5.4 Risk transfer and financing

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5.4.1 Risk financing and transfer: introduction and typology

Natural hazard risks can undermine development progress (UNISDR, 2015), financial and economic stability and well-being (World Bank, 2013). A sound financial protection strategy can lessen these impacts, speed up recovery and reconstruction, and harness knowledge and incentives for reducing risk (IPCC, 2012). Amidst growing damage and losses caused by natural and human-made hazards, some of which are further amplified by global environmental (including climate) change (IPCC, 2014), a comprehensive financial strategy is conducive to a better framed and informed risk management and governance.

The SFDRR (UN, 2015a) substantially reduced disaster losses and reinforced resilience as a top priority of international and national efforts. As part of the transformational change in how natural and human-made risks are dealt with (van der Vegt, Essens, Wahlström and George, 2015; Wahlström, 2015), the SFDRR emphasised investing in DRR and financing. The Addis Ababa action agenda on financing for development erected a financial framework that fosters inclusive economic prosperity and lines up financing resources and flows with the priorities of the 2030 agenda for sustainable development (UN, 2015b). Similarly, the Paris Agreement on climate change (UNFCCC, 2015) addressed the issue of promoting sound risk financing as part of climate adaptation and a strategy for coping with damage and losses.

A comprehensive disaster financing strategy is equally important in the context of the European Economic and Monetary Union. In the absence of financial protection tools for coping with disasters, the incidence of major disasters in several EU Member States may exacerbate economic imbalances and deteriorate credit ratings (S&P, 2015).

A comprehensive strategy for disaster financing can moderate the impacts of natural hazard risks, speed up recovery and reconstruction, and harness knowledge and incentives for risk reduction. Private financial sectors play an important role, along with governments and civil society organisations, in designing innovative financial protection goals and sharing knowledge and capacity.

A recent debt sustainability analy-

sis showed that marginal changes in nominal GDP growth and interest rates can lead to a much greater debt-to-GDP ratio than the one projected as a baseline (EC, 2016). By targeting residual risk that cannot be efficiently mitigated, risk financing complements regulatory and economic instruments such as prices, taxes, tradable permits and liability (see Chapter 5.1), which serve as a vehicle of DRR and transition to a low-carbon, resource-efficient and socially inclusive economy.

Recognising that in an increasingly interconnected world disasters can have far-reaching, spill-over effects, the G20 finance ministers invited the Organisation for Economic Co-operation and Development (OECD) to develop a voluntary framework helping governments to develop financial strategies for disaster risk. The ensuing methodological guide (OECD, 2012) defines risk financing as strategies and instruments used to manage the financial impact of disasters, ensuring adequate capacity to manage and mitigate the costs of disaster risk, thereby reducing the financial burden and economic costs of disasters and enabling rapid recovery in economic activity (ibid.). A thorough understanding of risk exposure and risk-bearing capacity, as well as institutional arrangements creating favourable regulatory and market infrastructure are the major constituents of the comprehensive disaster financing strategy, along with the choice of optimal risk financing and transfer instruments.

Here we introduce various instruments, their design criteria and their principles, carrying institutions and markets, as well as the different public and private roles of their realisation. Disaster financing embraces a variety of instruments that are intended for and capable of achieving different outcomes. Each of these instruments can efficiently handle only a certain type of risk, depending on their frequency, intensity and impacts. Consequently, a strategy that builds upon a diversified pool of mutually complementing financial tools and institutions is better equipped to cope with and respond to a variety of environmental and human-induced risks.

Risk layering means pairing the suitability of different instruments with

TABLE 5.4

Major categories of risk financing and transfer instruments
Source: Adapted based on G20 (2016), GFDRR (2014), MCII (2009, 2013), Okuyama (2010), UFCCCC (2016), World Bank (2012)

Categories	Examples of instruments
Saving and reallocation	— bank deposits and liquid securities — reserve/contingency/disaster relief funds — budget reallocation
Credit and assistance	— contingent credit facilities and microcredit — fiscal relief such as delayed or reduced tax and social security payments — external assistance and aid
Insurance	— catastrophe risk insurance (from micro- to macro-insurance) — indemnity vs index-based vs modelled insurance schemes
Catastrophe-linked securities	— cat bonds (catastrophe bonds)
Derivatives	— weather derivatives

levels of risk and risk-bearing capacity (Mechler et al., 2014). The contingent losses from frequent, low-impact risk can either be reduced or retained through adequate funds in the form of savings, set-aside reserves or credits. Medium- to high-level risk exceeding the risk-bearing capacity can be more efficiently managed by risk transfer via insurance or capital markets.

