



Working paper 515

Disaster risk insurance and the triple dividend of resilience

Lena Weingärtner, Catherine Simonet and Alice Caravani

Overseas Development Institute

203 Blackfriars Road
London SE1 8NJ

Tel. +44 (0) 20 7922 0300
Fax. +44 (0) 20 7922 0399
E-mail: info@odi.org.uk

www.odi.org
www.odi.org/facebook
www.odi.org/twitter

Readers are encouraged to reproduce material from ODI Reports for their own publications, as long as they are not being sold commercially. As copyright holder, ODI requests due acknowledgement and a copy of the publication. For online use, we ask readers to link to the original resource on the ODI website. The views presented in this paper are those of the author(s) and do not necessarily represent the views of ODI.

© Overseas Development Institute 2017. This work is licensed under a Creative Commons Attribution-NonCommercial Licence (CC BY-NC 4.0).

About the report

This paper applies the triple dividend of resilience framework (Surminski and Tanner, 2016) to disaster risk insurance, in order to explore the potential contribution that insurance can make to building resilience and driving development at different scales in developing countries. While we recognise that insurance is only one component of a larger toolbox of risk financing instruments and of disaster risk management (DRM) more generally, this paper focuses on disaster risk insurance to add an evidence-based perspective on the (co-)benefits and costs of such mechanisms to the broader debate. It aims to support private and public actors in their assessment of what (co-)benefits investing in insurance can provide and what (co-)costs it may produce. Building on a systematic review of grey and academic literature, the paper represents a first step towards capturing insurance net benefits more comprehensively in different contexts.

Acknowledgements

We are grateful to Daniel Clarke (U.K. Government Actuary's Department), Jonathon Gascoigne (Willis Towers Watson), Nathaniel Mason (Overseas Development Institute (ODI)), Alan Miller (ODI), Stephen Moss (Risk Management Solutions (RMS)), Robert Muir-Wood (RMS), Rebecca Nadin (ODI), Daniel Stander (RMS), Swenja Surminski (London School of Economics), Tom Tanner (ODI) and in particular Emily Wilkinson (ODI) for reviewing earlier versions of this paper and for providing valuable comments and inputs. Thanks to Sejal Patel for assisting with the literature search. We gratefully acknowledge the help of Anna Brown in copy-editing the report and the support of Hannah Caddick and Anna Hickman in design and communications. The authors would like to thank the Rockefeller Foundation for their ongoing support. This research builds on an ODI and Rockefeller Foundation collaboration. Further information and quarterly reviews of resilience articles and debates can be found at www.odi.org/resilience-scan.

Methodology

The paper builds on a systematic review of the literature. To capture recent developments in the field, the search of academic and grey publications focuses on the timeframe from January 2014 to March 2017. The selected documents were complemented with expert recommendations and used as a starting point. From this, reference tracing led to the identification of older but relevant articles to be included in the review.

To be considered in this review, literature needed to either (i) have a theoretical or conceptual focus on the impacts, benefits and constraints of insurance and risk transfer; or (ii) assess these impacts, benefits and constraints in an empirical study. The reviewed theoretical and conceptual literature and general reports informed the operation of insurance impacts along the lines of the triple dividend framework. Reviewed empirical literature then facilitated an assessment of how disaster risk insurance has – or has not – been found to help support actors at different scales to realise the triple dividend in practice.

Contents

About the report	3
Acknowledgements	3
Methodology	4
Executive summary	9
1. Introduction	11
2. The first dividend of resilience – is insurance helping to save lives and avoid losses?	14
3. The second dividend of resilience – is disaster risk insurance contributing to unlocking economic potential?	19
4. The third dividend of resilience – is disaster risk insurance generating development co-benefits?	24
5. Costs and potential adverse effects of disaster risk insurance	26
6. How to deploy disaster risk insurance in an effective way	30
7. Conclusions	34
References	35
Further reading	40
Annex 1. Description of methodology	42
Annex 2. List of institutions/networks searched for grey and academic literature	43
Annex 3. Search terms for Google and academic search engines	43
Annex 4. Triple dividend framework	44
Annex 5. Characteristics of insurance mechanisms	45
Annex 6. Outlining a comprehensive research agenda	47

List of boxes, figures and tables

Boxes

Box 1. Insurance and disaster risk finance	12
Box 2. Key challenges for insurance take-up and coverage	15
Box 3. Compensation effects from livestock and crop insurance	17
Box 4. The missing links between insurance and DRR	20
Box 5. Insurance driving agricultural investments in the absence of disasters	21
Box 6. Increases in agricultural productivity and welfare outcomes related to disaster risk insurance at the micro level	21

Figures

Figure 1. Disaster risk financing options	13
Figure 2. The 'financial gap' for insurance	15
Figure 3. How insurance may contribute to unlocking the second dividend of resilience	19
Figure 4. Ex ante and ex post dividends supported by disaster risk insurance	33
Figure 5. Flowchart of literature search	42
Figure 6. The triple dividend of resilience	44

Tables

Table 1. Institutions and networks for literature search	43
Table 2. Search terms	43

Acronyms

ARC	African Risk Capacity
CCRIF	Caribbean Catastrophe Risk Insurance Facility
DRM	Disaster risk management
DRR	Disaster risk reduction
FONDEN	Fund for National Disasters (Mexico)
GFDRR	(World Bank) Global Facility for Disaster Reduction and Recovery
IBLI	Index-Based Livestock Insurance
PPP	public–private partnership
UNISDR	United Nations Office for Disaster Risk Reduction

Executive summary

Disaster risk insurance mechanisms have attracted increased attention and large-scale funding from donors and development communities, for instance through the G7 insurance initiative InsuResilience in 2015. Insurance presents opportunities to improve disaster risk management, adapt to climate change and reduce poverty by generating broader benefits and providing financial security against disasters, including geophysical and climate-related events such as droughts or floods. Some of this enthusiasm may be misguided however. Financial infrastructure, regulatory frameworks and high-quality risk data are often inadequate or non-existent in developing countries, insurance programmes often struggle to cover the most vulnerable, and insurance policies need to be carefully designed to incentivise disaster risk reduction investments.

To date, there has been little overview of evidence on the various impacts that insurance can support, the conditions under which these can be realised and the role of insurance in resilience-building in developing countries. Many of these insurance markets are young, products offered are innovative and much of the target population is low-income, which results in particular challenges and the need for context-specific research. This working paper explores the multiple dimensions of (co-)benefits – that is, direct and indirect benefits as well as further reaching social, economic or environmental co-benefits – and costs emerging from disaster risk insurance implementation at different scales. It presents evidence from secondary literature to assess whether and how these (co-)benefits and costs have been observed in developing countries.

To do this, the paper applies the triple dividend of resilience framework (referred to in this paper as the ‘triple dividend framework’) to recent thinking and empirical research about disaster risk insurance impacts. Using evidence from grey and academic literature that was selected through a systematic literature review,¹ the paper presents the diverse nature of benefits and co-benefits of disaster risk insurance in developing countries. The triple dividend framework seeks to improve the business case for investing in disaster risk management (DRM), suggesting that such investments could yield significant and tangible

benefits, even in the absence of a disaster (Tanner et al., 2015). It highlights three types of benefits (or dividends): (i) avoiding losses when disasters strike; (ii) stimulating economic activity by reducing disaster risk; and (iii) social, environmental and economic benefits associated with specific DRM investments. The use of the triple dividend framework helps to pinpoint the added value of insurance schemes by highlighting the nature of the costs and benefits. It also supports the identification of knowledge gaps on this topic.

This working paper constitutes a critical business case for investments in the development, implementation and operation of disaster risk insurance approaches in developing countries. By collating recent existing evidence on insurance implementation and impacts through the triple dividend framework lens, the analysis supports a better understanding of the different (co-)benefits, as well as (co-)costs and adverse effects of insurance schemes. The analysis also highlights the key factors of insurance design, implementation and context that influence the achievement of the three dividends. These elements are essential to support the effectiveness of future insurance programme implementation across a broad range of impacts. Finally, the paper also supports the identification of gaps in research, where further evidence is needed to strengthen the business case and to better understand the potentials and pitfalls of disaster risk insurance.

Recognising that disaster risk insurance is only one component of a larger toolbox of risk financing instruments and DRM more generally, this working paper focuses on insurance to add an evidence-based perspective on the (co-)benefits and costs of such mechanisms to the broader debate. It aims to support private and public actors in their assessment of the (co-)benefits that investing in insurance can provide and the (co-)costs that it may produce. As such, the paper represents a first step towards capturing and contextualising insurance net benefits more comprehensively in different environments.

¹ For a more detailed description of the methodology, see Annexes 1–3. This paper does not analyse original data or conduct meta-analysis, but future research may use this review as a starting point to further assess insurance costs and benefits along the triple dividend framework through the use of primary data.

Key findings

Evidence from the analysis suggests that insurance can make a contribution to each of the three dividends.

First dividend: compensating losses and avoiding long-term negative impacts when disasters strike

The most direct benefit of well-functioning insurance mechanisms is to compensate policy holders for economic losses determined through physical assessment or according to a pre-defined index trigger. Evidence on payouts from agricultural insurance suggests that these can help farmers and herders smooth consumption and recover after shocks, but this effect can be undermined by inadequate or flawed insurance design. Swift payout from micro- and macroinsurance schemes may also help the insured to avoid indirect longer-term economic impacts from disasters, but empirical evidence on this effect is scarce.

Surprisingly, evidence focusing directly on the core function of insurance, i.e. reliably compensating for economic losses from disasters (first dividend), is less prevalent than expected. This is particularly noteworthy in the case of index insurance, where basis risk can introduce significant costs to the insured and/or the insurer that may affect the loss compensation function and, as such, undermine the insurance mechanism as a whole. Calibration, design of the scheme and the effective use of payouts by policy holders are essential to providing first dividend benefit. Few papers explore recent empirical evidence on these aspects, leaving some gaps to be filled.

Second dividend: stimulating economic activity by reducing actual and perceived disaster risk

The expectation of receiving a payout when an insured disaster or shock occurs can increase risk-taking and drive investment in productive activities, such as agriculture, even in the absence of disasters. Empirically, this mechanism has been well documented: the links between agricultural insurance and farmers' gains in productivity have represented a recent research focus. However, more evidence is needed to assess longer-term behavioural change related to insurance, the sustainability of these effects in the context of climate change and cross-scale impacts – for instance, the potential influence of sovereign disaster risk insurance at the macro level on micro-level investments by individuals, households or enterprises.

Third dividend: social, environmental and economic co-benefits

These co-benefits of investing in insurance are the least theoretically and empirically explored among the papers included in this review. Nevertheless, some innovative research has been conducted on social and political impacts. Co-benefits from disaster risk insurance can entail an increase in subjective wellbeing, because coverage provides 'peace of mind'. Insurance can also influence voter behaviour and contribute to political accountability. Finally, learning from insurance may present an opportunity to enhance planning and decision-making about risk-sensitive investments. Few empirical studies so far have explored these or other potential third dividend co-benefits, but an enhanced understanding of such impacts may constitute an additional driver of the adoption of insurance in the medium term.

These findings imply that, through their *ex post* and *ex ante* benefits, insurance systems can strengthen the capacity of individuals, households, firms, organisations or states to prepare for and cope with disasters, can drive (economic) development and can generate co-benefits even in the absence of disasters. At the same time, trade-offs in investment decisions, opportunity costs, unequally distributed impacts from insurance, gender biases, costs from insurer failure and deficiencies in the reliability or efficiency of insurance schemes can undermine some of these benefits for all or for specific target groups. However, the consideration of co-benefits, as well as co-costs, and the evidence for establishing whether and how these can be achieved are still weak in many contexts.

1. Introduction

Disaster risk insurance has recently received increased attention and large-scale funding in developing countries. Insurance is considered a way to reduce or compensate for economic losses from disasters through ex ante (prior to a disaster) risk management. Macroinsurance, meaning insurance at the sovereign level in this paper, at the same time can help to avoid issues such as delays and inefficiencies often associated with ex post (after a disaster strikes) emergency relief (Talbot et al., 2017).² The potential for micro-level (for individuals, households or small enterprises, for instance) and meso-level insurance (directed at cooperatives, microfinance institutions, NGOs, etc.) to stimulate economic investment and increase productivity by decreasing previously uninsured risks contributes further to the attractiveness of insurance more generally (see Annex 5 for definitions and characteristics of insurance mechanisms).

Some of this enthusiasm may be misguided, however, given that financial infrastructure, regulatory frameworks and high-quality risk data are often inadequate or non-existent in developing countries, insurance schemes often struggle to cover the most vulnerable, and insurance may decrease incentives for investing in risk reduction or the provision of safety nets. In addition, many insurance markets in developing countries are young, products offered are innovative and much of the target population is low-income, which results in particular challenges. The low level of insurance penetration in developing countries illustrates these barriers. In 2015, Latin America and Africa/Oceania only accounted for a 6% share of global insurance premiums (3% each), while Europe (32%), North America (31%) and Asia (30%) were the largest insurance markets in terms of premium volume (Insurance Europe, 2016).

To date, there is little consolidated evidence on the (co-) benefits and (co-)costs of disaster risk insurance schemes in

developing countries. Cost-benefit analyses have assessed some of the potential of insurance to mitigate losses from disasters, but they often miss out on capturing the broader co-benefits and the indirect impacts of investing in insurance³ at different scales.

1.1. Objective of the paper

This working paper applies the triple dividend of resilience framework (referred to here as the ‘triple dividend framework’) to disaster risk insurance, in order to explore the potential contribution that insurance can make to building resilience at different scales in developing countries. While the paper recognises that insurance is only one component of a larger toolbox of risk financing instruments and disaster risk management (DRM)⁴ more generally (see Box 1), it focuses on disaster risk insurance to add an evidence-based perspective on the (co-)benefits and costs of such mechanisms to the broader debate. It aims to support private and public actors in their assessment of the (co-)benefits and (co-)costs that investing in insurance can provide. As such, the paper represents a first step towards capturing and contextualising insurance net benefits more comprehensively in different contexts.

For these purposes, the working paper builds on an analysis of recent grey and academic literature compiled through a systematic literature review (see Annexes 1 to 3). Insights from the literature include: (a) theoretical assumptions underpinning the potential benefits of insurance approaches; and (b) evidence of both direct and indirect benefits, as well as costs achieved. The paper does not analyse original data or conduct meta-analysis, but future research may use this review as a starting point to further assess or quantify insurance costs and benefits along the lines of the triple dividend framework through the use of primary data.

2 This paper focuses on formal disaster risk insurance schemes that transfer pre-defined risks of a policy holder at a micro, meso or macro scale to a private company or state providing a guarantee of compensation for impacts resulting from disasters and extreme events in return for payment of a specified premium. The schemes discussed in this paper entail indemnity and index-based products, and most of them cover against losses from floods, droughts or rainfall shortage and variability. Due to the difficulty of disentangling potential climate or disaster impacts from other causes for claims, health and life insurance are excluded from the analysis. For more definition and characteristics of insurance mechanisms, see Annex 5.

3 Investment in disaster risk insurance, in this paper, encompasses investments by private or public entities in the development and operations of insurance schemes, for instance by providing technical support or subsidising insurance premiums.

4 This paper uses the UNISDR definition of DRM: ‘Disaster Risk Management is the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses’ (UNISDR terminology from: www.unisdr.org/we/inform/terminology, accessed 8 May 2017).

1.2. Insurance and the triple dividend of resilience

The triple dividend of resilience framework⁵ seeks to improve the business case for investing in building resilience⁶ with a proposition that these investments could yield significant and tangible benefits, even in the absence of a disaster (Tanner et al., 2015; Surminski and Tanner, 2016). The framework suggests there are three types of benefits (or dividends) that can be generated by investing in ex ante DRM: (i) avoiding losses when disasters strike; (ii) stimulating economic activity by reducing disaster risk; and (iii) social, environmental and economic co-benefits associated with specific DRM investments. Second and third dividend benefits can be achieved independently of whether a disaster actually occurs or not.

The framework has been illustrated with a number of examples to demonstrate its validity (Surminski and Tanner, 2016), but to date, it has not been applied systematically to specific DRM mechanisms or investments, which is the unique approach of this paper. As a risk financing strategy, insurance is one part of a comprehensive approach to DRM. Acknowledging the importance of interactions and synergies between different DRM components and also that insurance is not a panacea for managing risk (Hazell and Hess, 2010), this working paper explores potential resilience dividends to which insurance contributes. Accordingly, this is based on the following expectations:

1. for insurance to effectively and reliably compensate the disaster-related losses it intends to cover and avoid indirect and longer-term negative economic impacts from disasters (first dividend)
2. for insurance, irrespective of the occurrence of a disaster, to have the added benefit of unlocking economic growth by stimulating productive investment and behaviour through actual and perceived risk reduction, thus reducing uncertainty (second dividend) and
3. for insurance to provide social, economic or environmental co-benefits, also in the absence of disasters (third dividend).

While the first and second dividends, in the case of insurance, mainly support financial resilience and economic growth, their indirect impacts, along with the third dividend, are expected to drive development and strengthen resilience in a broader way. The design of the policy, the specific mechanism of an insurance scheme and the context in which it is implemented influence the achievement of insurance (co-)benefits and the nature of its (co-)costs and adverse effects (see Annex 5). As such, contexts and characteristics of the insurance scheme are discussed throughout the paper to delineate the conditions under which insurance can help achieve the different dividends.

In the following sections, the paper presents evidence from secondary literature on each of the three dividends related to investing in disaster risk insurance in developing countries at different scales. It concludes with a discussion on the costs and adverse effects of applying insurance to build resilience in developing countries and key recommendations for deploying insurance in a more comprehensive and equitable way.

