STUDY

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European Parliament

Compensation for victims of climate change disasters

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Compensation for victims of climate change disasters

Abstract

This study, commissioned by the European Parliament's Policy Department for Citizens' Rights and Constitutional Affairs at the request of the Committee on Petitions (PETI), analyses the kinds of compensation available to victims of climate change disasters in the EU. The study outlines the dangers and effects of climate change in the EU as well as the EU policies and mechanisms to deal with climate change disasters. A theoretical framework is developed to determine appropriate compensation mechanisms to deal with climate change disasters. Also, the compensation mechanisms for natural disasters in a representative selection of Member States are discussed. Furthermore, a critical analysis of the compensation mechanisms at EU and Member State level is provided, and policy recommendations are formulated.

This document was requested by the European Parliament's Committee on Petitions.

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LIST OF ABBREVIATIONS

CCR	Caisse Centrale de Réassurance (France)
CCS	Consorcio de Compensacion de Seguros (Spain)
CO2	Carbon dioxide
EAFRD	European Agricultural Fund for Rural Development
EAR	Emergency Aid Reserve
EEA	European Environmental Agency
EIB	European Investment Bank
EIOPA	European Insurance and Occupational Pensions Authority
ERDF	European Regional Development Fund
EU	European Union
EUCPM	European Union Civil Protection Mechanism
EUSF	European Union Solidarity Fund
IBRD	International Bank for Reconstruction and Development
IPCC	Intergovernmental Panel on Climate Change
MSB	Civil Contengencies Agency (Sweden)
NATCAT	Natural Catastrophes
PAD	Natural Disaster Insurance Policy (Romania)
PAID	Pool Against Natural Catastrophes (Romania)
PETI Committee	European Parliament's Committee on Petitions
RDPs	Rural Development Programmes
RON	Romanian leu
SEAR	Solidarity and Emergency Aid Reserve

SEK	Swedish Crownes
TEN-T	Trans-European Transport Networks
UCPM	European Union Civil Protection Mechanism

LIST OF FIGURES

EXECUTIVE SUMMARY

The European Union has witnessed an increase in climate change related disasters. Heavy rain, heatwaves and flooding are occurring more frequently than in the past, and the prediction is that climate change related disasters will only increase in the future. This can obviously lead to large losses for households and businesses. Moreover, in the absence of structural solutions to deal with those losses, there is also the danger that there may be secondary, systemic effects as a result of which the large losses related to disasters could lead to societal disruptions. It is against this backdrop that the question arises of what types of compensation are in place today for victims of climate change disasters in the EU.

The main aim of this study is to outline the dangers and effects of climate change in the EU, and to analyse what types of compensation mechanisms are available to victims today, both at EU level and in a representative selection of Member States. The approach of the study is therefore both positive and normative. At the same time, the study analyses which (combination of) mechanisms might be optimal to provide adequate compensation for those victims.

In order to realise these objectives, the study first analyses the dangers and effects of climate change in the EU based on a summary of the available literature. Notwithstanding uncertainties, the overall conclusion in existing studies is that the EU will be confronted with an increasing number of heatwaves, droughts, wildfires, heavy rainfall, floods, and rising sea-levels. Climate change will also have significant societal impact and will deepen existing inequalities. The economic losses related to weather and climate change related events have amounted on average to over EUR 12 billion/year in the 32 EEA member countries. Of all of these weather and climate related losses, on average only 1/4 to 1/3 were insured. As a result, there is a large gap between, on the one hand the losses caused by climate change disasters, and on the other the financial protection (more particularly insurance) available. It is therefore necessary to examine the financial mechanisms that could be employed to deal with climate change related losses, both mechanisms already available today and mechanisms that could be further developed in the future.

The EU has already developed a wide range of policies and instruments to strengthen resilience against climate change disasters. The most important instrument is the EU adaptation strategy. This strategy aims to protect citizens and the environment in the EU against the effects of climate change. Moreover, there are various particular instruments which are geared towards specific disaster risks. As far as natural disasters are concerned, the most important piece of EU legislation is undoubtedly the EU Floods Directive of 2007. The EU also has a variety of other mechanisms in place to deal with natural disasters, such as the European Union Civil Protection Mechanism (UCPM), the European Union Solidarity Fund (EUSF), and the Emergency Aid Reserve (EAR). The EUSF and the EAR have now been merged into the Solidarity and Emergency Aid Reserve (SEAR).

According to a report by the World Bank, it is doubtful whether the funds available in the SEAR will be sufficient if a major disaster were to occur. There is therefore a climate change funding gap between, on the one hand the funds available at the EU level and on the other, the potential damage that could occur in the Member States. Member States will therefore have to take measures at national level in order to finance the losses resulting from climate disasters.

From a theoretical perspective, there are several reasons why it is important to work out a funding mechanism to deal with climate change related disasters in a structural manner. Disasters may have a systemic effect as a result of which they could potentially lead to a disruption of society. Therefore, Member States should work out structural solutions to finance the losses related to climate disasters. Of all instruments that could theoretically be employed to reach that goal, first party disaster insurance

is undoubtedly the most attractive. A 2013 Green Paper on insurance of natural and man-made disasters encourages awareness-raising concerning the climate change risk and promotes a flexible natural catastrophe insurance market.

The major advantage of first-party insurance is that it can provide coverage that corresponds to the individual needs and preferences of the potential victims. Moreover, the insurance contract provides a guarantee for the potential victim that compensation will be provided in accordance with the conditions of the insurance policy. Furthermore, in order to remedy the moral hazard risk, the insurer will impose obligations on the insured through the policy conditions, aiming at reduction of the risks of disaster and mitigation of losses. However, as a result of underestimation of the risk and psychological biases, there may be insufficient demand for disaster insurance. To cope with weak demand, comprehensive mandatory insurance could be prescribed. Problems could also arise on the supply side, as catastrophes may require the availability of a large capacity to cover losses. In addition to commercial insurance and reinsurance, the state could act as reinsurer of last resort, thus increasing the capacity of the insurance market and stimulating the market solution.

The first-party insurance model is certainly preferable compared to other potentially available instruments. Liability rules cannot *de facto* guarantee compensation for victims of climate disasters, as it may often be absolutely impossible to find an identifiable injurer against whom a liability suit could be brought. Government-funded compensation (either *ad hoc* or through a compensation fund) has as a major disadvantage that it dilutes the incentives for disaster risk reduction and for mitigation of losses. It may, moreover, also dilute incentives to seek insurance coverage and could lead to negative redistribution. Insurance solutions are therefore to be preferred - by far - over using the public purse. This complies, moreover, with the principle that an *ex post* model of compensation for climate related losses should be structured in such a way that it also provides *ex ante* incentives for disaster risk reduction and mitigation of losses.

Seven Member States (Belgium, France, Germany, the Netherlands, Romania, Spain and Sweden) were examined and showed a wide variety of mechanisms for dealing with natural disasters. Those mechanisms are in principle the same instruments that can be employed to deal with climate related disasters. Of all models examined, the preferred model is France, which in 1982 introduced a system in which, in addition to a voluntarily concluded housing insurance (*multi-risques habitation*), automatic cover for natural disaster risks is added. As a result, all homeowners who have housing insurance are automatically insured against natural catastrophes as well. Similar models (with variations) apply in Belgium and Spain. Romania also has a system of mandatory insurance against earthquakes, landslides and floods. However, as a result of a lack of enforcement, *in fact* less than 20% of homes in Romania have insurance cover. Sweden relies heavily on first-party insurance to deal with the consequences of natural disasters, and the country has a very high penetration rate of insurance, although there is no compulsory insurance.

Other countries (more particularly the Netherlands and Germany) rely on a variety of public funding solutions. In both countries, the *ex post* government compensation is being debated, and policy proposals have been launched (so far unsuccessfully) to introduce (mandatory) first-party insurance against disasters.

The countries that have employed (mandatory) first-party insurance (in particular Belgium, France and Spain) also have a system whereby the government provides reinsurance of last resort. In France, this is entrusted to the (state-controlled) Caisse Centrale de Réassurance, in Belgium a similar role is fulfilled by the (government-financed) disaster fund.

From the analysis of the compensation mechanisms in the seven Member States it appears that there is a tendency towards an increasing use of first-party insurance solutions. This trend corresponds with the theory which holds that only first-party insurance has the advantage of providing both adequate compensation for victims and incentives for disaster risk reduction and mitigation of losses, which are the most important objectives of a financing mechanism for losses caused by climate disasters.

The insurance model developed in France in 1982 has since been transplanted into other EU Member States (but also into countries outside of the EU), and it can be considered as best practice. Obviously, mandatory insurance would not be necessary in a country that has a culture in which insurance coverage for disasters is already widespread anyway. However, this is the case only in Sweden. For the other Member States without a regulatory duty, there would be a market failure as a result of insufficient demand for disaster insurance. The case of Romania, moreover, shows that it does not suffice to mandate insurance if this is not accompanied by adequate enforcement. This also shows that it may be easier to add mandatory disaster cover to voluntarily concluded housing insurance (as in Belgium, France and Spain), than to directly oblige all households to take out disaster insurance (as was done in Romania).

In the countries that introduced (mandatory) disaster insurance, the government provided reinsurance as a last resort. That solution is theoretically preferable to government-provided compensation (either *ex post* or through a structural fund), because government-provided compensation dilutes incentives for disaster risk reduction. The intervention of the government as reinsurer of last resort can therefore be considered as a form of smart regulation which stimulates the functioning of the insurance market.

The EU can also stimulate the functioning of the insurance market by, for example, stimulating information exchange or (cautiously) allowing information exchange between insurers, in order to increase the predictability of the likelihood of disasters, which is necessary for premium calculation. The EU could also facilitate the insurance solution in Member States by generously allowing the state to act as reinsurer of last resort within the framework of state aid control, and it could even consider acting as reinsurer of last resort in cases where Member States may not be able to fulfil that role. This might even be more desirable than increasing the use of *ex post* funding mechanisms (such as the ERDF). Not only do these mechanisms provide immediate relief after a disaster, they also aim at *ex post* reconstruction, which could negatively affect the incentives for politicians in the Member States concerned to adequately invest in disaster risk reduction.

The compensation mechanisms employed in the Member States showed a wide diversity (even though there may be a trend towards an increasing use of first-party disaster insurance). However, the mere fact of there being differences between the Member States does not constitute a valid reason for harmonisation of those mechanisms at EU level. There does not seem to be any theoretical basis for such a centralisation (as there are no cross-border spill-overs, nor any danger of a race to the bottom). The wide degree of differences between the Member States, as far as currently available financing mechanisms are concerned, points to potentially high costs of harmonisation. It is for this reason that a facilitative role for the EU, i.e. stimulating the availability of disaster insurance, is preferable to harmonisation at EU level or increased funding from the EU to Member States, as the latter could dilute incentives for disaster risk reduction within the Member States.

This leads to the following recommendations:

1. Member states should develop a comprehensive national disaster financing strategy.
2. *Ex post* government-funded compensation for recovery should be avoided.
3. The development of comprehensive mandatory first-party insurance for losses caused by (climate change) disasters should be stimulated.

4. Mandatory disaster cover should be structured in such a way that the mandatory disaster cover is added on to another, voluntarily concluded, insurance.
5. Mandatory supplementary disaster cover should be structured in such a way that it corresponds as much as possible with market principles.
6. In order to solve supply-side problems, governments could intervene as reinsurer of last resort, in order to stimulate the capacity of the insurance market.
7. Market principles should be applied when the government acts as reinsurer of last resort.
8. The development of an over-arching strategy for integrating resilience investment at EU level should be stimulated as part of the greening of the EU.
9. Insurability should be stimulated through EU action.
10. The development of insurance for climate change related disasters at Member State level should be facilitated through flexible application of state aid rules.
11. The EU should promote Information exchange concerning the risk of climate change disasters.
12. Caution should be exercised with strengthening EU funding of losses caused by disasters in Member States, in particular funding through the EUSF.
13. Harmonisation of the compensation schemes to deal with losses created by climate change disasters in the EU Member States should not be considered as a policy option.
14. Provision of data on disaster risk and disaster risk financing should be improved.
15. An over-arching disaster risk financing strategy should be developed at EU level.

1. INTRODUCTION

1.1. Background of the study

The past decade has already seen an increasing amount of climate change related disasters. According to data from insurers there has been an increasing amount of losses due to heavy rainfall, hurricanes, flooding, and droughts. Even though most of the devastating consequences of climate change may have been felt in the Southern Hemisphere, the EU may also increasingly suffer from climate change related disasters. The expectation is that such climate events will only increase in the (near) future.

The EU Member States have (to varying extent) compensation mechanisms in place to deal with disasters in general, though not specifically for climate change induced disasters. As, from the victim's perspective, the cause of a disaster (climate change or not) does not matter, these general mechanisms can also be applied to disasters that are induced by climate change.

There is a wide variety of mechanisms to deal with the consequences of natural catastrophes (in the literature sometimes abbreviated as NATCATS)[1] in place. Some Member States have no specific compensation mechanism, but the government may provide *ad hoc* and *ex post* compensation in the case of a (large) natural catastrophe. That model is used *inter alia* in Germany and Italy. Other Member States have relied, or still rely largely, on a public compensation fund, which usually provides lump sum payments rather than full compensation. This model is applied *inter alia* in Austria, and has been applied for a long time in Belgium, but has lost importance there after legislative changes in 2005.

Yet another model is based on the example from France, which introduced a comprehensive compensation mechanism for natural catastrophes. Citizens who have a (voluntary) homeowners' insurance also have a (mandatory) add-on for natural catastrophes. This model was introduced via legislation in France in 1982 and is now also applied in Belgium (after a legislative change in 2005). Moreover, in addition to the model of mandatory disaster cover, some countries have introduced a public-private partnership whereby the government intervenes as a reinsurer of last resort, thus providing an additional layer of compensation. For example in France, this cover is provided through the (state-financed) Caisse Centrale de Réassurance (CCR). The same model is followed in Belgium and Spain. In sum, currently there is a "praise of diversity" as far as compensation for victims of climate change related disasters is concerned. This obviously has consequences for the extent to which victims of a climate change induced disaster can expect to be compensated.

1.2. The goals of the research

The goal of this study is to provide a clear and simple overview, understandable to the non-expert reader on the issue of compensation for victims of climate change disasters in the EU.

1.3. Scope and limits of the study

The study provides:

- an introduction to and overview of the dangers and effects of climate change in the EU and, more particularly, the likelihood that these will lead to more natural catastrophes with the related losses;
- an overview of the most important relevant EU legislation in this particular domain, and its relationship with the legislation in the Member States;

[1] For a comparative overview see *inter alia* the contributions in Faure & Hartlief 2006, Linnerooth-Bayer & Mechler 2007 and He & Faure 2021.

- an overview of the wide variety of compensation mechanisms that could potentially be used to provide compensation for victims of climate change related disasters; this section addresses the instruments that could potentially be employed, as well as their advantages and (practical) limitations;
- an overview which provides more specific details of the different types of compensation schemes and their effectiveness; the effectiveness analysis will focus in particular on the ability of compensation schemes to provide incentives for *ex ante* prevention, but also relate to their ability to provide adequate and certain *ex post* compensation;
- an overview of compensation measures actually in place today in a representative sample of EU Member States to serve as examples;
- suggestions and recommendations to improve the effectiveness of compensation for victims of climate change related disasters in the EU; these recommendations also focus on the desirability of EU policies or legislation for this particular domain.

1.4. The EU context

Just as many other regions of the world, the European Union is prone to nearly all types of natural disasters, including climate change related disasters. Measures taken by the Member States with respect to both prevention of natural disasters and compensation for victims of catastrophes, differ widely in scope and form. This has already led to EU action. For example, in 2013 the European Commission issued a Green Paper on the insurance of natural and man-made disasters[2] and it is actively examining the possibilities of insurance to provide cover for (climate change induced) disaster risks. Of particular importance is the creation of the so-called Solidarity Fund (EUSF), which pays the costs of emergency response, mostly aimed at the reconstruction of infrastructure. Moreover, on 26 June 2017, the Council adopted EU Regulation 2017/1199 to provide regions hit by earthquakes, floods, or other natural disasters with increased EU support, financed through the European Regional Development Fund (ERDF).

There are a few important angles from which compensation for victims of climate related disasters can be looked at. The first concerns the different EU actions to facilitate the insurability of disasters (in addition to the previously mentioned Green Paper on the insurance of natural and man-made disasters, there have also been discussions in the European Parliament that are worth discussing and examining further).

The second is the European Union Solidary Fund (EUSF), which was set up in 2002 to respond to major natural disasters and to express European solidarity with disaster-stricken regions in Europe. The fund was mainly created following devastating flooding in Central-Europe in the summer of that year. Furthermore, the European Solidarity Fund together with Regulation 2017/1199 ensure that the EU meets up to 95% of the reconstruction costs. However, there is also a significant threshold for applying for EUSF support and, as a result of this threshold, there is a significant funding gap according to a report from the World Bank.

Lastly, compensation for climate change victims can also be addressed from the perspective of the EU Adaptation Strategy and the Floods Directive.

[2] European Commission, Green Paper on the insurance of natural and man-made disasters, COM/2013/0213 final.

1.5. Approach/method

This study relies on existing available data, studies, and analyses from various sources, and documents from national and international institutions. For example, in order to reveal the dangers and effects of climate change in the EU, the study relies on existing quantitative and qualitative evidence.