Comprehensive risk management (MCII, 2013) embraces a systematic identification of risk arising from multiple hazards and employs a combination of financial instruments that take into account hazard exposure and risk-bearing capacity of (national and subnational) governments, homeowners, enterprises and the most vulnerable populations. In a more comprehensive way, the total climate risk approach, as adopted by the methodology of the Economics of Climate Adaptation Working Group (ECA, 2009), first explores manifold risks arising at a specific location or region today, then looks at the projected increase in risk due to economic development before finally considering the aggravation of risk due to a range of future climate change scenarios. The working group then devises and assesses a portfolio of infrastructural, technological, behavioural and financial investments to adapt to these risks. The various instruments (Table 5.4) differ in terms of access prerequisites, (opportunity) costs and activation time. This approach thus provides decision-makers with a fact base which enables them to understand the impact of weather and climate on their economy — and helps to identify actions to minimise that impact at the lowest cost to society. It therefore allows decision-makers to integrate adaptation with economic development and sustainable growth.

Disaster risk financing and transfer stretches out over several functions of responsible and accountable government, including fiscal (risk) and

TABLE 5.5

Disaster risk financing and transfer policy areas and benefits
Source: Adapted from World Bank (2014)

Sovereign disaster risk financing — Increases response and reconstruction capacity — Eases public expenditure by reducing volatility of disaster costs — Clarifies contingent liability — Provides incentives for investing in risk reduction	Property catastrophe risk insurance — Provides access to compensation for damage — Increases awareness of risk and understanding of financial vulnerability — Helps distribute risk and burden of recovery — Can incentivise investments in risk reduction
Disaster-linked social protection — Mitigates shocks by providing compensation for losses through safety nets — Increases awareness and understanding of vulnerability to disaster risk — Can incentivise investments in risk reduction — Safeguards vulnerable people from poverty	

budgetary policies, public finance, market and business development, and social protection (OECD, 2015; World Bank, 2014). Disaster risk poses implicit and explicit liabilities (Cummins and Mahul, 2009); explicit liability arises from statutory and contractual obligations, while implicit liability results from public expectations and political pressures. The latter poses the greater fiscal risk (World Bank, 2012). Governments play multiple roles, on both the demand and the supply sides of risk financing. As rule makers they: (i) provide public insurance and financing recovery and reconstruction expenses for public assets; (ii) organise (and cover the costs) of post-disaster order, rescue and relief; (iii) ensure social protection for vulnerable populations; and (iv) regulate and supervise financial markets (including insurance) and institutions. Nonetheless, only few countries have sought protection against fiscal impacts of disasters (World Bank, 2012).

The United Nations Environment Programme (UNEP), the United Nations Office for Disaster Risk Reduction (UNISDR); multilateral institutions such as the World Bank and the OECD, and other major actors have played a catalysing role for private sector involvement in DRR and financing. The UNEP's finance initiative, principles for sustainable insurance (PSI) (UN-FI 2012), and the UN-backed principles for responsible investment (PRI) have promoted sustainable lending, investment and insurance practices and sensitised nations to the environmental, social and governance challenges involved in business decision-making.
Other insurance-oriented initiatives, such as Global Insurance Industry Statements and the Climate Risk Statement of The Geneva Association, have urged contemplating climate risk in business investments and risk management strategies. More recently, a joint report by UNEP PSI and Inquire (Bacani, McDaniels and Robins, 2015) outlined three major initiatives: an Insurance Network on Sustainable Development to stimulate innovation and partnerships, a Sustainable Insurance Policy Forum to scale up intergovernmental cooperation and Insurance Development Goals to make the ways in which the insurance sector can contribute to meeting Sustainable Development Goals (SDGs) more explicit.

Similarly, international collaboration among financial businesses and financial regulators is growing, focused in large part on knowledge sharing and capacity building. The Financial Stability Board (FSB) convened a Task Force on Climate-related Financial Disclosures (TCFD, n.d.) focusing on disclosing market-relevant information on climate-related financial risk, the results of which were released in December 2016 (TCFD, 2016). The International Capital Market Association (ICMA) has coordinated the development of the 'green bond principles', which have helped catalyse the rapid growth of the green bond market (G20, 2016).