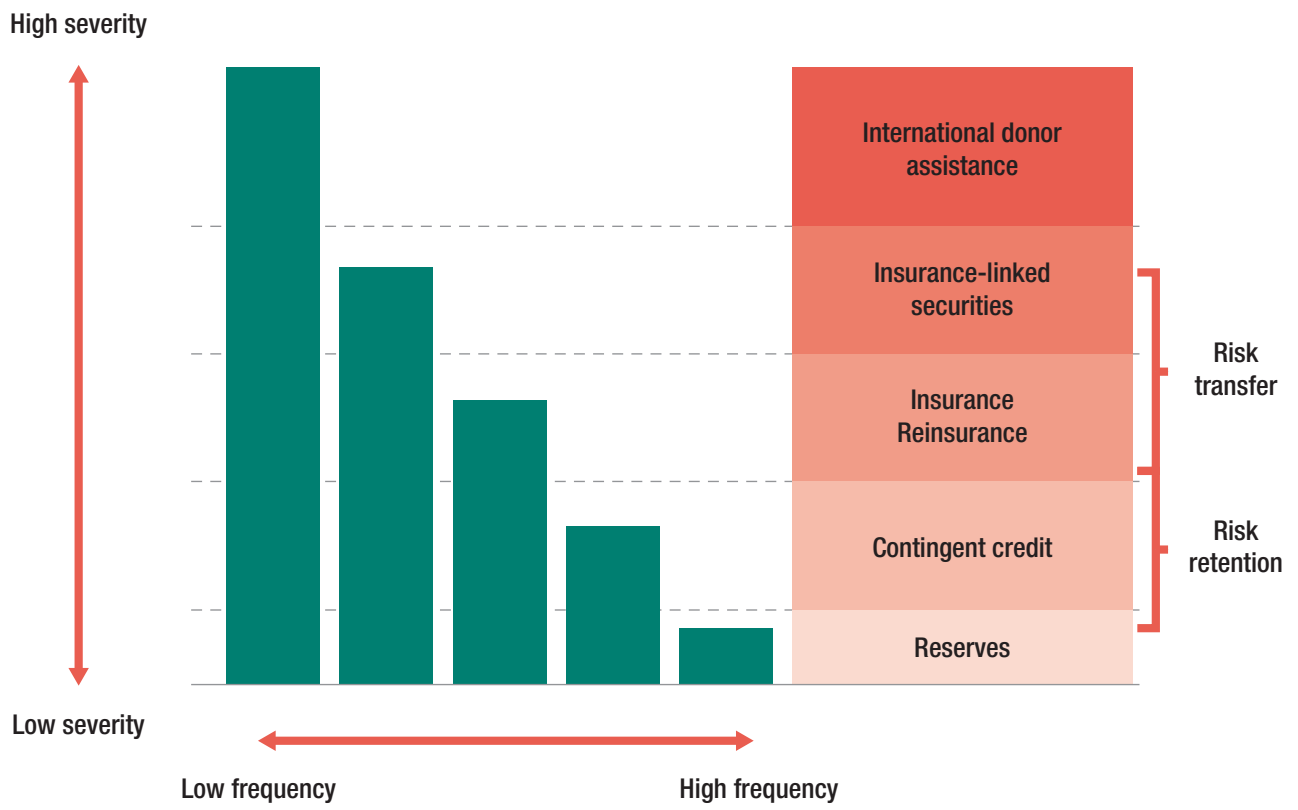
Box 1. Insurance and disaster risk finance

Disaster risk finance aims to increase the resilience of vulnerable countries or people to the impacts of disasters as part of a comprehensive approach to disaster risk management (Balogun, 2014; Shiferaw et al., 2014; Schaefer and Waters, 2016; World Bank, 2016a; Ye et al., 2016). Within a disaster risk financing system, ex ante financial mechanisms such as contingency funds, contingent credit or investment in disaster prevention and preparedness can help support risk management. Insurance and other risk transfer mechanisms are particularly important tools to deal with residual risk from low-frequency and high-severity events (see Figure 1). Ex post financial instruments such as budget reallocation, post-disaster credit, tax increases or international donor assistance can be arranged after a disaster, but are often ad hoc reactions and less effective than planning ahead (Clarke and Dercon, 2016; Talbot et al., 2017).

5 The triple dividend framework was developed by the Overseas Development Institute (ODI), the London School of Economics (LSE) and the World Bank Global Facility for Disaster Reduction and Recovery (GFDRR) in 2015, in response to observed low levels of international funding available before disasters strike despite increasing economic costs of disasters (Kellett and Caravani, 2013).

6 Referring to the triple dividend framework, the paper considers a broad definition of resilience, beyond financial aspects. Resilience is defined as 'the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management' (UNISDR terminology from: <https://www.unisdr.org/we/inform/terminology>, accessed 8 May 2017).

Figure 1. Disaster risk financing options



Source: Ghesquiere and Mahul (2010).

2. The first dividend of resilience – is insurance helping to save lives and avoid losses?

The first resilience dividend that can result from investing in DRM is to ‘avoid or reduce losses and damages (both immediate and long-run) in the event of a disaster’ (Tanner et al., 2015: 17). This encompasses saving lives, minimising the number of people affected by disaster, reducing damage to infrastructure and other assets, and reducing economic, health and other types of loss and damage.

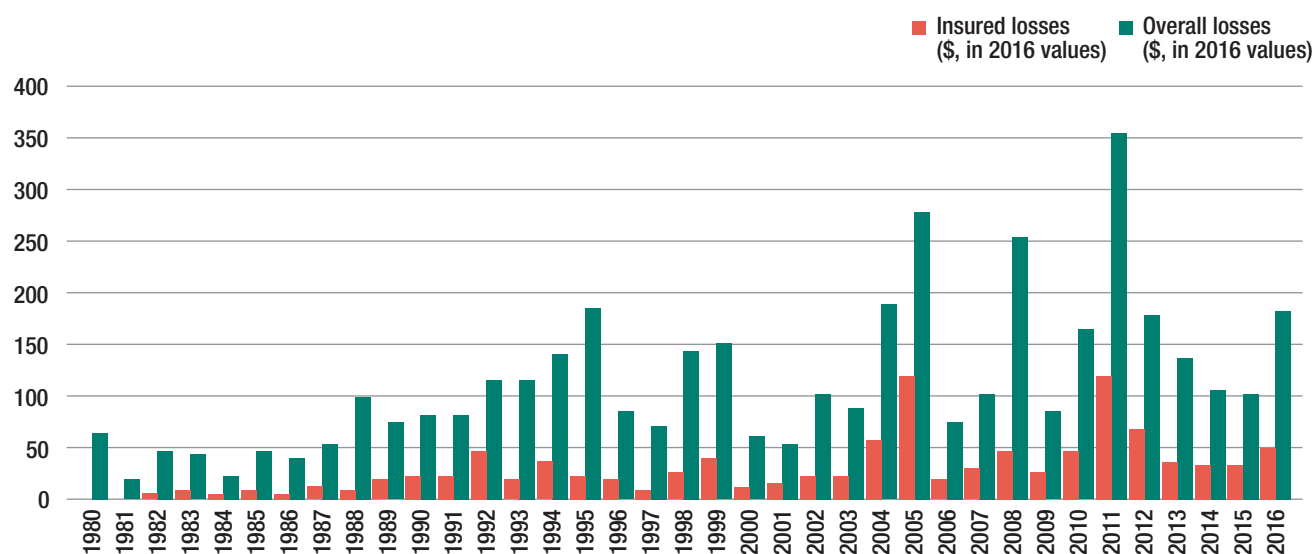
Insurance is not designed to prevent disaster losses, but evidence on the first dividend suggests that it compensates for covered direct economic losses, thus contributing to financial resilience. It also has the potential to reduce long-term and indirect disaster impacts through swift payouts, though this latter relationship still lacks empirical support in developing countries. However, reliability of insurance coverage is a concern across the literature and more longer-term evidence is required to assess net impacts of insurance payouts and sustainability of the mechanisms over time.

Unlike protective infrastructure investments aimed at preventing losses (for instance, wave breakers or dams), insurance secures, via payouts, an immediate and rapid compensation for losses following a disaster. While insurance does not avoid direct losses, the compensation of economic losses can be considered as a direct first dividend benefit resulting from insurance payouts financed by ex ante premium payments and ultimately aiming to reduce negative welfare impacts resulting from these losses (Hallegatte et al., 2016). In the case of index-based insurance schemes, the payout is not directly related to actual losses in the sense that it is captured through loss assessments. Index-based insurance payouts are linked to yield, satellite or weather triggers designed as a proxy for losses. This means they can still be considered as a

mechanism for loss compensation under the first dividend, even though their relation with losses is different from that of indemnity insurance.

However, even assuming an effective and reliable insurance mechanism can cover losses after a disaster, there is a substantive financial protection gap (meaning the difference between overall losses and insured losses), especially in developing countries where insurance market penetration is relatively low (see for, instance, Balogun, 2014; Baur and Parker, 2015) (see Figure 2). At the same time, economic losses, on average, are increasing in these countries, which demonstrates the rising potential for insurance coverage and the need to integrate this with additional risk management strategies.

Figure 2. The ‘financial gap’ for insurance



Source: Munich Re, NatCat SERVICE (2017); see also Baur and Parker (2015).

The key function, and most direct benefit, of insurance captured by the first dividend is the insurance payout, given that this a good proxy for actual losses. This represents a very narrow view of the insurance principle: the idea that insurance compensates for the loss of insured assets. However, insurance could also avoid indirect and longer-term negative economic impacts following a disaster – for example, fragmented economic activities or detrimental health impacts related to malnutrition may be averted by not selling off cattle or reducing consumption

at the household level. Theoretically, a rapid insurance payout could prevent the manifestation of vicious circles of poverty and debt post-disaster (Baur and Parker, 2015; Joyette et al., 2015; Hallegatte et al., 2016). Thus longer-term, indirect losses could be avoided. Unfortunately, the difficulty of attributing these indirect losses to one specific mechanism such as an insurance payout, especially over longer periods of time, means that few empirical publications assess the value of these indirect losses.

Box 2. Key challenges for insurance take-up and coverage

This box summarises key concepts of the insurance literature essential to understanding the challenges of insurance systems and the risks that are related to insurance implementation.

Moral hazard describes a situation where a party or agent prioritises own interests over common benefits. In the case of insurance, this can lead to an individual providing false information about its assets or credit capacity to the insurer or taking unusual risks in order to earn more profit.

Adverse selection is related to the risk of asymmetric information between agents that can bias the terms of a contract. In the case of insurance, adverse selection is the tendency for those that are most exposed to disaster risks, and therefore more likely to incur a loss, to obtain an insurance policy. Insurance companies can reduce adverse selection by using additional sources of information, for instance by sharing information between themselves (reputation information).

Basis risk, in the context of parametric insurance, is the financial risk of a disconnect between experienced losses and insurance payouts. In practice, this can mean, for instance, that a farmer encounters losses even though the index on which the product is based has not been triggered, or that the index is triggered when no losses have occurred.

Source: authors’ definitions adapted from the National Association of Insurance Commissioners’ Glossary (www.naic.org/consumer_glossary.htm#B, consulted May 2017), Dionne (2000) and Investopedia’s Glossary (www.investopedia.com/, consulted May 2017).

The correlation of the value of insured lost assets with the payout is one of the key dimensions of insurance efficiency and sustainability. The extent to which insurance can achieve perfect coverage of losses (first dividend) is often discussed and the design, calibration and implementation of insurance schemes are the subject of various studies assessing the effectiveness and sustainability of these (Farrin and Miranda, 2015; Lybbert and Carter, 2015; Mechler, 2016; World Bank, 2016b). In practice, insurance payouts can undervalue or overvalue real losses as a result of moral hazard, adverse selection or basis risk issues (see Box 2 on the reasons for this disconnect), or due to the previously discussed challenges related to attributing and quantifying indirect benefits and costs.

2.1. Compensating direct asset losses and avoiding negative indirect economic impacts

Most insurance schemes cannot ‘prevent or reduce the likelihood of direct damage and fatalities from extreme weather events’ (Dulal and Shah, 2014: 25), but compensate immediate economic losses through the payout mechanisms in the case of indemnity insurance and generate a financial buffer to cope with losses in the case of index insurance (Fuchs and Rodriguez-Chamussy, 2014; Cordella and Levy-Yayeti, 2015; de Janvry et al., 2015; World Bank, 2016a; Borenzstein et al., 2017). For instance, the Caribbean Catastrophe Risk Insurance Facility (CCRIF) has made eight payouts for more than \$32 million to seven national government members, representing the economic losses compensated through the CCRIF mechanism (Baur and Parker, 2015). These compensations, in turn, can support immediate preparation, facilitate recovery and help the insured to avoid additional negative economic impacts of a disaster (Hallegatte et al., 2016), for instance when they prevent the accumulation of debt.⁷ Other examples include Mexico’s Fund for National Disasters (FONDEN) and risk transfers by the Uruguayan government and the CCRIF, both of which underscore the speed with which these facilities can provide financing to national governments after a disaster (Hallegatte et al., 2016).

Insurance schemes and other financial risk management solutions at the national and (sub)sovereign level are expected to fill part of the protection gap between (micro)

insured and uninsured losses from natural catastrophes (Baur and Parker, 2015) (see Figure 2). Insurance can help contribute to reducing disaster-related macroeconomic costs and has advantages over traditional ex post financing. These include:

- the potential to address commitment problems (Clarke and Wren-Lewis, 2016; World Bank, 2016a)⁸
- guaranteed and speedy access to funds within a pre-determined limit and based on predictable premiums (especially in the case of parametric insurance), which supports budget planning; contrary to debt financing, insurance does not usually require repayment
- diversification of the funding options available to cope with natural catastrophes, reduce post-disaster stress to re-allocate other funds to crisis response and allow contingent liabilities to be lowered to ‘acceptable’ levels and
- a ‘price tag on risks’ to support cost-benefit analysis and facilitate decision-making for risk management and prevention (see also section 3) (Baur and Parker, 2015).

Nonetheless, few research papers quantify the direct losses that are compensated and the indirect negative economic impacts that are avoided as a result of insurance coverage at the different scales in developing countries. The exercise is challenging because it implies the definition of a counterfactual (a comparable situation without insurance) to assess the impact of insurance payouts (de Janvry et al., 2016), or it requires complex, hypotheses-driven models in contexts where low data availability is a common challenge (Hallegatte et al., 2010). For instance, the lack of disaggregated data on economic losses (by location and/or socioeconomic characteristics at the household levels), the spatial and sectoral inconsistency of aggregated economic damages or the low coverage of weather stations on a specific territory can limit the modelling exercise and its precision. To compensate for direct losses of public capital and prevent indirect follow-on losses from disasters, sovereign disaster risk insurance is one option next to others such as increased taxation, borrowing or budget reallocation. Whether insurance is a helpful mechanism thus depends not only on the scheme itself but also on the feasibility of potential alternatives, which largely differ between contexts (Bevan and Adam, 2016).

There are only a few evaluations considering aggregated consumption, expenditure or wealth impacts

7 See, for instance, Karim and Noy (2015) for an extensive literature review of papers looking to inform the impact of disasters on poverty indicators (including asset losses).

8 Commitment problems represent a range of difficulties related to making ex ante promises to undertake certain response actions, which may become less desirable after a disaster has occurred. This includes decisions on who finances reconstruction and recovery, a bias towards disaster response at the expense of adaptation and risk reduction, and scenarios where ‘those at risk deliberately under-protect themselves knowing that governments or donors will come to their rescue’ (Clarke and Wren-Lewis, 2016: 2), a situation also known as the Samaritan’s dilemma.

Box 3. Compensation effects from livestock and crop insurance

Most existing evidence on the Index-Based Livestock Insurance (IBLI) approach shows that compensation for livestock losses through the scheme helps reduce negative effects on consumption and supports recovery after a disaster (see, for instance, Bertram-Huemmer and Kraehnert, 2014; Carter et al., 2016; Chantarat et al., 2017). Jensen et al. (2014) find increases in the livestock survival rate as a result of an IBLI programme in northern Kenya because herders were better able to feed their animals, and conclude that the reduction of financial exposure to large shocks is directly proportional to the premium rates. Regarding further effects on income, they also observe that IBLI coverage increases investments in livestock health services and leads to an increase in milk productivity and total milk income. Similarly, insurance payouts helped herders sustain their animals and supported their recovery after the 2009/2010 winter disaster in Mongolia, though this positive impact decreased over the four years following the event (Bertram-Huemmer and Kraehnert, 2015). In northern Kenya, households with insurance are on average 12 percentage points less likely to reduce meals and 61 percentage points less likely to sell productive assets during the recovery period, implying that insurance could both have helped protect assets and smooth consumption after the 2011 drought (Janzen and Carter, 2013).

Similarly to livestock insurance, crop insurance has also been found to have positive impacts in addressing the negative economic impacts of disasters in some cases. Akotey and Adjasi (2014), for example, show that index-based microinsurance has positive welfare impacts on household asset accumulation in Ghana. A cost-benefit analysis study of CADENA, a large-scale index-based scheme funded and pioneered by the Mexican government, finds positive effects from receiving insurance payouts, with benefits exceeding the costs for farmers (de Janvry et al., 2016). Payouts also helped households avoid costly coping mechanisms, such as reducing consumption. Within a year after a payout, the land cultivated increased in comparison with municipalities that did not receive payments. De Janvry et al. (2016) also find increases in expenditure and income per capita of about 27% and 38%, respectively, even though these increases seemed to be partially offset by reduced remittances. Comparable to this reduction in remittances, an eight-year long impact evaluation of rainfall-based index insurance in India points to a reduction in transfers between peers caused by insurance payouts. The study did not find evidence for greater wellbeing or increased investment of farmers linked to insurance, and concludes that this indicates limited prospects for small-scale, unsubsidised market-based rainfall index crop insurance (Tobacman et al., 2017).

In many of these examples, it is difficult to disentangle the impacts of the first and second dividends (Janzen and Carter, 2013; Jensen et al., 2014; Castillo et al., 2016). For instance, a reduction in livestock losses can be related to the direct impact of payouts, allowing herders to avoid slaughtering or selling some livestock and smoothing their productive assets because they were compensated for disaster losses (first dividend); but, at the same time, greater investment due to enhanced credit access and behavioural changes in herd management as a result of being covered by insurance (second dividend) can also help reduce losses (Bertram-Huemmer and Kraehnert, 2014). An exception to this is the paper by de Janvry et al., (2016), whose identification strategy permits clear attribution of the effect on expenditure to the reception of payouts. The authors compare municipalities that are all part of the CADENA programme.

of compensated direct losses and indirect reduced negative disaster impacts related to microinsurance schemes.

