk pools, by Munich Re and Swiss Re for instance).

A related question is how losses in the selected area are valued- common approaches are based upon foregone income, or asset values, or expenditure. Each choice could result in a variety of outcomes, and strongly condition the impacts of the insurance scheme for the policyholder (see discussion about Chantararat et al (2017) in Section 3).

- **Pay-out mechanism**

Insurance pay-outs can be in cash or in kind, and can be delivered through a wide variety of distribution channels, including safety net schemes, financial institutions, cooperatives, organisations/employers, mobile networks, utilities, post offices, healthcare providers, retailers and directly. For agriculture insurance, contract farming is a further option (Hess and Hazell 2016; Merry et al 2014).

At the macro and meso level, at-risk individuals are not direct recipients of insurance pay-outs. How the pay-out to the policyholder translates into benefits felt by individuals depends on decisions relating to the form of the transfer, targeting and the broader policy objective (e.g.: equity-based as opposed to risk-based targeting- see Section 5). Literature assessing the relative success of different types of pay-out mechanism at the sovereign level in contributing to risk reduction and/or improved resilience at the individual level is scarce: independent reviews of ARC and the CCRIF have observed that they are weak in their ability to systematically monitor the link between pay-outs to governments and individual wellbeing or risk reduction (Clarke et al 2014). There is, however, a wide literature on the various types

³ <http://www.africanriskcapacity.org/2016/10/31/outbreak-epidemic/> NB: epidemic insurance itself is not an ARC innovation – it has been developed by Swiss Re and Munich Re, for example

of delivery mechanisms that could be linked with insurance pay-outs- for instance, see OPM (2016) on shock responsive social protection systems, and Young and Maxwell (2013) on delivery of food aid.

The modalities of cash and food transfers are common to both the delivery of assistance to households affected by disaster, and social protection to chronically poor households- hence, they represent a common tool that could potentially support a smooth transition between assistance in normal times and during a crisis. Recent research has emphasised the advantages of income support schemes/social safety net programmes as opposed to delivery of humanitarian aid in-kind, for reasons including transparency, cost-effectiveness and speed (Dercon and Clarke 2016). However the design of 'shock responsive' social protection systems is not without challenges. For instance, an evaluation of Kenya's Hunger Safety Net Programme highlighted the risk of political interference in targeting decisions during emergency scale-ups (OPM 2016). A further challenge relates to the ability of different actors through the government system to cooperate effectively.

- **Public and/or private involvement**

Private insurance is widely available in developed countries, and, in the agricultural sector at least, has proved to be efficient in dealing with non-systemic risk and with large farmers. But private insurance is limited or absent in many developing countries for a range of reasons that influence insurability and commercial viability.

Many successful insurance schemes are built upon public-private partnerships. 85% of the developing country flood insurance schemes assessed by Surminski and Oramas-Dorta (2014) involved both public and private sector, though in different capacities.

According to Mahul and Stutley (2010), the role of the government should be to address market and regulatory imperfections in order to encourage participation by the private insurance and reinsurance industry. This may include correcting information asymmetries, creating an appropriate regulatory environment, addressing systemic risk, compensating for low risk awareness of individuals and other factors that constrain micro or meso insurance take up (see Section 4) and seeking the necessary support to engage with the international reinsurance markets (see example of Uruguay's weather risk transaction in Section 2).

When designing pro-poor risk reduction schemes, however, the role of the government may go beyond provision of an enabling environment for the private sector, to supporting the bundling of the insurance product with other risk (and poverty) reduction initiatives (see Section 5). The exact nature of the division of responsibilities between public and private sector will vary according to context, and would ideally be defined through a risk layering approach (see Section 5).

- **Affordability and subsidization**

These matters are key, and are discussed further in Section 4 on insurance uptake. They are particularly important when considering how insurance can be harnessed to reduce the risk exposure.

Rates of subsidization vary greatly between different types of insurance product- tending to be higher for index based schemes- as well as between different countries and sectors. Mahul and Stutley (2010) review agricultural schemes in 65 countries (developed and developing), and find that almost two-thirds provide substantial premium subsidies. Subsidisation rates are higher in high-income countries than middle- and low-income

countries, though there are a few large schemes in middle/low income countries which have been able to scale up through heavy subsidisation- in India nearly one quarter of agricultural households participate in index insurance markets, and government subsidies account for 60-75% of premium costs (Isakson 2015). At the macro level, subsidies are also significant: for instance, one report on the PCRAFI stated that a USD30-40m donor contribution would be required to continue and expand the programme for five years or more (Pacific Islands Forum Secretariat 2014).

In their review of 39 agricultural insurance schemes operating in developing countries, Hess and Hazell (2016) show that of the index-based options, subsidization is very low in contract farming (0%) and input supplier schemes (averages of 0% and 37% respectively), and high in credit-linked, direct and safety net insurance schemes (averages of 62%, 67% and 80% respectively).

Despite their high prevalence, evidence does not suggest that subsidies are a precondition for high insurance penetration. Countries which have strong traditions of unsubsidised named peril crop insurance and livestock insurance, such as Argentina and Germany, show high levels of penetration (Mahul and Stutley 2010).

3 Linking risk transfer with DRM: evidence

As described in Section 2, modern disaster risk management demands a holistic approach, encompassing the analysis, reduction and transfer of disaster risks as well as strengthening preparedness, recovery and response mechanisms (GIZ GmbH 2016). Instead of being viewed as a single or separate component within the DRM cycle, risk reduction is dynamic and cross-cutting throughout the process.

This section reviews the evidence relating to whether, how and under what conditions insurance can contribute to disaster risk management, with a focus on risk reduction. Section 3.1 highlights some considerations that are specific to risk reduction at the macro level. Issues relating to risk reduction at the meso and micro level are addressed in the two subsequent sections on prevention and preparedness (3.2), and response and recovery (3.3).

3.1 Risk reduction at the macro level

The economic cost of natural catastrophes has increased dramatically in the last few decades- from around USD 25 billion per year in the 1980s to USD 175 billion in 2016 (Baur and Parker 2014; Munich Re 2017). In parallel, risk transfer has risen in prominence as a means for helping governments and other national-level entities to reduce their exposure and to mitigate the impact of disasters upon socio-economic development.

- **Public finance and economic growth**

Natural disasters can place significant pressure upon public finances, with major fiscal implications in the short-term and wider long-term implications for development. Risk transfer offers the possibility of not only easing the immediate fiscal burden, but also reducing or even avoiding long-term costs to public financial stability, economic growth and human development.

Premium payments contribute to budget planning certainty, compared to highly volatile post-disaster expenses. Baur and Parker (2014) study the economic impacts of disasters, and insurance, upon the public finances of Uruguay. In 2012 the country was pushed into a deficit when a drought forced the government to purchase electricity on the international spot market. In order to reduce its future exposure, and hence a major source of annual budget uncertainty, the state-owned hydro-electric power company entered into a weather and oil price risk transaction. The scheme used rainfall data and oil prices for settlement and compensated for the combined risk of drought conditions and energy price increases. The World Bank facilitated the \$450 million transaction, working with the global reinsurance market.

Should a disaster occur, the insurance payout frees up public resources that would have otherwise been channelled towards response and recovery for other productive investments or further risk reducing efforts (FSD Africa and CENTRI 2017). However, evidence is not conclusive on the cost-effectiveness of regular premium payments compared with other DRFI options over the medium to long term. This is partly due to the difficulty of obtaining a counterfactual. Premiums have a significant opportunity cost, as discussed in Section 4, and under certain circumstances other DRFIs may be more attractive and potentially more appropriate.

Some research suggests that insured losses can not only help to avoid harm to economic growth, but can actually have positive effects for GDP growth in the medium-term by deploying long-term capital into the real economy (Von Peter et al 2012)⁴. In general, the presence of an insurance industry can facilitate economic development by reducing interest rates (by lowering default probabilities and investing with long-term horizons), and modifying the level and allocation of individual and aggregate savings leading to a more optimal allocation of capital (ILO 2016).

However, should be noted that economic growth does not necessarily correlate with reduced exposure to disasters. Indeed, disaster losses represent an increasing burden on economies and public finances in both developed and developing countries. At the global level there is a trend toward more risk taking: between 1970 and 2010 the global population grew by 87% but the population living in cyclone prone coastlines grew by 192%. Exposure of GDP to tropical cyclones increased from 3.6% to 4.3% over the same period (Benson and Clay 2004; Hallegatte 2013).

Analysis shows that while higher incomes mean greater ability to invest in measures to prepare for and safeguard against disasters, they are also linked with more risk-taking behaviour. Kellenberg and Mobarak (2007) suggest that 'peak exposure' comes in the GDP per capita range of \$4000-7000, where households have sufficient income to pursue more risky income generation activities but do not have a sufficiently high willingness to pay for investments in protection and mitigation. This underscores the importance of integrating insurance with broader risk reduction activities, discussed in Section 5.

- **Good governance**

There is evidence to suggest that being party to an insurance contract can spur transformation in the way that countries manage risk (Schaefer and Waters 2016). This can occur by encouraging risk reduction, catalysing risk assessment, and driving a more structured decision-making processes around the management of ex ante risk, and potentially improving the quality and efficiency of disaster risk governance.

However, despite the apparent theoretical potential, there is scarce empirical evidence demonstrating an operational link between risk transfer and risk reduction (Schaefer and Waters 2016; Surminski and Oramas-Dorta 2013). Further, the link is under-researched- it is not clear under what conditions insurance will contribute to risk reduction at the macro level, as opposed to either making little impact or even incentivising risk creating behaviour such as moral hazard.