5.4.2 The role of insurance: spreading risk

Insurance is the most common form of financial protection against risk of contingent losses. The insured party or policyholder transfers the cost of potential loss to the insurer in exchange for monetary compensation known as a premium. By acquiring the costs of contingent losses from many policyholders, the insurer absorbs, pools and diversifies the individual risks, making them assessable and manageable.

Insurance is the most common form of financial protection against risk of contingent losses. But not all risks are insurable or covered by insurers. Climate change amplified natural hazard risks, and raising vulnerability may make financial protection unaffordable for some people and business, and risks uninsurable in certain places.

When the loss occurs from specified contingencies under an insurance contract, the insurer indemnifies or compensates the insured party. The premium charged should reflect the level of risk each policyholder cedes to the insurer. The premium will reflect not only the 'pure premium', i.e. the average losses expected from the contract, but also allowances for expenses and the contract's impact upon the insurer's capital requirements (and so its required contribution towards target return on capital).

Not all risks are insurable or covered by insurers. Insurable risks are those that are quantifiable, in terms of both the probability of an event's occurring and the extent of losses incurred, and for which premiums can be set for each policyholder or group of policyholders (H. C. Kunreuther and Michel-Kerjant, 2007).

In addition, risk ambiguity, asymmetry of information (implying adverse selection and moral hazard) and correlation between losses influence the ability and willingness of insurers to underwrite risk and the level of premium sought (Charpentier, 2008; Jemli, Chtourou and Feki, 2010; Louaas and Goussebaile, 2016). If the latter are high, risks may be insurable but not affordable for low-income subjects who may benefit most from insurance. Natural hazards that have been amplified by climate change may make financial protection unaffordable for some people and risks uninsurable in certain places. Recent estimates of the Bank of England (PRA, 2015) show that climate change and socioeconomic risk drivers may widen the gap between 'affordable' flood insurance premiums and premiums that reflect the technical price of flood insurance. Likewise, Kunreuther et al. (2011) demonstrated that climate change is likely to significantly increase premiums for building insurance in Florida. These studies also suggest that consistent risk reduction efforts may be effective in keeping premiums affordable. A better understanding of risk, product bundling and public interventions (see Chapter 5.4.4) contributes to making climate risk insurable.

Insurance is a financial service offering protection against the risks of contingent losses. However, directly or indirectly, it also serves other purposes. By facilitating prompt post-disaster recovery, insurance helps to contain the economic and social impacts of disasters. Beyond that, insurance serves public interests by promoting social protection and public welfare. Insurance makes it possible, for example, for individuals to get mortgage loans or compensation for injuries without going to court (Talesh, 2012). Insurance can also promote numerous economic activities in the higher risk/return market spectrum (Grant, 2012), thus contributing to higher productivity and innovation. And it can incentivise behaviour change and individual risk prevention, as shown in Chapter 5.4.3.

BOX 5.12

Role of insurance for better understanding of risks

The reinsurance industry has driven the development of catastrophe risk analytics over the last 30 years, moving from a position where hazard mechanisms, their impact and comparative risks were little understood, to one where sophisticated and integrated stochastic catastrophe models have become the norm in the industry. The models require and understanding and knowledge of:

- the likely hazard events, that is their frequency, severity and geographic scale;
- the buildings/goods insured, that is where they are, how they are built and how they are used;
- the vulnerability of these buildings/goods to the events;
- the financial/social loss caused.

The process of building and understanding these models, as much as the model results themselves, has lead to a transformation of the insurance and reinsurance industry, massively increasing technical understanding and financial resilience. The appropriateness of these modelling techniques, the ability of the models to provide objective rigour around risk mitigation and adaptation decision-making and the benefits of the consequential greater risk and hazard understanding are leading many governments and quasi-government organisations to consider adopting these methods. A catastrophe insurance scheme can be a catalyst to great risk understanding.