Where they exist, these often do not distinguish between the first dividend (dependent on the payout) and second dividend (based on insurance impacts in the absence of a disaster) (Jensen et al., 2014). One example of testing macroeconomic growth impacts from insurance points to potential positive effects from well-covered losses, especially in the reconstruction stage during the three years after a catastrophe (von Peter et al., 2012). Conversely, a lack of insurance can have negative effects on the scale and duration of the broader economic impact of disasters. This also entails reduced resilience in the speed of the recovery process for businesses, individuals and governments (Surminski et al., 2016).

2.2. Compensating livestock and crop losses

Agricultural microinsurance covers farmers against disaster-related losses through payouts in 'bad years' in return for regular premium payments (Morsink et al., 2016). In theory, when a disaster strikes, insurance can help individuals or households recover through less harmful coping strategies, and by stabilising their productive asset base and smoothing consumption levels (Janzen and Carter, 2013; Bertram-Huemmer and Kraehnert, 2015; Morsink et al., 2016). These insurance impacts depend, however, on reliable mechanisms, swift payouts and adequate use of funds, once received, by the insured.

In the case of index insurance, recent evidence has begun to demonstrate the positive effects of insurance payouts on expenditure and consumption patterns after a disaster (see, for example, Bertram-Huemmer and Kraehnert, 2015;

de Janvry et al., 2016), though these have not been found in all contexts and may not generally hold for small scale, unsubsidised, retail crop insurance (Tobacman et al., 2017) (Box 3).

Nevertheless, there is still limited evidence on the reliability of protection offered by index-based crop or livestock insurance (see section 5.4 on costs and potential adverse effects), and the compensation effect faces some key challenges, including the following, which may explain the low demand and uptake in the poorest areas (Carter et al., 2016):

- Premium prices are on average 150% higher than the actuarially fair price⁹ – the willingness to pay for insurance, however, often remains well below this price, as is the case for instance with IBLI contracts in developing countries (Carter et al., 2016).
- Basis risk reduces the reliability of insurance mechanisms and can therefore represent a caveat for take-up.

There is no guarantee that index-based insurance will effectively compensate losses because of basis risk (Box 2). On the contrary, this can present new risks to the insurer (resulting in over-payout when the index triggers despite no or low actual losses) and to the insured (resulting in under-payout when the index does not trigger, even though the client has experienced significant losses) (see section 5.4). Careful calibration and development can reduce basis risk and dedicated funds can help manage it. Nevertheless, basis risk remains inherent to index-based insurance products, and a lack of localised weather observations and limited capacities in many developing countries can reinforce it. Very few schemes appear to have effective funds or mechanisms in place to sustainably manage basis risk. Hence, comprehensive evidence on how well they work to support first dividend benefits is missing.

2.3. Smoothing national and regional expenditures and reducing ex post emergency spending

National or regional insurance schemes contribute to the first dividend by reducing public expenditure losses, allowing governments to respond to disasters using insurance payouts instead of allocating emergency budget. Macro-level schemes also aim to release funds in a faster and more transparent way than most international assistance, thus increasing the effectiveness of emergency response (Talbot et al., 2017) and reducing the macroeconomic cost of disasters.

Regional schemes such as the CCRIF, the African Risk Capacity (ARC) or the Pacific regional pilot risk transfer mechanism can support smoothing of national budget expenditures and reduce emergency spending (Baur and Parker, 2015; Joyette et al., 2015), although little detail is provided on the specific mechanisms and effects of this and their overall financial impact is difficult to quantify. By estimating the impact of FONDEN disaster funds on the economy, de Janvry et al. (2015), for instance, demonstrate that access to these funds increases local economic activity by as much as 2.57% one year after a disaster. However, the specific channel of the insurance impact cannot be disentangled in the analysis. The benefits of FONDEN for economic activity may follow from both the compensation of disaster-related losses (first dividend) and households' and local government's reallocation of resources from inefficient coping strategies to productive activities enabled by the insurance scheme (second dividend).¹⁰

Furthermore, the positive impact on expenditures can be reduced or inverted in practice, when insurance design and calibration are inadequate or flawed (Reeves, 2017). Assessing the impacts of such schemes and looking beyond budget benefits – for instance, analysing what payouts to sovereigns can help achieve at the micro level – is complex. Rigorous monitoring and evaluation processes and transparency of data and processes are crucial in this regard.

Microinsurance can also have an impact on the need for national or international emergency expenditures if coverage is wide enough. While empirical research to assess this and a quantification of the effect are limited to date, some anecdotal evidence highlights its potential impact. For example, IBLI has been described as bringing about a 33% reduction of food aid required in northern Kenya in 2014 (Castillo et al., 2016).

9 The price that is fair given the probability that a risk occurs.

10 For this specific study, it is assumed that the effect through the latter channel will occur with delay and, as such, it is not captured by the research (de Janvry et al., 2015).

3. The second dividend of resilience – is disaster risk insurance contributing to unlocking economic potential?

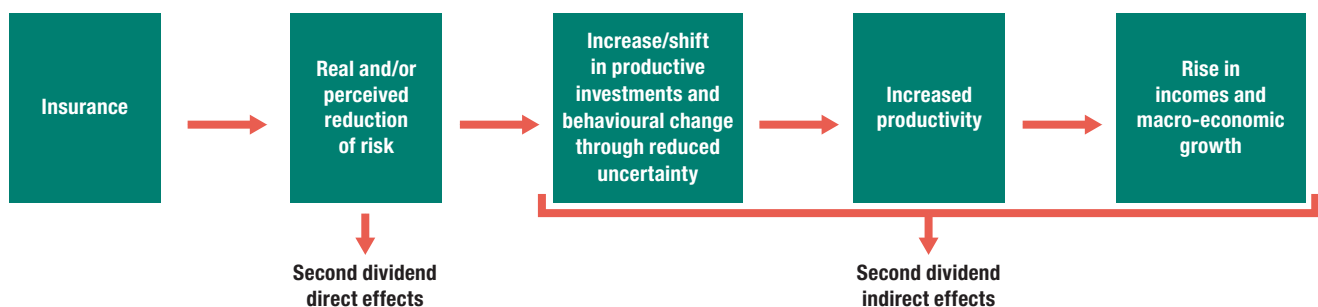
The second dividend is achieved by unlocking economic potential through the actual or perceived reduction of disaster risk, independent of whether a shock occurs.

Although there is a strong theoretical case for this relationship, the reviewed evidence is inconclusive as to whether insurance actually supports disaster risk reduction activities, especially in developing countries. On driving economic growth, literature implies that the transfer of risks through insurance can reduce uncertainty and stimulate investment, for instance in agriculture. This, in turn, can boost productivity and result in welfare gains and macroeconomic growth. Whether sovereign disaster risk insurance also results in an intensification and diversification of public investments is empirically less well established in developing countries.

Evidence on the second dividend suggests that disaster risk insurance can have micro- and macroeconomic development impacts, enhancing income growth and investment decisions even in the absence of disasters or shocks. These indirect impacts of insurance are largely explained by changes in how people perceive and manage risk. Such changes follow on from action taken to reduce risk that is incentivised or caused by insurance, as well

as from the experience or anticipation that certain pre-determined losses will be compensated by insurance when disaster strikes, which lowers perceived risk and reduces uncertainty. The transfer of risks through insurance can incentivise individuals, households or enterprises to engage in higher returns but riskier investments, thus contributing to increased productivity (Brainard, 2007).

Figure 3. How insurance may contribute to unlocking the second dividend of resilience



Source: authors' own.

The following sub-sections discuss the different direct and indirect impacts from disaster risk insurance outlined in Figure 3. The potential direct and ex ante effect of insurance to increase disaster risk reduction (DRR) is highlighted in theoretical and conceptual literature, but evidence on whether and how this is achieved in practice is lacking for developing countries. The contribution of insurance to reducing uncertainty with related indirect effects on macro- and microeconomic investment decisions has recently gained more attention, especially in the literature on agricultural risk management and development, though many studies focus on shorter-term impacts. In addition, the ways in which insurance may influence macroeconomic decision-making and whether it drives diversification of public investments is a subject of debate and is overall empirically understudied. Whether insurance can contribute to behavioural change and unlock economic potential depends on the reliability of the schemes and the reduced uncertainty perceived by policy holders.

3.1. Insurance impacts on disaster risk reduction

The link between insurance and DRR is often highlighted in the conceptual literature on disaster risk insurance.¹¹ There are various mechanisms by which insurance has the potential to incentivise DRR (Warner et al., 2009), including:

1. the provision of information and an increase in risk awareness
2. premiums that are based on risk levels, which would reduce premiums when risk is reduced and thus make DRR more attractive
3. insurance regulation that incentivises good practices and enables risk reduction

4. direct DRR financing provided through insurers in the form of loans or investment and
5. introducing DRR as a pre-condition to insurance coverage.

Through risk-based premiums, ‘insurance puts a price tag on risk’ (Baur and Parker, 2015). This price tag may incentivise investment in DRR as it unveils the actual costs of a certain risk that are reflected in the insurance premium. In turn, investment in DRR may keep insurance affordable through the risk-based pricing mechanism, i.e. by adjusting premiums according to actual risk levels, which would be reduced as a result of effective DRR. Insurance can be explicit in incentivising DRR – for instance, offering premium discounts for flood insurance policies that become effective when policy holders modify buildings to reduce flood risk (Chambwera et al., 2014). The relationship between insurance and DRR is therefore, according to Baur and Parker (2015), a mutually reinforcing one that is based on price incentives. Another potential way for insurance to support DRR is through the use of tools and information to guide decision-making for adaptation and risk reduction (see section 4 on the third dividend of resilience).

Systematic evidence on the links between insurance and DRR in developing countries remains scarce, which is likely related to the fact that risk-based pricing is difficult to implement and there are not many experiences to study yet (Keating et al., 2014). More worrying still is the potential for insurance to undermine DRR or increase maladaptation (Cutter et al., 2012), for instance, when the insured feel a ‘false’ sense of security or when insurance reduces the perceived urgency of managing disaster risks more broadly (Surminski, 2014).

The specific mechanisms of the relationship between insurance and DRR, and the enabling conditions for their successful integration in different developing country contexts, thus need greater underpinning from best practices and empirical studies.

Box 4. The missing links between insurance and DRR

Surminski and Oramas-Dorta (2014) review and assess 27 flood insurance schemes, mostly from the agricultural sector, focusing on the linkages between financial risk transfer and risk reduction and drawing on a pool of 123 risk transfer studies. They highlight that only a minority of schemes show any link between risk transfer and risk reduction. The paper considers this as a ‘missed opportunity’ in addressing climate-related risks.

One positive example where this relationship has been observed comes from an index-based insurance instrument linked to a forecast of imminent flooding in Peru from El Niño. This type of contingent insurance gives the opportunity to the insured to use the payout for preventive measures, such as strengthening the resilience of transport infrastructure or stocking up on savings to prepare financially for shocks.

¹¹ This working paper uses the UNISDR definition of DRR: ‘Disaster risk reduction is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development. Annotation: Disaster risk reduction is the policy objective of disaster risk management, and its goals and objectives are defined in disaster risk reduction strategies and plans’ (UNISDR terminology from: <https://www.unisdr.org/we/inform/terminology>, accessed on 08 May 2017).

3.2. Microeconomic impacts of insurance on individual and household investment behaviour and income growth

A central aspect of the second dividend is that DRM investment (in this case, insurance) increases agricultural productivity by incentivising individuals, households or enterprises to engage in riskier behaviour, even in the absence of a disaster or a shock (Tanner et al., 2015). Agricultural microinsurance, for instance, is expected to enhance risk management, increase productivity and, consequently, drive income growth and development at the individual and macroeconomic level (Castillo et al., 2016).

Index insurance, for example, has the potential to help farmers escape from poverty traps (Barnett et al., 2008), based on the assumption that farmers, who are risk-averse, invest less in risky agricultural practices, and so are less productive. If they can transfer some of their livelihood risks and increase access to credit through insurance, this stimulates (riskier) investment and, as a consequence, increases productivity. Two contrasting forces for driving risk-based investment are common in developing countries. On the one hand, uncertainty over investment returns discourages farmers to invest; on the other, the presence of risk generates extra investment as a precautionary measure. Therefore, any insurance impact on farmers' investment depends on which of these two forces prevail (de Nicola, 2015).

Box 5. Insurance driving agricultural investments in the absence of disasters

Offering index insurance contracts to cotton farmers in Mali increased the area dedicated to cotton production by 15% and increased the expenditure on seeds per hectare by 14% for these farmers (Elabed and Carter, 2015). Households that 'felt insured' by this scheme significantly heightened cotton production areas, input expenditures and land ownership, thus showing riskier behaviours. Furthermore, the findings from the interim impact evaluation (2013-2015) of the R4 Rural Resilience Initiative show that households with insurance, on average, spent more on agriculture inputs than those without insurance. This is related to farmers tending to feel more confident investing in agricultural inputs when protected by insurance (World Food Programme and Oxfam, 2016).*

* R4 is a strategic partnership between Oxfam and the World Food Programme (WFP). It aims to respond to the challenges faced by food-insecure communities in the context of increasing frequency and intensity of climate disasters and other shocks. The programme's four main risk management components are: (i) risk reduction (improved resource management through asset creation); (ii) risk transfer (insurance); (iii) prudent risk-taking (livelihood diversification and microcredit); and (iv) risk reserves (savings) (World Food Programme and Oxfam, 2016).

One of the indicators which insurance coverage appears to influence positively is the surface area that a farmer dedicates to agricultural production (see, for example, de Janvry et al., 2016). This effect is not only realised after an insurance payout, but also materialises when producers are confident of being covered if a disaster occurs in the future.

In these cases, the perceived reliability of the insurance scheme – rather than actual payouts – drives behavioural change and productive investment.

The examples in Box 5 indicate that insurance also entails a subjective benefit (further analysed as a third dividend in section 5.3), which gives people a feeling of protection that is somewhat more abstract, but still highly interlinked with the more tangible benefit of increased productivity due to its influence supporting riskier behaviour. These benefits for productivity have been equally well documented by empirical literature (see Box

Box 6. Increases in agricultural productivity and welfare outcomes related to disaster risk insurance at the micro level

In Mexico, index weather risk insurance increased cash crop productivity by 8%, on average, due to crop diversification (Fuchs and Wolff, 2011b). In China, a pig microinsurance scheme showed positive impacts on production (Zhang et al., 2016). Similarly, insurance provision in India induces farmers, particularly those who are educated, to shift production towards higher-return but higher-risk cash crops. Among the various uses of the insurance payouts were purchase of inputs for the winter season, immediate consumption and, interestingly, 36% of funds received were saved or used for debt relief (Cole et al., 2014). This example highlights that insurance can have particularly beneficial effects in areas where education levels are higher.

In the Sahel and other poor African countries, findings on increased agricultural productivity are also linked to reduced food insecurity. Crop insurance in Burkina Faso enables farmers to take higher risks by purchasing more fertilisers. Those who purchase insurance in the example realised, on average, higher yields and were better able to manage food insecurity and shocks than those who did not purchase it (Delavallade et al., 2015). In South Niger, an index drought insurance scheme for millet growers achieved similar results (Leblois and Quirion, 2011) and riskier investments as a result of crop insurance take-up have also been observed in Ghana (Karlan et al., 2012) and China (Cai et al., 2009).

Among herders in northern Kenya, a satellite-based index contract that measures the level of natural pasture available reduced sales of livestock and significantly stabilised consumption (Janzen and Carter, 2013).

6). Enhanced agricultural productivity is particularly noted in emerging markets such as Mexico, India and China.

Despite all of the examples, however, the strength of the relationship between insurance and agricultural production and its relative importance as compared to other mechanisms for managing risks and driving economic growth is not uniformly confirmed. In the cotton sector in northern Cameroon, for instance, the potential benefit that cotton farmers could gain from an insurance scheme was found to be lower than the benefits from using other financial instruments to protect themselves against price fluctuations currently provided by the national cotton company (Leblois et al., 2014). At the same time, insurance could increase productivity in the long run by incentivising the use of riskier but more productive technologies. This exemplifies the importance of considering alternative investments alongside insurance and of taking longer-term impacts into account.

The effectiveness of insurance schemes seems to depend, among other things, on income levels. The most significant outcomes from microinsurance on crop productivity, for instance, generally appear to occur in middle-income countries (Fuchs and Wolff, 2011b). Farmers seem to benefit differently from insurance mechanisms depending on their respective levels of wealth. While most farmers may be better off as a result of index insurance provision compared to credit or savings, this does not necessarily hold true in the long term (where savings can be more beneficial, especially for the wealthy).¹² Nor is it true for extremely poor farmers who achieve greater benefits from credit provision than from savings or unsubsidised insurance when they have to pay an actuarially unfair premium (de Nicola, 2015). This difference may be closely related to the sensitivity of insurance net benefits to premium pricing. Farmers in developing countries often have restrictive amounts of cash and are therefore more sensitive to any discounts from which they could benefit. Evidence from different contexts suggests that insurance take-up is often positively related to wealth (de Bock and Gelade, 2012; Bertram-Huemmer and Kraehnert, 2015). This supports the conclusion that the potential for benefiting from insurance at the micro level is dependent on household characteristics, with wealthier individuals or households needing less support to access and benefit from insurance than poorer ones (Schaefer and Waters, 2016).

Indeed, the type and magnitude of overall microinsurance impact appears highly dependent on which income groups the insurance targets. Positive effects are noted across groups that are not at risk of falling into the poverty trap, as it helps them to stay out of it and to maintain a certain level of income growth. However, the

poorest of the poor rarely benefit from this effect, as they cannot afford to pay an insurance premium. For insurance schemes to be useful in unlocking economic potential for these groups, they need to be supported through subsidies, integrated within broader disaster risk management and development strategies, or complemented by programmes aimed at expanding access to credit (Schaefer and Waters, 2016; Chantarat et al., 2017) (see section 6 on integrated approaches to risk management).

