Chapter 22
Climate Change Adaptation in Insurance

Marie Scholer and Pamela Schuermans

Abstract In this paper, we show three examples of how insurers can contribute to climate change adaptation, through insurers' underwriting and pricing practice. In the context of climate change, there is a clear need to go beyond traditional risk transfer products. Including risk reduction measures in an insurance product has the advantage of helping to better adapt to climate change by not only transferring the risk but by directly reducing avoidable damages when an event strikes, which as a result contributes to build a more resilient society.

Keywords Climate change · Adaptation · Insurance

Introduction

According to the 2020 World Economic Forum, more common extreme weather events could make insurance unaffordable or unavailable for individuals and businesses. Globally, the "catastrophe protection gap"—what should be insured but is not—reached US$280 billion (EUR€252 billion) in 2018. In Europe, only 35% of the losses from climate-related events are insured (EIOPA 2019).

There are limits to achieving a broad insurance penetration (Geneva Association 2019) and to climate change mitigation measures (European Commission 2020). Mitigation measures aim to avoid existing and new catastrophic events, whereas adaptation measures aim to limit the impact of these events. Adaptation as a means for anticipating the adverse effects of climate change and taking appropriate action to prevent or minimise the damage they can cause, or taking advantage of opportunities that may arise, plays an (increasingly) important role in ensuring society's resilience.

Insurance can contribute to limiting the impact (i.e. losses) of a catastrophic event, based on its knowledge and expertise in assessing (modelling, pricing) and pooling

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risks. The European taxonomy for sustainable activities includes non-life insurance as an eligible activity, which substantially contributes to adaptation: insurance against climate-related hazards not only supports risk-sharing but also is working throughout the risk management cycle (identify, analyse, plan, implement and evaluate) and the disaster management cycle (prevent and protect, prepare, respond and recover) (TEG 2020).

Through adaptation measures, insurers can contribute to limiting the potentially systemic risks to society arising from climate change, such as economic consequences, in terms of welfare, including damage to the capital stock, sectoral productivity and changes in consumption (JRC 2020).

Adaptation measures that reduce insured risks will in the future define the sustainability of the insurance business model. In light of the potential impact and interconnectivity of risks posed by climate change innovative solutions for risk assessment, prevention and residual risk transfer among civil society, the market and public authorities are needed.

In this paper, we provide three examples where insurance could make a significant contribution to climate change adaptation, through insurers' underwriting and pricing practice. The price of insurance and the contractual terms and conditions under which insurance is being offered are generally strong signals about the risk even if commercial considerations also determine the price of insurance. By taking measures that influence the price, or the contract, insurers send a message on how they are managing the risks.

Incentivise Risk Reduction Measures in Property Insurance

The first example of how insurance could contribute to climate change adaptation is by providing incentives for risk reduction through premium discounts to policyholders who protect their property against natural catastrophes damages. We present an example of such a practice for floods prevention measures.

A number of prevention measures can be taken by policyholders to lower potential flood impacts (Hudson et al. 2016), such as limit the potential damage once the water has entered a building (known as wet flood-proofing) or attempt to prevent water from entering a building (known as dry flood-proofing). An illustrative example of damage reduction when dry flood-proofing has been implemented is shown in Fig. 22.1. Each of these measures will have different costs (Aerts 2018) and effectiveness.

One way insurers could incentivise risk reduction could be by giving premium discounts to policyholders, which would implement adaptation measures to minimise the risk. The insurer could even communicate this when a new customer asks for a flood insurance contract (i.e. provide premium with and without risk reduction measures). An example is shown in Table 22.1. We can clearly see that the cost of implementing the risk reduction measure is compensated by the lower premium. If policyholders would get access to this information, it might very likely increase the probability that they take risk reduction measures.

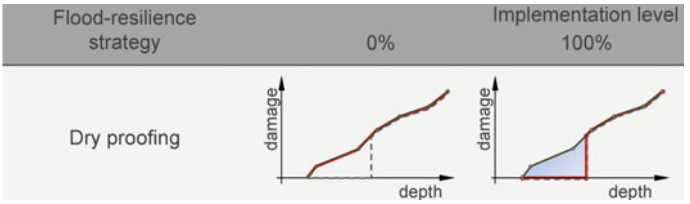

Fig. 22.1 Damage as a function of flood depth. Grey line: implementation level 0%; Dashed line: implementation level 100%; Light-blue area: reduced damage as the effect of flood-resilience technologies (Schinke et al. 2016)

Table 22.1 Based on the example of premium changes if risk reduction measures are considered (Kousky and Kunreuther 2014)

	Example	A zone [1] (USD)	V zone[2] (USD)
Premium	Premium for a house which is 3 feet below BFE[3]	4,000	18,550
Total cost: premium/year		**4,000**	**18,550**
Risk reduction measure	Cost to elevate to 1 foot above BFE	25,000 / annual loan (3%, 20 years) **1,660**	55,000 / annual loan (3%, 20 years) **3,660**
Premium	Premium 1 foot above BFE	**520** (more than 80% premium reduction)	**6,700** (more than 60% premium reduction)
Total cost: cost of risk reduction + premium/year		**2,180**	**10,360**

[1] A zone: is in the 1/100-year floodplain
[2] V zone: is in the 1/100-year floodplain in coastal areas
[3] Base Flood Elevation (BFE)—the estimated height of floodwaters during a 100-year period

In order to calculate the new premium based on different risk reduction measures, nat cat models would need to implement different vulnerability curves as shown in Fig. 22.1 (first using the one where the implementation level is 0% and then the one where implementation is 100%) and calculate the difference obtained in the estimated losses. These differences can then be reflected in the risk-based premium.