A variety of insurance schemes exists, depending on the type of risk and the protected asset (property, business assets and interruption, liability, sovereign risk, etc.). Natural hazard insurance is either an extension of property insurance (Bräuninger et al., 2011) or a stand-alone, for example agricultural (crop yield, revenue or income) and energy insurance. Sovereign insurance (Mahul and Ghesquiere, 2007) covers costs associated with damage to infrastructure and relief expenditure. Traditional insurance employs the principle of indemnity, claim payments are made to make good an actual loss ether in full or in part. However, indemnity insurance requires a thorough knowledge of the good(s) insured, how they react to a certain hazard and a post-event assessment of damage incurred, all adding to expense and delays in claim settlement. Parametric or index insurance schemes employ other, more easily measurable data (for example rainfall, yields or vegetation index) for determining pay-offs without the need to prove actual loss, requiring less detailed knowledge of the risk covered and enabling speedy payment (Collier et al., 2009; Hazell et al., 2010; IFAD and WFP, 2011).

Agriculture poses particular challenges for insurance because of the spatially correlated weather and climate risks and large information asymmetries (Porth and Seng Tan, 2015). Agricultural insurance schemes differ from country to country but often involve the public sector (Bielza et al. 2009; Capitanio, Bielza, Cafiero and Andolfini, 2011), either via premium subsidies or public participation in reinsurance systems. Insurance products can be classified according to the risks covered (named perils and multiple perils) and trigger of claim (e.g. indemnity or index based, crop revenue and farm income) (Iturrioz, 2009). More sophisticated insurance schemes include comprehensive income/revenue insurance packages also covering, besides production, market risks (e.g. price), although most insurance policies limit their coverage to yield variability risk (including single risk, combined, integral insurance and whole-farm integral insurance) unless the market risk can be transparently hedged in the commodities market. In the EU, farm risk management schemes are supported, among others, through rural development programmes (Bardají et al., 2016; EC, 2013c).

Based on 2015 data, the European insurance industry holds the largest share (32 %) of the global market (Insurance Europe, 2016). Property insurance accounts for about 8 % (around EUR 93 billion) of written premiums and 6 % (EUR 53 billion) of claims paid. Insurance coverage is very heterogeneous across the EU Member States and hazard types (A. M. Best, 2016; Maccaferri, Carboni and Campolongo, 2012). For natural hazard, some countries apply a free market system, others a centralised national or state scheme and others again an amalgam of public and private schemes. For example in the United Kingdom, natural hazard insurance is written competitively by private insurers, although with optional state-supported reinsurance for hazardous flood risks to ensure affordability. In contrast, in Spain, standardised natural catastrophe cover is provided by a public national pool.

On average over the period 1980-2015, out of the total registered natural hazard losses in Europe the share of those insured amounted to 30 % (EEA, 2015). Globally, written premiums in agriculture amount to around EUR 27 billion, an approximately fourfold increase since 2005 (Porth and Seng Tan, 2015).

In 2013 and as part of the EU Climate Adaptation Strategy package (EC, 2013a), the European Commission launched a broad consultation about which EU action could be appropriate for improving the performance of insurance markets (EC, 2013b). The responses cautioned against uniformising the regulation on natural hazard insurance across the EU (EC, 2014). Both the uneven distribution of hazard risk and the diversity of the economic standing and other requirements of customers have been brought up as reasons against an EU intervention (HM Treasury, 2013). Consequently, uniformised regulations could harm innovation and competition in insurance products. The European Parliament stressed that flexible markets should operate in a non-mandatory framework and that no 'one size fits all' solution would serve the magnitude of different risk and economic conditions in Europe (EP, 2014).

5.4.3 The role of insurance: incentivising risk reduction

Insurance can help dissuade policyholders from risky behaviour and incentivise risk reduction (Surminski and Oramas-Dorta, 2013; Surminski,

2009; Warner et al., 2009). Premiums and policy terms (e.g. deductibles) can be adjusted to reward good risks and penalise bad ones. The role that the insurance industry has played in deploying loss-prevention technologies such as automobile air bags and fire prevention/suppression systems is an example. Harnessing insurance for DRR becomes particularly significant in the context of increased frequency of disaster events, larger economic exposure, rising vulnerability and climate change.

Insurance and other financial instruments can contribute to reducing disaster risk, if designed and implemented to this end.