3.3. Public investment decisions

The potential to unlock economic growth through insurance appears to be strong with respect to changes in financial risk perception, and through extended planning horizons (Tanner et al., 2015). Insurance also supports the protection of public assets, enhances contingency planning (for example, by making contingency planning a precondition to access insurance) and frees up assets at the national level by reducing uncertainty. Thus, along with other fiscal DRM measures, insurance is ‘providing the grounds for synergistic investments into various sectors at the same time’ (Mechler et al., 2016: 32). In addition, insurance can reduce the likelihood of defaults, thereby relaxing a country’s borrowing constraints and enhancing its access to capital markets – although the presence of multilateral lenders providing inexpensive reconstruction funds in the aftermath of a disaster weakens (but does not eliminate) the demand for catalytic insurance (Cordella and Levy-Yeyati, 2015). Evidence on the effectiveness of these mechanisms and the conditions under which they can reach full potential to drive public investments is, however, largely lacking.

3.4. Macroeconomic growth impacts

Insurance has the potential to support macroeconomic growth through a number of mechanisms:

- Insurance can free up funds for investment that would otherwise have been used as reserves.
- Insurance, assuming that it is reliable, can reduce the risk of defaulting on credit because of disasters. This, in turn, brings down interest rates and advances an efficient financial system.
- (Re)insurance can stabilise the economic system as well as individual income, thus increasing disaster resilience.
- Insurance can redistribute risks over time and across people, potentially reducing the divide of unequal impacts from disasters¹³ (Kessler et al., 2016).

12 In her modelling exercise, de Nicola (2016) assumes that welfare benefits from savings increase over time, while the magnitude of credit and insurance welfare benefits decrease over time. This is because credit and insurance lead to an increase in consumption and cause a decline in ‘precautionary investment in riskless return-free assets’ (p. 16), a common practice where financial markets are absent.

13 Though others argue that insurance, instead, may increase inequalities, as discussed in section 5.

The use of insurance¹⁴ and national income are generally closely correlated across countries (Lester, 2014). Causality between both factors, however, has been less researched and is not as straightforward to establish as correlation. Most papers discussed in this review agree that country-specific conditions, and in particular (as noted), income levels, can influence the ability of the insurance sector to contribute to economic growth. While risk perception differs between individuals, mandatory catastrophe insurance for countries with actuarial pricing may improve overall welfare (Jaffee and Russel, 2013; Lester, 2014).

Empirical approaches to testing aggregated welfare benefits from insurance in the absence of a disaster are still limited, however, and have only recently received more attention. The potential distortion from aid flows in assessing disaster and insurance impacts in low-income countries has been one complicating factor, prompting some authors to focus such assessments on high- and middle-income countries (Lester, 2014).

Overall, evidence suggests that insurance can have second dividend impacts, observed through changes in how people or institutions perceive and manage risk. This can result in riskier behaviour, can in turn lead to higher investment, and can eventually contribute to increased incomes and macroeconomic growth. These attitudes are manifested independently from receiving an actual payout, although there is some evidence to indicate that past experience of reliable payouts, either personally or vicariously, reinforces the effect (Cai, 2012). The impacts of macro-level disaster risk insurance on stimulating public and private investments and on supporting economic activities at all scales, however, are less well studied and require further empirical support.

14 The insurance schemes included in Lester's (2014) review of impacts on growth are not limited to disaster risk insurance, but also entail life and other non-life insurance types.

4. The third dividend of resilience – is disaster risk insurance generating development co-benefits?

The third dividend is the achievement of additional co-benefits through DRM measures, irrespective of whether a disaster strikes.

Research on insurance benefits under the third dividend is mainly limited to social co-benefits, but implies some positive effects from disaster risk insurance on voter behaviour, political transparency and accountability, and subjective wellbeing. The latter is demonstrated especially in the form of socio-psychological benefits from the ‘peace of mind’ that insurance can provide to policy holders. Positive impacts from insurance for strengthening risk-sensitive policy and planning at government level are expected, but how these work out and are best realised in practice is not well documented in the literature.

There are few theoretical or conceptual studies on specific ecological, social and economic co-benefits related to insurance. However, some innovative empirical studies explore social co-benefits emerging from insurance, or risk transfer more generally, focusing on two broad effects: (i) the influence of insurance mechanisms on political accountability and voter behaviour; and (ii) socio-psychological support resulting from insurance. While this existing research outlines some social co-benefits from investing in insurance, there is less of a focus on either economic benefits beyond stimulating investment through risk taking (second dividend) or environmental co-benefits.

4.1. Socio-psychological support and subjective

Some innovative studies look beyond income and consumption to assess insurance co-benefits such as the socio-psychological support and ‘peace of mind’ that microinsurance offers to buyers (Tafere et al., 2015). As outlined in section 2, this can stimulate greater investment in productive activities (a second dividend benefit). In

addition, this peace of mind can have intrinsic value for risk-averse clients by enhancing their subjective wellbeing (Tafere et al., 2015). However, there is debate in the literature on insurance take-up over whether someone who is generally risk-averse will perceive insurance as a reliable mechanism to manage disaster-related risks or will experience greater risk aversion towards the insurance product, especially when (index) insurance is a new approach and trust in the product or the insurance provider is low (de Bock and Gelade, 2012).

In a study of the socioeconomic effects of microfinance services (including microinsurance schemes, as well as savings, credits, payment services, money transfers and social intermediation) among women in Kenya, insurance is found to enable women to build stronger relationships of trust, create more social networks and increase participation in development activities (Kireti and Sakwa, 2014). It is not clear whether these results were dependent on women being recipients of the other microfinance services, and caution is recommended in attributing increased trust to the provision of insurance alone. Nevertheless, the papers reviewed hint at a potential

connection between disaster risk insurance and subjective wellbeing that has not yet been well explored in the literature.

4.2. Political accountability/support

Another potential insurance co-benefit is related to political cycles. There is little research on this relationship, especially in developing countries, but a few recent studies highlight the direct effects of insurance schemes on political accountability, transparency and voter support.

Insurance payouts after a disaster can have an impact on voters and confidence in government. The discussion of a connection between disaster relief payouts and voter behaviour here is limited to those disaster relief mechanisms that are linked with insurance schemes. It is acknowledged, however, that this effect may apply to disaster response more generally, irrespective of its connection with insurance.¹⁵

Payouts after Hurricane Wilma in 2005, for instance, influenced voting behaviour in the Mexican presidential elections of 2006 (Fuchs and Rodriguez-Chamussy, 2014). Specifically, voter support for the incumbent party was greater in those areas that had experienced indemnity payments before the election. This was caused by voters switching parties, rather than being a result of higher turnout in those areas. This effect of insurance-backed disaster relief mechanisms on election results can represent a benefit to the incumbent political party and reward adequate reaction to disasters because insurance payouts are passed on to citizens through public channels. However, it may also contribute to overspending on disaster response at the expense of risk reduction, which is less visible, and therefore less appreciated by voters (Clarke and Dercon, 2016).

FONDEN has created somewhat greater financial discipline in politicians, improving commitment to – and more transparent management of – disaster risk financing in Mexico. This change has been prompted politically: Mexican voters punish politicians in power when disasters occur during election years. Local and national governments are also more likely to declare disasters in election years in order to release recovery funds and to increase voter support. Parametric thresholds, considered as relatively objective and independent measures to determine whether a disaster has occurred, are expected to help discipline politicians, because the release of funds is then bound to a physical trigger mechanism rather

than being influenced by political strategising. However, some disaster events are not tied to a physical threshold in FONDEN, for instance when technical capacities at a local level are missing. An increase in the number of non-threshold as compared to threshold disaster events that municipalities declare in election years implies that this may undermine the disciplining effect, because governments can shift to declaring non-threshold events when it is politically beneficial to them (Boudreau, 2016; World Bank, 2016a).

The political effects of insurance discussed in this working paper are mainly related to the actual occurrence of a disaster. It remains unclear whether voter support also increases, remains the same, or even decreases through insurance. The latter may be the case especially over longer periods of time without any disaster occurrence, where premiums continue to be paid but voters do not receive immediate returns.

4.3. Planning and decision-making

Insurance may guide decision-making for DRR and adaptation more generally, beyond the specific risk it covers, through tools and information developed in the insurance context. Risk planning that entails financial instruments such as insurance can help identify risks and integrate a variety of key actors for risk management from the private and public sector (Mechler et al., 2016). Actuarial information that is used to assess risk in insurance schemes can provide important information on risk levels more broadly. In this sense, insurance agents may take on another function as ‘risk messengers’ (Rose, 2016), communicating risk information to policy holders at different scales. In addition, public actors and NGOs can enhance the cost-effectiveness of their disaster response by learning from the insurance industry (Clarke and Dercon, 2016). Through assessing their contingent liabilities in advance, overall disaster financing needs can be better understood and addressed. While practical experience and research around this are still in their early stages in developing countries, and the way in which insurance can inform planning and decision-making is not discussed or analysed more specifically in the literature on agricultural insurance, a hypothetical example exploring the use of insurance modelling tools for adaptation decision-making in the built environment (Walker et al., 2016) implies potential co-benefits could emerge from this relationship and highlights the need for further empirical investigation in other sectors.

¹⁵ For a brief summary of this argument and examples, see Clarke and Dercon (2016).

5. Costs and potential adverse effects of disaster risk insurance

The triple dividend framework recognises that DRM measures not only provide benefits, but could also produce adverse effects and costs. These need to be taken into account, along with the benefits, to better understand the net effects and potential disadvantages of investing in DRM measures. While it is not intended to represent a comprehensive cost-benefit analysis, this working paper aims to highlight costs and adverse effects, as these can emerge from DRM investments, including insurance development and implementation, in addition to benefits (see the triple dividend framework in Figure 6, Annex 4).

Insurance produces several (co-)costs and trade-offs, both in absolute terms and in comparison with other financial mechanisms for managing disaster risk. While some of them are related to insurance generally, other costs and adverse effects are highly dependent on the specific type of insurance, distinguishing between indemnity insurance and index-based insurance.

5.1. Costs and trade-offs depend on the specific type of insurance

Indemnity insurance: moral hazard and adverse selection. Because indemnity insurance is based on individual claims, which are subjective and need to be verified, this implies transaction costs (Chantarat et al., 2017). For example, individuals might claim for losses that have not – or have only partly – occurred, representing a moral hazard. Where purchasing insurance is a voluntary option, it can create adverse selection, whereby only those likely to claim are prepared to buy the insurance, thus increasing the cost of the premium.

Index insurance: basis risk. Index insurance considers yield, rainfall or satellite/vegetation indices as proxies for determining the impacts of a shock, therefore reducing the risks and related costs identified above for indemnity insurance. However, index insurance includes a remaining uninsured basis risk; in the case of agricultural insurance, this means that ‘a farmer or herder may encounter losses when the index does not trigger, or that the index may

trigger when she does not have any loss’ (Carter et al., 2016: 17). A number of studies show that this risk has prevented the most risk-averse households from purchasing index insurance products because the risk of not receiving a payout after having purchased the premium would place the household in a worse situation than not having insurance in the first place (Woodard and Garcia, 2008, cited in Chantarat et al., 2017; Clarke 2011, cited in Carter et al., 2016; Jensen et al., 2014). Others find that basis risk can have ‘detrimental poverty impacts’ when insurance does not pay out where it should have, and can therefore present significant costs to the insured (Jensen et al., 2014; Morsink et al., 2016).

Clearly defining and assessing basis risk is crucial for evaluating the reliability of the index and, consequently, for determining any costs and benefits related to it. The assessments of costs incurred by a specific insurance scheme, however, can be rendered more difficult if the underlying model of an insurance trigger is complex and not transparent (Reeves, 2017).

5.2. Opportunity costs of insurance development, implementation and use

Premium payment. The decision to pay a premium, at all scale levels, is taken with the expectation that this cost will guarantee a payout when losses that are covered by the insurance policy materialise. However, in the context of climate change, where predicting when and how losses will manifest is extremely challenging, this becomes an even harder decision to take. Climate change may drive losses to a level where they become too frequent, too costly or too unpredictable to insure (Dulal and Shahm, 2014; Miller and Swann, 2016). Ensuring that the premium price is actuarially fair is therefore an extremely difficult but crucial task. Given the low level of financial resources at their disposal, opportunity costs for paying premiums are particularly high for low-income individuals, households and governments (Schaefer and Waters, 2016). When the reliability of a scheme is uncertain – for instance, due to defects, delays or basis risk of index-based triggers

– (opportunity) costs related to investing in insurance may thus become even greater, especially when the policy holder is risk-averse and lacks trust in the insurance mechanism.

Alternative investments to developing insurance schemes and subsidising premiums. Concerning premium payments by individuals or households, an important point raised in the literature (see, for instance, World Bank 2016b) is the need to assess the opportunity costs to governments or donors of subsidising insurance. There is a risk that, in the credit-constrained context of many developing countries, premium payment for sovereign schemes or national government subsidies to micro- or meso-level disaster risk insurance get diverted from other sectors or projects to which the government might otherwise have allocated funding. This can concern, for example, national DRR funding, adaptation measures or alternative social safety nets. In this context, cost-benefit analyses can help support government choices for a DRM investment portfolio. In comparison with hard infrastructure investments to reduce typhoon disaster risk in Shenzhen, China, for instance, premium subsidies were found to be more cost-effective. Subsidies, however, have limitations in terms of cost: some evidence indicates that, at up to 80%, the subsidisation becomes ineffective. At a sufficiently high level, the effect of premium subsidies has diminishing margins, while the cost is marginally increasing (Ye et al., 2016). Some hazard risks are better suited for direct insurance through private markets than others (Sandmark et al., 2013; Lester, 2014). Broader revenue or yield-based insurance coverage, for instance, tends to be subsidised in developing and industrial countries. Subsidies then become a trade-off between the fiscal costs of providing this support to premiums versus investing in other activities. In theory, this should be a short-term trade-off, as subsidies are a mechanism to support initial market development and are not necessarily intended for the longer term. Insurance subsidies ideally help a scheme to reach scale, which is expected to increase administrative efficiency and risk diversification, and eventually decrease premium rates over time. However, this mechanism is limited with low-income households (Vivid Economics et al., 2016), who may not have sufficient financial resources to pay even lower premiums and face higher opportunity costs. Furthermore, persistently high subsidies in the US (Sandmark et al., 2013) indicate that the trade-off can also be longer term in higher-income contexts.

Overall, subsidies can be an effective way to support low-income governments and households in accessing insurance products (Vivid Economics et al., 2016). When directed at microinsurance premiums, they can reduce costs from climate change for farmers, especially in highly vulnerable and exposed areas. However, literature on index

insurance subsidies so far lacks empirical evidence on the size of private and social insurance benefits, which could help advise when public investment in insurance could generate positive net returns (Hess and Hazell, 2016).

This is also a broader concern beyond microinsurance, as little data and evidence exist to date to determine premium subsidy impacts (Vivid Economics et al., 2016). Subsidies to sovereign disaster risk insurance, for instance through bilateral channels or by international donors, can provide an additional incentive for governments to take out insurance. Though low-income countries face budget constraints and are confronted with a great variety of alternative investment choices, they usually also have different options to finance sovereign disaster risk insurance premiums, for instance through increasing deficits or taxes. A national government's decision to use sovereign insurance, however, is greatly shaped by political priorities. Where insurance promises to be effective and evidence indicates that governments choose not to prioritise premium payment, subsidies may be justified to encourage sovereign insurance take-up (Vivid Economics et al., 2016).

Considerations around opportunity costs and comparative advantages should also take into account potential alternative strategies for managing risk as compared to investing in the development of an insurance scheme in the first place.¹⁶ The World Bank (2016b), for example, compares insurance with other risk financing mechanisms. It shows that the comparative advantage of insurance is dependent on a number of factors including the budget of the government, the types of shocks, the country's aversion to risk and the return rate. In general, insurance appears more cost-effective when national budget is limited as it results in an overall cheaper strategy than the post-disaster debt finance costs. Potential alternative investments are not limited to risk management, however, and equally include adaptation or mitigation measures which may be a more cost-effective way to strengthen resilience in some cases.¹⁷

16 For an overview of how to capture economic opportunity costs of different sovereign disaster risk financing strategies, see Clarke and Poulter (2014).

17 The Economics of Climate Adaptation working group, for instance, exemplifies how to support policy-making to effectively strengthen climate resilience through the use of cost curves that quantify benefits for different adaptation and risk management measures (Economics of Climate Adaptation, 2009).

5.3. Insurance crowding in versus crowding out other/informal risk-sharing

Additional co-costs from investing in the development and implementation of insurance schemes can emerge when insurance negatively affects other, often informal, risk sharing mechanisms of a policy holder or its wider community. Insurance may crowd in (meaning attract or facilitate additional risk sharing) or crowd out, i.e. undermine or erode alternative risk sharing structures).

Crowding in. By providing protection against aggregate shocks, index insurance can complement informal risk sharing arrangements and thereby improve farmers' ability to smooth consumption after such shocks (Mobarak and Rosenzweig, 2012). In Ethiopia, for instance, IBLI insurance may crowd in mechanisms of informal risk-sharing (Takahashi et al., 2017). In addition, the presence of basis risk in index insurance has attracted such informal mechanisms, implying the potential of risk indices to crowd in risk sharing (Dercon et al., 2014). This means that the transfer of one risk (in this case, rainfall variability) introduces another risk (basis risk); the limitations of the index insurance mechanism become the trigger for establishing further risk management structures.

Crowding out. Conversely, formal insurance can undermine or crowd out other risk management mechanisms (Cai, 2013), for instance by eroding adaptive strategies of diversifying agricultural production and instead driving mono-culture (Fuchs and Wolff, 2011a). This does not have to be a negative welfare effect per se. However, it may have detrimental impacts on a farmer's resilience due to reliance on single crops and markets, negative environmental effects related to agricultural intensification, and basis risk – for instance, in a multi-hazard environment where only one peril is covered or when actual losses do not correspond to the index insurance payout (Morsink et al., 2016). In addition, where some people switch to formal insurance coverage, informal risk sharing may be weakened, leaving those who cannot afford to, or do not want to, purchase insurance coverage less well-off, and potentially reducing the effectiveness of these structures for other (idiosyncratic) risks (Dercon, 2002). Factors that can reinforce these costs may be the complexity of products, including the index design and operation, paired with technical 'non-performance', high costs and issues around (the lack of) consumer protection (Akter, 2012).