The study uses a law and economics approach. Law and economics is a methodology whereby legal rules are analysed from an economic perspective. This economic approach to law pays detailed attention to the economics of disaster relief,[3] but also to efficient methods for compensating victims of disasters.[4] The economic approach to law is useful as it is based on principles of efficient compensation, and it points at the relationship between *ex post* compensation and incentives for *ex ante* prevention. Moreover, the law and economics methodology provides a critical analysis of the various instruments for compensating victims of climate change related disasters.

A comparative legal approach is followed, which looks at compensation mechanisms in a number of selected Member States, and the study focusses on a detailed analysis of the compensation regimes in seven Member States. These Member States were chosen because they have typical legislative solutions (or lack those) and the adequacy of their compensation mechanism has been discussed at length at national level. As a result, much information is available as regards the desirability of particular compensation mechanisms.

The study will specifically focus on France, as France introduced comprehensive mandatory coverage for natural catastrophes, a model which is now considered an example in many other legal systems. Belgium is interesting in this respect as it tried to follow the French example in two phases (2003, 2005), and discussions on the introduction of the French model also took place in the Netherlands. However, in 1998, the Netherlands opted for a government-provided *ad hoc* compensation mechanism, and insurance is still largely unavailable in that country.

In Germany, discussions on the introduction of a comprehensive insurance mechanism according to the French model were held, but eventually the French example was not followed. Germany therefore still largely relies on an *ex post ad hoc* compensation model.

Spain has an interesting compensation mechanism in the form of a so-called consortium of insurers, with state intervention. This is typical of the model in which the state acts as reinsurer of last resort.

Romania has a natural disaster insurance pool (PAID), which is a catastrophe insurance programme, and which administers a mandatory home insurance system that covers earthquakes, floods, and landslides.

Finally, and in order to have a balanced geographical spread, a Nordic country, Sweden, is reviewed as Sweden is known for its generous compensation mechanism. In sum, the study reviews the situation in the following seven EU Member States:

- Belgium
- France
- Germany
- The Netherlands
- Romania
- Spain
- Sweden

[3] See for example Dari-Mattiacci & Faure 2015.

[4] Faure 2007.

For each of the selected Member States, the study will focus on five different instruments or combinations thereof:

- liability rules, which are only discussed briefly as there is not much scope for applying liability rules to climate change related disasters;
- *ex post ad hoc* government compensation;
- a government-financed compensation fund;
- (comprehensive) first-party insurance for disasters;
- government intervention as reinsurer of last resort.

1.6. Structure

After this introduction, a comprehensive literature review will be provided, addressing the dangers and effects of climate change in the EU. This will provide a clear insight into the potential losses to which citizens in the EU may be exposed as a result of climate change (Chapter 2).

In Chapter 3 relevant EU legislation and policy will be reviewed. This will entail *inter alia*: the EU Adaptation Strategy (including the implementation of the Floods Directive), the measures taken at EU level to facilitate the insurability of disasters, the *ex post* compensation provided at EU level through the EU solidarity fund and Regulation 2017/1199, and finally, a brief discussion of state aid law will be provided with respect to intervention by the government as reinsurer of last resort.

Chapter 4 gives an overview of various compensation mechanisms will be provided from a theoretical perspective. The chapter will start with the fundamental goals and principles of a compensation mechanism, stressing the need to structure the compensation in such a way that it provides adequate incentives for *ex ante* prevention on an equal basis.

Next, in Chapter 5, the five compensation instruments that were identified will each be reviewed, addressing the potential of each instrument as well as the drawbacks. The compensation mechanisms available in the selected Member States Belgium, Germany, France, the Netherlands, Romania, Spain, and Sweden, will be addressed.

Chapter 6 contains a critical discussion and analysis of the role played by the EU so far (Chapter 3) and the compensation mechanisms identified in the Member States (Chapter 5) in light of the theoretical principles and discussions (Chapter 4). The study concludes with Chapter 7, which provides policy recommendations addressed at the most relevant EU actors, including the European Parliament.

2. DANGERS AND EFFECTS OF CLIMATE CHANGE IN THE EU

KEY FINDINGS

- Temperatures in Europe have increased at more than twice the global average over the last 30 years. Europe is therefore the fastest-heating region in the world.
- The main observed and projected climate-related dangers in Europe are heatwaves, droughts, wildfires, heavy rainfall, floods, and a rising sea-level.
- The largest negative impacts are projected for the southern European regions. For southern Europe, an increase in extreme heat, water scarcity, drought, and wildfires is forecast. Northern Europe is expected to experience reduced ice cover and increased temperatures, rainfall, and floods.
- Climate change will have significant societal impacts. The key sectors affected are expected to be health, agriculture and food, forestry, energy and water management, and biodiversity.
- Climate change will deepen (existing) inequalities. Southern Europe, European cities, and coastal areas will be most affected and are projected to become hotspots of multiple risks. Moreover, socially vulnerable groups as well as those practising traditional livelihoods are particularly vulnerable and exposed to climate risks.
- Between 1980 and 2020, the total economic losses from weather and climate related events amounted to EUR 450-520 billion (in 2020 euros) in the 32 EEA member countries. This is on average over EUR 12 billion per year.
- Between only one quarter and one third of these losses were insured. This shows an insurance protection gap, or 'climate protection gap', in Europe.
- There are large differences in insured losses depending on the weather and climate related event, but also between EEA member countries.
- More data on disaster risk financing arrangements in the Member States is needed to ascertain whether they have sufficient provisions for disaster response, and for closing the 'climate protection gap'.

Human-induced climate change will cause - and is already causing - a broad range of environmental and socio-economic impacts globally and across Europe. Climate change and its current and expected impacts therefore present one of the greatest challenges for the EU in the coming decades.

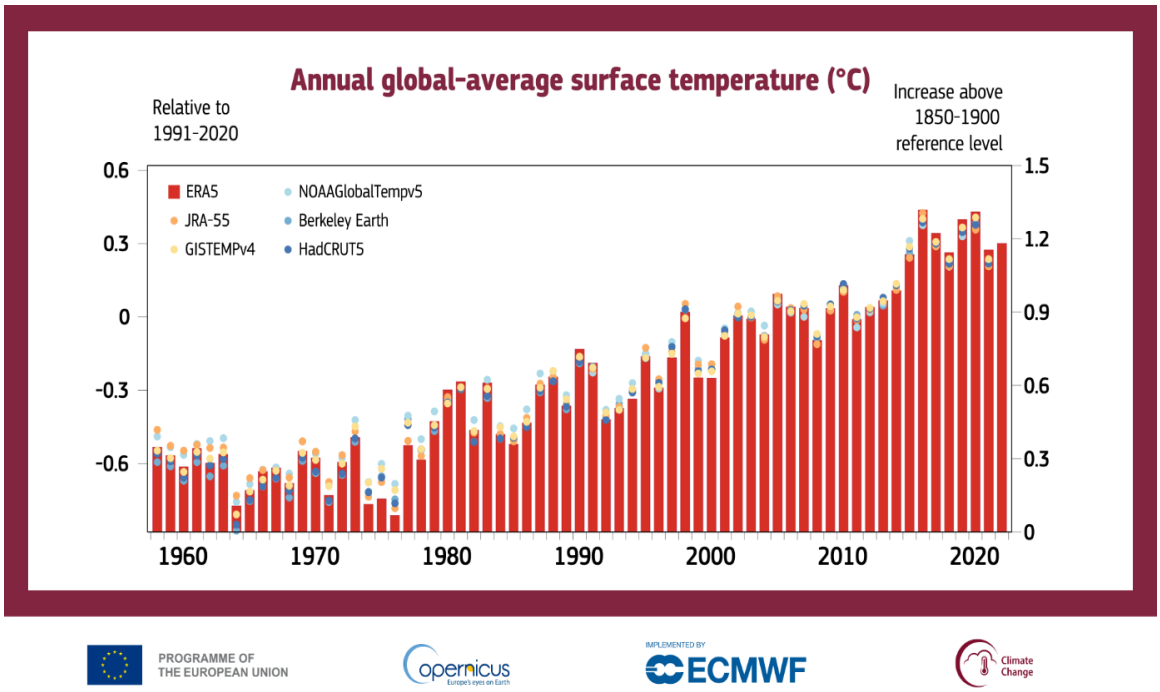
This chapter briefly outlines the consequences of climate change in the EU in terms of climate-related dangers and effects (2.1), societal effects of climate change (2.2), and damage and economic impact (2.3).

2.1. Dangers and effects of climate change in the EU

Climate change is already having visible effects on Europe and on the world. According to the Copernicus Climate Change Service (C3S) Global Climate Highlights 2022, and the World Meteorological Organisation's Provisional State of the Global Climate in 2022 report, the year 2022 was

the eighth year in a row with temperatures of more than 1°C above the pre-industrial level (Figure 1), and it would be the fifth warmest year on record after the record years 2016, 2020, 2019, and 2017 respectively. Millions of people have suffered from extreme heatwaves, drought, and devastating flooding.[5]

Figure 1: Annual global-average surface temperature (°C)



Annual averages of the estimated global surface temperature increase above the 1991–2020 (left-hand axis) and 1850–1900 (right-hand axis) reference levels. 2022 is based on dataset ERA5 only, all other years are based on six different datasets. Data sources: ERA5 (C3S/ECMWF), JRA-55 (JMA), GISTEMPv4 (NASA), HadCRUT5 (Met Office Hadley Centre), NOAAGlobalTempv5 (NOAA) and Berkeley Earth. Source: Copernicus Climate Change Service/ECMWF, https://climate.copernicus.eu/2022-saw-record-temperatures-europe-and-across-world.

Europe[6] is the fastest-heating region in the world. Temperatures have been rising at over twice the global average in the last 30 years. Between 1991 and 2021, temperatures across Europe have risen at an average rate of about +0.5°C per decade. The European Environmental Agency (EEA) holds that European land temperatures now have increased by 1.94°C to 1.99°C, depending on the data set used (Figure 2).[7] This can be explained by the fact that land temperatures rise faster than the temperature of the oceans. Furthermore, atmospheric changes to wind patterns and cloud cover contribute to the fact that parts of Europe but also the Middle East and Northern Asia warm faster than the planet as a whole.[8] For Europe, the 10 warmest years on record have all occurred since 2000.[9]

5 Copernicus Climate Change Service (C3S), Global Climate Highlights 2022, 10 January 2023, available at https://climate.copernicus.eu/global-climate-highlights-2022 and World Meteorological Organisation, Provisional State of the Global Climate 2022, 6 November 2022.

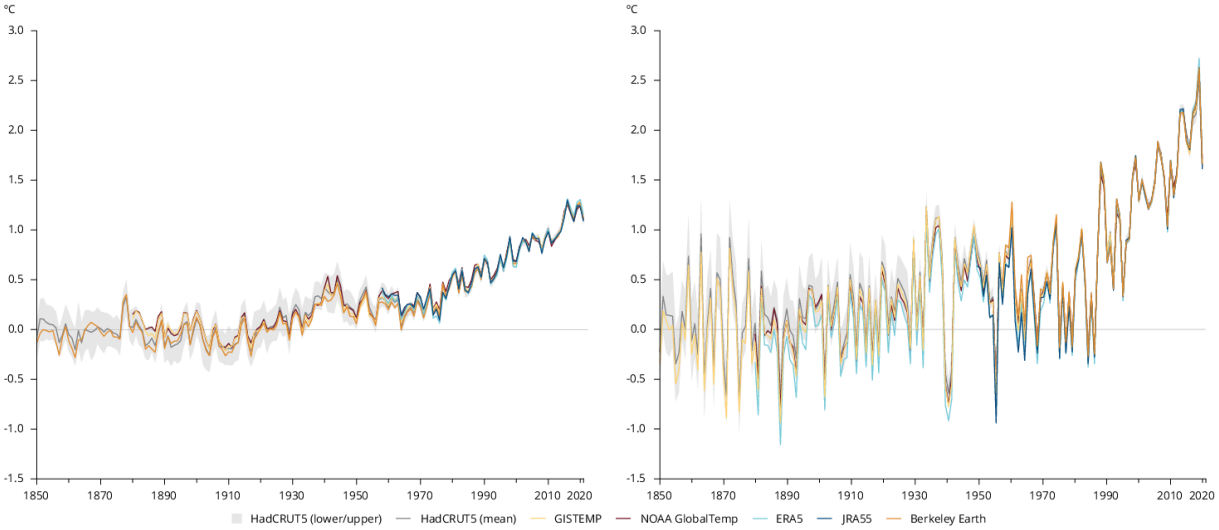
6 'Europe' refers to the land area of the 38 EEA member and cooperating countries (EEA-38), as of 1 February 2020.

7 https://www.eea.europa.eu/ims/global-and-european-temperatures.

8 https://climate.mit.edu/ask-mit/which-parts-planet-are-warming-fastest-and-why.

9 https://climate.copernicus.eu/copernicus-globally-seven-hottest-years-record-were-last-seven.

Figure 2: Global (left) and European land (right) average near-surface temperatures relative to the pre-industrial period 1850-1990



Source : https://www.eea.europa.eu/ims/global-and-european-temperatures

The 2020 State of the European Environment report concludes that climate change has increased the occurrence of weather extremes, such as summer heat waves, heavy precipitation, and droughts.[10] Not surprisingly, recent research links the increased frequency and intensity of the heatwaves seen in Europe in the last decade to human-induced climate change.[11]

Illustrative of the impact of climate change in Europe is the year 2021. The year 2021 was just outside the warmest ten on record, but a variety of extreme weather and climate events occurred in various parts of Europe.[12] On 14 and 15 July 2021, exceptionally severe floods led to an unprecedented death toll and enormous socio-economic damage in Belgium, Germany, and surrounding countries. On 11 August 2021, a location near Syracuse in Sicily, Italy, reached 48.8 °C, a provisional European record.[13] Southern Europe suffered from heatwaves and destructive wildfires devastated the region. In terms of burnt areas, it was one of the most destructive fire seasons in the region since 1991.[14] In short, the year 2021 presented a disturbing picture of the impact of climate change in Europe.

In 2022, the trend continued. Europe saw its hottest summer ever recorded, several temperature records were broken and intense heatwaves afflicted parts of western and northern Europe.[15]

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[10] The European Environment Agency, The European environment – state and outlook 2020 (SOER2020), Luxembourg, Publications Office of the European Union, 2019. ISBN: 978-92-9480-090-9. Available at https://www.eea.europa.eu/publications/soer-2020_72.

[11] World Weather Attribution, Human contribution to the record-breaking July 2019 heatwave in Western Europe, 2 August 2019. Available at https://www.worldweatherattribution.org/human-contribution-to-the-record-breaking-july-2019-heat-wave-in-western-europe/.

[12] Copernicus Climate Change Service (C3S), European State of the Climate 2021, available at https://climate.copernicus.eu/european-state-climate-2021-summary.

[13] World Meteorological Organisation, State of the Climate in Europe 2021, Geneva, 2022, in cooperation with the EU's Copernicus Climate Change Service.

[14] https://climate.copernicus.eu/esotc/2021.

[15] Copernicus Climate Change Service (C3S), Global Climate Highlights 2022, 10 January 2023. Available at https://climate.copernicus.eu/global-climate-highlights-2022. See also World Meteorological Organisation, State of the Climate in Europe 2021, Geneva, 2022, in cooperation with the EU's Copernicus Climate Change Service and the World Meteorological Organisation, Provisional State of the Global Climate 2022, 6 November 2022. The WMO State of the Global

Generally, the largest temperature increases have occurred in southern Europe in summer and in northern Europe in winter. Precipitation decreased in the south and increased in the north.[16]

The Intergovernmental Panel on Climate Change (IPCC) expects that temperatures will continue to rise in all European areas at a rate exceeding global mean changes, similar to past observations.[17] The main observed and projected climate-related dangers in Europe are heatwaves, droughts, forest fires, heavy rainfall, floods, and a rising sea-level.[18] Only very few dangers are specific to a geographical area. Yet, in southern Europe, an increase in extreme heat, water scarcity, drought, and wildfires is forecast. Northern Europe is expected to experience in particular reduced ice cover, higher temperatures, rainfall, and floods.[19]

Recent scientific reports echo the findings of the Intergovernmental Panel on Climate Change, and forecast that over the next decades all of Europe will face worsening impacts of climate change, even if greenhouse gas emissions could be reduced globally.[20]

Some European regions, including urban areas, are particularly vulnerable to climate change. These are southern Europe and the Mediterranean basin, mountainous areas, coastal zones, deltas, floodplains, Europe's far north, and the Artic.[21]

Europe is likely to become a hot continent. Global warming will result in an increase in exposure to and fatalities from temperature extremes. It is forecast that with 1.5°C of global warming, around 100 million Europeans will be exposed each year to an intense heatwave. This will grow to 170 million/year with 2°C, and nearly 300 million/year with 3°C of global warming. The rise in exposure to extreme heat will be most severe in southern Europe.[22]

With global warming, droughts will happen more frequently, last longer, and become more intense in southern and western regions of Europe. Drought conditions will be less extreme in northern and north-eastern parts of Europe. The Mediterranean region is projected to have the largest relative area affected by an increase in drought due to global warming.[23]

Heat and drought might also lead to wildfires. In recent years, large wildfires have affected several regions in northern and western Europe where fires had not been prevalent in the past. Yet, the absolute fire danger remains highest in southern Europe.[24]

Climate report is produced annually and provides information on the current state of the climate using key climate indicators and reporting on extreme events and impacts. The temperature figures used in the provisional 2022 report are until the end of September 2022. The final version will be issued in April 2023.