Promote Pro-active Management of Business Interruption Risks

Our second example of how insurance could make a significant contribution to climate change adaptation addresses the business interruption (BI) risks. Recent catastrophic events such as the Covid-19 pandemics or Hurricane Katrina have shown

that there is a significant protection gap for BI risks. Taken the size that the BI losses can potentially take, it is necessary to improve the modelling of these risks and extend the insurance coverage by including risk reduction measures. Risk transfer alone will not be sufficient to ensure sustainable insurance coverage.

Most insured losses caused by natural disasters come from property damage: damage to structures and their contents. Losses from the interruption of business activities, however, can make up a significant portion of total losses and insured losses. Hurricane Katrina, for example, caused about $25 billion in insured commercial losses, of which 6–9 billion dollars has been attributed to BI (AIR 2008). There is also evidence that BI can be the most important variable in the survival of a business after a natural catastrophe.

In addition to BI losses arising from building and/or content damage, another source of losses after a natural catastrophe can also be non-damage BI (NDBI). Some businesses, such as aviation companies, might not be able to continue operating after a catastrophic event even if they were not directly impacted.

Standard basic BI insurance policies will cover an insured for losses arising from interruption to their business as a result of damage to insured property. BI insurance is often considered as an "annexe" to property insurance and no individual assessment of the BI risk is done. This may suffice in respect of a "normal" property loss, such as a fire or machinery breakdown. However, where there is damage to the wider area as a result of a natural catastrophe, this basic cover is often not broad enough. Considering the current property market sum insured for windstorms in Europe (see Fig. 22.2), the largest component of the total sum insured stems from buildings. The sum insured for BI represents only a small percentage for the commercial (industrial, agricultural and commercial) sector.

To assess BI risk, catastrophe models can be used. However, catastrophe models are usually well developed for assessing property damage but modelling of business interruption (BI) lags far behind (Rose and Huyck 2016). One reason is the crude nature of functional relationships in nat cat models that translate property damage into BI. Another reason is that estimating BI losses is more complicated because

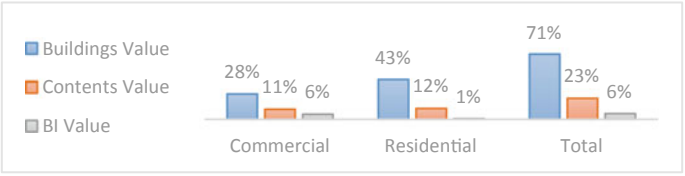

Fig. 22.2 Percentage of the total sum insured for building, content and BI for commercial (industrial, agricultural and commercial) and residential sectors for windstorms in Europe (data source: PERILS[1])

[1] https://www.perils.org/.

it depends greatly on public and private decisions during recovery with respect to resilience tactics that dampen losses.

BI insurance (for both BI and NDBI) is a key aspect to build a resilient society especially in the context of climate change adaptation. The survival of most businesses to natural catastrophes will depend on the extent to which an appropriate insurance policy has been chosen. Insurers need to offer adequate BI products by not only considering BI as an annexe to property insurance. In order for insurers to be able to offer adequate products, a clear BI risk assessment is needed to estimate the potential losses for proper risk-based premium calculation. Significant efforts should be put into the development of more accurate BI risk modelling. Insurers also have a clear role to promote the pro-active management of BI risks. They could, for example, offer premium rebates for undertaking contingency planning (e.g. plan to remove business activities from high hazard zones).

Improve Creditworthiness Through Adaptation Measures

Our third example shows that adaptation measures in property and NDBI insurance can contribute to reducing the risk from climate change in mortgage insurance and trade credit insurance (hereafter "credit insurance"). Additional adaptation measures from credit insurers can further contribute to climate change adaptation.

Creditworthiness, i.e. the ability to pay off one's debt, is central to mortgage and trade credit insurance. Mortgage insurance aims at paying off the outstanding debt in the event of the policyholder's death, disability, termination of employment or circumstances—specified in the policy—that may prevent the policyholder from earning income to service the debt. Trade credit insurance protects an insured from non-payment of commercial debt, i.e. it offers protection against the risk that a buyer defaults on a payment obligation.