There is an ample consensus that insurance can and should play an increasingly important role in mitigating disaster impacts, not only through risk sharing, but also through all aspects of the risk management cycle, including risk identification and modelling, risk awareness, damage prevention, risk transfer and recovery (Michel-Kerjan and Kunreuther, 2011; Evan Mills, 2012; Swenja Surminski, 2014). However, practical evidence of whether insurance encourages risk reduction in a climate context remains inconclusive (Botzen and van den Bergh, 2009; E. Mills, 2009; Surminski and Oramas-Dorta, 2011; Surminski et al., 2015). Few existing national catastrophe insurance schemes directly include risk reduction incentives (Swenja Surminski and Oramas-Dorta, 2014; von Ungern-Sternberg, 2004). Nevertheless, progress is being made. Insurers are increasingly rewarding customers who take steps to reduce their risk with lower premiums (or avoid the risk if they do not). The regional natural catastrophe scheme, African Risk Capacity (ARC), mandates that clients, in this case African countries, undergo a period of risk analysis and policy design with ARC staff before they are allowed to buy a policy. Countries are also required to agree contingency plans to put in place in the case of loss and agree a revised final implementation plan when a loss occurs.

Existing studies, such as Thieken et al. (2006) in Germany and Poussin et al. (2013, 2015) in France, rely on isolated surveys of insured and uninsured parties. Whilst they suggest that insured parties are slightly more likely to undertake risk reduction efforts than uninsured ones, there are some methodological issues that limit comparability and scalability. Survey response methods often suffer from fundamental problems of reliability and internal validity, and even when considered sufficiently robust, they offer no consistent and comparable method for assessing the cost-effectiveness of insurance mechanisms. Hudson et al (2014) found that those buying natural catastrophe insurance are particularly risk averse, which suggests that the higher observed risk reduction of the insured may be an effect of selection.

Measuring if and how insurance contributes to direct risk reduction remains challenging, as it requires an understanding of disaster impacts and the scope of risk prevention measures that are induced by insurance, including measures influencing the policyholder's behaviour, directly promoting actions by the policyholder and directly or indirectly affecting actions by third parties (such as the government). Various metrics for assessing the insurance impact on promoting risk reduction/prevention have been proposed in the literature, including Chrichton (2008), Paudel et al. (2012), Surminski and Oramas-Dorta (2013)and Surminski and Eldridge (2015). In the latter study, elements of this approach were applied to United Kingdom flood insurance schemes through a set of qualitative assessments.

Recently, attention has been brought to harnessing insurance for better protection of the environment as well as ecosystem services for the sake of DRR. Ecosystems may mitigate natural hazard risks by mediation of flows and nuisances or through maintenance of physical, chemical and biological conditions in the face of pressures. Ecosystem services for DRR are most frequently associated with mass stabilisation, water flow regulation (especially flood control), wind dissipation and (micro- and regional) temperature regulation. Other equally important hazard-mitigating services include control of pests, disease and alien species, water filtration, and dilution and detoxification of hazardous substances. The combination of increasing intensity and frequency of natural hazards, continuing conversion, uniformisation and simplification of (semi-)natural ecosystems and the footprint of built infrastruc-

ture may be contributing to the rapid increase in costs and damage from natural hazards. The European Commission research and innovation policy agenda on nature-based solutions (EC, 2015b) defined 'insurance value of ecosystems' as a 'sustained capacity of ecosystems to reduce risks to human society' caused by natural hazards, climate variability and climate change. The insurance value of ecosystems in this sense is equivalent to the net present value of avoided damage and losses obtained from the risk mitigation ESS. In other words, it is the monetary value that risk reduction by ecosystems would bring to risk transfer schemes such as insurance. One indicator could be a reduction in property insurance premiums in light of reduced risk; another could be the willingness of the private sector to underwrite a risk on the basis of confidence in ecosystem services.

Collective insurance schemes appear better equipped to deliver sizeable improvements of ecosystem services and to get around concerns about free riding. An example of a collective insurance reward under a state-subsidised insurance scheme is the Community Rating System (CRS) under the United States National Flood Insurance Program (NFIP), where households receive a premium discount if their community takes specified flood-mitigation measures; which can include nature-based solutions. Pollution insurance provided to businesses is another example of a positive relationship between taking out insurance and reducing harmful environmental damage (Surminski, 2015). A 2003 OECD study found that, with pollution insurance, the insurer may act as a private surrogate regulator aligning its interests with those of high environmental standards (OECD, 2003). More than that, properly priced insurance can help to internalise externalities (such as environmental risks) and hence improve or even secure more sustainable functioning of markets. The internalisation of environmental costs through the payment of premiums is compatible with the deterrence goal of any liability regime and with 'the polluter pays' principle. Conversely, Minoli and Bell (2003) found in an evaluation of two leading United Kingdom insurance companies' pollution claims that the insurers' initial underwriting assessments and post-loss investigations were insufficiently developed. The management practices of insured parties in connection with the prevention of pollution were also underdeveloped. Consequently, insurers' terms and conditions on policies were insufficient to work as an incentive to dissuade pollution losses.