5.4. Equity

Benefits experienced from microinsurance coverage may vary according to a person's socioeconomic or demographic characteristics (see section 3). Similarly, there is a great diversity in the (opportunity) costs that different people may experience related to insurance. Limitations of insurance that exist more generally are especially problematic for the poorest households (Hallegatte et

al., 2017). At the same time, poorer people struggle more to pay insurance premiums than wealthier people do and insurance may be less cost-efficient for the poorest, as premium payments leave relatively fewer resources for investment and growth (see also the discussion of opportunity costs earlier in this section; Kovacevic and Pflug, 2010; Janzen et al., 2012; Schaefer and Waters, 2016). Ironically, consecutive 'good' years without a disaster experience and payouts, as well as the presence of basis risk or other reliability issues, can worsen this effect. Eventually, insurance intended to support poorer populations may then intensify existing inequalities over time through these relatively high costs and inefficiencies (Schaefer and Waters, 2016). These unequal benefits from insurance indicate that insurance may not always be the most appropriate and most sustainable risk management mechanism for a respective country or target group in comparison with other approaches such as investing in effective adaptation measures, informal savings schemes, social safety nets, or cash transfer programmes (Dulal and Shah, 2014; Reeves, 2017).

Premium subsidies or social security mechanisms, potentially backed up by insurance, can be a way to counteract the spiral of deepening inequalities due to high opportunity costs of insurance premiums to the poor (Hallegatte et al., 2017). At the macro level, budget allocations towards establishing sovereign risk transfer or subsidising insurance always entails trade-offs, given that governments' resources tend to be limited (see section on opportunity costs). What this implies for equity and social justice with regard to who is protected through which mechanisms from disaster impacts, however, has not been empirically established to a great extent. The political component of disaster risk insurance development, distribution and subsidisation, including implications for political power, representation or equity, has so far been a relatively understudied area (with two exceptions being Kunreuther, 2015 and Reeves, 2017).

5.5. Gender biases

In Senegal and Burkina Faso, female farmers were found to be less likely to purchase agricultural insurance and more likely to invest in savings for emergencies. Although men and women are both exposed to yield risk, women face additional lifecycle risks – particularly health risks associated with fertility and childcare – that men are less exposed to (Delavallade et al., 2015). This may contribute to their different use of risk management strategies and shows how, when designing insurance products, gender biases should also be taken into account to ensure women are not excluded from coverage or can draw on insurance schemes that are more tailored to their specific needs.

Several examples from Ethiopia, Kenya and India illustrate how working with women's groups, supporting premium payments and combining insurance with other

services can make insurance more accessible to women and result in benefits such as gains in productivity, or increased female participation in development activities (Kireti and Sakwa, 2014; ACT, 2016; World Food Programme and Oxfam, 2016).

However, the question of how to support these benefits sustainably for women remains. Insurance premiums in the insurance for work mechanism (as implemented in the R4 rural resilience programme), in effect, are donor-paid and it is unclear whether the introduction of monetary premiums may undermine insurance benefits for women-headed households, as well as poor households more generally, by re-establishing the financial barrier to take-up described by Delavallade et al. (2015).

5.6. Costs from insurer failure

Economic growth impacts from insurer failure are hardly documented in the literature, even though this can represent a key limitation of insurance in the economy (Kessler et al., 2016). Some anecdotal evidence from Jamaica in the late 1990s and from the Caribbean in the aftermath of the 2007/2009 liquidity crisis indicates how insurer failure, in combination with poor governance and risk management linked to banking systems, contributed to broader systemic failure (Lester, 2014).

Overall, these examples show the importance of analysing the effects of insurance not in an isolated way, but as part of a system where many factors are involved in order to better understand not only the benefits, but also the costs and adverse effects related to disaster risk insurance.

6. How to deploy disaster risk insurance in an effective way

Insurance clearly has a role to play in generating each of the three dividends. This working paper identifies examples of where insurance has contributed to achieving different resilience dividends. Mexico, for instance, emerges as a successful example of a country where insurance has contributed to resilience benefits across all three dividends. However, integrating disaster risk insurance within a broader DRM strategy, increasing its reliability and minimising its (co-)costs and adverse effects are crucial to enhance insurance contributions towards realising benefits across the three dividends.

The following sections discuss some of the key insights from existing evidence of insurance impacts presented above, detail the important conditions for supporting the three dividends through insurance, highlight knowledge gaps and outline ways forward for supporting effective, evidence-grounded disaster risk insurance implementation that take broader (co-)benefits as well as (co-)costs and potential adverse effects of such approaches into account.

6.1. Designing an insurance system to help achieve the three dividends

For insurance to contribute to unlocking resilience (co-)benefits, certain conditions need to be met: ‘Mechanisms matter [and] the design of products (including their prices, term structure, flexibility and marketing) affects adoption and usage – and ultimately economic and social impacts’ (Karlán and Morduch, 2009, cited in Lester, 2014: 14) (see also Annex 5).

Some important challenges in insurance design and options to address them should be considered to ensure that disaster risk insurance can effectively support the compensation of losses, help to avoid long-term disaster impacts, stimulate economic activity and generate co-benefits. This does not represent a comprehensive and exclusive list, but aims to summarise some of the key points highlighted in the literature. Context always influences the specific conditions that need to be considered

and requires the application of principles and guidelines for insurance design and implementation.

- **Reduce constraints and manage risks related to the insurance product.** Constraints and risks to traditional indemnity insurance (moral hazards and adverse selection) challenge the achievement of all three dividends, because they can lead to inefficiencies and limit the uptake of insurance (Fuchs and Wolff, 2011a; Castillo et al., 2016). Index-based insurance mechanisms help avoid these issues, but their reliability can be reduced by basis risk. Here, indicators, database improvements and better trigger mechanisms can support index insurance to increase their reliability (Fuchs and Wolff, 2011a; Castillo et al., 2016; Morsink et al., 2016). To address basis risk and reduce the ‘gamble’ of whether index insurance actually decreases risk (Jensen et al., 2014), a better understanding is needed also of the perceptions and impacts of basis risk and related insurance performance and reliability. Morsink et al. (2016), for instance, suggest a range of indicators that can be a starting point for assessing index insurance reliability under the constraints of basis risk. Mechanisms to manage remaining basis risk, for instance specifically dedicated funds, may lend further support, but so far very little is known about how well these work in practice.
- **Ensure swift release and support adequate use of payouts.** One of the most important factors influencing how well insurance can support the first dividend is the delay of payouts after a disaster. Compensating losses and mitigating longer-term negative disaster impacts relies on speedy payout. For example, a catastrophe risk insurance pilot implemented in the Pacific region supported rapid recovery after Cyclone Ian in 2014, when swift payment allowed the national governments of Tonga to meet the most urgent repair and reconstruction needs (Baur and Parker, 2015). The benefits of rapid payouts for alleviating suffering, decreasing livelihood losses and reducing development

setbacks applies to all scales (Balogun, 2014). At the same time, the way in which payouts are used by the recipient – irrespective of whether this is a national government, a cooperative, a business, an individual or any other entity – matters for whether insurance can help to compensate losses and mitigate longer-term negative disaster impacts. This may be facilitated through contingency planning (Clarke and Hill, 2013). Efficient use of payouts is considered in insurance evaluations and cost-benefit analyses, but the literature is limited on the cross-scale effects of this use.

- **Enhance trust and understanding through delivery channels.** For insurance contributions to all three dividends, trust in the insurance scheme and in the institution providing it are crucial. This is because trust influences demand and take-up¹⁸ and may also determine to what extent insurance can contribute to achieving the second dividend. This is because policy holders who do not trust that they are effectively and reliably covered, i.e. do not perceive reduced uncertainty, may not be prompted to invest more in productive activities (Elabed and Carter, 2015). Setting up effective delivery channels that integrate local organisations as intermediaries or endorsement by a trusted third party can be ways to address this challenge (Cole et al., 2013; Carter et al., 2014; Tadesse et al., 2015).
- **Increase collaboration.** The extent to which insurance can contribute to the second and third dividends by facilitating a mutually reinforcing relationship with DRR and supporting risk-sensitive policy-making and planning partially depends on close collaboration between governments and the insurer (Mahul and Stutley, 2010). Public–private partnerships (PPPs) can provide a platform to support such collaboration. The role of governments to support insurance implementation – for instance in the form of regulating insurance, managing weather stations or providing premium subsidies – through PPPs is often highlighted (Mahul and Stutley, 2010; Carter et al., 2014; Tadesse et al., 2015; Schaefer and Waters, 2016) and can strengthen insurance development and functioning. However, this often lacks a feedback loop, which would present the possibility of knowledge and tools from insurance experiences and actors to inform public planning and decision-making more broadly; it is thus missing out on potential third dividend co-benefits.

- **Assess and address the needs of the target group.** Targeting specific groups requires particular attention throughout insurance design and implementation to increase benefits across all three dividends. When exploring options for how to make the best use of insurance for the poorest and most vulnerable people, organisations or countries, for instance, considerations around accessibility, affordability, equity and effective, integrated social protection, risk management and adaptation play a crucial role.¹⁹ Gender-sensitive insurance approaches are also important for targeting women (Delavallade, 2015).

This exemplifies how the design of an insurance scheme and its implementation should be tailored to the context, as well as to the dividend(s) that policy-makers and programmers aim to realise.

6.2. Integrated approaches to disaster risk management and adaptation

Integrated approaches to risk management often combine (but are not limited to) various risk financing mechanisms and risk reduction activities. Informal risk sharing arrangements and other complementary risk management approaches, for instance, need to complement index insurance in order to manage basis risk (Jensen et al., 2014). Greater integration or bundling of insurance, credit, savings and social safety nets may, on the one hand, drive insurance take-up and, on the other hand, enhance risk management by covering a greater variety of risks beyond the high-impact and low-frequency events suitable for insurance coverage (Hallegatte et al., 2010; Akotey and Adjasi, 2014; Karim and Noy, 2015; Tadesse et al., 2015). Another means of integration can be a strategic use of the complementarities between public and private sector engagement in risk transfer (Swain and Patnaik, 2016).

Furthermore, greater consideration of climate change in insurance practice and research is required, as few studies so far have theoretically or empirically explored these connections in detail.²⁰ This will help to assess the viability of insurance approaches and their impacts in a more comprehensive way. Linking disaster risk insurance, and DRM investments more generally, with adaptation and mitigation efforts is necessary to support the sustainability of insurance (co)benefits and to minimise adverse effects.

18 For a summary of this argument and evidence, see de Bock and Gelade (2012).

19 For a suggestion of principles to make insurance work for the poor and vulnerable, see Bond Development and Environment Group (2016) and Schaefer and Waters (2016).

20 Examples are presented by Starominski-Uehara and Keskitalo (2016), outlining how the literature on natural hazard insurance talks about climate change; Dulal and Shah (2014), who discuss climate-smart social protection; Lamond and Penning-Rowsell (2014), who assess flood insurance robustness in the context of climate change through a global review of insurance models; and Phelan et al. (2011) in their critique of how insurance systems (not limited to disaster risk insurance) respond to climate change.

6.3. Counteracting measurement challenges

The first dividend is at the core of insurance impacts, as it aligns with the most basic function of insurance. The direct compensated losses and avoided negative economic impacts related to a disaster, however, are still challenging to assess (Hallegatte et al., 2010) and the extent to which insurance mitigates these losses remains difficult to measure, especially for indirect and longer-term impacts. International initiatives compiling databases on economic losses, such as CRED-EMDAT, Munich Re's NatCat SERVICE, Swiss Re's sigma or the Desinventar initiative, are useful starting points but there remains work to be done to homogenise processes of data collection and to strengthen direct and indirect loss assessments (Simonet et al., 2015; Wilkinson et al., 2017). Without a 'baseline' providing a clear assessment of disaster impacts, and considering the multidimensionality (health, economic, financial, assets) of disaster consequences, the reduced disaster impacts supported by insurance mechanisms remain complex to assess. The Sendai Framework for Disaster Risk Reduction for 2015-2030 includes the monitoring of direct and indirect disaster-related losses, although indicators aimed at tracking progress at the national and global levels are concentrated mostly around direct losses and damage. This monitoring mechanism should support a greater investment by governments in tracking and assessing indirect economic impacts and the effectiveness of policies and mechanisms, including insurance, to counteract them. Private insurance companies would be well situated to support or complement these assessments, as the characterisation of risk and impact is an essential step to calibrate a sustainable insurance policy.

6.4. Addressing the potential co-costs and adverse effects of insurance

Developing and subsidising insurance approaches can have significant opportunity costs, especially for the poor. Therefore, insurance needs to be considered in relation to potential alternatives. These may be, on the one hand, no insurance coverage and higher pressures on post-disaster relief and reconstruction funding; or, on the other hand, higher investments in alternative risk management mechanisms, risk reduction, climate change adaptation, mitigation or social safety nets at the macro level. At the micro level, immediate consumption and expenditure and investments in informal risk sharing may compete with premium payments, and more evidence is required on how insurance may contribute to either strengthening or undermining such mechanisms.

6.5. Incorporating ex ante and ex post benefits, as well as costs, in planning decisions

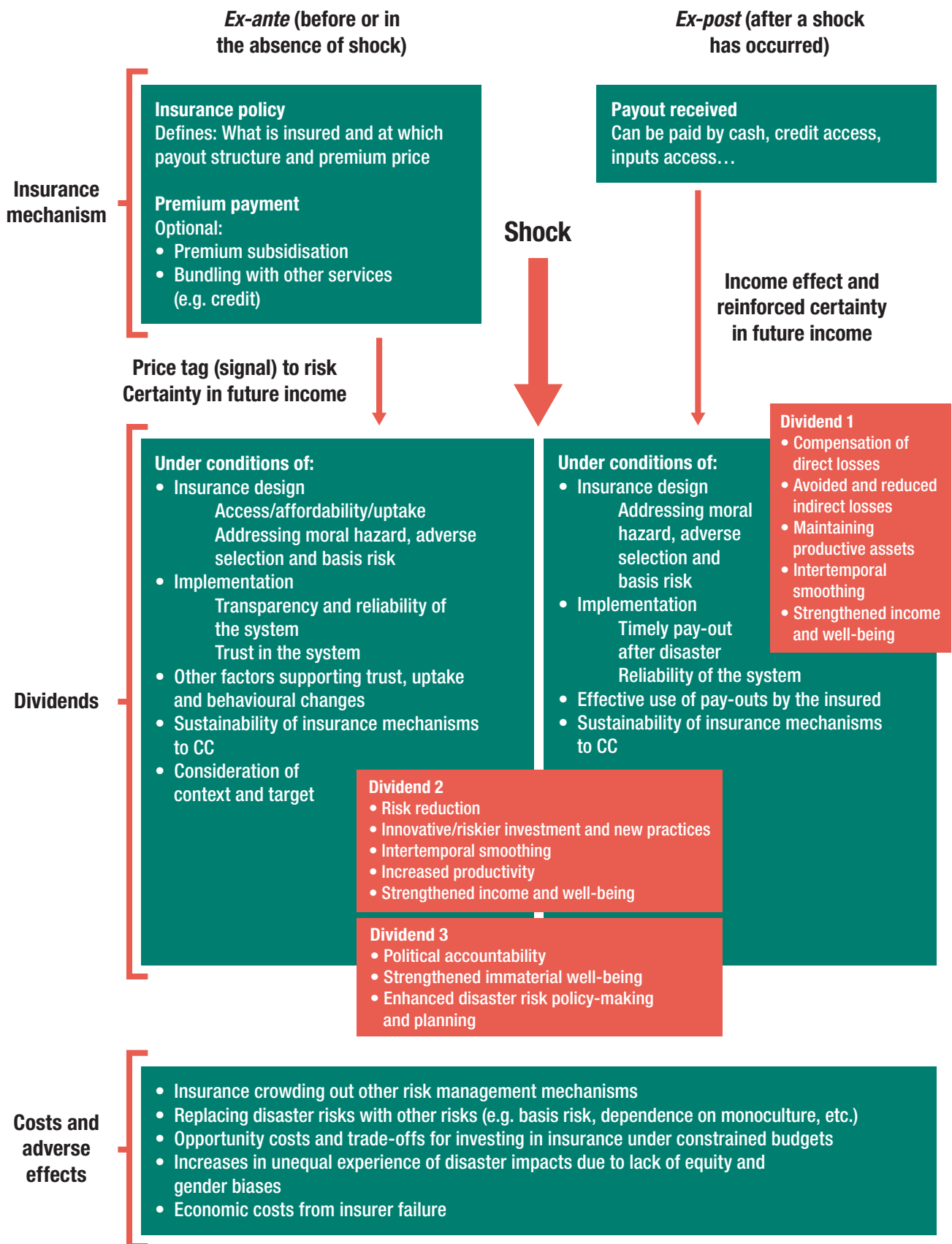
The triple dividend framework highlights resilience gains that can be achieved before, or in the absence of, disasters (ex ante), and those that materialise in response to an event (ex post). However, consideration of these benefits in DRM and adaptation planning decisions is still weak in many countries (Shiferaw et al., 2014).

Figure 4 presented in this working paper can be used as a tool to assess the full potential and pitfalls of insurance approaches and serve as a basis for application of the triple dividend framework to other DRM mechanisms. This schema intends to help improve planning and extend cost-benefit analysis to consider the full potential and pitfalls of insurance. It is flexible and can be adapted to accommodate additional aspects according to different institutional, geographic, economic, social, political and risk contexts. A next step in applying this schema to insurance policies, or to identify further research needs, is the definition of methodologies and indicators to comprehensively assess (co-)benefits and (co-)costs along the lines of the triple dividend framework.