16 Bednar-Friedl et al. 2022, 1817-1927.

17 Intergovernmental Panel on Climate Change, Sixth Assessment Report, working Group I, IPCC ARC6, WGI.

18 Bednar-Friedl et al. 2022, 1819. See also European Environmental Agency, Climate change impacts in Europe, https://www.eea.europa.eu/highlights/why-does-europe-need-to/climatechangeimpactineurope.pdf/view.

19 European Environmental Agency, Climate change impacts in Europe, https://www.eea.europa.eu/highlights/why-does-europe-need-to/climatechangeimpactineurope.pdf/view.

20 Copernicus Climate Change Service (C3S), European State of the Climate 2021, available at https://climate.copernicus.eu/european-state-climate-2021; World Meteorological Organisation, State of the Climate in Europe 2021, Geneva, 2022; Feyen et al. 2020.

21 European Environmental Agency, Climate change impacts in Europe, https://www.eea.europa.eu/highlights/why-does-europe-need-to/climatechangeimpactineurope.pdf/view.

22 Feyen et al. 2020.

23 Feyen et al. 2020, summary.

24 European Environmental Agency, Climate change impacts in Europe, https://www.eea.europa.eu/highlights/why-does-europe-need-to/climatechangeimpactineurope.pdf/view.

Global warming will also result in a changing precipitation pattern, leading to a general wetting of northern Europe and a drying of the south. In short, climate change will draw a curtain of rain across Europe.[25]

The intensity and frequency of heavy rainfall events, leading to torrential flooding and flash floods, is projected to increase. Flash floods can have considerable impacts, including danger to human lives. The 2021 floods in Belgium, Germany, and the Netherlands for example caused at least 243 deaths, damaged thousands of homes, and disrupted water and electricity supplies.[26]

Sea level rise is also increasing the risk of extreme and permanent flooding along Europe's coasts. Coastal flood damage is projected to increase at least tenfold by the end of the 21st century, and even more or earlier with current adaptation and mitigation. Sea level rise represents an existential threat for coastal communities and their cultural heritage, particularly beyond 2100.[27] Low-lying cities in the Netherlands, Germany, Belgium, and along the northern Italian coastline - especially Venice - will be exposed to coastal flooding due to a combination of sea level rise and storm surges.[28] The severity of the impact will depend on current and future flood protection measures.[29]

2.2. Societal effects of climate change in the EU

Climate change will not only result in weather extremes, it will also have significant effects on European society. The key affected sectors are expected to be health, agriculture and food, energy and water management, infrastructure, forestry, and biodiversity. Furthermore, climate change will deepen (existing) inequalities.[30]

Climate change will result in an increase in exposure to, and fatalities from, extreme heat, especially in southern Europe. Labour productivity will decline, particularly in the Mediterranean. The heat will make outdoor work hard and potentially deadly.[31]

Climate change will also impact European agriculture and food production. For farmers in the north of Europe, climate change may have benefits. Warmer winters, longer growing seasons and more rain mean that the north of Europe will be able to produce more food than today. For the south of Europe, however, droughts will lead to agriculture losses and disasters. Water scarcity and drought will lead to competition between water users such as agriculture, industry, tourism, and households.[32] Moreover, more energy will be needed to cool houses.[33]

Climate change will thus also require careful water management and an adjustment of the energy production due to the changing availability of water for hydropower and increased needs for cooling.

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25 https://www.politico.eu/article/how-climate-change-will-widen-european-divide-road-to-cop26/.

26 https://unric.org/en/2021-floods-un-researchers-aim-to-better-prepare-for-climate-risks/ and https://en.wikipedia.org/wiki/2021_European_floods.

27 Bednar-Friedl et al. 2022.

28 European Environmental Agency, Climate change impacts in Europe, https://www.eea.europa.eu/highlights/why-does-europe-need-to/climatechangeimpactineurope.pdf/view.

29 European Environmental Agency, Climate change impacts in Europe, https://www.eea.europa.eu/highlights/why-does-europe-need-to/climatechangeimpactineurope.pdf/view.

30 European Environment Agency Advancing towards climate resilience in Europe — Status of reported national adaptation actions in 2021) 2022, 20 and IPCC, Europe, 1819.

31 Feyen et al. 2020, summary.

32 https://climate-adapt.eea.europa.eu/en/metadata/indicators/river-flow-drought.

33 Feyen et al. 2020, summary.

Infrastructure, especially in flood-prone areas, will have to be upgraded to withstand the effects of climate change.[34]

While not the focus of this study, climate change also presents additional pressure on European ecosystems. It causes northward and uphill shifts in the distribution of many plant and animal species, which can lead to local extinctions.[35] Furthermore, climate change will facilitate the transmission of vector-borne diseases in Europe such as Zika, dengue, and chikungunya.[36]

European cities are likely to become hotspots for multiple risks of increasing temperatures and extreme heat, floods, and droughts. European cities were not built for climate change. Buildings, concrete, or asphalt seal the soil, which leaves few escape routes for rain, and the sewage systems mostly cannot cope with the water. Floods are especially dangerous for poorer households, which tend to be more exposed as they settle in cheaper flood-prone areas and lack insurance.[37]

Studies warn that climate change will deepen inequality. The economic impact of climate change will be several times larger in the south than in the north, thereby amplifying existing economic disparities among European regions. Moreover, the impact of climate change will be more severe for social vulnerable groups and those practising traditional livelihoods.[38]

While climate change is not the main driver of social inequality in Europe, poor households and marginalised groups are affected more strongly by flooding, heat, drought, and health risks due to spreading diseases, than other social groups. Urban poor and ethnic minorities often settle in more vulnerable settlement zones and are therefore impacted more by flooding. Many depend on food self-provisioning from lakes, the sea and the land. With higher temperatures, the availability of these sources of food is likely to be reduced, particularly in southern Europe. Unique cultures are also negatively affected by climate change across Europe. Semi-migratory reindeer herding, a way of life among indigenous and traditional communities in the European Arctic, is threatened by reduced ice and snow cover.[39]

In addition to being more exposed to climate risks, socially vulnerable groups are also less able to adapt to these risks, because of financial and institutional barriers. They mostly live in houses that cannot be cooled to comfortable levels during summer. These people are particularly vulnerable to risks from increasing heatwave days in European cities. They may also lack the means to protect against flooding or heat (e.g. when they do not own the property). Risk-based insurance premiums, which are intended to help people reduce climate risks, are mostly unaffordable for poor households. For indigenous people, the ability to adapt is also often limited, as they often lack the rights and governance of resources, particularly when in competition with economic interests such as resource mining, oil and gas, forestry, and expansion of bioenergy.[40]

In sum, although all of Europe will be affected, impacts will vary across and within European regions, sectors, and societal groups. Climate change impacts are unequally distributed across Europe and risk

[34] Lenaerts, Tagliapietra & Wolff 2022, Bruegel, 7.

[35] European Environmental Agency, Climate change impacts in Europe, https://www.eea.europa.eu/highlights/why-does-europe-need-to/climatechangeimpactineurope.pdf/view.

[36] Semenza & Suk 2018.

[37] Bednar-Friedl et al. 2022, 1827. See also https://www.politico.eu/article/how-climate-change-will-widen-european-divide-road-to-cop26/.

[38] Bednar-Friedl et al. 2022 and Feyen et al. 2020.

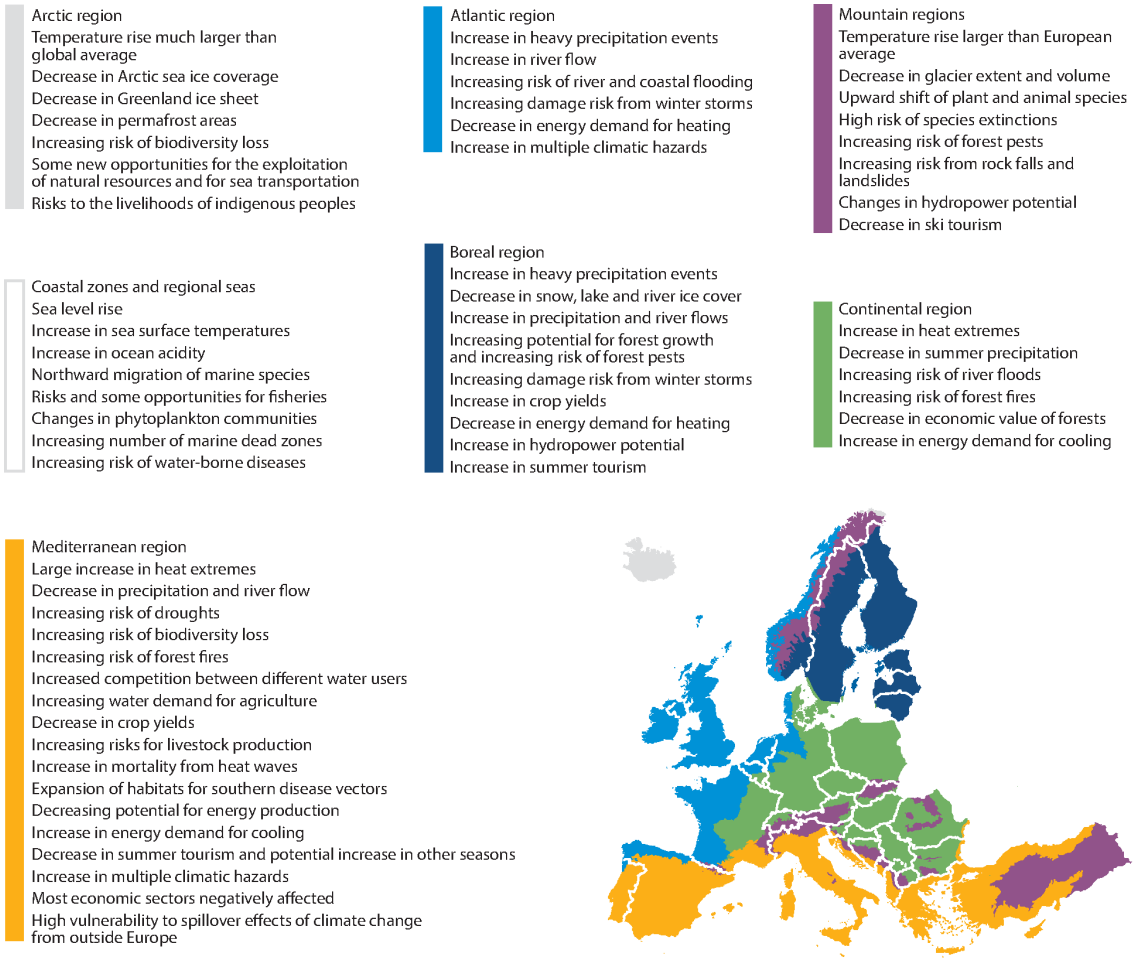
[39] Bednar-Friedl et al. 2022.

[40] Bednar-Friedl et al. 2022, 1889.

to deepen (already existing) inequalities.[41] The food–water–energy–land nexus will play an important role in amplifying overall risk levels in Europe. Southern Europe, European cities, and coastal areas will be most affected and are projected to become hotspots of multiple risks.[42]

The magnitude of the impact will depend on the implementation of climate change adaptation and mitigation measures.[43] However, although adaptation is happening across Europe, it is not implemented at the scale, depth and speed needed to avoid the risks described above.[44] Hence, choices have to be made over which areas to save and which to give up. Fierce political debates are likely to arise on who would have to invest to protect the most affected places, and whether the more fortunate countries and/or societal groups would have to support the most affected by climate change in Europe.[45]

Figure 3: Key observed and projected climate change and impacts for the main regions in Europe



Source: EEA, 2022 https://www.eea.europa.eu/data-and-maps/figures/key-past-and-projected-impacts-and-effects-on-sectors-for-the-main-biogeographic-regions-of-europe-5

41 Bednar-Friedl et al. 2022, 1819.

42 Bednar-Friedl et al. 2022, 1880.

43 Commission Staff Working document, Overview of Natural and Man-made disaster risks the European Union may face, executive summary, 2020 Edition, European Union, 2021, doi: 10.2795/19072. See also Feyen et al. 2020; Bednar-Friedl et al. 2022.

44 Bednar-Friedl et al. 2022, 1820.

45 https://www.politico.eu/article/how-climate-change-will-widen-european-divide-road-to-cop26/.

2.3. Damage and economic impact of climate change disasters in the EU

As part of the new EU adaptation strategy,[46] the EEA has updated information on economic losses and fatalities caused by weather and climate-related events in Europe.[47] For this, the EEA used two sources of databases: the CATDAT (RiskLayer GmbH) and NatCatSERVICE (Munich Re GmbH). Losses are categorised into three groups of weather and climate-related extreme events such as: meteorological events (e.g. storms), hydrological events (e.g. floods), and climatological events (e.g. heatwaves, cold waves or droughts).[48] All 32 EEA member countries are covered (Figures 4a and 4b).

For the 41-year period 1980-2020, total economic losses from weather and climate-related events amounted to EUR 450 and EUR 520 billion (in 2020 euros) in the 32 EEA member countries. This is on average over EUR 12 billion per year. Yet, only a small number of the climate and weather-related extreme events in Europe (3%) were responsible for around 60% of losses over the period 1980-2020.[49]

Meteorological events and hydrological events each caused between 34% and 44% of total losses, and climatological events (split up in heatwaves and other climatological events such as cold waves and droughts) caused between 22% and 24%. Current damage is thus mainly related to river floods and storms, but heat and drought will become major risks in the future.[50] Hazards such as earthquakes and volcanoes (so-called geo-technical hazards) are not included in the figures, as these natural hazards are not weather or climate-related extremes.[51]

It appears that between only one quarter and one third of these economic losses were insured. Moreover, it appears that there are large differences in insured losses between the three groups of events: 37-54% of total losses for meteorological events, 15-24% for hydrological events, and 7-16% for climatological events (Figures 4a and 4b).[52]

More than 85% of the fatalities due to weather and climate-related extreme events in the period 1981-2020 were the consequence of heatwaves. However, as heatwave fatalities are measured indirectly through excess mortality, estimates are influenced by other non-weather and climate-related events, and differ significantly per country and per data source used.[53]

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46 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Forging a climate-resilient Europe – the new EU strategy on Adaptation to Climate Change, COM/2021/82 final, Brussels, 24.2.2021.

47 EEA, Briefing no. 21/2021, Economic losses and fatalities from weather- and climate-related events in Europe, 3 February 2022, doi: 10.2800/530599.

48 Based on the classification of the International Council for Science (ICSU): Integrated Research on Disaster Risk (IRDR) Peril Classification and Hazard Glossary, 2014.

49 EEA, Briefing no. 21/2021, Economic losses and fatalities from weather- and climate-related events in Europe, 3 February 2022, doi: 10.2800/530599.

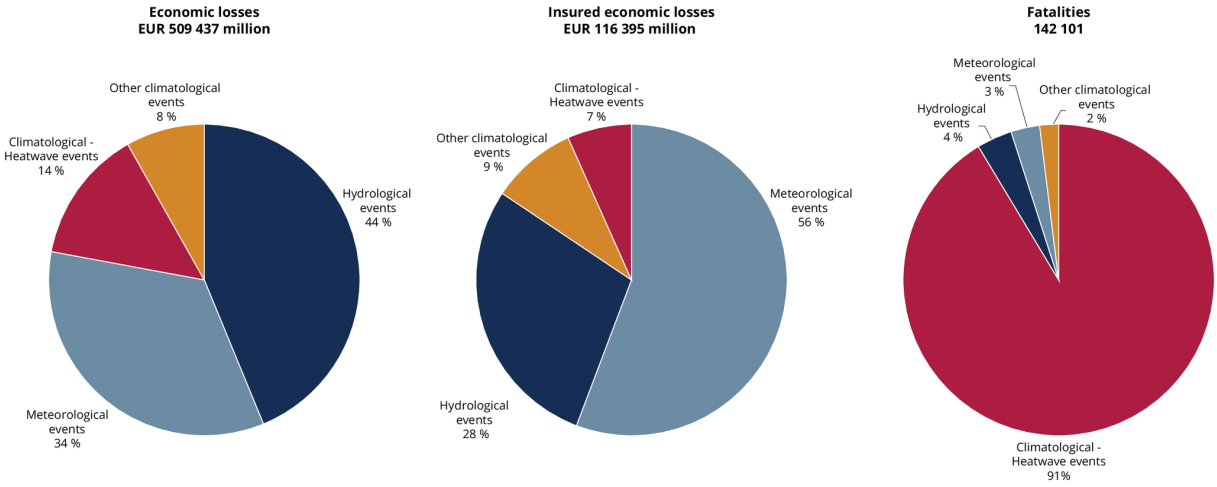
50 Bednar-Friedl et al. 2022, 1852.

51 EEA, Briefing no. 21/2021, Economic losses and fatalities from weather- and climate-related events in Europe, 3 February 2022, doi: 10.2800/530599.

52 EEA, Briefing no. 21/2021, Economic losses and fatalities from weather- and climate-related events in Europe, 3 February 2022, doi: 10.2800/530599.