The effectiveness of environmental insurance has been most extensively researched in the United States. For example, there is evidence that despite a range of practical barriers, environmental insurance can be efficient where government fines are not (Yin et al., 2011). The concept of liability for environmental damage, instituted in Europe by Directive 2004/35/CE (EC, 2004a), extended the law of tort to damage incurred to ecosystems. The directive points to sureties or bank guarantees but leaves it to Member States to guarantee financial solvency for damage rectification and clean-up. In the wake of this directive, insurers have developed data sets to map ecosystems and their characteristics with a view to facilitating restoration in case of accidental damage through an insured entity. This development points to a possible entry point for the more widespread incorporation of ESS concepts in an insurance.

5.4.4 Public–private partnerships for risk financing and transfer

A commercial insurance may not guarantee affordability and equitable access to insurance (EC, 2013b). Addressing affordability and equity issues in provision of disaster risk insurance combines business objectives with public policy goals (Solana, 2015). Consistently, the role of the public sector in this pursuit goes beyond the regulatory oversight to include an active involvement in insurance provision. Because public intervention may interfere with market equilibriums and undermine rather than encourage individual risk reduction (Surminski, 2009), reconciling the public and private roles and objectives necessitates a thorough analysis and organisation (Pérez-Blanco and Gómez, 2014).

'Public–private partnerships' (PPPs) is a term coined to denote different approaches to public and private cooperation for providing public services or projects (Bielza et al., 2009; CEA, 2011). PPP is a model for a joint bearing of responsibilities and efficient risk sharing intended to increase insurance coverage and penetration and guarantee a strong financial backing in view of uncertain tail distributions of risk (Johansen, 2006). PPPs are typically characterised as a long-standing

relationship bringing forth mutually beneficial resource and risk-sharing arrangements (EC, 2004b).

Ideally, the PPPs should be designed so as to address market failures such as a lack of or a limited access to affordable insurance and low insurance penetration. In doing so they should limit, to the extent possible, market distortion and preserve competition. Private insurers (should) 'have the opportunity to carry on using their savoir faire in an environment of mutual understanding' (Johansen, 2006). The PPPs should be shaped through constructive dialogues and conscious of mutual principles and limitations. The partnerships should actively promote or at least not harm the incentive for risk reduction, for example by making the individual insurance costs reflecting those risks that result from each individual's choices (Mysiak and Pérez-Blanco, 2016). They should be built on principles of transparency, equal treatment and efficient use of public resources.

In Europe, the most longstanding insurance-related PPP is embodied within the extraordinary risks insurance scheme of Spain's Insurance Compensation Consortium (Consorcio de Compensación de Seguros - CCS). Instituted in 1954 after its provisional creation in 1941, the CCS is an independent public company attached to the Ministry of Economics, Industry and Competitiveness but with separate accounts and a certain degree of entrepreneurial freedom (CCS, 2016).

As a tool at the service of the Spanish insurance sector, CCS performs many different functions, among others the lynchpin of the Spanish Extraordinary Risk System. The extraordinary hazards covered are well defined in the statutes and include floods (before 1986 conditional on declared catastrophe zone, Barredo et al., 2012); cyclones, tornadoes and wind storms (with gusts exceeding 120 km/h); earthquakes; tidal waves; volcanic eruptions; meteor strikes; and other hazards such as acts of terrorism and civil unrest. Spain counts additionally with a comprehensive combined agricultural insurance, managed by a pool of private companies (Agroseguro) in which CCS participates both as a co-insurer and as a reinsurer. A bulk of the estimated EUR 6.4 billion paid in compensations over the 1987-2014 period referred to floods and windstorms (Espejo Gil, 2016).

Public–private partnerships (PPPs) are a model for a joint bearing of responsibilities and efficient risk sharing, capable of increasing insurance coverage and penetration and guaranteeing a strong financial backing in view of uncertain tail distributions of risk.