6.6. Towards evidence-based disaster risk insurance

Throughout, this working paper has highlighted gaps in existing research and discussed contested impacts that require further investigation (see Annex 6 for a list of topics to inform a future research agenda). Addressing these evidence gaps should be supported to increase an understanding of what works for realising resilience (co-)benefits of investing in insurance. This entails close attention to costs and adverse effects, as well as to the enabling conditions and contexts that facilitate successful development, implementation and use of insurance at different scale. In addition, this review with its focus on developing countries should be complemented by evidence on insurance impacts from more established markets. Although these may include other products and operate in different contexts, valuable lessons can be learned from schemes that have operated for a longer time and inform the further development of effective disaster risk insurance globally.

Figure 4. Ex ante and ex post dividends supported by disaster risk insurance



Source: Authors' own

7. Conclusions

The triple dividend framework helps to shed light on how insurance mechanisms are sources of support to direct and indirect resilience benefits at different scales. Through payouts after a disaster, insurance can transfer and compensate for losses of various kinds (first dividend). By relaxing the budget constraint, insurance facilitates income-smoothing and supports investment decisions at the macro and micro levels, for instance related to the adoption of new technologies or specialisation in agriculture (second dividend). Finally, insurance is also a source of significant co-benefits by supporting greater institutional transparency or by contributing to the adoption of adaptive behaviours (third dividend).

Surprisingly, evidence focusing directly on the core function of insurance, i.e. reliably compensating for economic losses from disasters (first dividend), is less prevalent than expected. This is particularly concerning in the case of index insurance, where basis risk can introduce significant costs to the insured and/or the insurer that may undermine the insurance mechanisms. Calibration, design of the insurance mechanisms and the effective use of payouts by the insured are essential to the degree to which insurance can help achieve the first dividend. Few papers have empirically explored these aspects, though they could be helpful to support innovation on intelligent structuring and triggers. This working paper acknowledges that this type of research may be implemented by technical facilities in the context of developing specific insurance schemes. However, sharing insights and lessons from these processes is crucial to enhance effective insurance implementation on a broader scale.

The links between agricultural insurance and gains in productivity (second dividend) have represented a recent focus in empirical literature and have become increasingly well established. However, more evidence is needed to assess longer-term behavioural change from insurance, the sustainability of these effects in the context of climate change and cross-scale impacts (for instance, the potential influence of sovereign disaster risk insurance at the macro level on micro-level investments by individuals, households or enterprises).

The co-benefits of investing in insurance (third dividend) have been less well explored, although a few studies suggest insurance, and risk transfer mechanisms more broadly, can have positive political impacts and lead to improvements in non-material wellbeing. An enhanced understanding of these co-benefits could help promote the adoption of insurance.

Overall, this working paper reveals a lack of research that explores the cross-scale effects of insurance and the interactions between insurance mechanisms at different scales, as well as little to no evidence on the impacts of meso-level insurance schemes – for instance covering cooperatives, microfinance groups or NGOs. Greater attention to whether and how such approaches can increase financial coping capacities, drive development and contribute to broader co-benefits is therefore crucial.

Insurance is a crucial tool in ex ante risk management, which could avoid the delays and inefficiencies that often characterise emergency response finance. Insurance mechanisms should be considered as a component that needs to be integrated within a holistic approach to risk management. It can be combined with other risk financing mechanisms to address the financial gap, which is particularly important in developing countries. Implementation of such integrated approaches, however, seems to lag behind and less is known about the nature of mutually reinforcing mechanisms between insurance and DRR. The findings in this working paper imply that, through their ex post and ex ante benefits, insurance systems can strengthen the capacity of individuals, households, firms, organisations or states to prepare for and cope with disasters – and may drive (economic) development and generate co-benefits also in the absence of disasters. At the same time, however, trade-offs in investment decisions, opportunity costs, unequally distributed impacts from insurance, gender biases, costs from insurer failure and deficiencies in the reliability or efficiency of insurance schemes can undermine some of these benefits for all or for specific target groups. The consideration of co-benefits, as well as co-costs, and the evidence for establishing whether and how these can be achieved are still weak in many contexts.

References

- Action on Climate Today (ACT) (2016) *ACT on Knowledge #4: Disaster microinsurance*. New Delhi, India: Action on Climate Today (ACT) programme.
- Akotey, J.O. and Adjasi, C. (2014) 'The impact of microinsurance on household asset accumulation in Ghana: An asset index approach', *The Geneva Papers on Risk and Insurance Issues and Practice* 39(2): 304-21.
- Akter, S. (2012) 'The role of microinsurance as a safety net against environmental risks in Bangladesh', *Journal of Environment and Development* 21(2): 263-80.
- Balogun, K. (2014) 'Applicability of risk transfer tools to manage loss and damage from slow-onset climatic risks', *Procedia Economics and Finance* 18: 710-17.
- Barnett, B.J., Barrett, C.B. and Skees, J.R. (2008) 'Poverty traps and index-based risk transfer products', *World Development* 36(10): 1766-785.
- Baur, E. and Parker, M. (2015) 'Building financial resilience-the role of risk transfer for sovereign disaster risk management', *Planet@ Risk* 3(1).
- Bertram-Huemmer, V. and Kraehnert, K. (2015) 'Does index insurance help households recover from disaster? Evidence from IBLI Mongolia'. DIW Discussion Papers, No. 1515.
- Bevan, D and Adam, C. (2016) 'Financing the Reconstruction of Public Capital after a Natural Disaster'. Policy Research Working Paper No. 7718. Washington, DC: World Bank.
- Bond Development and Environment Group (2016) *Equitable, effective and pro-poor climate risk insurance. The role of insurance in loss and damage*. London: Bond.
- Borensztein, E., Cavallo, E. and Jeanne, O. (2017) 'The welfare gains from macro-insurance against natural disasters', *Journal of Development Economics* 124: 142-56.
- Boudreau L. (2016) 'Discipline and disasters: The political economy of Mexico's Sovereign Disaster Risk Financing Program'. Foundation for Studies and Research on International Development (FERDI)policy brief no. 128.
- Brainard, L. (2007) *What is the role of insurance in economic development?* Zurich: Zurich Government and Industry Affairs.
- Cai, H., Chen, Y., Fang, H., Zhou, L-A. (2009) 'Microinsurance, trust and economic development: evidence from a randomized natural field experiment'. National Bureau of Economic Research (NBER) Working Paper No. 15396.
- Cai, J. (2013) 'The impact of insurance provision on households' production and financial decisions'. Munich Personal RePEc Archive No. 46864
- Cai, J. (2012) 'Social networks and the decision to insure: Evidence from randomized experiments in China', (http://igov.berkeley.edu/sites/default/files/JMP_JingCai_012812.pdf).
- Carter, M.R., Janzen, S.A. and Stoeffler, Q. (2016) 'Can insurance help manage climate risk and food insecurity? Evidence from the pastoral regions of East Africa' (<http://www.montana.edu/sjanzen/caninsurancehelpmanageclimateriskfoodinsecurity.pdf>).
- Castillo, M.J., Boucher, S. and Carter, M. (2016) 'Index insurance: Using public data to benefit small-scale agriculture', *International Food and Agribusiness Management Review* 19(A).
- Chambwera, M., G. Heal, C. Dubeux, S. Hallegatte, L. Leclerc, A. Markandya, B.A. McCarl, R. Mechler and Neumann, J.E. (2014) 'Economics of adaptation', in C.B. Field, V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and White, L.L. (eds) *Climate change 2014: impacts, adaptation, and vulnerability. Part A: global and sectoral aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge and New York: Cambridge University Press: 945-77.
- Chantarat, S., Mude, A.G., Barrett, C.B. and Turvey, C.G. (2017) 'Welfare impacts of index insurance in the presence of a poverty trap', *World Development* 94: 119-38.
- Clarke, D.J. and Dercon, S. (2016) *Dull Disasters? How planning ahead will make a difference*. Oxford: Oxford University Press.
- Clarke, D.J., Mahul, O., Poulter, R., and Teh, T.L. (2016) 'Evaluating Sovereign Disaster Risk Finance Strategies. A framework'. Policy Research Working Paper No. 7721. Washington, DC: World Bank.

- Clarke, D.J. and Hill, R.V. (2013) 'Cost-Benefit Analysis of the African Risk Capacity Facility'. IFPRI Discussion Paper 01292. Washington DC: International Food Policy Research Institute (IFPRI)
- Cole, S., Giné, X. and Vickery, J. (2014) 'How does risk management influence production decisions? Evidence from a field experiment'. Harvard Business School Working Paper, No. 13. Boston, MA: Harvard Business School.
- Cole, S., Giné, X., Tobacman, J., Topalova, P., Townsend, R. and Vickery, J. (2013) 'Barriers to Household Risk Management: Evidence from India', *American Economic Journal: Applied Economics* 5(1): 104-35.
- Cordella, T. and Levy-Yeyati, E.L. (2015) 'CATalytic insurance: the case of natural disasters'. Policy Research Working Paper No. 5377. Washington, DC: World Bank.
- Cutter, S., Osman-Elasha, B., Campbell, J., Cheong, S.-M., McCormick, S., Pulwarty, R., Supratid, S., and Ziervogel, G. (2012) 'Managing the risks from climate extremes at the local level', in C.B. Field, V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley, (eds) *Managing the risks of extreme events and disasters to advance climate change adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC)*. Cambridge and New York: Cambridge University Press: 291-338.
- de Bock, O. and Gelade, W. (2012) 'The demand for microinsurance: A literature review'. Microinsurance Innovation Facility, Working Paper No. 26. Geneva: International Labour Office.
- de Janvry, A., del Valle, A. and Sadoulet, E. (2015) 'Insuring Growth: The Impact of Disaster Funds on Economic Development'. Foundation for Studies and Research on International Development (FERDI) policy brief no. 125.
- de Janvry, A., Ramirez-Ritchie, E. and Sadoulet, E. (2016) 'Weather index insurance and shock coping: evidence from Mexico's CADENA Program'. Policy Research Working Paper No. 7715. Washington, DC: World Bank.
- de Nicola, F. (2015) 'Handling the weather: Insurance, savings and credit in West Africa'. Policy Research Working Paper No. 7187. Washington, DC: World Bank.
- Delavallade, C., Dizon, F., Hill, R.V and Petraud, J.P. (2015) 'Managing risk with insurance and savings: experimental evidence for male and female farm managers in the Sahel'. Policy Research Working Paper No. 7176. Washington, DC: World Bank.
- Dercon, S., (2002) 'Income risk, coping strategies, and safety nets', *The World Bank Research Observer* 17(2): 141-66.
- Dercon, S., Hill, R.V., Clarke, D., Outes-Leon, I. and Taffesse, A.S. (2014) 'Offering rainfall insurance to informal insurance groups: Evidence from a field experiment in Ethiopia', *Journal of Development Economics* 106: 132-43.
- Dionne, G. (2000) *Handbook of Insurance*. New York, NY: Springer.
- Dulal, H.B. and Shah, K.U. (2014) "'Climate-smart" social protection: Can it be achieved without a targeted household approach?' *Environmental Development* 10: 16-35.
- Economics of Climate Adaptation (2009) *Shaping climate resilient development. A framework for decision-making*. ClimateWorks Foundation, Global Environment Facility, European Commission, McKinsey & Company, The Rockefeller Foundation, Standard Chartered Bank and Swiss Re.
- Elabed, G., Carter, M.R. (2015) 'Ex-ante impacts of agricultural insurance: Evidence from a field experiment in Mali' (<http://www.gdn.int/fullpaper/Paper%20for%20Session%2017-Elabed-Carter-Cotton-Ex-Ante%20Impacts%20of%20Agricultural.....pdf>).
- Farrin, K. and Miranda, M.J. (2015) 'A heterogeneous agent model of credit-linked index insurance and farm technology adoption', *Journal of Development Economics* 116: 199-211.
- Fuchs, A. and Rodriguez-Chamussy, L. (2014) 'Voter response to natural disaster aid: A Quasi-experimental evidence from drought relief payments in Mexico'. Policy Research Working Paper No. 6836. Washington, DC: World Bank.
- Fuchs, A. and Wolff, H. (2011a) 'Concept and unintended consequences of weather index insurance: The case of Mexico'. IZA Discussion Paper No. 6234.ma
- Fuchs, A., and Wolff, H. (2011b) 'Drought and retribution: evidence from a large-scale rainfall-indexed insurance program in Mexico' ([https://www2.gwu.edu/~iiep/signatureinitiatives/adaptation/docs/Wolff,%20Drought%20and%20Retribution%20Evidence%20from%20a%20large%20scale%20Rainfall-Indexed%20\(updated\).pdf](https://www2.gwu.edu/~iiep/signatureinitiatives/adaptation/docs/Wolff,%20Drought%20and%20Retribution%20Evidence%20from%20a%20large%20scale%20Rainfall-Indexed%20(updated).pdf)).
- Ghesquiere, F., and Mahul, O. (2010) 'Financial protection of the state against natural disasters – a primer'. Policy Research Working Paper No. 5429. Washington, DC: World Bank.
- Hallegatte, S., Bangalore, M. and Jouanjean, M.-A. (2016) 'Avoided losses and the development dividend of resilience', in S. Surminski and T. Tanner (eds) *Realising the 'Triple Dividend of Resilience'. A New Business Case for Disaster Risk Management*. Switzerland: Springer International Publishing.
- Hallegatte, S., Henriot, F., Patwardhan, A., Narayanan, K., Ghosh, S., Karmakar, S. and Naville, N. (2010) 'Flood risks, climate change impacts and adaptation benefits in Mumbai: An initial assessment of socio-economic consequences of present and climate change induced flood risks and of possible adaptation options'. OECD Publishing no. 27. Paris: Organisation for Economic Co-operation and Development (OECD)

- Hallegatte, S., Vogt-Schilb, A., Bangalore, M. and Rozenberg, J. (2017) *Unbreakable: Building the resilience of the poor in the face of natural disasters*. Washington, DC: World Bank
- Hazell P. and Hess, U. (2010) 'Drought insurance for agricultural development and food security in dryland areas', *Food Security* 2(4): 395-405.
- 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?* Bonn: GIZ.
- Insurance Europe (2016) 'European Insurance in Figures: 2015 data'. Brussels: Insurance Europe.
- Jaffee, D. and Russell, T. (2013) 'The Welfare Economics of Catastrophe Losses and Insurance', *The Geneva Papers* 38: 469-94
- Janzen, S. and Carter, M. (2013) 'After the drought: the impact of microinsurance on consumption smoothing and asset protection'. Working Paper (19702). Cambridge, MA: National Bureau of Economic Research.
- Janzen, S., Carter, M. and Ikegami, M. (2012) 'Valuing asset insurance in the presence of poverty traps: a dynamic approach'. Working Paper. Davis, CA: University of California (<https://basis.ucdavis.edu/sites/g/files/dgvnsk466/files/inline-files/Valuing-Asset-Insurance.pdf>).
- Jensen, N.D., Barrett, C.B. and Mude, A.G. (2014) 'Index insurance and cash transfers: A comparative analysis from northern Kenya' (https://mpra.ub.uni-muenchen.de/61372/1/MPRA_paper_61372.pdf).
- Joyette, A.R., Nurse, L.A. and Pulwarty, R.S. (2015) 'Disaster risk insurance and catastrophe models in risk-prone small Caribbean islands', *Disasters* 39(3): 467-92.
- Karim, A. and Noy, I. (2015) 'Poverty and natural disasters – a qualitative survey of the empirical literature'. *The Singapore Economic Review* 61(01): p.1640001.
- Karlan, D. and Morduch, J. (2009) 'Access to Finance: Credit Markets, Insurance, and Saving', in D. Rodrik and M. Rosenzweig, (eds), *Handbook of Development Economics, Vol. 5*, North Holland.
- Karlan, D., Osei, R., Osei-Akoto, I., Udry, C. (2012) Agricultural Decisions after Relaxing Credit and Risk Constraints. NBER Working Paper No. 18463. Cambridge, MA: National Bureau of Economic Research.
- Keating, A., Campbell, K., Mechler, R., Michel-Kerjan, E., Mochizuki, J., Kunreuther, H., Bayer, J., Hanger, S., McCallum, I., See, L., Williges, K., Atreya, A., Botzen, W., Collier, B., Czajkowski, J., Hochrainer, S. and Egan, C. (2014) *Operationalizing resilience against natural disaster risk: Opportunities, barriers and a way forward*. Zurich Flood Resilience Alliance. Laxenburg: IIASA.
- Kellet, J. and Caravani, A. (2013) *Financing Disaster Risk Reduction: A 20 year story of international aid*. London and Washington DC: Overseas Development Institute and GFDRR.
- Kessler, D., de Montchalin, A. and Thimann, C. (2016) 'Insurance and economic development: growth, stabilization and distribution'. Impact Insurance Paper No. 46. Geneva: ILO.
- Kireti, G.W. and Sakwa, M. (2014) 'Socio-economic effects of microfinance services on women: the case of Rosewo Microfinance, Nakuru County, Kenya', *International Journal of Academic Research in Economics and Management Sciences* 3(3): 43.
- Koloma, Y. (2015) 'Crop Microinsurance for Maize Farmers in Burkina Faso: Access and Agriculture Performance in the Dandé Village', *Strategic Change* 24(1): 115-29.
- Kovacevic, R., and Pflug, G. (2010) 'Does Insurance Help to Escape the Poverty Trap? A Ruin Theoretic Approach', *Journal of Risk and Insurance* 78(4): 1003–28.
- Kunreuther, H. (2015) 'The role of insurance in reducing losses from extreme events: The need for public-private partnerships', *The Geneva Papers on Risk and Insurance Issues and Practice* 40(4): 741-62.
- Lamond, J. and Penning-Rowsell, E. (2014) 'The robustness of flood insurance regimes given changing risk resulting from climate change', *Climate Risk Management* 2: 1-10.
- Leblois, A., Quirion, P. and Sultan, B. (2014) 'Price vs. weather shock hedging for cash crops: ex ante evaluation for cotton producers in Cameroon', *Ecological Economics* 101: 67-80.
- Le Quesne, F. (2017) '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. Bonn: GIZ and MCII.
- Lester, R. (2014) 'Insurance and inclusive growth'. Policy Research Working Paper No. 6943. Washington, DC: World Bank.
- Lybbert, T.J. and Carter, M.R. (2015) 'Bundling drought tolerance and index insurance to reduce rural household vulnerability to drought', in A. Balisacan, U. Chakravorty and M.-L. Ravago (eds), *Sustainable Economic Development: Resources, Environment, and Institutions*. Elsevier Academic Press.
- Mahul, O. and Stutley, C.J. (2010) *Government support to agricultural insurance: challenges and options for developing countries*. Washington, D.C.: World Bank.