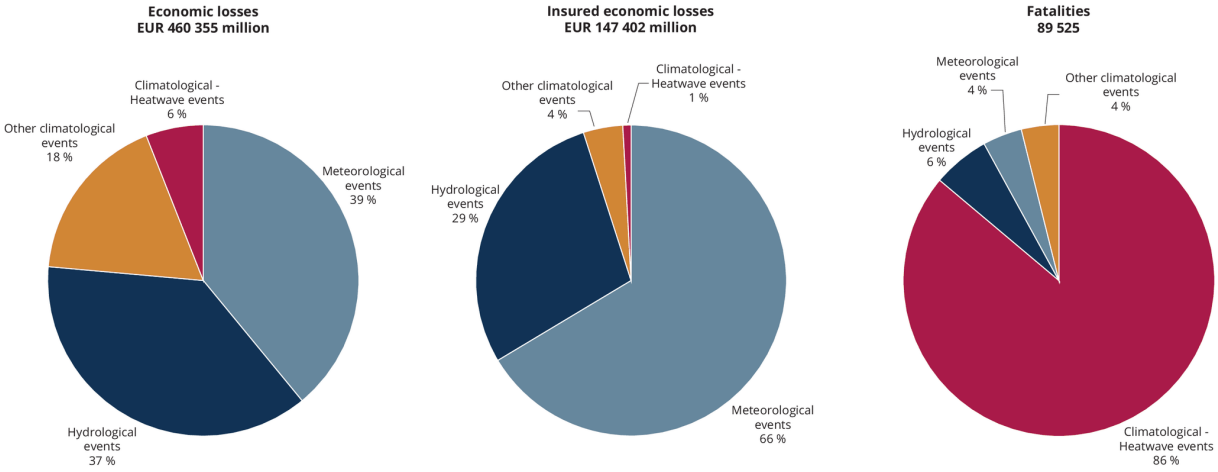
53 EEA, Briefing no. 21/2021, Economic losses and fatalities from weather- and climate-related events in Europe, 3 February 2022, doi: 10.2800/530599.

Figure 4: Economic damage caused by weather and climate-related extreme events in EEA member countries (1980-2020) - per hazard type based on CATDAT (RiskLayer GMBH)



Source: EEA, Briefing no. 21/2021, Economic losses and fatalities from weather- and climate-related events in Europe

Figure 5: Economic damage caused by weather and climate-related extreme events in EEA member countries (1980-2020) - per Hazard type based on NatCatSERVICE

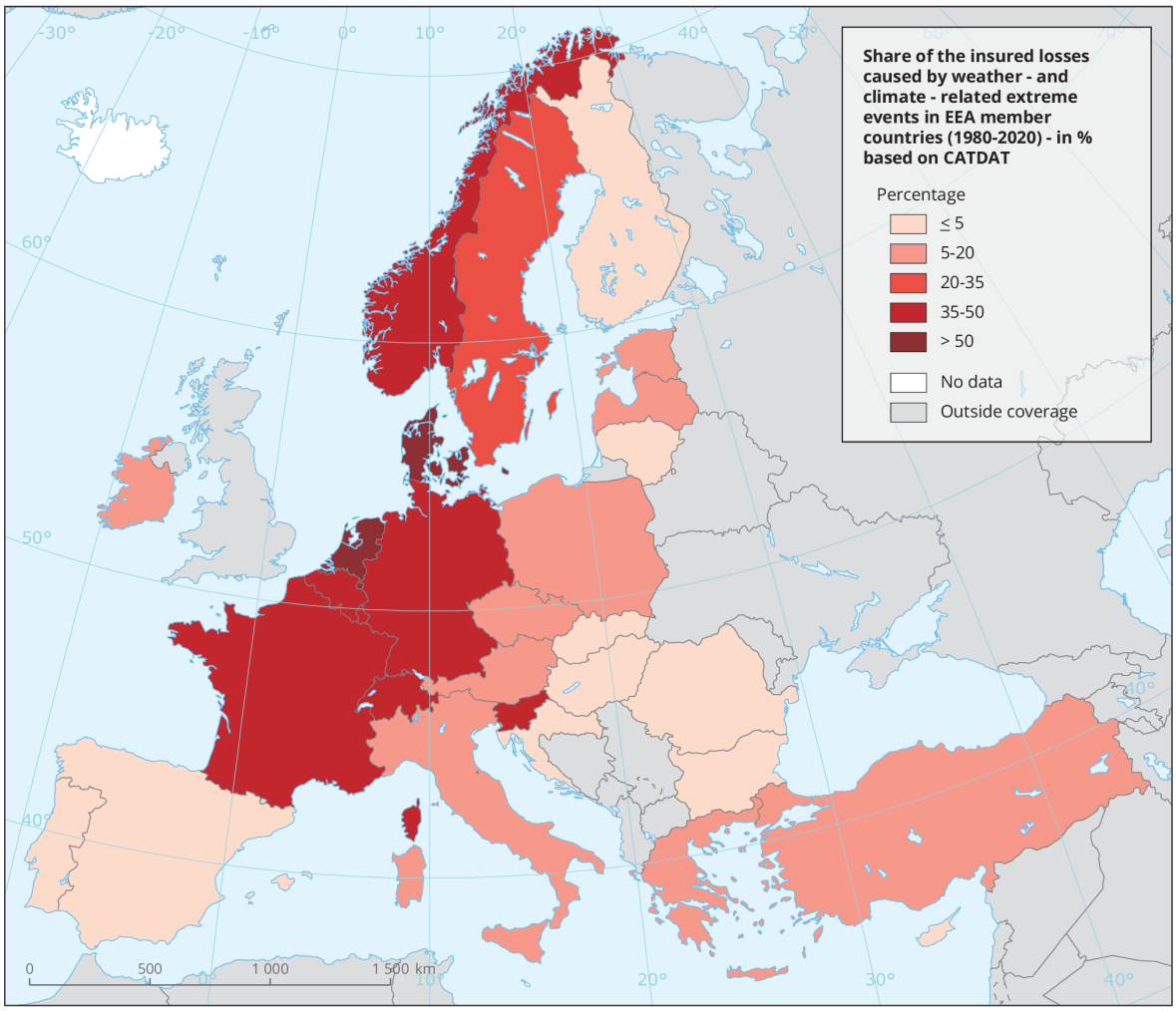


Source: EEA, Briefing no. 21/2021, Economic losses and fatalities from weather and climate-related events in Europe.

The EEA also shows that, in addition to differences in insured losses between the different types of events, there are also large differences between EEA member countries. Based on CATDAT data, the countries with the highest levels of insured economic losses as a percentage of total losses are Denmark, the Netherlands, and Norway (48-56%), while Croatia, Lithuania, and Romania have the lowest values (0.5-1.5%) (Figure 5). Based on NatCatSERVICE data, Belgium, Luxembourg, and Denmark

have the highest percentages of insured economic losses, while Lithuania, Romania, and Cyprus have the lowest.[54]

Figure 6: Share of the insured losses caused by weather and climate-related extreme events in EEA member countries (1980-2020) - in % based on CATDAT



Reference data: ©ESRI

Source: EEA, Briefing no. 21/2021, Economic losses and fatalities from weather and climate-related events in Europe.

It is difficult to identify trends in economic losses and fatalities from weather and climate-related events in Europe. This can be explained by the high variability in losses from year to year, but also by the effect of adaptation measures. Nevertheless, the CATDAT data shows steadily increasing average annual (inflation-corrected) total losses over the decades, from EUR 10.0 billion in 1981-1990, to EUR 11.0 billion in 1991-2000, 13.2 billion in 1991-2002, to EUR 14.7 billion in 2011-2020. NatCatSERVICE data does not show a clear trend.[55]

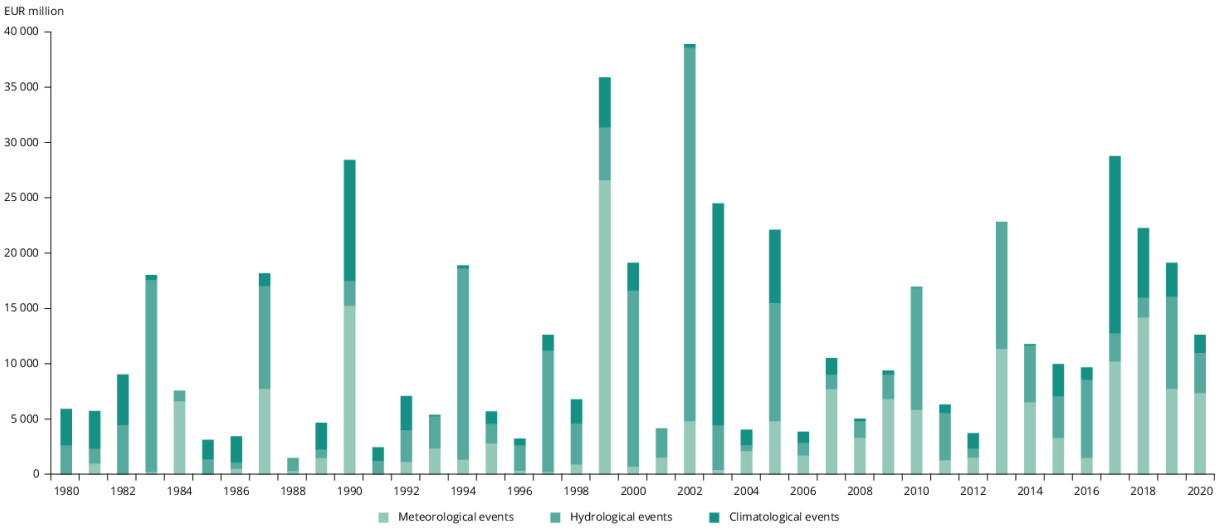
The economic impact of weather and climate-related extremes also varies significantly among the EEA countries. In absolute terms, the highest economic losses in the period 1980-2020 were registered in

[54] EEA, Briefing no. 21/2021, Economic losses and fatalities from weather and climate-related events in Europe, 3 February 2022, doi: 10.2800/530599.

[55] EEA, Briefing no. 21/2021, Economic losses and fatalities from weather and climate-related events in Europe, 3 February 2022, doi: 10.2800/530599.

Germany, France, and Italy. The highest losses per capita were recorded in Switzerland, Slovenia, and France, whereas the highest losses per area were reported in Switzerland, Germany, and Italy.[56]

Figure 7: Economic damage caused by weather and climate-related extreme events in EEA member countries (1980-2020) - per year based on CATDAT



Source: EEA, Briefing no. 21/2021, Economic losses and fatalities from weather and climate-related events in Europe.

The above findings point to an **insurance protection gap** or '**climate protection gap**'. The term 'climate protection gap' is used to refer to the share of non-insured economic losses in total losses after a climate-related catastrophe event. It has also been used to refer to the perceived gap between expected climate-related impacts and current adaptation and resilience measures.[57]

The Intergovernmental Panel on Climate Change (IPCC) forecasts an increase in economic loss and damage for the European economies due to an increase in weather and climate-related extreme events. The JRC PESETA IV study reaches similar conclusions.[58] As a consequence, the price of insurance is also expected to increase. This can lead to insurance becoming unavailable or unaffordable, especially for vulnerable groups, resulting in a further widening of the insurance protection gap.[59]

The main factor for the increase in economic loss and damage would be mortality due to heat stress, followed by reduced labour productivity, coastal and inland flooding, water scarcity, and drought.[60] There will also be a clear north-south divide in the regional distribution of economic losses.[61] Welfare

[56] EEA, Briefing no. 21/2021, Economic losses and fatalities from weather and climate-related events in Europe, 3 February 2022, doi: 10.2800/530599.

[57] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change, Brussels, 24.2.2021, COM(2021) 82 final. See also Commission Staff Working Document, Closing the climate protection gap - Scoping policy and data gaps, Brussels, 27.5.2021 SWD(2021) 123 final.

[58] Feyen et al. 2020. See also Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Forging a climate-resilient Europe – the new EU strategy on Adaptation to Climate Change, COM/2021/82 final, Brussels, 24.2.2021.

[59] European Insurance and Occupational Pensions Authority (EIOPA), The Dashboard on Insurance Protection Gap for Natural Catastrophes in a Nutshell, EIOPA-22/507, 5 December 2022, available online.

[60] Bednar-Friedl et al. 2022, 1850-1881.

[61] Feyen et al. 2020, 58.

losses will be highest in southern Europe, with losses several times larger than those in northern Europe.

According to the JRC PESETA IV study, climate measures in line with a 1.5°C instead of a 3°C temperature increase scenario could prevent up to 60,000 annual fatalities due to heatwaves, and prevent drought losses of EUR 20 billion per year by the end of this century. With such climate measures damage from river floods could be halved, to around EUR 24 billion per year, and economic losses from coastal flooding could be reduced by more than EUR 100 billion per year by 2100.[62]

The International Bank for Reconstruction/the World Bank report complements the findings of the IPCC and the JRC PESETA IV study, and warns that weather and climate-related disasters can slow down economic growth and reduce government revenue due to, for instance, destroyed private and public buildings, and infrastructure. This in turn affects businesses, and might cause supply chain breakdowns.[63]

With respect to private parties, it is estimated that damage to residential buildings constitutes over 50% of total loss for both flood and earthquake risk. Impacts are therefore especially problematic if extreme climate-related disasters happen in areas with low insurance coverage. Thus, climate change related disasters can also induce poverty, especially amongst the most vulnerable. This points to an urgent need to increase access to and uptake of catastrophe home insurance.[64]

The International Bank for Reconstruction/the World Bank report also shows that data on disaster risk financing arrangements in the Member States is limited, and the report recommends that a comprehensive overview be drawn up in order to ascertain whether the Member States have sufficient provisions for disaster response.[65] In the European Green Deal and the EU adaptation strategy, climate-related disaster risk and loss data, as well as data on insurance provisions in all Member States, was identified as being essential for closing the climate protection gap.

This finding is supported by European Insurance and Occupational Pensions Authority (EIOPA), which prepared a dashboard that depicts the insurance protection gap for natural catastrophes across Europe. This tool is the first dashboard which presents the reasons underlying a climate-related insurance protection gap, and its aim is to identify measures that will help increase resilience in the event of natural catastrophes in Europe.[66]

Overall, the International Bank for Reconstruction/the World Bank report finds that financial instruments to manage disaster risk seem to be limited in most of the Member States, but also at EU level, despite the expected increase in climate change related disasters in Europe.[67]

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62 Feyen et al. 2020, 12.

63 International Bank for Reconstruction and Development / The World Bank, Economics for Disaster Prevention and Preparedness Financial Risk and Opportunities to Build Resilience in Europe, 2021.

64 International Bank for Reconstruction and Development / The World Bank, Economics for Disaster Prevention and Preparedness Financial Risk and Opportunities to Build Resilience in Europe, 2021, 17-22.

65 International Bank for Reconstruction and Development / The World Bank, Economics for Disaster Prevention and Preparedness Financial Risk and Opportunities to Build Resilience in Europe, 2021, 16.

66 European Insurance and Occupational Pensions Authority (EIOPA), The Dashboard on Insurance Protection Gap for Natural Catastrophes in a Nutshell, EIOPA-22/507, 5 December 2022.

67 International Bank for Reconstruction and Development / The World Bank, Economics for Disaster Prevention and Preparedness Financial Risk and Opportunities to Build Resilience in Europe, 2021, executive summary.

3. EU POLICIES AND MECHANISMS TO DEAL WITH CLIMATE CHANGE DISASTERS

KEY FINDINGS

- The basis for EU action on climate change adaptation can be found in the EU Treaties, in particular Articles 191 and 192 (1) TFEU. The EU now has a wide range of policies and instruments in place that aim to strengthen the EU's resilience against climate change disasters.
- The EU's Adaptation Strategy of 2021 is a key part of the European Green Deal and aims to increase and accelerate the EU's efforts to protect citizens and the environment against the effects of climate change. The Strategy's objectives are to make adaptation smarter, swifter, and more systemic, and to improve international action on climate change adaptation.
- A wide range of EU sectoral legislation addresses specific disaster risks. With respect to natural disasters, the EU Floods Directive of 2007[68] is a key risk management instrument.
- The EU finances adaptation to climate change in Europe through various instruments, such as the Recovery and Resilience Facility, the European Regional Development Fund, and the Cohesion Fund.
- The EU also has mechanisms in place to react to natural disasters, in particular the European Union Civil Protection Mechanism (UCPM), the European Union Solidarity Fund (EUSF), and the Emergency Aid Reserve (EUSF and EAR now merged into SEAR).
- EU policies and instruments mainly concern risk management and adaptation, and emergency response. The EU does not finance compensation for the population or reconstruction of private housing or assets.
- The 2013 Green Paper on the insurance of natural and man-made disasters is meant to stimulate the insurance market in order to improve the way in which it manages climate change risks.
- The merger of the EUSF with the EAR into SEAR increased the uncertainty on whether the amount of funding available to the EUSF will be sufficient in the case of major disasters.
- Studies point to a climate protection gap and high reliance on national reserves to cover disaster costs.
- This suggests that there is a need to incentivise national governments to invest in disaster risk financing, as well as a need to encourage the uptake of disaster insurance by private households.
- Compensation for victims of a natural disaster is compatible with the internal market if the compensation does not exceed the amount of the damage; the granting of compensation has to be notified to the Commission, which verifies the application of the state aid rules.
- Regulation EU No. 651/2014 exempts aid for particular natural catastrophes such as earthquakes, avalanches, landslides, floods, tornados, and hurricanes from notification, as this type of aid is compatible with the internal market.

[68] Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks (Text with EEA relevance). OJ L 288, 6.11.2007.