As discussed in Section 4, the incentives provided to politicians by voters in relation to disasters can be suboptimal in terms of good governance. For instance, voters appear to reward politicians for allocations of aid in a post-disaster context, which invites opportunistic resource allocation (Boudreau 2016). However index insurance, in particular, limits politicians' discretion to allocate funds following disasters as pay-outs are based upon objective mechanisms.

Insurance solutions can make disaster and climate risk more transparent (UNISDR 2015b), as rules and transparency compel the government to behave in a certain way or be punished by voters. More generally, they can provide a way for governments to commit to systems and rules for spending money, take measures against fraud and leakage and consolidate public

⁴ GDP growth measures flows (investment for reconstruction) not stocks (destruction of physical capital). GDP growth is not intended to be an indicator for wellbeing- the research recognises that disasters invariably diminish wellbeing of affected population even if growth rebounds (Von Peter et al 2012)

policy making. These impacts are particularly significant in situations of weak functionality and credibility of national relief and public financial institutions.

Dercon and Clarke (2016) argue that the “credible pre-disaster planning” required by some insurance contracts could transform the efficacy and impact of disaster response by removing ambiguity about who owns the risk, who needs to respond and how it is financed. They refer to Mexico’s Fund for National Disasters, FONDEN, as an example of a rules-based system where the roles and actions of the federal government, state governments and the private sector are agreed in advance.

Boudreau (2016) provides preliminary evidence suggesting that FONDEN has disciplined politicians in light of the incentives provided by voters. In their assessment of Mexico’s CADENA programme (the Ministry of Agriculture’s catastrophic fund), De Janvry et al (2016) argue that, by design, the programme disciplines the responses of state governments to weather shocks.

General criteria of good governance are likely to influence the impact of risk upon DRM and risk reduction. These criteria include transparency, accountability, responsiveness, rule of law, and degree and nature of participation. For instance, the research of Von Peter et al (2012) on the aftermath of the New Zealand earthquake in 2010 shows that in this case the certainty of policyholders that they would receive a pay-out was sufficient for them to immediately start to rebuild, even prior to actually receiving the pay-out. This outcome depends upon a range of factors including individuals’ trust of the insurance scheme and belief that the government would fulfil its commitment as de-factor insurer of last resort. It also depends upon their financial resources prior to receiving the pay-out.

Some insurance schemes explicitly demand that certain minimum conditions of planning and governance for DRM are met. The African Risk Capacity (ARC) Facility, for instance, requires potential members to go through a contingency or operations planning process. Governments are required to identify the optimal use of funds from an ARC pay-out in advance and in a manner that accords with ARC’s principles, namely, time-sensitivity, use for protecting livelihoods, and six month duration for activities. Governments are encouraged to utilise the funds to scale up existing programmes to improve targeting and gains in speed⁵. While ARC has not been in place long enough for the generation of rigorous evidence on the impact of contingency planning upon the quality of national DRM in general, there is certainly potential that such approaches could catalyse the transformation in risk governance described in this section. However, as noted previously, the technical capacity demands of sovereign and multi-national risk pooling schemes are substantial – particularly in ensuring that the pay-out is used in a manner that contributes ultimately to greater resilience among exposed populations.

3.2 Prevention and preparedness

- **Forecast-based insurance**

One important feature of index insurance schemes is that they open up the potential for making payments based on forecasts, and hence financing preventative action. This type of scheme is still rare and so evidence is limited.

The Extreme El Nino Insurance Product (EENIP) in Peru was the world’s first forecast-based insurance coverage, triggered by extreme increases in Pacific Sea Surface Temperature

⁵ <http://www.africanriskcapacity.org/2016/10/31/contingency-planning/>

(SST) that occur during El Niño years. The SST indicator is observed months before the onset of heavy rainfall on land, thus triggering pay-outs and providing policyholders with the liquidity (as well as advance information) to take measures to reduce the impact of the eventual weather event. While expectations for EENIP are high, no systematic evidence appears to exist in relation to its impacts on disaster risk reduction.

- **Generation and sharing of risk information**

Risk assessment, a core function of insurance approaches, requires the identification of hazard potential, exposure and vulnerability (Warner et al 2012). The tools, analysis and data involved are of high value to governments in designing policies for DRM and climate change loss and damage, and also for individuals and businesses.

Further, the insurance industry can motivate the standardisation of available data, which further supports analysis and action. For instance, the PCRAFI has stimulated the development of one of the most comprehensive collections of geospatial data for Pacific Island Countries (PICs), as well as the most developed historical disaster archives for the Pacific region (UN ESCAP 2015). Further, local insurance companies have expressed interest in utilising the risk models generated by the PCRAFI- which could indicate the expansion of meso and microinsurance provision in the region (Pacific Islands Forum Secretariat 2014).

It is important to note that there are several steps in between data generation and its application to reduce risk.

One consideration is the fact that the data is not always available for public use. Insurers often charge a fee for accessing the information that they generate and maintain as part of their business model. Governments, too, may restrict the information they disclose potentially for reasons for sensitivity or because information sharing channels are poorly maintained. As policyholders, particularly the poor, are likely to be unwilling or unable to pay for this, there is a role for governments or other intermediaries to ensure this information reaches the most vulnerable, likely as a public good.

A further consideration is that the information generated for use in insurance models is unlikely to be comprehensible to policyholders, in terms of the metrics and terminology used, and the scale and time period referred to. An example of an initiative to improve accessibility and relevance of risk information is the Africa Risk View, designed for ARC countries⁶. The tool enables risk modelling at the national level, customisable to the country in question.

Evidence on the impact of schemes which incorporate capacity-building and informational exchange along with insurance products is relevant here. For example, the Indonesian Rice Crop Insurance programme, in coordination with local governments and the Ministry of Agriculture, incorporated training components on using climate and weather information for rice farming, as part of its capacity development scheme (Hess and Hazell 2016). Similarly, a contract-farming based weather index insurance initiative run by PepsiCo in India also offers technical advice on production practices and weather information and advisories via text message, in order to enable farmers to reduce their vulnerability to disasters (Hazell et al 2010).

- **Mandatory conditions**

⁶ See <http://www.africanriskcapacity.org/2016/10/31/africa-riskview-methodology/>

Risk aggregators, such as meso and macro level institutions, and insurance companies often mandate compliance with particular criteria, as a condition of offering cover. In Iceland and most Swiss Cantons, insurance coverage of flood risk is mandatory for all residential and commercial buildings. With the introduction of the Turkish Catastrophe Insurance Pool, the Government of Turkey declared that it would no longer support private residents to reconstruct their homes after an earthquake unless part of their losses are insured. An important objective for the pool was to improve enforcement of building codes for seismic risk- which were stringent in their design, but poorly enforced (GFDRR 2007). A further example of mandatory conditions is the ARC contingency planning process: countries must demonstrate sufficient compliance before joining the risk pool.

While mandatory conditions can directly contribute to risk reduction, and substantially reduce the likelihood of moral hazard, they may result in excluding from insurance those without the resources to implement the conditions required.

- **Financial incentives to reduce risk**

A widely acknowledged feature of insurance is that by pricing risk, and translating that price into premiums charged to policyholders, it provides an important price signal that can incentivise risk reducing behaviour. Some insurance schemes offer reduced premiums on the basis of risk reduction efforts- such as India's Weather-Based Crop Insurance Scheme, which offers lower premium rates for farmers who undertake soil and water conservation measures (on the assumption that these measures help to decrease their vulnerability to flooding and drought (Hess and Hazell 2016).

However, the poorest individuals may not be able to respond to the price incentive of risk-based premiums- which negates the risk reduction function, and raises important questions about the fairness of a scheme that charges the highest fee to the most vulnerable, who in turn are often the poorest (Surminski and Oramas-Dorta 2014). A further discussion on the distinction between insurance schemes based on the principle of equity, and those based on the principle of efficiency, is in Section 5.

3.3 Response and recovery

- **Rapid response**

A widely cited advantage of insurance is its rapid pay-out function, providing badly needed liquidity soon after a disaster has struck (though this feature is not exclusive to insurance, noting for instance CAT DDOs). Further, it provides transparency and assurance about the amount of money received in a pay-out, and how and when it will be delivered. Timeliness and reliability are two features that may be critical in stalling a rollback in development gains and preventing vulnerable non-poor people from slipping below the poverty line.

The speed by which insurance can be converted into cash for spending on disaster response is a key design element of insurance schemes (Dercon and Clarke 2016).

- **Poverty reduction and economic resilience at the household level**

Evidence suggests that insurance can contribute to greater financial stability, development opportunity and coping capacity for vulnerable individuals and households.

Uninsured poor households react to the anticipation of negative shocks by refraining from undertaking profitable but risky activities, instead investing in technologies with a low rate of

return. This tendency can hold poor households permanently at the risk of poverty traps (Chantarat et al 2017; Elabed and Carter 2014; Karlan et al 2014).

Insurance has been widely acknowledged as a tool for inducing farmers to take more profitable but riskier activities. It does so by reducing the financial repercussions of volatility, with implications for individuals' ability to plan, save and invest – potentially in more resilient and profitable livelihood opportunities (Schaefer and Waters 2016).

Elabed and Carter (2014) study the impact of insurance on the agricultural decision-making of cotton farming households in Mali. They find that offering insurance resulted in a 15% increase in the area of cotton planted, and a 14% increase in the expenditure of seeds per hectare.