- Mechler, R. (2016) 'Reviewing estimates of the economic efficiency of disaster risk management: opportunities and limitations of using risk-based cost-benefit analysis', *Natural Hazards* 81(3): 2121-47.
- Mechler, R., Mochizuki, J. and Hochrainer-Stigler, S. (2016) 'Disaster risk management and fiscal policy: Narratives, tools and evidence associated with assessing fiscal risk and building resilience'. Policy Research Working Paper No. 7635. Washington, DC: World Bank.
- Miller, A. and Swann, S. (2016) 'Innovative insurance to manage climate risks'. EMCompass Note 9. Washington, DC: IFC.
- Mobarak, A.M. and Rosenzweig, M.R. (2012) 'Selling formal insurance to the informally insured'. Yale Economics Department Working Paper No. 72 (http://web.stanford.edu/group/SITE/archive/SITE_2012/2012_segment_1/2012_SITE_Segment_1_papers/rosenzweig.pdf).
- Morsink, K, Clarke, D.J. and Mapfumo, S. (2016) 'How to measure whether index insurance provides reliable protection'. Policy Research Working Paper No. 7744. Washington, DC: World Bank.
- Munich Re (2017) NatCat SERVICE (<http://natcatservice.munichre.com/>).
- Phelan, L., Taplin, R., Henderson-Sellers, A. and Albrecht, G. (2011) 'Ecological viability or liability? Insurance system responses to climate risk', *Environmental Policy and Governance* 21(2): 112-30.
- Poole, L. (2014) 'A Calculated Risk: How donors should engage with risk financing and transfer mechanisms'. OECD Development Co-operation Working Paper 17. Paris: OECD.
- Reeves, J. (2017) *The wrong model for resilience: How G7-backed drought insurance failed Malawi, and what we must learn from it*. Johannesburg: ActionAid.
- Rose, A. (2016) 'Capturing the Co-benefits of Disaster Risk Management in the Private Sector', in S. Surminski and T. Tanner (eds) *Realising the 'Triple Dividend of Resilience'. A New Business Case for Disaster Risk Management*. Cham, Switzerland: Springer International Publishing.
- Sandmark, T., Debar, J.-C. and Tatin-Jaleran, C. (2013) 'The emergence and development of agriculture microinsurance'. A Discussion Paper. Luxembourg: Microinsurance Network.
- Schaefer, L. and Waters, E. (2016) *Climate Risk Insurance for the Poor & Vulnerable: How to effectively implement the pro-poor focus of InsuResilience*. Bonn: Munich Climate Insurance Initiative (MCII).
- Shiferaw, B., Tesfaye, K., Kassie, M., Abate, T., Prasanna, B.M. and Menkir, A. (2014) 'Managing vulnerability to drought and enhancing livelihood resilience in sub-Saharan Africa: Technological, institutional and policy options', *Weather and Climate Extremes* 3: 67-79.
- Simonet, C., Comba, E., Wilkinson, E. (2017) 'Disasters and national economic resilience. An analysis of BRACED countries'. BRACED Working Paper. London: Overseas Development Institute.
- Starominski-Uehara, M. and Keskitalo, E.C.H. (2016) 'How Does Natural Hazard Insurance Literature Discuss the Risks of Climate Change?', *Journal of Insurance Regulation* 35(6).
- Surminski, S. (2014) 'The role of insurance in reducing direct risk: the case of flood insurance', *International Review of Environmental and Resource Economics* 7(3-4): 241-78.
- Surminski, S., Bouwer, L.M. and Linnerooth-Bayer, J. (2016) 'How insurance can support climate resilience', *Nature Climate Change* 6(4): 333-34.
- Surminski, S. and Oramas-Dorta, D. (2014) 'Flood insurance schemes and climate adaptation in developing countries', *International Journal of Disaster Risk Reduction* 7: 154-64.
- Surminski, S. and Tanner, T. (eds) (2016) *Realising the "triple dividend of resilience": a new business case for disaster risk management*. Climate Risk Management, Policy and Governance Series. Cham, Switzerland: Springer International Publishing.
- Swain, M. and Patnaik, S. (2016) 'Performance assessment of crop insurance schemes in Odisha in Eastern India'. SANDEE Working Paper No. 104-16. Kathmandu: SANDEE.
- Tadesse, M.A., Shiferaw, B.A. and Erenstein, O. (2015) 'Weather index insurance for managing drought risk in smallholder agriculture: lessons and policy implications for sub-Saharan Africa', *Agricultural and Food Economics* 3(1): 26.
- Tafere, K., Barrett, C.B., Lentz, E. and Ayana, B.T. (2015) 'The subjective well-being gains from insurance that doesn't pay out' (http://barrett.dyson.cornell.edu/files/papers/150427_TafereBarrettLentz_SubjectiveInsurance.pdf).
- Takahashi, K., Barrett, C.B. and Ikegami, M. (2017) 'Does index insurance crowd in or crowd out informal risk sharing? Evidence from Rural Ethiopia' (http://barrett.dyson.cornell.edu/files/papers/Takahashi%20et%20al%20March%2010_cbb.pdf).
- Talbot, T., Dercon, S. and Barder, O. (2017) 'Payouts for perils. how insurance can radically improve emergency aid'. Washington DC: Center for Global Development.

-
- Tanner, T., Surminski, S., Wilkinson, E., Reid, R., Rentschler, J. and Rajput, S. (2015) *The triple dividend of resilience. Realising development goals through the multiple benefits of disaster risk management*. London and Washington DC: Overseas Development Institute and The World Bank.
- Tobacman, J., Stein, D., Shah, V., Litvine, L., Cole, S. and Chattopadhyay, R. (2017) 'Formal Insurance Against Weather Shocks: Evidence from a Randomized Controlled Trial in India' (<http://assets.wharton.upenn.edu/~tobacman/papers/Formal%20Insurance%20Against%20Weather%20Shocks.pdf>).
- Vivid Economics, Surminski Consulting and Callund Consulting (2016) *Final Report: Understanding the role of publicly funded premium subsidies in disaster risk insurance in developing countries*. UK: Evidence on demand.
- Von Peter, G., von Dahlen, S., Saxena, S. (2012) 'Unmitigated disasters? New evidence on the macroeconomic cost of natural catastrophes'. BIS Working Paper 394
- Walker, G.R., Mason, M.S., Crompton, R.P. and Musulin, R.T. (2016) 'Application of insurance modelling tools to climate change adaptation decision-making relating to the built environment', *Structure and Infrastructure Engineering* 12(4): 450-62.
- Warner, K., Ranger, N., Surminski, S., Arnold, M., Linnerooth-Bayer, J., Michel-Kerjan, E., Kovacs, P. and Herweijer, C. (2009) 'Adaptation to Climate Change: Linking Disaster Risk Reduction and Insurance'. Geneva: UNISDR.
- 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).
- Wilkinson, E., Twigg, J., Weingärtner, L. and Peters, K. (2017) 'Delivering disaster risk reduction by 2030. Pathways to progress'. London: Overseas Development Institute.
- World Bank (2016a) *Disaster Risk finance as a tool for development: A summary of findings from the disaster risk finance impact analysis project*. Washington, DC: World Bank.
- World Bank (2016b) *Evaluating sovereign disaster risk finance strategies: Case studies and guidance*. Washington, DC: World Bank.
- World Food Program Oxfam (2016) *Impact Evaluation of the R4 Rural Resilience Initiative in Senegal. Final Evaluation*. Boston, MA/Washington, DC: Oxfam America/Dalberg.
- Ye, T., Wang, Y., Wu, B., Shi, P., Wang, M. and Hu, X. (2016) 'Government investment in disaster risk reduction based on a probabilistic risk model: a case study of typhoon disasters in Shenzhen, China', *International Journal of Disaster Risk Science* 7(2): 123-37.
- Zhang, Y., Zhu, X. and Turvey, C.G. (2016) 'On the impact of agricultural livestock microinsurance on death-loss, production and vaccine use: observations from a quasi-natural experiment in China', *The Geneva Papers on Risk and Insurance Issues and Practice* 41(2): 225-43.

Further reading

- Akter, S. and Fatema, N. (2011) 'The role of microcredit and microinsurance in coping with natural hazard risks'. Paper presented at the 18th Annual Conference of the European Association of Environmental and Resource Economists, Rome, Italy.
- Arent, D.J., Tol, R.S.J., Faust, E., Hella, J.P., Kumar, S., Strzepek, K.M., Tóth, F.L. and Yan, D. (2014) 'Key economic sectors and services', in Field, C.B., Barros, V.R., Dokken, D.J., Mach, K.J., Mastrandrea, M.D., Bilir, T.E., Chatterjee, M., Ebi, K.L. Estrada, Y.O., Genova, R.C., Girma, B., Kissel, E.S., Levy, A.N., MacCracken, S., Mastrandrea, P.R. and White, L.L. (eds) *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge and New York: Cambridge University Press: 659-708.
- Arrow, K. and Lind, R. (1970) 'Uncertainty and the evaluation of public investment decisions', *American Economic Review* 60(3): 364-78.
- Cabezon, E.R., Hunter, L., Tumbarello, P., Washimi, K. and Wu, Y. (2015) 'Enhancing Macroeconomic Resilience to Natural Disasters and Climate Change in the Small States of the Pacific'. IMF Working Paper 15/125. Washington, DC: IMF.
- Carter, M., de Janvry, A., Sadoulet, E. and Sarris, A. (2014) 'Index-based weather insurance for developing countries: A review of evidence and a set of propositions for up-scaling'. Development Policies Working Paper, 111. Clermont-Ferrand: FERDI.
- Carter, M.R. and Janzen, S. (2015) 'Social protection in the face of climate change: Targeting principles and financing mechanisms' (https://arefiles.ucdavis.edu/uploads/filer_public/76/24/762413bf-12fe-4c0e-a419-22b9cccf0995/carter_janzen_v2.pdf).
- Chambwera, M., Heal, G., Dubeux, C., Hallegatte, S., Leclerc, L., Markandya, A., McCarl, B.A., Mechler, R. and Neumann, J.E. (2014) 'Economics of adaptation', in Field, C.B., Barros, V.R., Dokken, D.J., Mach, K.J., Mastrandrea, M.D., Bilir, T.E., Chatterjee, M., Ebi, K.L. Estrada, Y.O., Genova, R.C., Girma, B., Kissel, E.S., Levy, A.N., MacCracken, S., Mastrandrea, P.R. and White, L.L. (eds) *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge and New York: Cambridge University Press: 945-977.
- Chen, J.M. (2014) 'Correlation, coverage, and catastrophe: the contours of financial preparedness for disaster', *Fordham Environmental Law Journal* 26(1): 56-94.
- Clarke, D.J., and Wren-Lewis, L. (2016) 'Solving commitment problems in disaster risk finance'. Policy Research Working Paper No. 7720. Washington, DC: World Bank.
- ClimateWise, The Geneva Association, MCII, UNEP FI (2014) 'Global insurance industry statement on: Adapting to climate change in developing countries' (http://www.unepfi.org/fileadmin/documents/insurance_climatechange_statement.pdf).
- Dana, J. and von Dahlen, S. (2014) 'An overview of potential pathways to app raising impact of sovereign DRFI: Where should we be looking to assess benefits'. SDRFI Impact Appraisal Project. Washington, DC: GFDRR.
- Dercon, S. (2005) *Insurance against poverty*. Oxford: Oxford University Press.
- Filatova, T. (2014) 'Market-based instruments for flood risk management: a review of theory, practice and perspectives for climate adaptation policy', *Environmental Science and Policy* 37: 227-42.
- Geneva Association (2014) 'The Social and Economic Value of Insurance', *The Geneva Reports* 4(1): 165-204.
- Ghesquiere, F. and Mahul, O. (2007) 'Sovereign Natural Disaster Insurance for Developing Countries: A Paradigm Shift in Catastrophe Risk Financing'. World Bank Policy Research Working Paper No. 4345. Washington, DC: World Bank.
- Giné, X. and Yang, D. (2009) 'Insurance, credit, and technology adoption: Field experimental evidence from Malawi', *Journal of Development Economics* 89(1): 1-11.
- Gupta, A.K. (2016) 'Impact of micro-insurance vulnerability on low income families: a case study of Varanasi District', *ZENITH International Journal of Multidisciplinary Research* 6(4): 11-21.
- Gurenko, E.N. (2015) *Climate change and insurance: disaster risk financing in developing countries*. Routledge.
- Gurenko, E., and Lester, R. (2004) 'Rapid Onset Natural Disasters: The Role of Financing in Effective Risk Management'. Policy Research Working Paper No. 3278. Washington, DC: World Bank.

-
- Hallegatte, S., Bangalore, M., Bonzanigo, L., Fay, M., Kane, T., Narloch, U., Rozenberg, J., Treguer, D., and Vogt-Schilb, A. (2016) *Shock Waves: Managing the Impacts of Climate Change on Poverty*. Washington, DC: World Bank.
- Haworth, A., Frandon-Martinez, C., Fayolle, V. and Simonet, C. (2016) 'Climate resilience and financial services'. BRACED Working Paper. London: Overseas Development Institute.
- IFRC (2016) *World Disasters Report, Resilience: Saving lives today, investing for tomorrow*. Geneva: IFRC.
- International Monetary Fund (2016) *Small States' Resilience to Natural Disasters and Climate Change – Role for the IMF*. Washington, DC: IMF.
- Isakson, S.R. (2015) 'Derivatives for development? Small-farmer vulnerability and the financialization of climate risk management', *Journal of Agrarian Change* 15(4): 569-80.
- Jensen, N., Barrett, C.B. and Mude, A.G. (2016) 'Index Insurance Quality and Basis Risk: Evidence from Northern Kenya', *American Journal of Agricultural Economics* 98(5): 1450-1469.
- Johnson, L. (2015) 'Catastrophic fixes: cyclical devaluation and accumulation through climate change impacts', *Environment and Planning A*, 47(12): 2503-21.
- Leblois, A., Quirion, P., Alhassane, A. and Traoré, S. (2014) 'Weather index drought insurance: An ex ante evaluation for millet growers in Niger', *Environmental and Resource Economics* 57(4): 527-51.
- Magnoni, B., and Bufzyna, I. (2013) *Doing the Math – Calamity Insurance in the Philippines*. MILK Report No. 17, Microinsurance Centre.
- Mahul, O., and Gurenko, E. (2006) 'The macro financing of natural hazards in developing countries'. Policy Research Working Paper No. 4075. Washington, DC: World Bank.
- McSharry, P. (2014) 'The role of scientific modelling and insurance in providing innovative solutions for managing the risk of natural disasters', in *Reducing Disaster: Early Warning Systems For Climate Change*. Netherlands: Springer: 325-38.
- Mechler, R. and Hochrainer-Stigler (2014) 'Revisiting Arrow-Lind: Managing Sovereign Disaster Risk', *Journal of Natural Resources Policy Research* 6(1).
- Murray, V., McBean, G., Bhatt, M., Borsch, S., Cheong, T.S., Erian, W.F., Llosa, S., Nadim, F., Nunez, M., Oyun, R. and Suarez, A.G. (2012) 'Case studies', in C.B. Field, V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley, (eds) *Managing the risks of extreme events and disasters to advance climate change adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC)*. Cambridge and New York: Cambridge University Press: 945-977.
- Murphy, A.G., Hartell, J., Cardenas, V., and Skees, J.R. (2012) 'Risk management instruments for food price volatility and weather risk in Latin America and the Caribbean: the under of risk management instruments'. Discussion Paper No. IDB-DP-220 Washington, DC: Inter-American Development Bank.
- Nicola, F. (2015) 'The impact of weather insurance on consumption, investment, and welfare', *Quantitative Economics* 6(3): 637-61.
- Palliyaguru, R., Amaratunga, D. and Baldry, D. (2014) 'Constructing a holistic approach to disaster risk reduction: the significance of focusing on vulnerability reduction', *Disasters* 38(1): 45-61.
- Reynolds, J. (2015) 'A critical examination of the climate engineering moral hazard and risk compensation concern', *The Anthropocene Review* 2(2): 174-91.
- Ricome, A., Affholder, F., Gérard, F., Muller, B., Poeydebat, C., Quirion, P. and Sall, M. (2017) 'Are subsidies to weather-index insurance the best use of public funds? A bio-economic farm model applied to the Senegalese groundnut basin'. *Agricultural Systems* 156: 149-176.
- Shapiro, J. (2009) 'Weather Insurance and Investment Choice' (<http://economics.mit.edu/files/4796>).
- Surminski, S. (2013) 'The role of insurance risk transfer in encouraging climate investment in developing countries', in P.-M. Dupuy, and J.E. Viñuales (eds) *Harnessing foreign investment to promote environmental protection*. Cambridge, UK: Cambridge University Press: 228-50.
- Surminski, S. and Oramas-Dorta, D. (2014) 'Flood insurance schemes and climate adaptation in developing countries', *International Journal of Disaster Risk Reduction* 7: 154-64.
- Surminski, S. and Oramas-Dorta, D. (2013) 'Do flood insurance schemes in developing countries provide incentives to reduce physical risks?' Grantham Research Institute on Climate Change and the Environment Working Papers, 119. London: LSE.
- Taylor, M. (2016) 'Risky Ventures: Financial Inclusion, Risk Management and the Uncertain Rise of Index-Based Insurance', in Soederberg, S. (ed.) *Risking Capitalism. Research in Political Economy, Volume 31*. Bingley: Emerald Group Publishing.
- UNICEF, Stanford University and All India Disaster Mitigation Institute (2014) 'Risk transfer through disaster insurance'. Policy Brief. New York: UNICEF.
- World Bank (2014a) *Caribbean and Central American Partnership for Catastrophe Risk Insurance: Pooling Risk to Safeguard against Catastrophes Generated by natural events*. Washington, DC: World Bank.
- World Bank (2014b) *Risk and Opportunity: Managing Risk for Development*. Washington, DC: World Bank.