At European level, a wide range of policies and instruments is in place to adapt to climate change and to minimise the risk and the impact of climate change related disasters. Section 3.1 discusses the EU's competence in this matter, the EU's climate adaptation strategy, and EU funding for adaptation measures. Section 3.2 focuses on EU policies and mechanisms in place to react to climate change related disasters. Section 3.3 focuses on the responses of the EU to natural disasters, while section 3.4 addresses the application of the provisions on state aid to compensation for disasters.

3.1. EU competence

By means of adaptation, the EU aims to anticipate the adverse effects of climate change and to take appropriate action to prevent or minimise the potential damage. It has been shown that well-planned adaptation action will save money and lives later.[69]

The basis for EU action on climate change adaptation can be found in the EU Treaties. Articles 191 and 192 (1) of the TFEU state that the EU's environmental policy should protect and improve the quality of the environment, and contribute to the protection of human health and the prudent and rational use of natural resources. The EU's environmental policy is, moreover, based on the precautionary principle and preventive action.[70]

Given the impact of climate change on EU citizens and the environment, adaptation as a preventive policy falls within this scope.[71]

Environmental policy is a competence that is shared with the EU Member States. According to the subsidiarity principle, the EU may take action if action at EU level is more effective than action taken at national, regional or local level.[72]

The European Climate Law of 2021 (Regulation (EU) 2021/1119) also explicitly addresses both the EU institutions and the Member States, and requires the Union institutions and the Member States to ensure that policies on adaptation in the Union and in the Member States are coherent, mutually supportive, provide co-benefits for sectoral policies, and work towards better integration of adaptation to climate change in all policy areas. A particular focus is required for the most vulnerable and impacted populations and sectors. Member States are required to adopt and implement national adaptation strategies and plans, taking into consideration the Union strategy on adaptation to climate change based on robust climate change and vulnerability analyses, progress assessments and indicators, and guided by the best available and most recent scientific evidence.[73]

Furthermore, the Paris Agreement forms an additional international legal basis on which the Union can base its efforts in climate change adaptation.[74]

There are several arguments for EU action with respect to climate change adaptation. A first important one is advantages of scale. Gathering scientific knowledge on current and future climate impacts by means of satellite-based earth observation programmes (such as the EU's Copernicus programme) may be beyond the capacity of the Member States. Hence, scale advantages might be reached through EU

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69 https://ec.europa.eu/clima/policies/adaptation_en.

70 Articles 191 and 192 (1) TFEU. Lenaerts, Tagliapietra & Wolff 2022, Bruegel, 7.

71 Lenaerts, Tagliapietra & Wolff 2022, Bruegel, 7.

72 Article 5(3) TEU (the 'subsidiarity principle').

73 Regulation 2021/1119, Article 3.

74 European Commission, Impact Assessment Report accompanying the document "forging a climate-resilient Europe – the new EU Strategy of Adaptation to Climate Change, COM (2021) 25 final, p. 25.

action. Another example of advantages of scale could be emergency response to major climate-related disasters, where national response capacities may be exhausted more quickly.[75]

EU action with respect to climate change adaptation is also required because of transboundary effects, as climate change impacts do not stop at Member States' borders and therefore require cooperation and joint adaptation efforts. Transnational shared rivers, for example, require joint river management for irrigation or energy purposes, especially with regard to the increasing risk of droughts, as well as for the management of floods.[76]

Climate impacts may also affect the functioning of the Single Market or the EU budget, because of damaged critical infrastructure (e.g. bridges) or disrupted supply chains. Moreover, different policy areas within the EU's competences play a crucial role in supporting climate change adaptation, for instance, the EU's regional and agricultural policy, insurance and financial regulations, or fiscal rules.[77]

Lastly, climate change will lead to increasing economic divergence between Member States. Solidarity and a just transition are arguments for EU action, in order to preserve cohesion in Europe.[78]

3.2. EU policies and mechanisms

3.2.1. The EU Strategy on adaptation to climate change

After an initial European adaptation framework was set out in a White Paper[79] in 2009, the European Commission introduced the first EU Adaptation Strategy in 2013. The Strategy set out a framework and mechanisms for preparing the EU for current and future climate impacts. The Strategy had three main objectives: promoting action by Member States, promoting better-informed decision-making, and promoting adaptation in key vulnerable sectors.

Although progress was made through the adoption of strategies by all EU Member States and the establishment of the Climate-ADAPT platform, commitments by Member States' governments and the progress made in the last decade were not sufficient to ensure resilience.[80]

On 24 February 2021, the Commission adopted a new EU Adaptation Strategy. This Strategy is a key part of the European Green Deal and aims to increase and accelerate the EU's efforts to protect EU citizens and the environment against the impacts of climate change.[81]

The new Strategy has four principal objectives: "to make adaptation smarter, swifter, and more systemic, and to step up international action on adaptation to climate change".[82]

Smarter adaptation refers to 'closing the data gap' and the need to obtain more knowledge and data on climate-related disaster loss. Data on climate-related disaster losses is essential to understanding the climate resilience gap, and is necessary to make informed adaptation choices and raise awareness

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75 Lenaerts, Tagliapietra & Wolff 2022, Bruegel, 7.

76 Lenaerts, Tagliapietra & Wolff 2022, Bruegel, 7.

77 Lenaerts, Tagliapietra & Wolff 2022, Bruegel, 7.

78 Lenaerts, Tagliapietra & Wolff 2022, Bruegel, 8.

79 European Commission, White Paper 'Adapting to climate change: Towards a European framework for action', Brussels, 1 April 2009 COM(2009) 147 final.

80 Lenaerts, Tagliapietra & Wolff 2022, Bruegel, 9; European Commission 2021 a, p. 26.

81 https://climate.ec.europa.eu/eu-action/adaptation-climate-change_en.

82 https://climate.ec.europa.eu/eu-action/adaptation-climate-change/eu-adaptation-strategy_en.

among citizens and policymakers.[83] Yet, collecting data is not enough. It is necessary as well to close the knowledge-action gap.[84]

Faster adaptation refers to developing and implementing adaptation solutions to increase resilience. Overall, however, the proposed actions refer mainly to developing guidance, standards and best practices.[85]

More systemic adaptation is needed as climate change impacts all levels of society and all sectors of the economy. Further development and implementation of adaptation strategies, and plans at all levels of governance are needed. There are three cross-cutting priorities: integrating adaptation into macro-fiscal policy, nature-based solutions for adaptation (for example green roofs and walls), and local adaptation action.[86]

The last objective of the new Strategy is to boost international climate adaptation. The EU will increase support for international climate resilience and preparedness by scaling up international finance, and through stronger global engagement and exchanges on adaptation.[87]

3.2.2. Disaster insurance

In 2013, a Green Paper on the Insurance of natural and man-made disasters (addressing the suitability of the insurance conditions in Europe due to the higher occurrence of extreme events) accompanied the EU Strategy on adaptation to climate change. The Green Paper posed a number of questions concerning the adequacy and availability of appropriate disaster insurance. The objective was to raise awareness and to assess whether or not action at EU level could be appropriate or warranted to improve the market for disaster insurance in the European Union.[88] The Green Paper was also a first step in encouraging insurers to improve the way they help to manage climate change risks.

The European Parliament welcomed the Commission's efforts to raise awareness regarding disasters, but pointed out that most Member States already had some form of insurance-based system for floods and other natural damage. It argued that this system could be supplemented with state funds to compensate for those assets which could not be privately insured. State funds could also compensate for insurance claims exceeding the maximum amounts or for other exceptionally heavy damage. The European Parliament further took the view that a Member State could participate in compensation for damage by providing re-insurance. However, as the systems in the Member States differed in many respects, it would not be prudent or necessary to unify them.[89]

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[83] European Commission, Communication from the Commission to the European Parliament, he Council, the European Economic and Social Committee and the Committee of the Regions, Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change SWD(2021) 26 final, Brussels, 24.2.2021 COM(2021) 82 final, p. 3-5.

[84] Knutti 2019, 21-23.

[85] European Commission, Communication from the Commission to the European Parliament, he Council, the European Economic and Social Committee and the Committee of the Regions, Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change SWD(2021) 26 final, Brussels, 24.2.2021 COM(2021) 82 final, p. 12-13.

[86] European Commission, Communication from the Commission to the European Parliament, he Council, the European Economic and Social Committee and the Committee of the Regions, Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change SWD(2021) 26 final, Brussels, 24.2.2021 COM(2021) 82 final, p. 7-12.

[87] European Commission, Communication from the Commission to the European Parliament, he Council, the European Economic and Social Committee and the Committee of the Regions, Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change SWD(2021) 26 final, Brussels, 24.2.2021 COM(2021) 82 final, p. 17.

[88] European Commission, Green Paper on the insurance of natural and man-made disasters, Brussels, 16.4.2013, COM(2013) 0213 final.

[89] European Parliament, *Report on the insurance of natural and man-made disasters*(2013/2174(INI)),Committee on Economic and Monetary Affairs, A7-0005/2014, 20.12.2013, 5/7.

Hence, in 2013, the European Parliament considered that a flexible natural catastrophe insurance market would allow insurance companies to adapt their products to different conditions, and it believed that a non-mandatory framework would be the best way to develop products that match with natural risks in a given geographical area. In 2023 - a decade later - no further steps have been taken by the Commission, other than the publication, in December 2022, by EIOPA (the European Insurance and Occupational Pensions Authority) of a European dashboard which depicts the insurance protection gap for natural catastrophes. With the dashboard, EIOPA hopes to identify measures to improve Europe's resilience against natural catastrophes.[90]

3.2.3. The Floods directive (Directive 2007/60/EC)

A wide range of EU sectoral legislation addresses specific disaster risks. With respect to natural disasters, the EU Floods Directive of 2007[91] is a key risk management instrument. (Flash) Floods can cause injury and deaths, considerable economic costs, and damage to the environment and cultural heritage. It is expected that, due to climate change, flood risk in Europe will rise, as will economic damage. Full implementation of this directive by the Member States will help increase resilience and facilitate adaptation efforts.[92] Flood risk management is an integral part of integrated river basin management. The Floods Directive is therefore closely coordinated with the Water Framework Directive.[93] The directive is also backed by cohesion policy funding and the European Floods Awareness System.

3.2.4. EU funding for climate adaptation

The EU finances adaptation to climate change in Europe through a wide range of instruments.[94] The Multiannual Financial Framework 2021-2027 requires that at least 25% of the European budget is climate-related expenditure. Climate adaptation actions therefore have to be integrated into all major EU spending programmes. The most important funding streams related to adaptation are:

- The Recovery and Resilience Facility, which is at the core of Europe's recovery plan, NextGenerationEU. The Facility aims to mitigate the economic and social impact of the COVID-19 crisis and make European economies and societies more sustainable and resilient. EU countries are responsible for developing national recovery and resilience plans. The Facility is a temporary recovery instrument which allows the Commission to raise funds to help Member States implement reforms and investments that are in line with the EU's priorities and that address the challenges identified in country-specific recommendations under the European Semester framework of economic and social policy coordination.[95]
- The EU Cohesion Policy is the EU's main investment policy to support sustainable development and the improvement of citizens' quality of life. The funding is delivered through specific funds including:

[90] https://www.eiopa.europa.eu/tools-and-data/dashboard-insurance-protection-gap-natural-catastrophes_en, last assessed on 21 March 2023.

[91] Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks (Text with EEA relevance). OJ L 288, 6.11.2007.

[92] European Commission, White Paper 'Adapting to climate change: Towards a European framework for action', Brussels, 1.4.2009 COM(2009) 147 final, p. 10.

[93] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, OJ L 327, 22.12.2000.

[94] For an extensive discussion, see: https://climate-adapt.eea.europa.eu/en/eu-adaptation-policy/funding.

[95] https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility_en.

(1) the *European Regional Development Fund*, which aims to strengthen economic, social, and territorial cohesion in the European Union by correcting imbalances between its regions.

Regulation 2017/1199 introduced a separate priority axis, with a co-financing rate of up to 95%, in order to provide additional assistance to Member States hit by natural disasters. The operations to be co-financed under the separate priority axis for natural disasters should be aimed at reconstruction in response to major or regional natural disasters as defined in Council Regulation (EC) No 2012/2002 (see section 3.3 EU natural disaster responses);

(2) the *Cohesion Fund*, which targets the reduction of economic and social disparities through investment in environment and Trans-European Transport Networks (TEN-T); and

(3) the *Just Transition Fund*, which is a key tool to support the territories most affected by the transition towards climate neutrality, and provide them with specific support.

- The *Connecting Europe Facility* is a funding programme that supports trans-European networks and infrastructures in the sectors of transport, telecommunications, and energy.
- The *European Agricultural Fund for Rural Development* (EAFRD), which falls under the Common Agricultural Policy, provides funding through rural development programmes (RDPs). RDPs are co-financed by national budgets and may be prepared on either a national or regional basis. At least 30% of funding for each RDP must be dedicated to measures relevant for the environment and climate change.
- The *European Maritime, Fisheries and Aquaculture Fund* runs from 2021 to 2027 and supports the EU's common fisheries policy, the EU maritime policy, and the EU agenda for international ocean governance. It provides support for developing innovative projects to ensure that aquatic and maritime resources are used sustainably.
- The *European Bank for Reconstruction and Development* supports its clients in identifying climate change impacts that are likely to affect their operations. This is expected to lead to the formulation of adaptation strategies.
- The *European Investment Bank* (EIB) supports disaster risk management projects, including projects building on climate resilience, through loans and financial and technical expertise.
- Funding also goes to innovative research via *Horizon Europe*, and the *LIFE Programme*, which is dedicated entirely to the environment and climate action.[96]

The EU's funding for climate adaptation is preventive and is meant to reduce the risk and damage of climate change related natural disasters. As not all disasters can be avoided, adaptation to climate change needs to be backed up with natural disaster response mechanisms.

3.3. EU natural disaster responses

This section discusses EU policies and mechanisms already in place to react to climate change related disasters. The focus is on four EU tools and mechanisms which are used to react to natural disasters. These tools and mechanisms include: the European Union Civil Protection Mechanism (UCPM), the European Union Solidarity Fund (EUSF), the Emergency Aid Reserve, and the funding by the European Regional Development Fund (ERDF) under the EU's Cohesion Policy.

[96] Lenaerts, Tagliapietra & Wolff 2022, Bruegel, 10.

3.3.1. European Union Civil Protection Mechanism (UCPM)

The European Union Civil Protection Mechanism (UCPM) was established by the European Commission in October 2001. The Mechanism aims to strengthen cooperation between the Member States and 8 other participating states (Albania, Bosnia and Herzegovina, Iceland, Montenegro, North Macedonia, Norway, Serbia and Turkey) with respect to rescue and humanitarian assistance in the event of natural and man-made disasters whose scale or nature exceed the response capabilities of the affected country (legal basis: Decision 1313/13/EU).[97]

The Mechanism pools response capacities from all Member States and the 8 participating states in a European Civil Protection Pool. This pool constitutes the backbone of the Mechanism and allows for better planning and coordination of disaster response activities.[98]

The Mechanism can be deployed inside the EU and around the world. When a disaster overwhelms the response capabilities of any country in the world, it can request assistance through the Mechanism. Since 2001, the EU Civil Protection Mechanism has responded to over 600 requests for assistance inside and outside the EU.[99] Besides assistance (such as deployment of experts and specialised teams) after a disaster, the Mechanism also supports and complements the prevention and preparedness efforts of its members, and focuses on areas where a joint European approach is more effective than separate national actions. This includes risk assessments to identify the disaster risks across the EU, encouraging research to promote disaster resilience, and reinforcing early warning tools.[100]

To guarantee an effective response to disasters and to provide an additional layer of protection, in 2019, the EU established a European reserve of additional capacities (the 'rescEU reserve'), which is 100% EU-financed. The rescEU reserve includes, inter alia, firefighting planes and helicopters, as well as a stock of medical equipment and field hospitals that can be used to respond to health emergencies.[101]

The UCPM has also raised awareness for prevention among its member states. Furthermore, its use has increased significantly in 2020 and 2021, mainly due to COVID-19, but the mechanism was also activated to help countries deal with natural disasters such as the floods in Belgium (2021), and the forest fires in the Mediterranean.[102]

In order to be able to better respond to future challenges, new legislation on civil protection was adopted in May 2021. It gives the EU additional capacities to respond to new risks in Europe and around the world. Thus, the UCPM will become a reinforced and more ambitious crisis management system.[103]

3.3.2. European Solidarity Fund (EUSF)

The European Union Solidarity Fund (EUSF) was set up to respond to major natural disasters and to express European solidarity with disaster-stricken regions within Europe. The EUSF was established in 2002, following devastating flooding in Central Europe in the summer of that year. It was revised in

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97 https://civil-protection-humanitarian-aid.ec.europa.eu/what/civil-protection/eu-civil-protection-mechanism_en. For a discussion, see also Hochrainer-Stigler et al. 2022, 24-26 and International Bank for Reconstruction and Development/The World Bank, *Economics for Disaster Prevention and Preparedness Financial Risk and Opportunities to Build Resilience in Europe*, 2021, p. 30.

98 https://civil-protection-humanitarian-aid.ec.europa.eu/what/civil-protection/eu-civil-protection-mechanism_en.

99 https://civil-protection-humanitarian-aid.ec.europa.eu/what/civil-protection/eu-civil-protection-mechanism_en.

100 https://civil-protection-humanitarian-aid.ec.europa.eu/what/civil-protection/eu-civil-protection-mechanism_en.