These findings are similar in theme to a variety of other case-based investigations. Cai et al (2009) who find that increased insurance adoption leads to an increase in sows in Southwestern China. In their research with farmers in northern Ghana, Karlan et al (2014) find that the binding constraint to larger agricultural investment is insured risks: “when provided with insurance against the primary catastrophic risk they face, farmers are able to fund resources to increase expenditure on their farms”. They show that insurance, compared to cash grants, leads to significantly larger investment and riskier production choices. Overall cultivation expenditures increased 13% over those of uninsured farmers. Similarly, Cole et al (2013) find that insurance caused households to shift agricultural investments in and land devoted to the production of higher-risk cash crops. Mobarak and Rosenzweig (2013) find similar risk taking behaviour amongst rice farmers in India, who in response to rainfall insurance were more likely to plant higher-risk, higher-return rice varieties with a lower drought resistance.

While it is generally acknowledged that risk-taking reinforces economic growth at the macro level (e.g.: Hallegate 2013), at the micro level there remains the question of whether the greater risk exposure will be mitigated by the greater resilience linked with higher incomes. In much of the literature the ‘higher risk’ counterpart of the ‘higher profit’ outcome is not questioned. Isakson (2015) points out that intensive agriculture, which generates more profits compared to subsistence or small-scale agriculture, can contribute to the simplification of agricultural landscapes and biodiversity loss which strips crop systems of their resilience to weather-related disasters. Reeves (2016), too, observes that there is nothing inherent to insurance that prevents it from incentivising maladaptation and entrenched vulnerability- also pointing to the bundling of insurance products with modern agricultural inputs, as an example.

This links into the discussion in Section 5 about the need to balance insurance with efforts to address the drivers of risk. In some cases the imperatives associated with extending insurance coverage and addressing the drivers of risk each may be contradictory. For instance where poor farmers are using agricultural inputs that are ecologically damaging, the better solution would be not to insure their existing livelihoods but to support them to transition to a more resilient livelihood.

A further point to make is that insurance schemes may exclude the very poor. In their study of the impacts of a livestock insurance scheme upon pastoralists in northern Kenya, Chantarat et al (2017) find that the group most benefitting are the vulnerable-but-non-poor (whose herd size is just above the critical poverty threshold). In their case, the insurance creates an effective safety net that protects them from falling into a poverty trap after a drought. However, in the case of the poorest herders, their assets are too small relative to

the critical threshold, such that the depth of their vulnerability cannot be altered by insurance alone.

Similarly, research on poor farmers in India has shown that insurance pay-outs are unlikely to be sufficient for farmers to escape the cycle of debt into which they are locked. The pay-outs are linked to the value of their crops, but the root of the vulnerability is the fact that the market value is lower than their production costs (Reeves 2016).

As mentioned previously, there appears to be a fundamental distinction between insurance schemes that prioritise equity and reduction of vulnerability on the one hand, and those that prioritise efficient pricing of risk on the other. Several reasons why risk-based pricing will not work for the poor are mentioned throughout this report. One conclusion that follows is that products that target the poor need to be designed in a particular manner. Schaefer and Waters (2016) present seven principles that specifically 'pro-poor' insurance might abide by⁷. A further conclusion relates to the need to go beyond insurance products themselves and pay attention to the structural factors that contribute to this outcome.

2.4 Challenges

Risk transfer could be detrimental to risk reduction, if not properly structured (IPCC 2012). Some of the main challenges and concerns are discussed below.

- **Design of the tool**

The functionality and impact of insurance is partly determined by how well the insurance product is designed. As well as the speed of the conversion (discussed above), other key design elements are the discipline required to use an instrument, its cost, its accuracy, and whether it is designed in accordance with the needs of the target population.

The availability of the financial expertise needed to design the instrument, and the degree to which this expertise is acknowledged in the planning process, are important considerations.

In developing countries, such expertise can be very constrained. This constraint was cited in the mid-term evaluation of a meso-level scheme called the Microinsurance Catastrophe Risk Organisation (MiCRO) in Haiti. MiCRO acted as a reinsurer to the borrowers to a local MFI that served female entrepreneurs throughout Haiti. The evaluation cited a variety of shortcomings including misunderstanding of the risk context, lack of financial literacy and failure to accurately correlate risk models with losses on the ground (IFC 2014).

Decisions relating to the design characteristics described in Section 2 will condition impact in ways that are highly contextually dependent. Chantarat et al (2017) illustrate how the question of what a scheme is designed to insure can significantly influence outcomes for policyholders. In the case of a livestock insurance scheme in northern Kenya, the focus of their study, they observe that insuring lost assets is more appropriate than insuring lost income, particularly for herders operating near the poverty line. The loss of livestock can have impacts far bigger than immediate income lost: if herd size falls below a certain level, herd dynamics bifurcate and stock wealth collapses, with disastrous implications for future income. Further, the coping mechanisms that herders undertake can disrupt future income opportunities.

⁷ These principles are: 1: comprehensive needs-based solutions; 2: client value; 3: affordability; 4: accessibility; 5: participation, transparency and accountability; 6: sustainability; 7: enabling environment.

- **Moral hazard**

Moral hazard is one of the primary risks associated with indemnity insurance- and is not fully eliminated with index based schemes, particularly at the macro level, though more research is required in this area. It raises risk, as by taking fewer preventative actions (or acting to induce a disaster), a policyholder increases his or her risk exposure. A further problem that can obstruct efficient function of insurance instruments is adverse risk selection, where majority of the policy value is held by individuals facing a high level of risk⁸. A good amount of research has been conducted on moral hazard in the agricultural insurance market- generally finding that the emergence of these conditions depends on individual insurance market characteristics such as the degree of asymmetrical information and the risk aversion of individuals (Hudson et al 2014).

- **Benefits relative to costs**

The opportunity cost of premium payments is an important factor conditioning the impact of risk transfer upon the vulnerability of policyholders.

For very poor households, premiums can retard their progress out of poverty by limiting their investment potential (Chantararat et al 2017). Research suggests that insurance may not be financially sustainable even for households with capital above, but near, a critical asset threshold: Kovacevic and Pug (2010) found that for these households the probability that they would collapse to a low level equilibrium increases with the introduction of insurance, as the premium payments reduce the ability to create growth.

A further relevant issue is the return on the payment- and basis risk is a key consideration here. The existence of basis risk means that index insurance products may not reduce risk at all, and in fact could leave a policyholder worse off following a disaster given the opportunity cost of her premium payments. This risk is particularly high if their idiosyncratic risk is high, or if the index is inaccurate.

Until recently there has been a lack of ways for measuring the size of basis risk and how it affects the impact of pay-outs. Morsink, Clarke and Mapfumo (2016) propose new indicators to help answer the questions of whether insurance firstly provides reliable coverage of the losses it was designed to insure, and secondly provides coverage for losses that are important in terms of livelihood impacts. The first indicator assesses the basis risk of the insured peril; the second indicator compares claim pay-outs to actual losses suffered by agricultural production.

Some insurance products have integrated components to try and reduce the impacts of basis risk, particularly for poor clients. For instance, the MiCRO programme in Haiti combined parametric insurance based on weather and seismic indices (underwritten by SwissRe) along with a basis risk component which MiCRO retained rather than passing onto clients. The model provided indemnity insurance to clients but with another layer of parametric insurance, leaving MiCRO to assume the basis risk. Integrated schemes are common at the sovereign level, such as FONDEN (see discussion on risk layering in Section 5).

A further issue that conditions the benefits compared to the costs, from the perspective of individual recipients, is the nature and effectiveness of the mechanism used for distributing pay-outs (see discussion in Section 2).

⁸ This is another point demonstrating the difference between schemes based on efficiency (where adverse selection inhibits market forces) and equity (where policies are specifically targeted at those carrying high levels of risk)

- **Weakening informal risk sharing schemes**

One of the widely heralded benefits of microinsurance is its ability to address the shortcomings of informal risk sharing mechanisms. While there are many cases of informal mechanisms working effectively to reduce and transfer risk, generally their ability to do so is incomplete- particularly in responding to aggregate shocks. This leads exposed farmers to choose low risk and lower-yield production methods, asset portfolios and crops instead of riskier but more profitable alternatives (Cai et al; Mobarak and Rosenzweig 2013; Morsink et al 2016).

Theoretically, formal insurance can complement and operate alongside informal insurance mechanisms- they may address different risks, and provide different benefits. In particular, research has suggested that informal mechanisms could address the basis risk of index insurance schemes. However, Attanasio and Rios-Rull (2000) showed how informal support systems may break down due to the introduction of a formal insurance scheme, even if they cover different risks. Some members of the informal system may even be made worse off through the introduction of the formal scheme, even if it's voluntary, as some members would withdraw from the informal scheme leaving the existing members with less protection.

There is only limited evidence from developing countries regarding this type of adverse impact in the case of insurance- but a stronger body of evidence relating to similar impacts of introducing formal social safety net programmes, which may be transferable.

As discussed previously, research suggests that the benefits of formal insurance may elude the very poor. Schemes may exacerbate inequalities within communities, which would also damage the socio-economic relations underpinning informal risk sharing schemes.

- **Gender impacts**

There appears to be limited research that specifically explores gendered dynamics of insurance and risk reduction. The evaluation of Oxfam and WFP's HARITA programme found that female-headed households (which were among the poorest evaluated) reported particularly significant impacts, including some of the greatest productivity gains, increases in agricultural investments and decrease in "sharecropping out" (the practice of renting land to tenants for 50% of yield, which is frequently practised due to lack of oxen or human capacity to farm their own land). In a similar vein, an evaluation of the effectiveness of a disaster microinsurance product called Afat Vimo in India found that women in the community in question were more receptive than men to the benefits of microinsurance- and therefore encouraged efforts to engage with women's groups to sell insurance (ACT 2016).