The scheme is financed by compulsory surcharge on designated insurance policies. Insurance policies covering property damage (with some exceptions), business interruption and personal life and accident.The flat rate surcharge is based on the total insured value and varies only across the type of underlying insurance policies. For example for dwellings and office building the surcharge amounts to 0.008 per thousand.The same rate applies without differentiation for any degree of exposure and any risk across the entire country, as it is calculated considering all claims and risks covered as a whole. Deductibles are applied to commercial policyholders but not to households (ibid.). Risk underwriting is the task of private insurers and the extraordinary risk cover is entirely transferred to CCS. In exchange, the insurers retain 5 % of the collected surcharges to cover administrative costs. Claims are managed and indemnified by CCS. The fact that the scheme has very low administrative costs (less than 10 % of the collected surcharges including the costs of claim processing) is an argument in favour of this arrangement (von Ungern-Sternberg, 2004). Half of the CCS Board of Administrators is composed of chief executive officers from Spanish insurance companies and the other half of senior officials of the public sector. All decisions affecting CCS or the Extraordinary Risk Coverage System emanate from the board, setting another example of PPPs, which is also a flexible mechanism to easily introduce modifications to the system.

France introduced the 'Catastrophes naturelles' (CatNat) insurance regime back in 1982 in the aftermath of the devastating Saône, Rhone and southwest France floods (CCS, 2008; Magnan, 1995). It is based on a mandatory extension of insurance policies against fire and damage to property (theft, water damage, etc.) and land

vehicles, to protect also against damage caused by extreme natural hazard events deemed uninsurable. A defining characteristic of the CatNat regime is that the exceptional character of the natural hazard events, serving as a trigger for damage compensation, has to be sanctioned by an interministerial decree. What qualifies as natural disaster is not exactly specified by statutes and is indeed sanctioned case by case. The CatNat system usually applies to floods, landslides, subsidence, droughts, avalanches, earthquakes and tidal waves. CatNat exemplifies a system in which policyholders cannot exclude the natural hazard coverage, and the insurers have to supply it (Grislain-Letrémy et al., 2012). The additional premiums (or surcharges) are set by the government as uniform percentage rates of the underlying property insurance premium without any regional differentiation, equal for all risks covered and any degree of risk exposure. The government also determines the level of deductibles that are compulsory even if the underlying (base) policies do not envisage them. The deductibles serve as an incentive for risk prevention: the policyholders in districts without a risk prevention plan (Plans de Prévention des Risques - PPR) have to accept higher deductibles when exceptional events of the same hazard types occur consecutively (von Ungern-Sternberg, 2004). In addition, a levy on the CatNat premiums flows into aFund for the Prevention of Major Natural Hazards (Fonds de Prévention des Risques Naturels Majeurs - FPRNM), which finances prevention measures.

Private insurers underwrite the risk, collect premiums and process the claims. Except for the premium rates and deductibles, the natural disaster cover follows the terms and conditions of the underlying insurance policy. The insurers may choose to reinsure the underwritten risks by a Central Re-insurance Company (Caisse Centrale de Réassurance - CCR), initially a public entity of commercial nature and later turned into a state-owned limited company. The CCR offers two types of complementary and inseparable reinsurance contracts: (i) quota-sharing contracts under which the CCR accepts a share of the risk in exchange for a share of the collected premiums; and (ii) stop-loss contracts under which the CCR compensates the loss that exceeds the insurer's annual premium income by a certain factor (OECD, 2014). The CCR holds a dominant position in the reinsurance market in France (Grislain-Letrémy et al., 2012). In 2015 the French Insurance Federation (Fédération Française de l'Assurance - FFA), estimated that by 2040 the human induced climate change may increase the disaster losses by 90 % (EUR 44 billion) compared to losses over the past 25-year-long period (FFA, 2016a). To improve the sustainability and viability of the CatNat regime, the FFA made several suggestions about how to make DRR an integral part of the regime. Among other things, the FFA recommended that the insurers should be able to define the level of deductibles for major policyholders (with insured value beyond EUR 50 million) (FFA, 2016b).