101 https://civil-protection-humanitarian-aid.ec.europa.eu/what/civil-protection/resceu_en, last assessed 18 January 2023.

102 Hochrainer-Stigler et al. 2022, 24-25.

103 Regulation (EU) 2021/836.

2014 and 2020. The EUSF is a special instrument which is financed outside the EU's multiannual financial framework.

Since 2002, the EUSF has been used for 100 disasters covering a range of different catastrophic events including floods, forest fires, earthquakes, storms, and drought. 28 different European countries have been supported so far, to an amount of over EUR 7 billion.[104]

The main purpose of the EUSF is the provision of assistance to Member States or accession countries whose regions are affected by major natural disasters such as floods, fires, storms, drought, and earthquakes with serious effects on the living conditions of the citizens of the affected regions, as well as their economic welfare or the natural environment.[105]

A disaster is considered major if the direct damage caused by it corresponds to an amount of at least EUR 3 billion[106] or exceeds 0.6% of the gross national income (GNI) of the affected state.[107] The EUSF can also intervene in the case of regional disasters where the majority of the population of a region is affected, and if it is deemed that the disaster will have serious and lasting effects on the economic stability and living conditions of that region. Furthermore, pursuant to the neighbouring country criterion, Member States or accession states suffering from the impacts of the same disaster as another state for which the status of major disaster has already been declared, may also receive assistance.[108]

Assistance from the EUSF takes the form of a grant to supplement public spending by the beneficiary state and is intended to finance measures to alleviate non-insurable damage.[109] The aid can be spent on four predefined types of interventions: restoration to working order of infrastructure and plants providing energy, drinking water, waste water disposal, telecommunications, transport, healthcare, and education; provision of temporary accommodation and funding of rescue services in order to meet the needs of the population affected; immediate consolidation of preventive infrastructure and protection of cultural heritage sites; and cleaning-up of disaster-stricken areas, including natural zones.[110] Solidarity Fund grants are financed outside the normal EU budget.

The EUSF is thus only mobilised for disasters above pre-defined thresholds of loss and upon application and assessment of their eligibility. It can cover losses up to a maximum annual level.

Italy has been the biggest beneficiary of the fund, having received more than EUR 3 billion, predominantly for earthquake damage, followed by Germany (floods), and Croatia (earthquake). In the period 2002-2020, flooding was by far the most frequently occurring disaster affecting European countries, followed by storm. However, proportionally, payouts for earthquake were the largest.[111]

In 2021, the floods hitting especially Belgium and Germany, but also Luxembourg, the Netherlands, and Austria as neighbouring countries, as well as the earthquake in Crete (Greece) and the volcano

[104] https://ec.europa.eu/regional_policy/funding/solidarity-fund_en, last assessed 18 January 2023.

[105] https://ec.europa.eu/regional_policy/funding/solidarity-fund_en, last assessed 18 January 2023.

[106] At 2011 prices.

[107] Council Regulation (EC) No 2012/2002 of 11 November 2002 establishing the European Union Solidarity Fund (OJ L 311, 14.11.2002, Article 2 (2).

[108] Council Regulation (EC) No 2012/2002 of 11 November 2002 establishing the European Union Solidarity Fund (OJ L 311, 14.11.2002, Article 2. In Article 2 (2), a region is further defined as a region at NUTS level 2.

[109] Council Regulation (EC) No 2012/2002 of 11 November 2002 establishing the European Union Solidarity Fund (OJ L 311, 14.11.2002 Article 3 (3).

[110] Council Regulation, No 2012/2002 of 11 November 2002 establishing the European Union Solidarity Fund, OJ L 311, 14.11.2002, Article 3.

[111] https://cohesiondata.ec.europa.eu/stories/s/An-overview-of-the-EU-Solidarity-Fund-2002-2020, last assessed on 19 January 2023.

eruption on La Palma (Spain), demonstrated the vulnerability of Europe to natural disasters. Between October - December 2021, Germany, Belgium, the Netherlands, Austria, Luxembourg, Spain, and Greece submitted applications for assistance following the natural disasters that took place in these countries. As all applications met the conditions for providing a financial contribution from the Fund, the Decision allocating EUR 718.5 million to the seven countries was adopted on 14 December 2022, and published in the Official Journal on 10 January 2023.[112]

However, the functioning of the EUSF is not without criticism. Since its creation in 2002, it had become clear that changes were needed to live up to the expectations of disaster-stricken countries and regions looking for EU aid. While the instrument generally met its objectives well, it was considered insufficiently responsive, as certain criteria for its activation were too complicated or not sufficiently clear. Moreover, the procedure for granting assistance was lengthy, it usually took around one year from the disaster to the payment of the grant.[113]

Regulation (EU) No 661/2014 of 15 May 2014 amended Council Regulation (EC) No 2012/2002 of 11 November 2002 establishing the European Union Solidarity Fund and made the EUSF faster, clearer, and simpler to use. The 2014 reform included the following modifications: speeding-up of payments, the introduction of possible advance payments, a clearer definition of the scope for intervention through the Solidarity Fund, and simplification of the administrative procedures by combining decisions on the award of grants with the implementation agreement.[114]

Furthermore, the reform encouraged Member States to increase their efforts with respect to disaster prevention and risk management strategies. Article 8 (3) obliged beneficiary states to present an implementation report in which preventive measures taken to limit future damage are described.[115] As such, the European Commission has taken clear steps to link the Fund to pro-active risk reduction.

Due to the COVID-19 pandemic and the urgent need to tackle the public health crisis, the scope of the European Union Solidarity Fund (EUSF) was extended by modifying Regulation 2020/461, adopted on 1st April 2020, to cover major public health emergencies**.**

Major health emergencies are now added as a separate field of intervention for the EUSF, yet covered from the same budget as disasters. The threshold for mobilising the assistance for major health emergencies is lower - by half - than for other disasters (EUR 1.5 billion or 0.3% of GNI). The EUSF can also finance, in relation to health emergencies, measures such as prevention, monitoring, or control of the spread of diseases, combating severe risks to public health, or mitigation of impacts on public health.[116] While the analysis in this study does not explicitly account for COVID-19 impact, the reform might result in lower funding available for natural disasters.[117]

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[112] Decision (EU) 2023/68 - adopted by the co-legislators on 14 December 2022 - concerning the mobilisation of the *European Union Solidarity Fund (EUSF)* to provide assistance to Germany, Belgium, the Netherlands, Austria, Luxembourg, Spain and Greece further to natural disasters that took place in those countries in the course of 2021.

[113] European Commission, Press Release, *Making the EU Solidarity Fund faster and simpler for support after disasters*, Brussels, 25 July 2013; European Commission, Memo, *Q&A on the reform of the European Union Solidarity Fund*, Brussels, 23 July 2013, IP/13/732.

[114] Regulation (EU) No 661/2014 of the European Parliament and of the Council of 15 May 2014 amending Council Regulation (EC) No 2012/2002 establishing the European Union Solidarity Fund, OJ L 189/143, 27.6.2014.

[115] Regulation (EU) No 661/2014, Article 8.

[116] Regulation (EU) No 461/2020 of the European Parliament and of the Council of 30/03/2020 amending Council regulation (EC). No 2012/2002 and https://ec.europa.eu/regional_policy/funding/solidarity-fund/covid-19_en.

[117] International Bank for Reconstruction and Development/The World Bank, *Economics for Disaster Prevention and Preparedness Financial Risk and Opportunities to Build Resilience in Europe*, 2021, p. 29-30.

The Multi-annual Financial Framework for the period 2021–2027 also introduced some changes in the EUSF's mechanism. The EUSF was merged with the Emergency Aid Reserve. Before an evaluation of this change can be made, the Emergency Aid Reserve will first be explained.

3.3.3. Emergency Aid Reserve (EAR)

The Emergency Aid Reserve, like the EUSF, is a special instrument outside the Multi-annual Financial Framework and is designed to finance humanitarian aid, civilian crisis management, and protection operations in non-EU countries in order to quickly respond to unforeseen events. For example, the Emergency Aid Reserve was mobilised in 2017 and 2018 to provide funding for healthcare, nutrition and food security, sanitation, and water in Rohingya refugee camps in Bangladesh.[118]

Under the Multi-annual Financial Framework for the period 2021–2027, the Emergency Aid Reserve will continue to address extraordinary crisis situations that cannot be tackled by other programmes. What is important and new is that the EAR can now also be used for emergencies within the Member States.

3.3.4. SEAR: merging of EUSF and EAR

The merging of the EUSF and the EAR created the **Solidarity and Emergency Aid Reserve (SEAR)**.

The Solidarity and Emergency Aid Reserve may be used to finance:

a. "assistance to respond to emergency situations resulting from major disasters that are covered by the European Union Solidarity Fund, the objectives and scope of which are set out in Council Regulation (EC) No 2012/2002; and

b. rapid responses to specific emergency needs within the Union or in third countries following events which could not be foreseen when the budget was established, in particular for emergency responses and support operations following natural disasters not covered by point (a), man-made disasters, humanitarian crises in cases of large-scale public health, veterinary or phytosanitary threats, as well as in situations of particular pressure at the Union's external borders resulting from migratory flows, where circumstances so require".[119]

The SEAR has a maximum budget of EUR 1.2 billion (in 2018 prices) per year, with the following limitations: 25% of the total should be reserved until October of each year to cover unexpected costs, and out of the remaining 75%, each fund is allocated 50% of funding. The total amount is renewed annually.

In exceptional cases and if the remaining financial resources available in the SEAR are not sufficient, current-year disasters can be funded from the future-year budget (called front-loading) up to a maximum amount of EUR 400 million (in 2018 prices). In the opposite situation, where part of the annual amount is not used in the current year, this may be used up in the following year as a carry-over.[120]

[118] https://commission.europa.eu/strategy-and-policy/eu-budget/long-term-eu-budget/2014-020/spending/flexibility-and-special-instruments_en.

[119] Council Regulation (EU, Euratom) 2020/2093 of 17 December 2020 laying down the multiannual financial framework for the years 2021 to 2027.

[120] Council Regulation (EU, Euratom) 2020/2093 of 17 December 2020 laying down the multiannual financial framework for the years 2021 to 2027 and International Bank for Reconstruction and Development/The World Bank, *Economics for Disaster Prevention and Preparedness Financial Risk and Opportunities to Build Resilience in Europe*, 2021, p. 29.

Several studies have assessed the effectiveness of the merging of EUSF and EAR, and these studies hold that, so far, the EUSF meets it objective to provide (a relatively limited amount of) financial aid to Member States after a disaster.[121] Nevertheless, eligible States face long waiting times to receive funding. Disbursement takes on average 56 weeks (although advances can be provided).

Furthermore, and importantly, the merger of the EUSF with the Emergency Aid Reserve, creating the Solidarity and Emergency Aid Reserve, with a combined budget of EUR 1.2 billion for both instruments, increased uncertainty about whether the amount of funding available to the EUSF would be sufficient in the case of major disasters. Especially in cases of catastrophic disasters that affect multiple countries at the same time, the amount of available funding might be insufficient.[122]

Hochrainer-Stigler et al. also hold that natural disasters and large-scale public health emergencies are different in nature. While the risk of losses due to natural disasters is relatively measurable, the assessment of risks related to public health emergencies is much more difficult, as such risks are difficult to quantify and rather unpredictable. This makes it virtually impossible to determine adequate funding requirements for solidarity in the event of current and future natural disasters. Hochrainer-Stigler et al. therefore conclude that assistance in the case of natural disasters and major public health emergencies, due to their difference in nature, should not be managed by the same instrument.[123]

Additionally, it is important to note that the EUSF does not finance compensation for the population or reconstruction of private housing or assets. However, the EUSF can finance public spending on private facilities (for example, if public money is being used to restore private schools, then the EUSF can be used for covering this public expenditure).[124]

Finally, the International Bank for Reconstruction and Development / The World Bank study indicates that EU level instruments are, by design, able to cover only a small fraction of the response costs of medium to severe events.[125] There is, therefore, a significant funding gap between on the one hand the funds available at the EU level, and on the other the potential damage that could occur within the Member States. Consequently, there is a high reliance on national reserves to cover the disaster costs. The EUSF mechanism, by providing (limited) financial aid in extreme situations, is only a supplement for national strategies.[126] In view of an increasing risk of climate change disasters, there is a need to incentivise national governments to invest in disaster risk financing, and a need to encourage the uptake of disaster insurance by private households.[127]

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[121] Van Lierop 2021; Hochrainer-Stigler et al. 2022; International Bank for Reconstruction and Development/The World Bank, *Economics for Disaster Prevention and Preparedness Financial Risk and Opportunities to Build Resilience in Europe*, 2021.

[122] Van Lierop 2021, 10; Hochrainer-Stigler et al. 2022, 24; International Bank for Reconstruction and Development/The World Bank, *Economics for Disaster Prevention and Preparedness Financial Risk and Opportunities to Build Resilience in Europe*, 2021, p. 30.

[123] Hochrainer-Stigler et al. 2022, 39.

[124] International Bank for Reconstruction and Development/The World Bank, *Economics for Disaster Prevention and Preparedness Financial Risk and Opportunities to Build Resilience in Europe*, 2021, p. 30.

[125] International Bank for Reconstruction and Development/The World Bank, *Economics for Disaster Prevention and Preparedness Financial Risk and Opportunities to Build Resilience in Europe*, 2021, p. 18.

[126] International Bank for Reconstruction and Development/The World Bank, *Economics for Disaster Prevention and Preparedness Financial Risk and Opportunities to Build Resilience in Europe*, 2021, p. 66.

[127] International Bank for Reconstruction and Development/The World Bank, *Economics for Disaster Prevention and Preparedness Financial Risk and Opportunities to Build Resilience in Europe*, 2021, p. 66.

The studies finally stress that funding should be linked to risk reduction efforts, following the 'Build Back Better' principle. This could be achieved by linking EUSF funding with cohesion policy investments.[128]

3.3.5. European Regional Development Fund (ERDF) - Cohesion policy

In 2016, earthquakes struck four regions in Central Italy, which had a devastating effect on the people living in the area.[129] Large-scale reconstruction works would be required, notably to restore the cultural heritage of the affected areas. In the wake of the earthquakes, Commission President Juncker announced that the EU would stand by Italy and its citizens, and help to fully reconstruct the areas damaged, including the Basilica of San Benedetto in Norcia.[130]

The Commission argued that Europe needed to be able to provide prompt additional, effective support from the European Regional Development Fund (ERDF) to Member States and regions hit by major or regional natural disasters, complementing the means available under the European Union Solidarity Fund (EUSF). In order to provide such additional assistance to Member States, the Commission proposed to introduce the possibility of a separate priority axis for reconstruction operations supported by the ERDF within an operational program.[131]

On 26 June 2017, Regulation (EU) 2017/1199 of the European Parliament and of the Council of 4 July 2017 amending Regulation (EU) No 1303/2013 as regards specific measures to provide additional assistance to Member States affected by natural disasters, was adopted.[132] In Article 120 of Regulation (EU) No 1303/2013, the following paragraph was added: "a separate priority axis with a co-financing rate of up to 95% may be established within an operational program to support operations which fulfil all of the following conditions: the operations are selected by managing authorities in response to major or regional natural disasters as defined in Article 2(2) and (3) of Council Regulation (EC) No 2012/2002; the operations are aimed at reconstruction in response to the natural disaster; and the operations are supported under an ERDF investment priority".

The co-financing rate of 95% more than doubles the EU's financial contribution for developed regions from the current level of 40% (see conditions for financing 2021-2027).[133] Indeed, without changing the volume of national European Regional Development Fund envelopes, it means that a disaster-stricken region whose Cohesion Policy program foresees a 40% co-financing rate, like most French and German regions, could receive almost double funding from the EU to finance reconstruction works. Programs with an 85% EU co-financing rate, like in the Italian region of Calabria, could get an exceptional top-up that would spare public resources in difficult times.[134]

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[128] Hochrainer-Stigler et al. 2022, 48.

[129] The earthquakes happened on 24 August 2016 and on 27 October 2016.

[130] http://europa.eu/rapid/press-release_IP-16-4095_en.htm, last assessed 5-9-2017.

[131] Proposal for a Regulation of the European Parliament and of the Council, amending Regulation (EU) No 1303/2013 as regards specific measures to provide additional assistance to Member States affected by natural disasters, Brussels, 30.11.2016 COM(2016) 778 final, Explanatory Memorandum. See also Regulation (EU) No 1301/2013 of the European Parliament and of the Council of 17 December 2013 on the European Regional Development Fund and on specific provisions concerning the Investment for growth and jobs goal and repealing Regulation (EC) No 1080/2006, OJ L 347, 20.12.2013.

[132] Regulation (EU) 2017/1199 of the European Parliament and of the Council of 4 July 2017 amending Regulation (EU) No 1303/2013 as regards specific measures to provide additional assistance to Member States affected by natural disasters, OJ L 176/1, 7.7.2017.

[133] https://ec.europa.eu/regional_policy/funding/financial-management_en.

[134] http://ec.europa.eu/regional_policy/en/newsroom/news/2017/07/27-07-2017-special-eu-support-in-case-of-natural-disasters-enters-into-force-today.