While this evidence suggests that women could play a key role in maximising the risk reduction outcomes of insurance, schemes will need to be carefully designed to enable this. Without specific gender targeting there is a risk that insurance schemes could shift the balance of decision-making power and resources towards the male head of household. This is likely given that insurance policies tend to be taken out in a single individual's name (with costs for adding additional people), and that some insurance schemes require land ownership or bank accounts, which women disproportionately lack access to.

4 Scope and uptake of insurance

This section discusses factors affecting the availability of insurance and the willingness of at-risk parties to participate in insurance contracts.

4.1 Insurance companies

From the perspective of insurance and reinsurance companies, a key consideration is the insurability of the risk. Insurable risks are those risks that meet the criteria set for efficient operation of insurance- which according to one widely cited study are nine⁹. Research collectively reveals a wide range of problems with meeting those criteria- in developing countries, but also in developed countries, where insurers are struggling to factor climate change into insurance risk models, and growing risks are putting pressure on premiums (Surminski 2014).

If information on data on hazards and exposure is not already available, the company will consider whether there is a commercial case for acquiring the data itself. In many cases the costs will be prohibitively high- though, index insurance can mitigate this concern as its sole reference is an independently verifiable index. This is particularly significant for progressive perils, whose impacts on losses builds up gradually over time, and is difficult to isolate from other perils (Morsink et al 2016).

The legal and regulatory framework of the jurisdiction in question is a strong conditioning factor for insurers' assessments of their ability to manage their risk exposures, and hence of insurance supply (FSD Africa and CENTRI 2017). Enforceable contracts that insurers (and policyholders) can trust, as well as guidelines for insurance licensing and operations, are critical for the engagement of insurers in a given market (Schaefer et al 2016). While specific regulatory requirements will change depending on the market segment and scale in question, the general components of an insurance regulatory framework are likely to include authorizing laws (including licensing), solvency and risk management regulation, corporate governance regulation, reinsurance regulations and intermediary regulation. Insurers will also want to see basic rule of law conditions fulfilled, which generally support commercial operations (IDF).

For insurers, an ability to make a profit from offering insurance is also an important consideration. Critical to operationalising the framework is the technical capacity of government to enforce it, and ability of clients to appreciate their rights and responsibilities within it.

Other considerations include the size of the transaction costs involved, the size of the client base and value of their assets and, in the case of public-private partnerships, the likelihood that partners will deliver in their responsibilities. It is common to see international financial institutions playing the role of intermediaries in macro level insurance transactions, for instance the World Bank's role in Uruguay's weather risk transaction (discussed previously) and in both the CCRIF and PCRAFI.

⁹ According to Berliner, reproduced in Biener and Eling (2012): there are 5 actuarial criteria (randomness of loss occurrence, manageable maximum possible loss, moderate average loss per event, large loss exposure, not excessive information asymmetry), 2 market criteria (affordability and cost recovery of the insurance premium, and acceptable cover limits), and 2 societal criteria (sufficient public policy framework and legal restrictions).

4.2 Governments

- **Political viability**

Studies show that voters punish politicians for the occurrence of natural disasters but reward them for the allocation of post-disaster aid (Boudreau 2016; Clarke et al 2015). For instance, Fuchs and Rodriguez-Chamussy (2014) analyse the impact of insurance payouts on voter behaviour in Mexico's 2006 presidential election. They estimated that the incumbent party garnered 8% more votes where indemnity payments had been made prior to the election. As discussed earlier, this is a case in which voters create suboptimal incentives for politicians-specifically to find ways to channel funds that benefit their own voting record but may not be in the interests of disaster risk reduction. The degree to which politicians support formal insurance schemes will depend upon incentive structures upheld through policy and regulation, transparency of information relating to the use of public expenditures, and media discourse (Dercon and Clarke 2016; De Janvry 2015).

For governments, downside basis risk presents a significant challenge to their political credibility and capital. It is hard to justify use of taxpayer money on premiums to an insurance scheme that potentially would not pay out in the case of a disaster- as illustrated by the Solomon Islands' withdrawal from the PCRAFI scheme on the grounds that the scheme had failed to pay-out following two disasters (earthquake and flooding), although neither qualified as an eligible event according to the insurance contract (UNESCAP 2015).

Multi-national risk pools present specific political considerations. Governments may be concerned about relinquishing some of their sovereign decision-making power through intergovernmental schemes, or wary of 'management capture' by supra-national entities set up to manage schemes (Dornan and Cain 2014). Further lessons learned from the PCRAFI confirm that risk pooling requires strong discipline and coordination among participating countries (Pacific Islands Forum Secretariat 2014).

- **Cost benefit analysis**

Insurance is not necessarily the most cost-effective option for governments. It appears to be particularly suitable for financing immediate post-disaster needs following low frequency, high impact events (Baur and Parker 2015; Clarke et al 2015; Dercon and Clarke 2016). In such cases, research on sovereign level insurance indicates that it makes financial resources more readily available and at a lower long-term cost (Clarke et al 2015).

However the literature appears to suggest that insurance is unlikely to be the most appropriate choice for responding to either for high frequency, low impact events, or for the bulk of reconstruction costs following any event. Bevan and Adam (2015; cited in Dercon and Clarke 2016) apply a macroeconomic model developed by the IMF to Jamaica's tropical cyclone risk. They find that ex post tax-financed reconstruction of public assets would be more cost-effective than insurance, even though it would lead to slower restoration of the capital stock. Their argument is that potential shocks are not large relative to national income - and smoothing the cost of the shock over time at the national level is more cost-effective than insurance.

Other research agrees that for high frequency, low impact disasters, other types of ex ante measure, and ex post measures, remain the most cost-effective measure. Contingent credit facilities, an ex-ante agreement that guarantees credit for disaster recovery and reconstruction, can support timely and efficient financial response, and have been employed

in countries like Lao PDR and Viet Nam. Multi-year reserves can cover frequent, small-scale disasters, as employed by the Marshall Islands for instance (UNESCAP 2015).

The opportunity cost of premium payments- and availability of (smart) subsidies- also influences cost-benefit analysis. There are many other potential investments that a government could make with a view to risk management and risk reduction, including shock responsive social safety nets, alternative livelihood programmes, contingency funds and infrastructure that could enable rapid response. Even within a single insurance scheme there are more specific opportunity costs, such as between a decision to extend the scope of the coverage as opposed to target specific groups who would then receive higher payments.

As mentioned above, these different policy options come with different political (and electoral) implications. Political incentives can skew cost-benefit analyses based on logics of efficiency and value for money. The case of ex post humanitarian aid for disaster response is a case in point. While several authors observe that post-disaster aid relief leads to slow recovery, low value for money, and political manipulation of funding allocations (e.g.: Clarke et al 2015), research also shows that the availability of aid appears to reduce incentives for purchasing insurance. People living in disaster prone areas (and therefore their governments) expect financial aid after major disasters- and perceive little reason to adopt an alternative option for which they have to pay (Lucas 2015).

Additional considerations include the cost of putting in place the policy and regulatory standards required by insurers- and the fact that the time taken to do so may exceed a single political term; the technical capacity of the government and their prior experience with financial tools in general and insurance in particular; and the availability of the skilled professionals required to negotiate and implement the insurance contract.

4.3 Individuals, households, small and medium enterprises.

As Cole et al (2013b) observe, a fundamental aspect of success for a market-based approach to risk diversification is that consumers make good decisions about whether to purchase products.

A wide body of research confirms that willingness to pay for insurance is typically well below the actuarially fair price. Index insurance schemes in developing countries have seen very limited uptake (e.g.: Gaurav et al 2014), which is surprising given the high expectations for index schemes in the literature.

- **Affordability and reliability**

Several studies find that affordability and liquidity are key factors influencing uptake of insurance by farmers.

As discussed in Section 2.4, premium payments represent a significant opportunity cost for poor households. Some meso and sovereign schemes are free to individual beneficiaries- such as Mexico's CADENA programme- though research didn't appear to be available showing to what the impacts of those schemes could be linked to the lack of premium costs.

Karlan et al (2014) find that while many farmers appeared to recognise the value of insurance in general, substantially fewer (less than 20%) of farmers were willing to purchase the product at market price. This is in line with McIntosh et al (2013), who found that 62% of farmers expressed interest in buying an insurance product but, when provided the terms of

an actual product, demand was lower and significantly influenced by the availability of subsidies.

Casaburi and Willis (2017) undertake a Randomised Controlled Trial (RCT) in a contract farming scheme in Kenya to test a product in which the buyer of the crop offers insurance and deducts the premium from farmer revenues at harvest time. They find that take-up is 67% higher than under a standard insurance contract requiring upfront payment of the premium, and so confirm that liquidity constraints are an important driver of insurance take-up, particularly for poor farmers. Offering a discount on insurance with up-front payment did not increase demand- which leads them to suggest that timing might even be a stronger determinant of demand than price.

Bundling insurance with financial and non-financial services is a potential means of increasing its perceived value among potential customers. Bundling with credit, for example, can ease liquidity constraints and contribute to improved take-up of insurance, and is appealing for insurers as it can reduce the default risk on their lending portfolio. The evidence, though, is not conclusive as in some cases credit acts as a substitute for insurance (Matul et al 2013). There are certain risks with bundling- for instance, that the purchaser is not properly informed and will not fully understand the terms and function of the various products they are buying.