The Flood Reinsurance Scheme (FR Scheme or Flood Re (n.d.)) in the United Kingdom is an example of a public–private reinsurance mechanism for flood components of housing policies. Private flood risk insurance in the United Kingdom has a long tradition and coverage of residential properties is among the highest in Europe (Maccaferri et al., 2012). Housing insurance typically covers a portfolio of risks in addition to floods and is compulsory for securing mortgage loans. Public–private cooperation in the flood insurance sector started in the 1960s and gradually evolved into a partnership entailing tangible commitments on both the public and private ends (Penning-Rowsell et al., 2014; Ball et al., 2013; Lamond, Proverbs and Hammond, 2009; Penning-Rowsell and Priest, 2015).

The FR Scheme had been designed as a publicly accountable but privately owned and managed, non-profit service organisation. The ownership and management of the scheme is entirely in the hands of the insurance industry, with a limited government membership role. The commercial insurers are free to choose whether to reinsure the written market risk or cede the flood-risk component of housing policies to the scheme at predetermined, capped prices. In the latter case, any and all damage claims are paid by the scheme and the primary insurers continue acting as a broker. The capped premiums are specified by the regulation (FR Regulation, 2016), annually updated by the consumer price index and revised every 5 years.

The FR Scheme is funded by an annual statutory levy set at GBP 180 million (EUR 213.5 million) for the first 5-year period, which is imposed on all home insurers operating in the United Kingdom. The total amount of the primary levy was decided as an equivalent level of current cross-sub-

sidy, which amounts to an estimated GBP 10.5 (EUR 12.5) per household. The FR Scheme administrator can raise supplementary (top-up) levies or contributions in cases where it does not have sufficient resources to meet its non-reinsured claims.

Because the statutory and top-up levies constitute a state aid and the scheme entails a selective advantage, the European Commission had been notified and reviewed the FR Schemes. In its review, the Commission recognised the goal of ensuring affordable insurance against flood risk as a legitimate aim of public policy (EC, 2015a). Furthermore, it recognised that the FR Scheme promotes a free flood insurance market and rectifies market failures that might or eventually would compel insurers to stop providing insurance cover in some areas or only at high prices that would not be affordable by all households. Neither of these outcomes was deemed acceptable. The Commission acknowledged that the FR Scheme was designed in such a way as to minimise the (competitive) advantage granted to the insurers, and that the threshold above which the insurers will be able to cede the premiums to the Flood RE scheme will be attuned in a way that limits market intervention to only around 2 % of domestic insurance policies. Other design criteria have prompted a positive review of the scheme. The fact that the capped premium is differentiated by the Council tax band and is adjusted to inflation made the scheme proportional to its objectives. More importantly, the scheme is designed as a transitional measure to be phased out after 20-25 years. While the Government has publicly committed to continue flood risk defence efforts, Flood Re does not provide any incentives for risk reduction and resilience, which has been highlighted as a problem for ensuring future affordability and availability of flood insurance. (Surminski, 2017; Jenkins et. al. 2017).

5.4.5 Conclusions and key messages

Partnership

A comprehensive strategy for disaster financing can moderate the impacts of natural hazard risks, speed up recovery and reconstruction, and harness knowledge and incentives for risk reduction. Private financial sectors play an important role, along with governments and civil society organisations, in designing innovative financial protection goals and sharing knowledge and capacity. PPPs are a model for a joint bearing of responsibilities and efficient risk sharing, capable of increasing insurance coverage and penetration and guaranteeing a strong financial backing in view of uncertain tail distributions of risk.

Knowledge

Climate change has amplified natural hazard risks, and raising vulnerability may make financial protection unaffordable for some people and businesses as well as risks uninsurable in certain places. Insurance and other financial instruments can contribute to reducing disaster risk, if designed and implemented to this end. The reinsurance industry has driven the development of catastrophe risk analytics over the last 30 years, moving from a position where hazards mechanisms, their impacts and comparative risks were little understood to one where sophisticated and integrated stochastic catastrophe models have become the norm in the industry.

Innovation

Insurance can help dissuade policyholders from risky behaviour and incentivise risk reduction. Premiums and policy terms (e.g. deductibles) can be adjusted to reward good risks and penalise bad ones. Harnessing insurance for DRR becomes particularly significant in the context of increased frequency of disaster events, larger economic exposure, rising vulnerability and climate change. Comprehensive strategies for risk financing help to shed light on impacts of disaster risk on economy and society and facilitate identification of actions to minimise them. They allow decision-makers to integrate adaptation and risk reduction with economic development and sustainable growth.

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5.1 Prevention and mitigation: avoiding and reducing the new and existing risks

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5.3 Recovery and avoiding risk creation

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