In principle, it is quite appropriate to use the European Regional Development Fund (ERDF) to complement the EUSF in the event of major disasters, as the two funds share the same ethical principles and certain programmatic criteria for action. Furthermore, both funds provide evidence of European solidarity, and the operations that they finance work towards the same goals of promoting economic growth and balanced and sustainable development, including climate change adaptation actions in Europe's regions. Moreover, the regulation is only applicable to major natural disasters and does not stand in for Member States in the event of disasters where the resulting damage is assessed below the threshold as defined in Council Regulation (EC) No 2012/2002.[135]

3.4. Provisions on state aid

Financial assistance in the form of compensation for undertakings that suffered damage by a natural disaster is considered as state aid if the criteria of Article 107 (1) TFEU are fulfilled:

…. "any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the internal market".[136]

However, Article 107(2) TFEU provides that such compensation is compatible with the internal market if the compensation does not exceed the amount of the damage. It is allowed:

…" to make good the damage caused by natural disasters or exceptional occurrences".[137]

Illustrative are two recent judgments by the General Court on the link between natural disasters and state aid: T-850/19, Greece v European Commission, and T-347/20, Soja Ellas v European Commission. In both cases, the undertakings received damage compensation that was not proportional to the damage suffered.[138]

According to Article 108 TFEU, Member States have the obligation to notify aid schemes to make good the damage caused by a particular natural disaster to the Commission, which is responsible for verifying the occurrence of the natural disaster invoked to justify the granting of aid. No aid can be granted before approval of the notified scheme by the Commission.[139]

However, according to Article 109 of the TFEU, the Council may determine categories of aid that are exempted from this notification requirement.[140]

Regulation (EU) No 651/2014 (amended by Commission Regulation (EU) 2021/1237 of 23 July 2021) declares certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the TFEU. The regulation includes aid for earthquakes, avalanches, landslides, floods, tornadoes, hurricanes, volcanic eruptions and wild fires of natural origins, and damage between aid exempted from Notification (but subject to Communication).

Aid shall be granted subject to the following conditions:

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[135] Council Regulation (EC) No 2012/2002 of 11 November 2002 establishing the European Union Solidarity Fund (OJ L 311, 14.11.2002, p. 3).

[136] Article 107 (1) TFEU.

[137] Article 107 (2) TFEU.

[138] Nicolaides 2022, https://www.lexxion.eu/en/stateaidpost/natural-disasters-and-state_aid/, last assessed on 21 March 2023.

[139] Article 108 TFEU.

[140] Article 109 TFEU.

(a) the competent public authorities of a Member State have formally recognised the character of the event as a natural disaster;

(b) there is a direct causal link between the natural disaster and the damage suffered by the affected undertaking.

Aid schemes related to a specific natural disaster shall be introduced within three years following the occurrence of the event. Aid on the basis of such schemes shall be granted within four years following the occurrence. The costs arising from the damage incurred as a direct consequence of the natural disaster, as assessed by an independent expert recognised by the competent national authority or by an insurance undertaking, shall be eligible costs. Such damage may include material damage to assets such as buildings, equipment, machinery or stocks, and loss of income due to the full or partial suspension of activity for a period not exceeding six months from the occurrence of the disaster.

To conform with article 107 (2) TFEU, the aid and any other payments received to compensate for the damage, including payments under insurance policies, shall not exceed the eligible costs.[141]

[141] Commission Regulation (EU) No 651/2014, of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty, OJ L 187 26.6.2014, Article 50, revised by Commission Regulation (EU) 2021/1237 of 23 July 2021 amending Regulation (EU) No 651/2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty, OJ L 270, 29.7.2021.

4. COMPENSATION MECHANISMS FOR CLIMATE CHANGE DISASTERS: A THEORETICAL PERSPECTIVE

KEY FINDINGS

- Compensation for victims of climate change disasters is important, not only for political reasons, but since disasters can constitute a systemic risk.
- It is important to organise a system of compensation in such a way that it does not negatively affect incentives for prevention.
- Therefore, it is important to respect principles of risk differentiation, i.e. also allocate the duty to finance compensation for those who can affect the risk or mitigate the damage.
- Liability rules are not suited to deal with climate change damage. The compensation provided through liability rules is uncertain and liability rules simply do not have the possibility to provide substantial compensation for a large amount of victims of a climate change disaster.
- *Ex post ad hoc* government compensation is not a suitable mechanism to provide compensation either, the *ad hoc* nature creates inequality and uncertainty, and *ex post* compensation negatively affects incentives for prevention.
- A government-financed compensation fund can provide more structural compensation (compared to an *ad hoc* solution), but will also have negative effects on the incentives for prevention.
- The best solution to deal with climate change disasters is third-party insurance by victims. This would require the creation of mandatory comprehensive cover (to deal with demand-side problems) and having the state act as reinsurer of last resort (to deal with supply-side problems).
- Government intervention as reinsurer of last resort has the advantage that it can avoid *ex post ad hoc* compensation (with negative incentive effect) and thus constitute a public-private partnership, positively affecting incentives for prevention. However, intervention of the government as reinsurer of last resort should correspond to certain principles, such as charging risk-based premiums, the absence of market solutions, and the temporary nature of the intervention.
- Summarising: from a theoretical perspective, a combination of mandatory first-party insurance with intervention by the state as reinsurer of last resort can provide compensation for climate change disasters, reaching both the goals of compensation and prevention.

4.1. Introduction

This chapter discusses some more fundamental issues concerning compensation for climate change disasters in the European context. One of the questions that needs to be addressed is why there should be any compensation for this particular type of damage, and how *ex post* compensation relates to incentives for *ex ante* prevention (4.2). Moreover, in the introduction five compensation mechanisms were sketched that could theoretically be used to compensate victims of climate change disasters. In section 4.3 those five mechanisms are analysed in further detail with respect to their ability to provide adequate compensation for victims. The question which will receive more specific attention, is the one concerning which of the five mechanisms is best able to provide effective compensation in a manner that respects the fundamental goals and principles discussed in section 4.2.

4.2. Fundamental goals and principles

4.2.1. Why compensate?

In a growing number of countries, including in the EU Member States (to be illustrated in the next chapter), legislators are increasingly involved in remedying catastrophic financial loss caused by disasters. Laws are created to compensate victims after disasters have occurred.

First of all, it is striking that disasters are apparently treated differently from ordinary accidents, which obviously has to do with the particular features of a disaster. No matter how a disaster is defined, in terms of property damage incurred, economic loss, or personal injury suffered, one common feature of disasters compared to other accidents is that in the case of a disaster the amount of victims involved is usually much larger. The massive character of a disaster (compared to an individual accident) already explains the interest of legislators in providing compensation for victims of disasters rather than for victims of individual accidents. After all, legislators are politicians who may seek re-election and, as a result, there may be large political benefits in providing *ex post* relief to victims. Already in 1953 Hirschleifer pointed out the fact that providing compensation after the occurrence of a disaster is so politically attractive that the government will invariably find it impossible to resist payment.[142] In the words of Viscusi, it is simply politically impossible to deny assistance "once there are identified victims and their stories are featured on the evening news".[143]

This may explain why legislators may prefer to focus on compensating victims of a disaster rather than victims of an individual accident. It does not justify, however, why victims of a disaster should, as a matter of public policy, deserve better treatment (in the sense of being compensated) than victims of an ordinary accident. From the perspective of an individual victim, it would be difficult to explain why a victim would be treated better if he/she was part of a group hit by a disaster than someone who was victim of an individual accident. Creating a separate regime for particular accident victims may, according to some, be incompatible with the equality principle, which requires equal treatment for victims.[144] In Germany, the question was raised whether separate (better) treatment for victims of a catastrophe could be reconciled with the equality principle.[145]

There may, however, be reasons for focusing specifically (and in a different manner) on disaster rather than on individual accidents. Some have argued that there may be strong normative beliefs that providing disaster relief is one of the principle functions of government.[146] Moreover, leaving victims of disasters without any relief could also be considered incompatible with the concept of the welfare state, at least in the way it is conceived in most Member States.[147] Finally, it could also be argued that a catastrophe (in contrast with an individual accident) may have a so-called systemic effect, implying that there could be consequences that go far beyond the reach of the individual victim, and could potentially even lead to a disruption of larger parts of society. For example, wide-spread flooding which could lead to large losses in critical infrastructure and damage to houses, as a result of which houses would become inhabitable for a longer period of time. The negative consequences would not only affect the homeowners, but potentially also the financial institutions that relied on the value of the real estate as collateral for mortgages. If the financial losses were not covered, this could potentially lead to

[142] Hirschleifer 1953.

[143] Viscusi 2010, 146.

[144] See in that respect the Dutch scholar Bloembergen 1992, 167-178.

[145] Magnus 2006.

[146] Priest 1996, 235.

[147] So Schwarze & Wagner 2004.

non-performing loans and, if the amount of those was large, to disruption of the financial sector. To some extent, the 2008 financial crisis as well as the 2020 COVID-19 crisis have provided examples of such systemic risks. This may therefore provide an important justification to search for financial compensation for victims of climate change disasters and, more particularly, to prevent repercussions beyond the losses of the individual victims, in other words: systemic effects.

4.2.2. Prevention, relief and recovery

This study basically focuses on *ex post* compensation for victims of climate change disasters. However, there are different types of government intervention with respect to disasters. A distinction is made between prevention, relief, and recovery.[148]

Prevention efforts are made *ex ante* (at time – 1), i.e. before the disaster strikes, relief efforts are made in the immediate aftermath of a disaster (at time 0), and recovery efforts are made *ex post* (at time + 1).

Preventive efforts are all actions to be taken *ex ante* in order to prevent an event from happening, to reduce its probability, or to mitigate the seriousness of its consequences.[149] Relief efforts consist of executing an effective, damage limiting response immediately after an event, for example, providing basic temporary shelter. Recovery is compensation intended to return conditions to those that prevailed *ex ante*.[150] Recovery, therefore, is *ex post* intervention consisting of, on the one hand reconstruction activities (aimed at restoring public services and infrastructure), and on the other victim compensation, including payments which go beyond immediate relief for victims of disasters.

The distinction between the three phases is important, as relief may have different effects on prevention than recovery. It has been argued that relief (immediate action, at time 0) does not negatively affect incentives for victims to invest in prevention. Relief may reduce the costs of recovery and can therefore have a positive *ex post* effect, as it can reduce the victims' losses.[151]

Ex post recovery (more particularly compensation, at time + 1) will, however, affect incentives for victims to invest in prevention. To the extent that *ex post* compensation is expected, recovery reduces the incentives for victims to take preventive measures, and therefore increases social costs.[152] The distinctions between prevention, relief, and recovery and, more particularly, the way in which relief and recovery affect prevention, lead to particular principles of effective compensation that allow for a critical review of specific compensation mechanisms in the next section (4.3).

4.2.3. Principles of effective compensation

The starting point should be that a negative redistribution or cross subsidisation should be avoided as far as possible. As a consequence, every effort should be made to individualise and differentiate possible risks. This means that, in principle, the individual seeking a particular protection will pay for this protection to the extent that he/she is exposed to the risk. Higher risks require a higher contribution to a financing solution than lower risks. According to this principle, risks and costs should not be passed on to the collectivity.

The reason behind this principle is the idea that making individuals pay according to the risk they pose will make them aware of e.g. their exposure to a natural hazard, and this may have a positive impact on

[148] See Dari-Mattiacci & Faure 2015.

[149] Leonard & Howitt 2010.

[150] Compare Mileti 1999.

[151] Dari-Mattiacci & Faure 2015, 195-196.

[152] Epstein 1996; Zeckhauser 1996.

their behaviour, i.e. provide incentives for prevention. Hence, the efficiency reason behind risk differentiation is to provide incentives for prevention, risk reduction, and/or mitigation of damage.

Such a risk differentiation could also be defended for reasons of distribution. Solidarity on the basis of which all (tax payers) pay for those exposed to risk, could imply a redistribution where those who accepted risk are compensated by those who faced no risk. The distributional problem can be explained with the following example: suppose a particular individual purchases a cheap villa in a flood-prone area next to a river. An important reason why the nice villa is obviously cheap, is its location in the flood-prone area. If the individual can (when flooding occurs) rely on compensation by the government (i.e. from the general tax payers) a distributional problem could arise. The individual has (at least from an economic perspective) *ex ante* already been compensated for the loss (by having purchased the house at a lower price), and may not have taken out insurance. Thus he/she may not have paid insurance premiums, nor taken the essential preventive measures, and can subsequently pass the risk to the collectivity.

Such solidarity may hence be at odds with efficiency and distributional principles. However, the extent to which this distributional problem may grow depends, especially in developing countries, on the existence of realistic alternatives. Remember that in many developing countries (like the case of Bangladesh) individuals may simply not have another option than choosing a residence in a hazard-prone area. In that case, one could rather make the reverse argument, which is that there would be a case in favour of providing compensation for that individual (who apparently had no alternative solution) from the collectivity.

A second principle is that, where possible, a solution should be introduced with the lowest administrative costs.

Third, where possible, a competitive market solution should (if it is less costly) be preferred to a bureaucratic intervention by government. The market will usually be able to provide coverage at lower costs.[153] However, there may be some (perhaps exceptional) cases where a government monopoly in the provision of disaster insurance could provide better results than competitive markets.[154]

Next, five different models for compensation for victims of climate change disasters are presented and examined as to the extent at which they correspond to some of the principles developed in this section.

4.3. Overview of compensation mechanisms

4.3.1. Introduction

The goal of this section is to discuss the five possible compensation mechanisms mentioned in the introduction in light of the principles of effective compensation elaborated in the previous section. For each compensation mechanism first a brief explanation of what the mechanism exactly is will be provided, in other words: what the mechanism contains. Next, the question of whether the mechanism can allow for an effective compensation of victims *ex post* will be addressed. This relates to the question of whether the mechanism can, in principle, provide compensation for all victims and for all damage suffered by the victim. Next, the question of whether the *ex post* mechanism provides positive incentives for *ex ante* prevention will be addressed. Lastly, in light of the earlier assessment, a

[153] See Bruggeman, Faure & Fiore 2010, 381.

[154] This would more particularly be the case in Switzerland. For a discussion see Emons 2001; Von Ungern-Sternberg 1996; 2004.

conclusion will be drawn as to whether the particular mechanism can be considered suitable to deal with damage from climate change disasters.

4.3.2. Liability rules

- **What is?**

A liability rule is, in very simple terms, a private law mechanism according to which a tortfeasor (injurer) has to pay compensation for the losses suffered by a victim. This liability in tort can be either fault/negligence-based (requiring the victim to show that the tortfeasor violated a due care standard) or strict liability (in which case the victim only needs to prove that the injurer's behaviour caused the victim's losses.

- **Compensation**

With respect to compensation, the picture is rather confused. Generally, the tort system is considered highly selective. Meta studies providing an overview of how many victims get actual compensation via the tort system indicate that it is a highly selective system, and it is shown that less than 10% of injured people would take action, and even less (2%) would file a lawsuit.[155] For those victims who do file a lawsuit, it is not certain they will succeed in court as there may be high thresholds for obtaining compensation. However, for those who eventually succeed, the tort system provides generous compensation, i.e. the goal of the tort system is to put the victim, in principle, back in the same situation as if the tort had not occurred. This means that a successful claimant can, in principle, not only claim income losses, but also compensation for all costs, both pecuniary and non-pecuniary, in principle without financial limits. Some therefore qualify the tort system as a lottery[156] (as only a few victims may effectively be compensated under the tort system), but at the same time it is a luxury system as well. Those who, symbolically, hit the jackpot get the "luxury" of full compensation.

As far as a specific focus on disasters is concerned, one has to realise that only under a strict liability regime will the injurer always be forced (in principle) to always provide compensation for the victim. Under negligence, the tortfeasor will have incentives to follow the efficient care level required by the legal system. As a result, the tortfeasor would not be held liable and the victim would not be compensated. Moreover, even if there were a strict liability rule, an insolvency problem could arise, also referred to as the "judgment proof problem". This would therefore require the introduction of mandatory financial guarantees such as compulsory liability insurance.[157] Without such a financial security, there is always the danger that the magnitude of the damage caused as a result of the (climate change) disaster would outweigh the assets of the individual tortfeasor.

There is, however, a more serious problem concerning the ability to use liability rules to compensate for damage caused by a climate change disaster. The problem is that natural disasters are often deemed "acts of God". As a result, no liable tortfeasor can be found, e.g. in the case of damage caused by sea-level rise, flooding, or hail storms. The only possibility to apply tort law in the case of natural disasters is to argue that public authorities were at fault, e.g. by failing to prevent the disaster or not taking adequate measures to mitigate the damage. It could, for example, be argued that public authorities failed to give adequate warnings, e.g. of a flood, or failed to take sufficient preventive measures. The only liability questions that therefore arise after natural catastrophes are often linked to the liability of public authorities. This was, for example, the case after hurricane Katrina.[158] However,

[155] See for an overview of these empirical studies, Van Velthoven 2009, 463-465.

[156] Some victims may receive (generous) compensation via the tort mechanism if they are successful, whereas others may receive no compensation whatsoever (Faure 2013, 252).

[157] Shavell 1986.

[158] See Bier 2006 and Walters & Kettl 2006.

legislators have often reacted by creating (partial) immunities for public authorities in order to limit the scope of liability, or imposing a high threshold for such liability to be accepted (for example requiring the proof of gross negligence). In the literature, it has been argued that there may be good reasons to limit the scope of liability of public authorities, as they are considered multi-task agents which have to weigh different externalities. As a result, they need a wide margin of discretion, as a too extensive liability might lead to so-called chilling effects.[159] In summary, liability rules may only work in legal systems that widely accept governmental liability, but even then the road for victims to receive compensation via tort law may be a complicated one. Therefore, liability rules are certainly not the ideal mechanism to provide compensation for most victims of climate change disasters.