Another approach is extracting payment in-kind, instead of through cash. Oxfam and WFP's R4 programme allows low-income farmers to exchange work for insurance instead of paying premiums. The programme experienced more demand for its work-for-insurance offer than budget would allow them to provide, which appears to confirm the significance of affordability in conditioning insurance uptake (Oxfam and WFP 2014). However, an approach like this is conditional upon the premium cost being borne by entities other than the beneficiary, which raises questions about its sustainability.

The degree of basis risk is also identified as a key influence upon individual decisions to purchase agricultural insurance (Hess and Hazell, 2016). Mobarak and Rosenzweig (2013) found that there was a decrease of 6.4% in farmer demand for every kilometre of distance to the rainfall station.

- **Psychology of disaster risk**

Research has shown that individuals have a tendency to underestimate the true probability of disaster risk as it relates to themselves, which translates into a societal tendency to under-insure against catastrophic risks. The same outcome is also explained by a shortage of information about the true nature of risk. For insurance in particular, loss aversion and narrow framing may deter people from purchasing policies- for example, farmers may think that the rain will be good and they will receive no benefit from the product (Gaurav et al 2011).

- **Strategic behaviour**

The public demonstrates a tendency for strategic behaviour in selecting their response to disaster risks. Awareness that the state has a responsibility- and in many cases, functioning mechanisms- to provide assistance to them, free of charge, can disincentive private purchase of further assistance. This is less relevant in the case of indirect insurance schemes, where the payment is received by an intermediary rather than the final beneficiary.

- **Trust**

Research on the determinants of demand for microinsurance find that trust is a key issue, particularly where farmers are required to pay their insurance premium upfront without receiving any potential benefit (as is the case with most microinsurance). Farmers are concerned about whether they will receive the payment, and in many contexts would have limited legal recourse should they not. This perception may be strengthened by previous bad experiences with financial products, such as witnessing mismanagement or fraud.

Cai et al (2012) carry out an RCT to explore the demand-side dynamics of subsidized insurance for sows in southwestern China. They find that endorsement from a trusted third party about the insurance policy significantly increases take-up of insurance policies, in a context where lack of trust of government-sponsored insurance products is a significant barrier to farmers' willingness to participate in the insurance scheme. Cole et al (2013b) show that a pay-out of 1,000 rupees increases the probability that rural farming households in Gujarat, India will purchase insurance in the next year by 25-50%, controlling for crop losses. The effect is stronger when more individuals in a village receive pay-out.

Karlan et al (2014), reaching a similar conclusion in their research with farmers in northern Ghana, observe the irony that while insurance offers its largest benefit for low-probability high-loss events, rare pay-outs harm demand; this is something that could be addressed, at least in part, through educating people on the nature of insurance mechanisms- see the following section.

- **Education and financial literacy.**

Other research has attributed weak demand for formal insurance to the inability of potential policyholders to understand the nature of the product and assess the most rational option for reducing their exposure. There is a range of evidence showing that individuals with low financial (and climate) literacy are less likely to participate in insurance markets.

Insurance products are complicated: rainfall index insurance, for example, maps rainfall distribution over an entire growing season to a single payment vector, using a metric (mm) that is unfamiliar to many farmers (Gaurav et al 2014).

Cole et al (2013) compare levels of education of farmers enrolling in rainfall insurance in India, and find that literate farmers were 15 percentage points more likely to take up rainfall insurance and use it to plant cash crops. In a previous pilot, Cole et al (2011) had found that participation in education programmes on rainfall insurance more than doubled the uptake of rainfall insurance. Gaurav et al (2014) research the consequences of offering financial education to microinsurance policyholders in Gujarat state in India upon their purchase decisions. The effect of the financial literacy training was evaluated using an RCT, in which half the sample was offered training. The study found that the financial education module significantly increased demand for the insurance product (by 5.3%).

Information sharing and capacity building would seem, in this case, to be an obvious solution. An evaluation of the effectiveness of a disaster microinsurance product called Afat Vimo in India, following Cyclone Phailin's impacts in Odisha state, found that the work undertaken with communities by one of the partners in the insurance programme to reduce information asymmetry and speed up claim verification was an important factor in its success (ACT 2016).

Other research has focused on more ambitious efforts to inculcate behavioural change among potential policyholders. Isakson (2015) refers to the pedagogical campaigns funded by insurance brokers, among others, to instil a 'culture of insurance' in areas where they

have identified a high perceived need for insurance yet see a low willingness to pay. In Ethiopia, one game is attributed with increasing uptake of insurance by one third- and in Peru, more than half of the 500 participants of a game, all cotton producers, shifted to the high-return activity, both borrowing money and purchasing insurance.

- **Weakening informal risk sharing schemes**

Mobarak and Rosenzweig (2013) examined the impact of the existence of caste-based informal risk-sharing networks in India on the uptake of rainfall insurance in Tamil Nadu, Andhra Pradesh, and Uttar Pradesh, India. In this region pre-existing risk sharing networks often provided coverage against household-specific losses (crop loss) and sometimes even against aggregate rainfall shocks, when other caste members are engaged in non-agricultural occupations. They found that informal systems have a different impact depending on whether they also cover aggregate shocks.

In cases where informal systems covered aggregated rainfall shock, farmers were less likely to purchase insurance. In cases where informal systems only covered household-level risks farmers were more likely to purchase insurance than in the areas devoid of informal systems, as they felt that they could afford the inherent basis risk of index insurance. Furthermore, in villages with a rainfall station (i.e.: no basis risk), household demand for index insurance is not affected by the extent to which the informal network is able to indemnify idiosyncratic risk.

5 Incorporating insurance within a DRM strategy

Sections 3 and 4 showed that insurance can contribute to integrated disaster risk management approaches under certain conditions. Insurance is not a sufficient instrument for achieving effective disaster risk management and disaster risk reduction at a societal level. At-risk parties, whether individuals, businesses or governments, must decide when insurance is appropriate and what other tools to use when it is not.

- **Deciding when insurance is appropriate**

Insurance is not a standalone solution for DRM.

To begin with, not all perils can be insured against, as discussed in Section 4.1. Climate change is presenting substantial challenges to the insurability of already-priced risks (for instance, causing large increases in loss occurrence linked to heat waves or floods), and also presents risks that cannot currently be insured, such as desertification (see Silver N and Dlugolecki A 2009).

Further, under-insurance is likely to remain a problem given that insurance products are complicated to understand, and also given mistrust, strategic behaviour and other factors discussed in Sections 3 and 4.

Even if it were hypothetically possible to insure all risks, there is clear evidence showing that insurance is not always the most appropriate tool for risk reduction.

The appropriateness of insurance for addressing a given risk will be assessed based on a number of criteria, including the frequency and severity of the hazard itself, the opportunity cost of the premium payment, and the availability of alternative mechanisms for managing the risk. As discussed in Section 4.2, insurance is not a cost effective response to high frequency, low impact disasters. For these, options such as multi-year reserves, informal risk transfer schemes, support to livelihood diversification and better forecasting information would be more appropriate. At the macro level, multi-year reserves are one of several options, and at the meso and micro level, informal risk sharing schemes and interventions that support alternative livelihoods are more appropriate choices.

If the conditions are such that insurance is appropriate, the next step is to consider what type of product. Insurance products themselves are designed differently depending on various circumstantial considerations, varying from objective considerations about the nature of the hazard, to socio-economic criteria such as the average income and education level of the recipients, to the strategic and policy objectives of the government or other intermediary.

Linked to this point is the observation made several times in this paper that a given type of insurance product is not equally valuable to everyone. Poor people are likely to be excluded from commercial insurance products, for example, and so if insurance is to reach them it must be designed differently- Schaefer and Waters' (2016) seven 'pro poor insurance' principles are relevant here (see Section 3).

- **A risk layering approach**

A strong conclusion in the literature on contemporary disaster risk management is that risk financing instruments should be integrated within an overall DRM strategy. The process should involve "identifying the various layers of disaster risk, who bears each level of risk, and the possible risk transfer instruments available to each layer" (Miller and Keipi 2005).

Along with a thorough appreciation of the nature of the hazard(s) and exposure, cost benefit analysis is a critical component in the process of matching responses to risks.

Part of this process is consideration of which risks the policyholder or intermediary should seek to reduce, and which should be retained as residual risk. It is not economically feasible, nor technologically possible, to prevent or mitigate all types of risk. In some cases governments can use policy and financial tools to avoid risk entirely, such as refusing planning permission to developments in high-risk areas such as flood plains. In other cases, where reducing or avoiding risk is infeasible, the priority will be given to effective prevention, response and recovery.

While the outcomes of this risk layering approach will vary in case, Mahul and Stutley (2010) propose that in general, small but recurrent losses will be retained by individuals; more severe by less frequent losses can be transferred to cooperative/mutual insurance schemes, commercial insurers and re-insurers; and governments will take responsibility for major disasters. Mongolia's Index-Based Livestock Insurance Project (IBLIP) has a format where herders take out commercial insurance to cover themselves against small losses, and for larger losses are covered by a social safety net funded by the transfer of risk at the government level to private insurance and reinsurance markets. Schaefer and Waters (2016) observe that this model has been highly successful.

A further example is Mexico's FONDEN, which has three main components at the federal level: a risk retention vehicle that allows the government to budget for the costs produced by frequent disasters, a reinsurance programme that leverages budget funds to purchase cover for severe and infrequent disasters, and a parametric layer of cover that provides immediately emergency funds if a major and severe disaster occurs.

Going beyond insurance, in Uruguay, the government has been collaborating with the World Bank to develop a series of risk financing options within an overall strategy for managing risks to its energy supply. In addition to the weather and oil price risk transaction mentioned in Section 2, an oil hedging program was implemented in 2016 to manage the risks of an oil price hike- this was the first case of a sovereign government executing a commodity hedging with the bank (World Bank 2016).