Climate (change)-related costs are a source of credit risk: economic costs from physical and transition risks caused by climate change are ultimately borne by households and firms, affecting their cash flows and wealth, which are key determinants of their creditworthiness (Monnin 2018). Following a natural catastrophe, citizens may face the double burden of paying off a mortgage while also paying the reconstruction of their homes, potentially facing disaster-related unemployment. Businesses may face business interruption and/or physical damage to their property and, due to business interruption, create additional risks to the employment of individuals. All these risks are likely to lead to increased defaults on the payment for the purchase of goods and services or the servicing of a loan, leading to high incurred losses and pay-outs by credit insurers.

The impact of climate (change)-related events on mortgage insurance is well illustrated by the case study research by Corelogic on loan payment performance in Texas, after Hurricane Harvey hit the end of August 2017 (Corelogic 2018). In Hurricane Harvey FEMA (US Federal Emergency Management Agency) designated counties, properties estimated to have damage saw a 205% increase in 90+ day

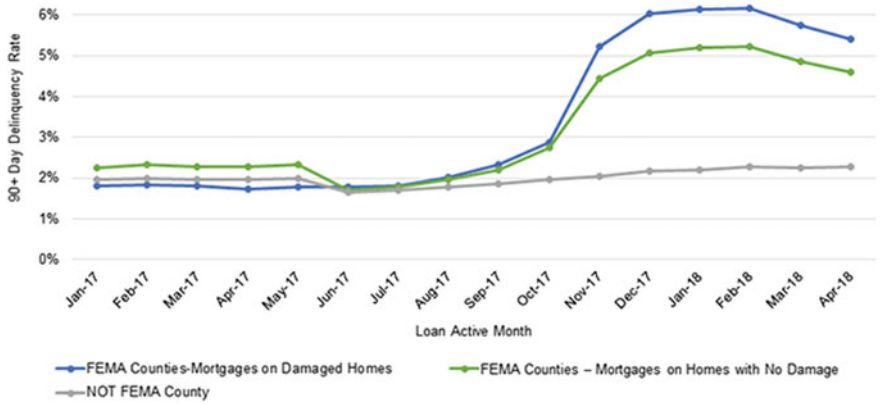

Fig. 22.3 90+ Day delinquency rate for TX . *Source* Corelogic 2018

mortgage delinquency, while properties estimated to have no damage saw a 167% increase in 90+ day mortgage delinquency when compared to delinquency rates just six months prior (Fig. 22.3).

As illustrated in our first and second examples, adaptive measures in property insurance and NDBI insurance can reduce insured risk. Adaptive measures to the property and business contingency planning can impact the cost for mortgage insurance or trade credit insurance, as these measures may contribute to reducing vulnerability to payment defaults arising from climate change. Applied to the case study of Corelogic: adaptation measures aimed at protecting the property against physical damages may lower the blue curve. Adaptation measures aimed at improving the business contingency planning to climate change scenarios may lower the green curve, across society.

Credit insurers can also themselves contribute to climate change adaptation in different ways: based on their risk assessment, credit insurers can support the insured in the buyer/sectoral risk assessment, to identify counterparties that may be particularly prone to default under climate (change)-related risks. Through an improved knowledge of the regional and global impact of climate change, credit insurers can also improve their country/region risk assessment.

Estimates of the damage and reconstruction cost of the property after a natural catastrophe can help improve the mortgage insurer's view of the risk of climate change to the mortgaged property, hence the relevance of looking at the underlying terms and conditions of the property insurance covering the mortgaged property. Based on the assessment of the possible longer-term financial burden on a policyholder following a disaster, a credit insurer could adapt the terms and conditions of the credit insurance (e.g. flexible premium payments, or temporarily lower deductibles).

Conclusions

In this paper, we have shown how an insurer could contribute to climate change adaptation, through insurers' underwriting and pricing practice. In the context of climate change, there is a clear need to go beyond traditional risk transfer products. Systematic consideration of how to integrate prevention measures to mitigate the insured risk should be the way forward. Including adaptation measures in an insurance product has the advantage to help to better adapt to climate change by not only transferring the risk (transferring the risk does not reduce the actual damage incurred) but by directly reducing avoidable damages when an event strikes. Examples were made of prevention measures for flood in property insurance, contingency planning for BI insurance and the impact of adaptation measures on credit insurance.

Climate change strengthens the need to have adequate risk transfer products, for example for business interruption as a significant protection gap exists for BI losses. Significant efforts should be put into the development of tools to identify protection gaps and in models to improve the quantification of risks and support risk-based pricing. Risk-based premiums are an important indicator of the evolving risk. Prevention measures aimed to reduce the insured risk can only be properly quantified and thus reflected in the premium if adequate models are available.

Going forward, if no adaptation measures are being taken, premia may become unaffordable or insurers' financial capacity may be lacking to cover for losses arising from climate change or other potentially systemic risks. Innovative risk solutions require relevant public and private stakeholders to share their data and exchange on different aspects of the risk assessment, prevention and transfer to ensure that risks remain insurable.

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