Annex 1. Description of methodology

This working paper builds on a systematic review of the literature. To capture recent developments in the field, the search of academic and grey publications focuses on the timeframe from 2014 to March 2017. The initial search for academic literature was carried out via the Google Scholar, Ingenta Connect and Web of Science search engines. These databases were selected because they cover a broad spectrum of journals. Grey literature was identified through a general Google search as well as through websites of institutions and networks. This literature was complemented with expert recommendations and used as a starting point. From this, reference tracing led to the identification of older but relevant articles to be included in the review.

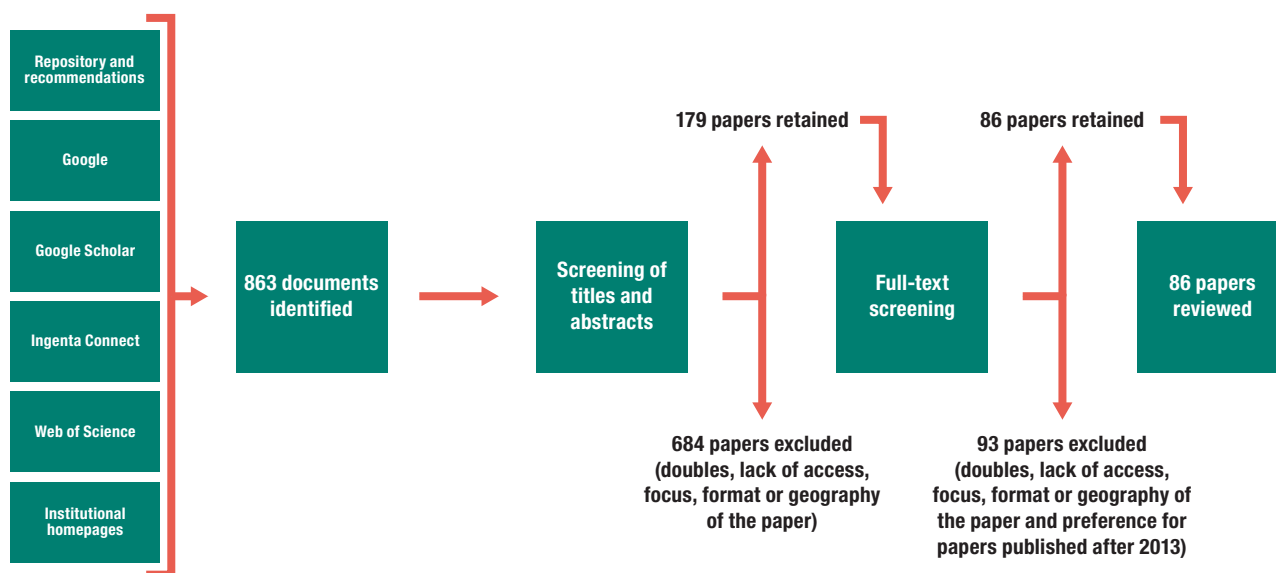
To delineate the scope of results and for purposes of quality control, documents considered in the review are limited to peer-reviewed journal articles, books or individual book chapters, and reports or working papers published by a recognised institution or author. To be considered in this review, literature needed to either (i) have a theoretical or conceptual focus on the impacts, benefits and constraints of insurance; or (ii) assess these impacts, benefits and constraints in an empirical study. The reviewed theoretical and conceptual literature informs the operationalisation of insurance impacts along the lines of the triple dividend framework. Reviewed empirical

literature, which builds mainly on original data, then facilitates this assessment of how insurance has – or has not – been found to help support actors at different scales to realise the triple dividend of resilience in practice.

Studies identified through the initial search may be excluded from the review based on the following criteria.

- The geographic focus of the paper is on high-income countries.
- The language was not English (even though French and Spanish papers may be included when relevant documents are encountered during the search, the initial search through search engines was only carried out in English).
- The paper was published before 2014 (for the general search; this does not apply to ‘high-impact’ research).
- Thematic scope, when the paper:
 - is not focused on insurance approaches
 - does not assess benefits or limitations of insurance approaches, but mainly revolves around other aspects (take-up, distribution, etc.).
- Methodology, when the paper:
 - is not focused on conceptualising, discussing or assessing insurance impacts
 - is not of sufficient depth or quality.

Figure 5. Flowchart of literature search



Source: Authors' own

Annex 2. List of institutions/networks searched for grey and academic literature

The institutions and networks in Table 1 were selected for an in-depth search to identify grey literature in addition to the general Google search. These were selected based on their involvement in the development or implementation of insurance approaches at different scales, because of the research they conduct and working paper series they provide, or because they operate a comprehensive library of publications from various sources on the topic. This list does not claim to be all-encompassing, but serves as a starting point for the search of grey literature.

Table 1. Institutions and networks for literature search

Category	Institution / website
Research institutes, universities and think tanks	Consultative Group to Assist the Poor (CGAP) Consultative Group on International Agricultural Research (CGIAR) Research Program on Climate Change, Agriculture and Food Security (CCAFS)
Development banks	World Bank Open Knowledge Repository & Open Learning Campus Global Index Insurance Facility (GIIF) Index Insurance Forum
International organisations	International Labour Organisation (ILO) Impact Insurance Facility
Networks and platforms	PreventionWeb

Annex 3. Search terms for Google and academic search engines

The search terms in Table 2 are used for search engines (Google, Google Scholar, Ingenta Connect and Web of Science) and institutional websites.

Table 2. Search terms

Search engine	Search terms	Specification
Google Scholar	("risk transfer" OR insurance) (developing OR low-income OR poor OR vulnerable) (micro OR meso OR macro OR sovereign) (disaster OR "extreme event" OR hazard OR climate OR weather) (impact OR theory OR concept OR effect)	One search limited to 2014–2017; one search without time restrictions
	insurance risk transfer impact disaster OR weather OR climate OR hazard OR developing OR vulnerable – "health insurance" – "employment insurance"	One search limited to 2014–2017; one search without time restrictions
Web of Science	TOPIC: (risk transfer OR insurance) AND TOPIC: (developing OR low-income OR poor OR vulnerable) AND TOPIC: (disaster OR extreme event OR hazard OR climate OR weather) AND TOPIC: (impact OR theory OR concept OR effect) NOT TOPIC: ("health insurance")	Time restriction 2014–2017
Ingenta Connect	("risk transfer" OR insurance) AND (developing OR low-income OR poor OR vulnerable) AND (disaster OR "extreme event" OR hazard OR climate OR weather) AND (impact OR theory OR concept OR effect)	No time restriction
Google	("risk transfer" OR insurance) AND (developing OR low-income OR poor OR vulnerable) AND (micro OR meso OR macro OR sovereign) AND (disaster OR "extreme event" OR hazard OR climate OR weather) AND (impact OR theory OR concept OR effect)	One search limited to 2014–2017; one search without time restrictions
CGAP	Insurance Risk transfer	Search limited to "Reports" repository
CCAFS	Insurance	Time restriction 2014–2017

Search engine	Search terms	Specification
Index Insurance Forum	n/a; reviewed all titles	No time restriction
ILO Impact Insurance Facility	n/a; reviewed all titles	No time restriction
PreventionWeb	insurance risk transfer impact developing evidence	No time restriction
World Bank Open Knowledge Repository	insurance "risk transfer" evidence insurance "risk transfer" impact	No time restriction

Note: In contrast to other search engines, Ingenta Connect does not support a Boolean search for full text. The Ingenta Connect results are based on a Boolean search of titles and abstracts.

Annex 4. Triple dividend framework

The triple dividend framework was developed by the Overseas Development Institute (ODI), the London School of Economics (LSE) and the World Bank Global Facility for Disaster Reduction and Recovery (GFDRR) in 2015, in response to the observed low levels of international funding available before disasters strike despite increasing economic costs of disasters. The framework outlines the benefits from investing in disaster risk management (DRM) approaches. It highlights how DRM investments can help avoid losses when disasters strike, but also stimulate the economy

and generate co-benefits even in the absence of disasters (see Figure 6). Drawing attention to further reaching and indirect benefits that are typically overlooked in traditional cost benefit analyses of DRM measures, the framework thus makes a business case for DRM investments (Surminski and Tanner, 2016; Tanner et al., 2015).

The framework suggests there are three types of benefits (or dividends) that can be generated by investing in ex ante DRM²¹ (see Figure 6):

Figure 6. The triple dividend of resilience

Investing in resilience reduces losses and damages in the case of a disaster. However, it can also yield development benefits regardless of disasters. Typically, standard disaster risk management investment appraisals fail to account for the 2nd and 3rd dividends of resilience.



Source: Tanner et al. (2015).

21 This working paper uses the UNISDR definition of DRM: 'Disaster Risk Management is the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses' (UNISDR terminology from: www.unisdr.org/we/inform/terminology, accessed on 8 May 2017).

1. **Avoiding losses when disasters strike.** This includes saving lives and reducing the number of people affected; reducing infrastructure or other asset damages; reducing economic and non-monetary losses (direct and indirect).
2. **Stimulating economic activity by reducing disaster risk.** This entails economic gains from risk taking (e.g. innovation and entrepreneurship); investments in productive assets (e.g. small-scale agriculture); savings and land value increases after DRM investment.
3. **Social, environmental and economic benefits associated with specific DRM investments.** These co-benefits include

economic co-benefits (e.g. flood protection supporting the fishery sector); social co-benefits (e.g. improved transparency or social cohesion) and environmental co-benefits (e.g. watershed protection) (Ibid.).

In addition to these benefits, the triple dividend framework also highlights the potential of co-costs and adverse effects associated with investing in DRM measures. These need to be considered to evaluate net benefits of DRM.

Annex 5. Characteristics of insurance mechanisms

Insurance mechanisms are based on risk pooling and risk spreading, meaning that the risks of many actors are combined and spread at a higher scale and usually covered by reinsurance or guarantees to avoid a default of the scheme when all policy holders are eligible for payout at the same time. Insurance policies can be designed for individuals, households, (sub)national governments or companies. The specific coverage, mechanisms for compensation and the premium are defined by the terms of the insurance policy.

The following elements are important to understand the disaster risk insurance landscape (Le Quesne, 2017):

- i. **Structure for triggering the payout.** Two main types of insurance can be distinguished: indemnity-based and index-based insurance.²² Indemnity-based insurance pays out on the basis of losses declared by the insured, which are assessed on behalf of the insurer. When losses are not easily verifiable, insurance can be affected by problems of moral hazard and adverse selection, meaning the policy holder may receive higher payouts because he or she provided false information to the insurer (Box 2).

Index insurance is most extensively used in developing countries where limited infrastructure and lack of data, for instance on household assets, produce high transaction costs for insurers, delays in payouts and high moral hazard. These factors have prevented indemnity disaster risk insurance markets from developing in many countries. Instead of directly assessing individual damage and claims, index insurance considers yield, rainfall or satellite/vegetation indices as proxies for determining the impacts of a shock. The index insurance principle relies on the assumption that the index corresponds with experienced economic

losses from the hazard against which it insures. In the case of rainfall-based index insurance in agriculture, for instance, this would require that a rainfall deficit indicated by a rain gauge used in index triggering is the same as the actual rainfall deficit on the insured farmer's field. Basis risk (the difference between the payout and actual losses from the insured hazard) is inherent to index insurance, and can present serious costs to the insurer and/or the insured (see section 5.4 and Box 2 for definition).

- ii. **Type and scale of insurance.** This working paper considers the various parties that can be insured, from individuals to national governments (Warner et al., 2013; Le Quesne, 2017). Insurance can be at the micro level (individuals, households, small enterprises, etc.), meso level (businesses, cooperatives, mutuals, microfinance institutions, NGOs, etc.) and macro level (governments, multi-nationals) – although importantly, the scale of the insurance may be different from the reach of the insurance. Similarly, insurance at a certain scale can result in impacts at other scales. Benefits from macro-level insurance, for example, can have micro-level impacts when payouts are passed on from the government to individuals. This may be the case where insurance is used to scale up post-disaster food aid through effective government distribution mechanisms and thus supports rapid disaster response and enhances food security (Clarke and Hill, 2013). Conversely, microinsurance may contribute to national income growth when it incentivises productive investment among a large share of the population.
- iii. **Insurance coverage.** What is being insured encompasses the **types of climate risks** considered

²² See Le Quesne (2017) for a more detailed categorisation of insurance based on insurance type.

in the insurance policy (multiple or single peril) and the **assets that are considered to be covered** by the insurance contract. Assets insured are directly related to the hazard profile and impact. Crops, livestock, agricultural inputs, credits, income and houses are the most common insured assets that are considered in the insurance policies reviewed in this working paper. In developing countries, the agricultural sector is a significant source of income. In 2015, agricultural added value represented, on average, 31% of the GDP in low-income countries.²³ Because agricultural production is highly exposed to climate extremes (due to lack of infrastructures or irrigation, flood protection or drought-resistant crops), the majority of the insurance schemes and research reviewed in this paper consider agricultural outputs (including both crops and livestock).

- iv. **Insurance delivery mechanism and public/private involvement.** Insurance has different delivery mechanisms at different scales, involving both private and/or public actors. The insurance scheme may affect the efficiency of delivery. For instance, a case study in a World Bank (2016b) report compares three sovereign insurance options for a large and diversified country facing earthquakes and tropical cyclones: (i) individual insurance contracts for each region; (ii) regions jointly approach the reinsurance market with a portfolio of region-specific insurance policies; and (iii) regions establish a catastrophe risk insurance facility, acting as a joint reserve mechanism, where smaller payouts are retained through reserves and excess losses are transferred to the reinsurance market. Which of these

strategies is the most cost-effective depends on the capital of the government, the return rate, the risk aversion and the specific shock profiles. Some papers reviewed in this study look at the efficiency of different delivery systems through cost-benefit analysis; other papers discuss the legal aspects of public/private arrangements. In general, literature looking at this concept is primarily informing the first dividend (see section 5.1).

- v. **Affordability and subsidisation.** In developing countries in particular, low-income populations struggle to afford insurance premiums. For agricultural insurance, this effect is exacerbated because premiums need to be paid at the beginning of the growing season, i.e. before the harvest, when farmers are particularly low on cash. Premium subsidies integrated in the insurance scheme can therefore be used to make insurance more affordable²⁴ and to counteract low take-up rates in developing countries (where those are a result of liquidity constraints). They may also be used to incentivise behavioural change, for instance in agricultural investment practices. The subsidisation of insurance premiums is extensively studied in the literature and is discussed in relation to the second and third dividends in this working paper (see sections 5.2, 5.3 and 5.4).

The above factors influence the potential impacts of insurance across all dividends. Where the reviewed literature provides information on these factors, the paper highlights how their consideration through the specific calibration of insurance schemes and enabling environments can help build resilience in the following assessment.

23 World Development Indicators, consulted in June 2017 (http://databank.worldbank.org/data/reports.aspx?Code=NY.GDP.MKTP.KD.ZG&id=1ff4a498&report_name=Popular-Indicators&populartype=series&ispopular=y).

24 Levels of premium subsidies for agricultural insurance, however, are on average much lower in many developing countries compared with countries in the European Union or North America (Sandmark et al., 2013).

Annex 6. Outlining a comprehensive research agenda

Based on gaps in research identified throughout this review, the following list presents aspects that should drive further research. All suggested topics ultimately aim to increase an understanding of what works for realising resilience (co-)benefits of investing in insurance and risk transfer. This entails close attention to costs and adverse effects, as well as to the enabling conditions and contexts that facilitate successful development, implementation and use of insurance and risk transfer on different scales.

Disaster risk insurance benefits

- Increase empirical evidence on the effectiveness of insurance in realising the first dividend (i.e. the core function of insurance) under consideration of basis risk and showcase different strategies to manage this risk sustainably and equitably.
- Expand on the literature assessing the avoidance of negative indirect and longer-term disaster impacts through insurance.
- Generate more evidence on whether, how and under what conditions insurance and DRR can build a mutually reinforcing relationship.
- Assess for which target groups different types and scales of insurance can realise the greatest net benefits.
- Accompany innovative approaches to meso-level insurance in developing countries with research and evaluation to expand on the understanding of their benefits and costs.

Costs and adverse effects of insurance

- Strengthen research on crowding-in and crowding-out effects between different disaster risk management and financing mechanisms, including potential distortion of DRR, social security and aid flows as a result of subsidising insurance.
- Build a stronger body of literature that assesses the political economy of risk transfer and insurance approaches, including considerations of opportunity costs, decision-making, accountability (especially with regard to PPPs) and equity.

Enabling environments

- Support practical approaches through more systematic research on enabling conditions for implementation of insurance approaches.
- Further analyse limitations of the insurance system for reducing inequality and assess how to overcome these barriers.
- Fill the data gap between developed countries, in which insurance already benefits from a big data system, and developing countries – which would have positive spillovers beyond the insurance sphere.

Integrating DRM (including insurance), climate change adaptation and mitigation

- Increase consideration of climate change in assessing insurance costs and benefits – including, for instance, impacts of insurance on mitigation and adaptation efforts – to support greater synergistic integration of DRM and climate change policy and practice.



ODI is the UK's leading independent think tank on international development and humanitarian issues.

Readers are encouraged to reproduce material from ODI Working Papers for their own publications, as long as they are not being sold commercially. As copyright holder, ODI requests due acknowledgement and a copy of the publication. For online use, we ask readers to link to the original resource on the ODI website. The views presented in this paper are those of the author(s) and do not necessarily represent the views of ODI.

© Overseas Development Institute 2017. This work is licensed under a Creative Commons Attribution-NonCommercial Licence (CC BY-NC 4.0).

All ODI Working Papers are available from www.odi.org

Overseas Development Institute
203 Blackfriars Road
London SE1 8NJ
Tel +44 (0) 20 7922 0300
Fax +44 (0) 20 7922 0399

odi.org