This risk layering approach would likely be comprised of ex-post and ex-ante funding mechanisms, as well as mitigation investments. It could include different types of insurance mechanism with varying objectives and characteristics (Baur and Parker 2015). At the micro level, households and small/medium enterprises may choose to use index insurance complemented with informal risk transfer, which can help to further manage the remaining basis risk.

There is an opportunity for those designing schemes to 'bundle' insurance products with other risk reduction activities that are suited to vulnerable people's needs (ACT 2016). For instance, the R4 programme funded by Oxfam and the World Food Programme supports insurance along with improved resource management through asset creation, livelihoods diversification, microcredit and savings. The programme does appear to improved the resilience of farmers and communities, in terms of food security outcomes, increased assets and group solidarity (Oxfam and WFP 2015). The multi-faceted nature of this development project, though, means transferable lessons to more limited schemes that have less scope for heavy subsidisation, and/or may just offer insurance, are difficult to ascertain.

While "risk layering" aligns well with the holistic approach to DRM described in Section 2, it is demanding in terms of policy and planning capabilities. There is no robust methodology that

could help governments to compare the options for utilising budgeting and financial instruments in a consistent, comprehensive way- hence making it difficult for them to answer such questions as “How much reliance should be placed on emergency reallocations of funds away from other parts of our budget to finance disaster losses?” and “How can we evaluate proposals for risk transfer products such as disaster insurance or catastrophe insurance? (Clarke et al 2016).

Tool selection is an inevitably political exercise that requires balancing timeliness, accuracy and cost (Dercon and Clarke 2016). It will also require addressing trade-offs, some of which are discussed in the section below.

- **Trade-offs**

Equity vs efficiency in risk-based pricing

From the perspective of tool design, efficiency relates to whether prices accurately reflect the degree of risk being insured; the higher the risk, the higher the premium. The assumption is that applying a risk-based premium would motivate the insured party to engage in risk reducing behaviour, and could ideally lead to an overall reduction of their exposure. However, from the perspective of fairness and equity, it is not acceptable that those who are most vulnerable to risk should have to pay the highest premiums. This is underlined by the common finding that those most exposed to risk are also characterised by poverty, social and political marginalisation, and limited social capital. If an objective of the risk reduction exercise is to target the poorest, and to help them move away from poverty traps, then the evidence suggests that insurance should be firmly integrated within a broader risk reduction programme, likely ‘bundled’ with other aspects such as credit provision and social protection. The focus would be on community-based (not-for-profit) mechanisms rather than premiums-based instruments.

Maximization vs distributional fairness

In a similar vein, there is a potential trade-off between risk transfer schemes that maximize poverty reduction outcomes and those that follow strict principles of distributional fairness.

Chantarat et al (2017) simulate optimal targeting of premium subsidization to East African herders, in terms of poverty reduction outcomes. Their results imply that the optimum scheme would provide insurance free to the non-poor likely to fall into poverty in the long-run, at the actuarially fair premium rate to vulnerable non-poor groups, and with no subsidies to the poorest and the most secure. This approach achieved the greatest gains in terms of mean herd sizes increases and decreases in the asset poverty headcount. One alternative approach to targeting would be to follow the principle of distributional fairness, such that, for instance, those with herd sizes below a certain threshold received free insurance provision. A simulation of this approach found less than half of the results of the optimal scheme described above was achieved.

However, this targeted subsidy approach is likely to be very expensive and demanding of financial and human resources. Avoiding the additional cost of creating new mechanisms is partly why there is interest in using social protection measures for DRM.

Cost-effectiveness vs commitment function

There is potentially a balance to be struck between cost effectiveness and ability to achieve co-benefits, such as risk reduction. De Janvry (2015) observes that while in some cases

sovereign reserves may be more cost effective than insurance (as discussed above), the ability of insurance to incentivize risk reduction actions may mean it is perceived as more valuable. However, as mentioned earlier, there is very little evidence of insurance schemes actually inducing risk-reducing behaviours (though the theoretical potential is widely acknowledged. The impact of schemes like ARC, where risk reduction is explicitly built into insurance contracts, is yet to be understood.

- **Addressing the drivers of risk**

In all cases, it is preferable to avoid risks entirely than to transfer them- and even the transferring of risks is threatened by insurability challenges associated with climate change among other things. Critical literature has demanded that attention be paid to the social determinants of risk, and cautions against the presentation of risk as an inescapable feature of human life that needs to be managed but its root causes ignored.

In the context of climate change, where insurers are struggling to incorporate forecasts into loss models, and to balance affordable premiums with accurately priced risk, it is essential to tackle root causes in parallel with management of manifestations (Surminski 2014). Climate change could increase the annual costs of flooding in the UK almost 15-fold by the 2080s under high emissions scenarios, but risk reduction policies- including controlling development in floodplains and increasing investment in flood defences- could limit the rising costs to a possible four-fold increase (ABI 2005).

An evaluation of the predecessor to Oxfam and WFP's R4 programme, HARITA, found while on average households experienced a higher level of wealth and better access to credit at the end of the project cycle, farmers observed that the project had not delivered long-term, transformative impacts. Such impacts, they said, would require support in accessing irrigation and diversification of income (Oxfam and WFP 2014). The impact evaluation of R4 in Senegal found that while some improvement in organizational capabilities and feelings of in-group solidarity could be attributed to the programme, there remained a lack of effective mechanisms to generate group responses to unexpected shocks. Interventions to nurture this organizational capacity were needed (Oxfam and WFP 2015).

Taylor (2016) takes a historical approach to the index-based livestock insurance scheme in Mongolia, explaining how risk was redistributed during the transition away from collectivization. New land rights regimes weakened the central principle of reciprocity over pasture and engendered competition for access, resulting in a widening of inequality between those herders with access rights and those without- and within a context of risk privatisation. Risk was produced and distributed as a function of the new capitalist economic system, and he argues that it is short-sighted to ignore these necessarily political roots when considering risk management.

Da Costa (2013) observes that risk is caused by the investment decisions and policies of governments and businesses, who then take out policies to insure themselves and their populations against the consequences. Focusing on the case of India, Da Costa (2013) argues for policies that address risk causes instead of merely managing symptoms- in India, this would involve widespread irrigation, as well as reversing the initiatives introduced to retract social banking and encourage privatization of common lands.

The key message underlying these studies is that while risk transfer has a role to play in DRM and in DRR, it cannot substitute for the social and ecological foundations of security (Isakson 2015). As anticipated in the description of integrated DRM in Section 2, risk transfer

is one element in a dynamic process of planning, implementing and adapting to build societal resilience to disasters and climate change.

- **Key Points**

- Comprehensive Disaster Risk Management (DRM) is a dynamic process in which risk reduction should be seen as a crosscutting element
- A DRM strategy should involve 'risk layering', in which different tools are selected to respond to different types of risk, in line with the nature of the risks, the policy objectives and the resources available.
- Insurance is not always a cost effective option, at the micro, meso or macro level. This depends on the type of disaster and the purpose of the intervention.
- Strengthening the link between risk transfer and risk reduction is encouraged in the theoretical literature, and is in the interest of both insurers and policyholders- but there is scarce empirical evidence on this link.
- Higher incomes do not necessarily correlate with reduced exposure to risk, which underscores the importance of integrating risk reduction with risk management in developing and developed countries.
- Good governance, and good public financial management, are critical to developing and maintaining a strong link between risk transfer and risk reduction.
- For policymakers, it is critical to address the drivers of risk as well as adopt tools to manage risk- only doing the latter, without the former, could worsen inequality and vulnerability
- Pricing risk is not necessarily an equitable approach, in that those facing the highest risk may be the most vulnerable and hence least in a position to take risk reduction measures.
- While insurance can be designed to work for the poor, it does not appear to work as a tool for lifting the poorest out of poverty- one reason being that it does not address the structural barriers that they face.

Bibliography

ACT. 2016. ACT on Knowledge #4: Disaster microinsurance. Action on Climate Today (ACT) programme; New Delhi, India.

Attanasio O, Rios-Rull J. 2000. Consumption smoothing in island economies: Can public insurance reduce welfare? *European Economic Review* 44 (7) pp1225-1258

Baur E, Parker M. 2015. Building financial resilience – the role of risk transfer for sovereign disaster risk management. *Planet @ risk* Vol 3, No 1.

Biener C, Eling M. Insurability in Microinsurance Markets: An Analysis of Problems and Potential Solutions. *The Geneva Papers on Risk and Insurance- Issues and Practice* 37(1) pp77-107

Boudreau L. 2016. Discipline and disasters: The political economy of Mexico's Sovereign Disaster Risk Financing Program. FERDI policy brief no. 128.

Cai H, Chen Y, Fang H, Zhou L. The effect of microinsurance on economic activities: evidence from a randomized field experiment.

Cai J. 2012. The Impact of Insurance Provision on Households' Production and Financial Decisions.

Casaburi L, Willis J. 2016. Time vs State in Insurance: Experimental Evidence from Contract Farming in Kenya. Working Paper.

Chantararat S, Mude, A, Barrett B, Turvey C. 2017. *Welfare Impacts of Index Insurance in the Presence of a Poverty Trap*. *World Development* (article in press)

Clarke D, Adam B, Bazuuro P, Bevan D, Dana J, de Janvry A, Hallegatte S, Mahul O, Poulter R, The T, von Dahlen S. 2014. Overview of operational framework. Sovereign DRFI Impact Appraisal Project: Overall methodology, paper 1.

Clarke D, De Janvry A, Sadoulet E, Skoufias E (eds). *Disaster Risk Financing and Insurance: Issues and results*. Report on a workshop held at the Ferdi on June 4 and 5, 2015. GFDRR

Clarke D, Wren-Lewis L. 2016. Solving Commitment Problems in Disaster Risk Finance. In: *Disaster Risk Finance as a Tool for Development: A Summary of Findings from the Disaster Risk Finance Impact Analytics Project*. GFDRR, World Bank.

Clarke D, Mahul O, Poulter R, Tse-Ling T. 2016. Evaluation Sovereign Disaster Risk Finance Strategies: A Framework. In: *Disaster Risk Finance as a Tool for Development: A Summary of Findings from the Disaster Risk Finance Impact Analytics Project*. GFDRR, World Bank.

Cole, S. Gaurav, S. and Tobacman. J. 2011. Marketing Complex Financial Products in Emerging Markets: Evidence from Rainfall Insurance in India. *Journal of Marketing Research* 48(2011): S150-S162. In combination with Cole, S. Gaurav, S. and Tobacman. J. 2017. *Marketing Rainfall Insurance in India*. Poverty Action Lab.

Cole, S. Gine, X. and Vickery, J. 2013. "How Does Risk Management Influence Production Decisions? Evidence from a Field Experiment." Harvard Business School Working Paper. In combination with. Cole, S. Gine, X. and Vickery, J. 2017. *Impact of Rainfall Insurance on Farmer Behaviour in India*. Poverty Action Lab.

Cole S, Stein D, Tobacman J. 2013 (2013b). Dynamics of Demand for Index Insurance: Evidence from a Long-Run Field Experiment. *American Economic Review* 104(5) pp284-90

Da Costa D. 2013. The 'rule of experts' in making a dynamic microinsurance industry in India. *The Journal of Peasant Studies* 40:5

De Janvry, A. 2015. Quantifying through Ex Post Assessments the Micro-Level Impacts of Sovereign Disaster Risk Financing and Insurance Programs. World Bank Finance and Markets Global Practice Group & Global Facility for Disaster Reduction and Recovery.

De Janvry A, Ritchie E, Sadoulet E. 2016. Weather Index Insurance and Shock Coping: Evidence from Mexico's CADENA Program. In: *Disaster Risk Finance as a Tool for Development: A Summary of Findings from the Disaster Risk Finance Impact Analytics Project*. GFDRR, World Bank.

Dercon S, Clarke D. 2016. *Dull Disasters: How planning ahead will make a difference*. Oxford University Press; Oxford, UK.

Dornan M, Cain T N. 2014. Regional Service Delivery among Pacific Island Countries: An Assessment. *Asia & The Pacific Policy Studies* 1(3) pp541-560

Elabed G, Carter M. 2014. Ex-ante Impacts of Agricultural Insurance: Evidence from a Field Experiment in Mali.

FSD Africa & CENFRI. March 2017. *Funding the Frontier: The Link between Inclusive Insurance Market, Growth and Poverty Reduction in Africa*.

Fuchs A, Rodriguez-Chamussy L. 2014. Voter Response to Natural Disaster Aid: Quasi-Experimental Evidence from Drought Relief Payments in Mexico. Policy Research Working Paper 6836. World Bank.

Gaurav S, Cole S, Tobacman J. 2011. Marketing Complex Financial Products in Emerging Markets: Evidence from Rainfall Insurance in India. Microinsurance Innovation Facility Research Paper #1. International Labour Organisation; Geneva, Switzerland.

GFDRR. 2011. Turkish Catastrophe Insurance Pool: Providing Affordable Earthquake Risk Insurance. Risk Financing and Insurance Case Study. GFDRR.

Ghesquiere F, Mahul O. 2007. Sovereign Natural Disaster Insurance for Developing Countries: A Paradigm Shift in Catastrophe Risk Financing. Policy Research Working Paper 4345.

GFDRR. 2011. Sovereign Disaster Risk Financing. Disaster Risk Financing and Insurance Concept Note.

GIZ GmbH. 2016. Promoting Integrated Climate Risk Management and Transfer (ICRM): At a Glance.

Hallegatte S. 2013. An exploration of the link between development, economic growth and natural risk. World Development Report 2014 Background Paper.

Hazell, P., Anderson, J., Balzer, N., Hastrup Clemmensen, A., Hess, U. and Rispoli, F., 2010. The potential for scale and sustainability in weather index insurance for agriculture and rural livelihoods. World Food Programme (WFP).

Hess, U. and Hazell, P. 2016. Innovations and Emerging Trends in Agricultural Insurance. How can we transfer natural risks out of rural livelihoods to empower and protect people? Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Bonn/Eschborn

Hudson P, Botzen W, Czajkowski J, Kreibich K. 2014. Moral hazard in natural disaster insurance markets: empirical evidence from Germany and the United States. Working Paper# 2014-07. Philadelphia: Wharton School, University of Pennsylvania.

Intergovernmental Panel on Climate Change (IPCC). 2012. Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. Cambridge University Press; Cambridge, UK.

Isakson S.R. 2015. Derivatives for Development? Small Farmer Vulnerability and the Financialization of Climate Risk Management. *Journal of Agrarian Change*.

Insurance Development Forum (IDF). Draft paper: Promoting resiliency to natural catastrophes: the critical legal, regulatory and policy architecture.

ILO. 2016. Insurance and economic development: Growth, stabilization and distribution. Briefing Note. Impact Insurance Facility, International Labour Organization (ILO); Geneva, Switzerland.

International Financial Consulting (IFC). 2014. Mid-Term Evaluation of the Performance of the Operations of MiCRO in Haiti. Evaluation Report. 21 November 2014.

Karlan, D. Osei, R. Osei-Akoto, I. and Udry, C. 2014. Agricultural Decisions After Relaxing Credit and Risk Constraints. *Quarterly Journal of Economics* 129(2): 597-652. In combination with Karlan, D. Osei, R. Osei-Akoto, I. and Udry, C. 2017. Examining Underinvestment in Agriculture: Returns to Capital and Insurance Among Farmers in Ghana. Poverty Action Lab.

Kovacevic R, Pug G. 2010. Does insurance help to escape the poverty trap? A ruin theoretic approach. *Journal of Risk and Insurance* (78) 4, pp1003-1028.

Lucas B. 2015. Disaster risk financing and insurance in the Pacific. GSDRC Applied Knowledge Services.

McIntosh, C. Sarris, A. and Papadopoulos, F. 2013. Productivity, credit, risk, and the demand for weather index insurance in smallholder agriculture in Ethiopia. *Agricultural Economics* 44: 399–417.

Merry A, Prashad P, Hoffarth T. Microinsurance Distribution Channels. Impact Insurance Paper No. 33. International Labour Organization; Geneva.

Matul et al. 2013. Why people do not buy microinsurance and what can we do about it. Microinsurance Paper No. 20. The International Labour Organisation; Geneva.

Mahul O, Stutley C. 2010. Government Support to Agricultural Insurance: Challenges and Options for Developing Countries. The International Bank for Reconstruction and Development / The World Bank; Washington DC

Miller S, Keipi K. 2005. Strategies and Financial Instruments for Disaster Risk Management in Latin America and the Caribbean. Inter-American Development Bank.

Mobarak, M and Rosenzweig, M. 2013. Informal Risk Sharing, Index Insurance, and Risk Taking in Developing Countries. *American Economic Review* 101(3): 375-380 In combination with Mobarak, M and Rosenzweig, M. 2017. Formal Rainfall Insurance for the Informally Insured in India. Poverty Action Lab. URL:

Morsink K, Clarke D, Mapfumo S. 2016. How to Measure Whether Index Insurance Provides Reliable Protection. Policy Research Working Paper 7744. World Bank.

Munich Re. Press release: Natural catastrophe losses at their highest for four years. Available at: <https://www.munichre.com/en/media-relations/publications/press-releases/2017/2017-01-04-press-release/index.html> Accessed 2nd May 2017.

Oxfam and World Food Programme (WFP). 2014. Managing Risks to agricultural livelihoods. Impact Evaluation of the HARITA Project in Ethiopia (2009-2012).

Oxfam and World Food Programme (WFP). 2015. Rural Resilience in Action: Preliminary results of the impact evaluation for the R4 rural resilience initiative in Senegal (2013-2015).

Oxford Policy Management. 2016. DFID Shock-Responsive Social Protection Systems research: Literature review. Oxford Policy Management, Oxford, UK.

Pacific Islands Forum Secretariat. Strengthening Economic Linkages: Climate Financing and Disaster Risk Reduction: Pilot Country Experiences with the Pacific Catastrophic Risk Insurance Pilot. Paper prepared by the World Bank for the Forum Economic Ministers Meeting and Forum Economic Officials Meeting, 8-11 July, 2014, Solomon Islands.

Poole, L. 2014. A Calculated Risk: How Donors Should Engage with Risk Financing and Transfer Mechanisms. OECD Development Co-operation Working Paper 17.

Prabhakar S, Rao G, Fukuda K, Hayashi S. 2012. Promoting risk insurance in the Asia-Pacific region: Lessons from the ground for the future climate regime under UNFCCC. In P. Schmidt-Thorne and J. Knieling, *Implementing Climate Adaptation Strategies*, London; Blackwell Publishers.

Reeves J. 2016. Ten concerns about climate and disaster insurance schemes- and one rights-based alternative. ActionAid blog post, 24 May 2016.

Reisinger A, Kitching R, Chiew F, Hugher L, Newton P, Schuster S, Tait A, Whetton P. 2014. Australasia. In: *Climate Change 2014: Impacts, Adaptation and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, UK and New York, p1371 – 1438

Schafer L, Waters E. 2016. Climate Risk Insurance for the Poor & Vulnerable: How to effectively implement the pro-poor focus of InsuResilience. Munich Climate Risk Insurance Initiative.

Schafer L, Waters E, Kreft S, Zissener M. 2016. Making Climate Risk Insurance Work for the Most Vulnerable: Seven Guiding Principles. Munich Climate Insurance Insurance/ UNU-EHS Publication Series. Policy Report 2016 No 1. United Nations University.

Silver N, Dlugolecki A. 2009. The Insurability of the Impacts of Climate Change. Paper presented at the GIRO conference, Edinburgh, October 2009.

Simonet C, Comba E, Wilkinson E. 2017. Disasters and National Economic Resilience: An analysis of BRACED countries. Working Paper. BRACED Knowledge Manager.

Surminski S. 2014. Taking a risk on the weather. *Financial World*, Feb/Mar, pp49-51.

Surminski S, Oramas-Dorta D. 2014. Flood insurance schemes and climate adaptation in developing countries. *International Journal of Disaster Risk Reduction* 7 pp154-164.

UN ESCAP. Discussion Paper: Third International Conference on Financing for Development. Addis Ababa, Ethiopia. July 2015. UN ESCAP, Bangkok Thailand.

UNFCCC. 2008. Mechanisms to manage financial risks from direct impacts of climate change in developing countries. Technical paper. FCCC/TP/2008/9.

UNISDR. 2015. Making Development Sustainable: The Future of Disaster Risk Management. Global Assessment Report on Disaster Risk Reduction. Geneva, Switzerland: United Nations Office for Disaster Risk Reduction (UNISDR).

UNISDR. 2015b. Working Session on Disaster Risk Transfer and Insurance. Issue Brief for the UN World Conference on Disaster Risk Reduction.

UN General Assembly. 2016. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction.

Von Peter G, Von Dahlen S, Saxena S. 2012. Unmitigated Disasters? New Evidence on the Macroeconomic cost of Natural Catastrophes. Bank for International Settlements.

Warner K, Kreft S, Zissener M, Hoppe P, Bals C, Loster T, Linnerooth-Bayer J, Tschudi S, Gurenko E, Haas A, Young S, Kovacs P, Dlugolech A, Oxley A, 2012. Insurance solutions in the context of climate change-related loss and damage. Policy Brief No. 6. Munich Climate Insurance Initiative / UNU-EHS Publication Series.

Warner K, Yuzva K, Zissener M, Gille S, Voss J, Wanczeck S. 2013. Innovative insurance solutions for climate change: how to integrate climate risk insurance into a comprehensive climate risk management approach. Report No. 12. Bonn: United Nations University Institute for Environment and Human Security (UNU-EHS).

World Bank. 2016. Case Study: Managing Exposure to Oil Price Volatility in Uruguay. World Bank Treasury. Available at <http://treasury.worldbank.org/bdm/pdf/Uruguay-Oil-Hedge-Case-Study.pdf>. Accessed on 2nd May 2017.

Young H, Maxwell D. 2013. Participation, political economy and protection: food aid governance in Darfur, Sudan. *Disasters* 37 (4) pp555 - 578

Annex 1: Overview of insurance and risk transfer tools¹⁰

Name of tool	Category	Description	Application examples	Advantages	Challenges
Indemnity insurance: (a) Single Peril (b) Multiple Peril	Traditional insurance	Insurance in which the claim is calculated by measuring the degree of damage to the insured asset soon after the event occurs.	Many examples in the developed countries, including hail insurance, flood insurance and multi-peril agricultural insurance Limited examples in developing countries, mainly from big government schemes in Latin America (e.g.: ProAgro Brazil and Mexico)	<ul style="list-style-type: none"> • Indemnity based on actual damage • Established distribution pathways • Proven scalability 	<ul style="list-style-type: none"> • High transaction costs, including moral hazard and adverse selection • High barriers to entry in some cases, so excludes vulnerable population groups
(a) area-yield (b) weather-indexed (c) NDVI/satellite-based	Index insurance	Pay-out calculated according to what is usually an independently verified proxy (index), rather than the actual damage to the specific asset.	Limited examples in both developed and developing world. But pilots are increasingly common in developing countries, with the following schemes operating at scale: (a) The Indian National Agriculture Insurance Scheme (b) The Ghana Agricultural Insurance Pool (c) Kenya and	<ul style="list-style-type: none"> • Lower transaction costs than indemnity insurance • Less demanding of institutional capacity, monitoring capacity and financial literacy than indemnity insurance 	<ul style="list-style-type: none"> • Weak farmer demand and first mover problems • Basis risk • Insufficient public investment in necessary infrastructure (i.e. weather stations etc) • Not a “profitable” form of risk transfer so would have to be substantially reliant on governments or donor funding

¹⁰ This table is not exhaustive. Schemes that are closely linked to those listed here include government insurance programmes and scalable ‘shock responsive’ social protection schemes (see OPM 2016)

			Ethiopia Index-Based Livestock Insurance		
Natural Catastrophe Bonds	Alternative risk transfer tools/ insurance-linked securities (ILS)	Securities that transfer natural catastrophe (re)insurance risks to the capital market	Many examples in developed regions. World Bank's MultiCat programme facilitated CAT bonds for sponsors including the Government of Mexico. Additionally, Munich Re recently expanded its third-party capital ILS investor base for catastrophe bond issues	<ul style="list-style-type: none"> • For investors: relatively high returns and low correlation with other asset classes means promise of diversification. • For sponsors: CAT bonds allow access to a much bigger pool of capital, and longer coverage periods, than conventional re-insurance 	<ul style="list-style-type: none"> • Significant barriers to entry for developing country governments e.g.: lack of familiarity with reinsurance and CAT bonds; lack of resources to deal with complex legal documentation and high transaction costs; limited or non-existence modelling of disaster exposure; other political disincentives linked to insurance (see elsewhere in the document)
Sidecars	Alternative risk transfer tools (ILS)	Securities that transfer a quota-share portion of the risk to the outside investors in the capital market. Generally have a limited lifespan and used to capture the increase in rates after a major catastrophe.	Many examples of this in (Re)insurance companies. Munich Re recently expanded its third-party capital ILS investor base for collateralised sidecar issues (Eden Re II sidecar) ⁱ	<ul style="list-style-type: none"> • For investors: relatively high returns and low correlation with other asset classes means promise of diversification, while the quota-set-up limits the extent of the risk • For insurers: sidecars allow access to a much bigger pool of capital, the limited lifespan offers quick access to capital and the quota-system allows for splitting up of larger risks 	<ul style="list-style-type: none"> • Significant barriers to entry for developing country governments (see above) • No focus on vulnerable populations
Weather Derivatives	Alternative risk transfer	Intermediation services that provide options on	Weather derivatives have become common	<ul style="list-style-type: none"> • Can be used at a 	<ul style="list-style-type: none"> • Significant barriers to

	tools (ILS)	weather indices (i.e. a rainfall index) for specific sectors	in the US and other developed countries, linked to performance of specific industries or sectors (i.e. agriculture). However, there have been efforts to build the weather derivatives market in developing countries, one of the first first being in Malawi to protect maize protection from drought (rainfall index) ¹ⁱⁱ	sector or company level <ul style="list-style-type: none"> • Enables access to financial markets • Can allow better planning and budgeting at the national and company level 	entry for developing country governments (see above) <ul style="list-style-type: none"> • No necessary focus on vulnerable populations • Requires pre-existing weather index
Early Recovery vouchersⁱⁱⁱ	Hybrid tool	Early recovery vouchers (ERVOs) (a) provide eligible households with an insurance policy guaranteeing immediate disaster payments in cash following natural disasters and (b) can be conditional on recipient households participating in risk reduction and resilience building measures	ERVO-like schemes are being piloted in China, Peru, Mexico's CADENA system	<ul style="list-style-type: none"> • Specifically target poor households to ensure direct and timely assistance • Have resilience building measures as a precondition to receiving the vouchers • can be integrated into existing safety net and cash transfer programs, especially for the identification of eligible households • Lower basis risk than IBI, as it focuses on high covariate risk and can be used for entire regions regardless of economic sector 	<ul style="list-style-type: none"> • Not a "profitable" form of risk transfer so would have to be substantially reliant on governments or donor funding • The challenge of finding an appropriate index with a low basis risk for the recipient households
Informal risk pooling	Alternative risk transfer tools	Informal risk transfer tools in the form of community risk pools	Informal caste-based risk pools in India	<ul style="list-style-type: none"> • Highly tailored to existing institutions, norms and practices of communities 	<ul style="list-style-type: none"> • Unlikely to insure against aggregate risks

				<ul style="list-style-type: none"> • Wide scope- can insure against aggregate risks as well as idiosyncratic risks (though far less common) • Flexible 	
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ⁱ <http://www.artemis.bm/blog/2017/03/15/munich-re-expands-its-ils-investor-base-broadens-sidecar-lines/>

ⁱⁱ <http://documents.worldbank.org/curated/en/549461468188946567/Weather-derivative-in-Malawi-mitigating-the-impact-of-drought-on-food-security>

ⁱⁱⁱ Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). 2016. Innovations and Emerging Trends in Agricultural Insurance. How can we transfer natural risks out of rural livelihoods to empower and protect people? Bonn/Eschborn. Kuhn, Saskia; Hess, Ulrich; Hazell, Peter 2016-07