- **Perfect on prevention**

As far as prevention is concerned, the question arises whether liability rules would provide incentives for all stakeholders that could either have prevented the risk of natural hazards occurring, or could have mitigated the damage after the disaster occurred. An advantage of liability rules is that, in principle, they have a deterrent effect, thus providing incentives for prevention to the potential injurer exposed to liability. To the extent that this would concern public authorities that could have prevented the climate change disaster from occurring, it could be argued that an exposure to liability could provide them with incentives for prevention. However, it is questionable whether the liability mechanism is efficient in providing incentives for prevention to public authorities.

Public authorities are not utility maximising individuals and may be exposed to different incentives, as a result of which there are doubts about the effectiveness of deterrence in this particular context.[160] To the extent that victims should also be given incentives to mitigate losses, this could be achieved via a comparative negligence defence. As a result, the claim of the victim would be reduced proportionally, based on the extent to which the victim failed to take optimal preventive measures where this would have been possible. However, for the reasons mentioned above, it is doubtful that liability rules will have this preventive effect. More particularly, given the high barriers in the tort system, only a few victims may effectively bring a claim, as a result of which tortfeasors (presumably only public authorities) would not be seriously deterred by a liability suit.

- **Suited for climate change damage**

From the previous analysis it follows that victims of climate change disasters may face impressive hurdles if they want to use liability rules to obtain compensation. Given these high thresholds and the fact that only public authorities can be addressed as defendants in the case of a climate change disaster, liability rules do not have the possibility to provide substantial compensation for a large amount of victims in a structural manner.

Before concluding the discussion on liability rules, there is obviously one topic that needs to be addressed as well and that is the possibility of holding operators, more particularly emitters of CO_2, liable in the case of climate change disasters. Theoretically, there would be such a possibility under the heading of "climate change liability". However, most of the (increasingly successful) climate change claims against either governments (as in the Urgenda case in the Netherlands) or operators (as in the case of Milieudefensie versus Shell) aim at obtaining mitigation, in other words a reduction of CO_2 emissions, not compensation. It is also held that climate change liability should not aim at seeking compensation, as this may lead to unsurmountable causation problems.[161]

[159] See De Geest 2012 and De Mot & Faure 2016.

[160] See in that respect especially Schäfer 2012.

[161] See Faure & Peeters 2011.

Even though most cases in climate change litigation aim at obtaining an injunction seeking mitigation, this does certainly not exclude that in the future claims for monetary compensation will (successfully) be brought as well. One such example is the lawsuit from a farmer, Saul Lliuya, from Peru, who filed a lawsuit against RWE to demand that the company pay for the protective structure for his house at the foot of the Andes. Mr Lliuya claimed to be in danger of damage from a glacial flood, which would be the result of global warming to which RWE had contributed through its greenhouse gas emissions.[162] In December 2016, the claim was denied by the *Landgericht* Essen, which argued that the chain of causality was too diffuse and too complex. The plaintiff had claimed approximately EUR 70,000, which would be 0.47% of the costs (the estimated contribution of RWE to climate change).[163] But the plaintiff was more successful before the OLG Hamm, which argued that liability cannot be ruled out just because a large number of polluters contributed to global warming. The court requested an on-site hearing of the evidence in Peru, which was apparently delayed as a result of the pandemic.[164] A new feature is that, as the German case shows, plaintiffs in climate change litigation no longer only ask for an injunction (to reduce emissions), but also claim damages.

However, these cases are still rather exceptional and still include the problem that the application of liability rules will only lead to *ad hoc* relief (if successful) for particular victims who are successful in the "tort law lottery". It would, however, not provide a structural solution that can provide relief for most victims of climate change disasters.

4.3.3. *Ex post* government compensation

- **What is?**

Ex post government compensation is compensation that is paid from the public budget by the government. Note that this is about *ex post* (in other words t+1) recovery, not about immediate relief (at t 0) at the moment of the disaster. This type of *ex post* compensation can take different forms, but the essence is that it is *ad hoc* and *ex post*. *Ad hoc* refers to the fact that the government decides on the basis of the nature and the scope of the disaster whether it will provide compensation, and what particular type of compensation will be provided. In other words, this *ex post* government compensation does not give a right to compensation to victims. The payment is from the public budget (and therefore from tax payers) and the decision is made *ex post*. This implies that only after the disaster occurred will the government decide if, and how much, compensation will be provided to victims.

- **Compensation**

At first glance, this type of intervention looks attractive, as it can provide *ex post* compensation for victims who are in need, for example to finance the rebuilding of their houses after flooding has occurred. However, also from the victim's perspective this *ex post* compensation is in fact not ideal. The first (major) problem is that the choice whether to provide this compensation *ex post* or not, is basically a political one. As mentioned earlier, when the scope of the disaster is large and there is substantial media coverage, there will be strong (political) pressure to provide compensation for victims *ex post*.[165] However, there is no *ex ante* structural regime that would give victims a right to compensation in case a disaster might happen. In other words, if the disaster is considered sufficiently large and gets a lot of media coverage, there may be political pressure for *ex post* compensation, but if that is not the case, the government may simply decide not to provide this compensation at all. Victims are, in other words,

[162] For a detailed analysis, see Wagner 2020, 17-22.

[163] Hinteregger 2017, 244.

[164] The climate gets the benefit of the doubt, see https://www.horizons-mag.ch/2022/03/03/the-climate-gets-the-benefit-of-the-doubt/ and Wagner 2020, 21-22.

[165] Dari-Mattiacci & Faure 2015, 183.

left in uncertainty. As some victims of disasters may receive compensation and others not, this may also be problematic from the perspective of the equality principle. Moreover, even in cases where the government decides to provide *ex post* compensation, it is not certain how much will be paid. Usually a symbolic lump sum *ex gratia* payment is provided, but there is no guarantee of full compensation. Again, the amounts paid for one disaster may be different than for another.[166]

- **Effect on prevention**

There are several problems with this type of *ex post* government intervention. The first problem is that when there is an expectation that the government will compensate *ex post*, no incentives are provided for potential victims to take effective preventive measures. Of course it depends on the nature of the disaster whether it is realistic for victims to take preventive measures. Large structural measures, e.g. to protect a country against the risk of flooding, will primarily be a government task. However, there are certainly measures which individual potential victims can take. Those are not so much focused on the prevention of the likelihood of a disaster, but rather aim to mitigate the losses. In the case of flooding, damage could be prevented, e.g. by not building in flood-prone areas or by not installing the most valuable objects in the cellar or on the ground floor. The problem is that charity by the government can reduce or even eliminate those incentives for prevention. This is referred to in the literature as the Samaritan's dilemma: the government grants *ex post* compensation even if this is likely to have negative *ex ante* effects on incentives.[167] This problem is also referred to as the "charity hazard".[168] It is for this reason that Epstein referred to *ex post* compensation as "catastrophic responses to catastrophic risks".[169]

The second problem is that if victims count on government compensation, they may no longer have an incentive to purchase insurance. Counting on government-provided compensation, potential victims could simply free-ride on the state.[170] In the words of Gollier: "Solidarity kills market insurance".[171] This is not only a theoretical issue. Empirical studies confirm that the availability of *ex post* compensation does have a significant negative impact on the willingness, e.g. of farmers, to purchase crop insurance.[172] An empirical study comparing compensation for damage caused by flooding in Austria, Switzerland, and the German state of Bavaria, came to the same conclusion.[173]

A third problem with *ex post* government compensation is simply distribution. The effect of using tax-payers' money to bail out victims of disasters *ex post* may be that those victims (who for example purchased houses at lower prices in flood-prone areas) *de facto* free-ride on the general tax payers who finance the *ex post* compensation. It could even be argued that they are compensated twice: once *ex ante* when they purchased their house in a flood-prone area (the lower housing price reflecting the flooding risk), and a second time when tax-payers' money is used for compensation.

- **Suited for climate change damage**

For all the reasons mentioned above, *ex post* government compensation is not a suitable mechanism to provide compensation. From the victim's perspective, the problem is that the *ad hoc* nature of the charity by the government creates inequality. If a disaster receives less attention in the media, and thus

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166 See for examples of different *ex post* payments made by the (Dutch) government for (technological) disasters, Hartlief & Faure 2015, 1014-1018.

167 Coate 1995.

168 Raschky & Weck-Hannemann 2007.

169 Epstein 1996, and see equally Kaplow 1991.

170 So Levmore & Logue 2003.

171 Gollier 2005, 25.

172 Van Asseldonk, Meuwissen & Huirne 2002.

173 Raschky, Schwarze, Schwindt & Weck-Hannemann 2009.

becomes politically less sensitive, there is a danger that government compensation could be absent. Moreover, from a societal perspective this type of *ex post* compensation is dramatic, as it was shown to provide negative incentives for prevention. Vulnerable uninsured victims may require more *ex post* compensation, which in turn makes the disaster more salient and politicians more eager to stage a rescue. This negative spiral results in a less safe environment and higher death tolls.[174] However, even though *ex post* compensation is considered problematic, it is still very likely that politicians will keep providing it. The reason, as indicated by Depoorter, is that the political rewards for *ex post* compensation may be very strong, as a result of which there may be an oversupply of *ex post* compensation notwithstanding the devastating effects on prevention.[175]

4.3.4. Government-financed compensation fund

- **What is?**

A fund is comparable to the above-mentioned *ad hoc* government compensation, but there is a fundamental difference. Whereas *ex post* compensation is only decided *ad hoc* after the disaster occurred, a compensation fund has a structural character. This means that the government has *ex ante* created a fund to compensate particular victims of disasters, and the conditions for government intervention (e.g. that a particular event has formally to be declared a disaster) are specified *ex ante* in legislation. If these conditions are met, victims will have a right to compensation from the fund.

With a compensation fund, the conditions for payment are therefore determined *ex ante* and create a right to compensation for the victims. However, in the case of natural catastrophes, the compensation fund is usually financed by the public purse, which means that, from a financial perspective, a compensation fund is also comparable with *ex post* government compensation.

- **Compensation**

Whereas the *ex post ad hoc* compensation model has the disadvantage for the victim that there is no certainty of compensation, the compensation fund is a uniform and structural arrangement. This means that victims know whether they are entitled to compensation after a catastrophe or not.[176] Thus, a compensation fund provides more certainty of compensation than an *ex post ad hoc* solution. However, a compensation fund usually does not guarantee full compensation of the victim's losses, but rather provides a lump sum payment of a limited amount as a token of solidarity.

- **Effect on prevention**

Some economists argue that the negative effects of *ex post* government compensation for prevention equally apply to structural compensation funds. More particularly, Gron and Sykes have argued that the existence of such a structural fund may provide a wrong signal to the market.[177] They argue that when market participants are aware that in the event of catastrophe the financial consequences will be covered through a structural fund, this will provide them with little incentive to develop financial solutions themselves. Law and economics scholars are usually not enthusiastic about compensation funds. The reason is that a compensation fund is usually financed from the general budget and not by risk-related contributions from the risk creators. That explains why the compensation fund does not have positive incentive effects for risk prevention by those who create the risk. Moreover, the certainty of compensation through a fund, will also have negative effects on incentives for prevention by victims,

[174] So Pidot 2013.

[175] Depoorter 2006.

[176] It is from this perspective that some lawyers prefer the certainty of the compensation fund. See more particularly Ammerlaan & Van Boom 2003, 2336.

[177] Gron & Sykes 2002 and Gron & Sykes 2003.

as the fund, in principle, guarantees a compensation to victims of a disaster.[178] In theory, a compensation fund would therefore be even worse than *ad hoc* compensation, for the reason that it provides even more certainty to potential victims, thus increasing the danger of moral hazard.

Whether the real difference concerning the effect on prevention between structural and *ad hoc* solutions is that large, can of course be doubted. For example, in a country like Italy, every year very generous *ad hoc* compensation is provided to the tune of an average EUR 3.5-4 billion per year to indemnify damage caused by catastrophic events.[179] Even though in Italy *ex post* compensation is formally *ad hoc* (as there is no structural disaster fund), *de facto* the government always provides compensation after a disaster. As a result, potential victims can count on it and adapt their behaviour accordingly.[180] This means that the same negative effects on prevention will occur with a structural as with an *ad hoc* solution.

- **Suited for climate change damage**

Here the same reasoning applies as with the previously discussed *ex post* government compensation. A structural compensation fund may have a (slight) advantage for potential victims, as it provides an *ex ante* structural solution and can provide a right to compensation for victims if particular conditions are met. It is, however, precisely this certainty of compensation being awarded to victims that may dilute the incentives for prevention that should be provided as well. This would generally be an argument against using compensation funds as structural solutions for climate change related disasters. An argument could still be made that, as the fund does not provide full compensation, victims could still be incentivised to take preventive measures. But then this incentive effect will be dependent on the financial limit on the compensation for the victim. The lower the limit, the better the incentives for prevention, but that may again endanger the compensation function which should be achieved as well.

Generally, it is held that if it is important to control the moral hazard by the victim, this is best done using the instrument to be discussed in the next section, namely insurance. Insurers are generally considered to be better able to control the moral hazard risk (and thus to provide incentives for prevention) than a government-operated fund.[181]

4.3.5. First-party insurance for natural disasters

- **What is?**

First-party insurance is insurance that is taken out by the person who suffers the loss, i.e. the victim. This is distinguished from third-party insurance, where a person takes out insurance to cover the risk that he/she would have to pay to a third party. A typical example of a third-party insurance is liability insurance. More particularly since, as was explained above, liability will in principle not be an instrument of major importance for compensating the damage caused by climate change disasters, the focus here is on the role of first-party disaster insurance. This is a model where the insured, in principle, demands coverage according to his/her own particular needs and preferences.[182]

[178] Faure & Hartlief 1996.

[179] Monti & Chiaves 2006.

[180] Faure 2007, 354.

[181] Priest 1996; Zeckhauser 1996.

[182] First-party insurance has especially been advocated as a tool to deal with disasters by Kunreuther (1968) and by Priest (1996).

- **Compensation**

The major advantage of a first-party disaster insurance model is that it can provide both certainty of compensation and an adequate amount of compensation. In the case of insurance, potential victims are no longer dependent (as with *ad hoc ex post* compensation) on the political will of the government. The conditions under which the insurance company has to intervene are laid down in the insurance policy. There is, in other words, a contractual obligation of the insurer to compensate the victim once the conditions in the policy materialise (e.g. a flooding with particular characteristics). Moreover, in contrast to a compensation fund (where the compensation is often limited to capped lump sum amounts), in the case of insurance, the insurance company, in principle, pays the amount agreed upon in the policy. This can, depending on the formulation of the policy conditions (and obviously on the corresponding premium), amount to full compensation. From the victim's perspective, insurance therefore provides both certainty and adequacy of compensation for climate change disasters.

- **Effect on prevention**

A major advantage of insurance is that the insurer will have to control the moral hazard risk.[183] This means that the insurer will apply risk differentiation based on the particular risk. For the area of (climate change) disasters, this could *inter alia* imply that the insurer would charge a higher premium for risky activities (such as building a house on a flood plain), or reward the good risks (e.g. those who construct their dwellings using materials that are less vulnerable to disasters). Through the charging of risk-dependent premiums, insurance would have the effect of contributing to the prevention of the risk.[184]

- **Suited for climate change damage**

Notwithstanding the theoretical advantages of first-party insurance, there are also problems, both on the supply and the demand side. As far as the demand side is concerned, it is striking that in jurisdictions where disaster insurance is widely available, there is only a limited number of potential victims that demand this type of insurance. For example, after the "Jahrhundert flood" of the Elbe in Germany,[185] but also after the Katrina disaster in the US,[186] it appeared that only a limited number of victims had adequate insurance coverage.

There are several phenomena that cause this problem of under-insurance. First, individuals apparently have difficulties in assessing risks which have a very low probability (e.g. natural disasters) in a correct manner. As the probability of occurrence is very low, individuals wrongly assume that this implies that the risk is in fact zero.[187] Second, individuals apparently consider insurance as a type of investment. The problem with disaster insurance is that the insured will be confronted with a certain loss on a yearly basis (this being the payment of the premium), whereas there is only a small expectation that a return on this "investment" will follow.[188] Third, the literature points to the fact that potential victims count on *ex post* government compensation, which reduces the incentives to take insurance cover.[189] Here one recognises again the problem of the *charity hazard* discussed earlier.

There are also problems on the supply side. Insurers complain that the occurrence of disasters is hard to predict. Disasters can also suffer from an adverse selection problem, i.e. disaster cover would only be attractive for high-risk individuals (for example those living in a flood-prone area). As a result,

[183] Shavell 1979.

[184] Priest 1996.

[185] Endres, Ohl & Rundshagen 2003.

[186] See the different contributions in Daniels, Kettl & Kunreuther 2006.

[187] Kunreuther 1996, 175.

[188] See further on that Slovic et al. 1977.

[189] See on that *inter alia* Harrington 2000.

insurers could be stuck with only the bad risks, which is typically the anti-selection problem that could lead to uninsurability.[190]

Moreover, as was indicated in a previous section (4.2.1), disasters can have a systemic character, implying that they are not limited to one incident, but that in case of a disaster a large amount of losses can accumulate for the insurer. The compensation the insurer needs to pay in case of a loss should, in principle, be provided by the collection of all the premiums paid by the insured. However, in the case of a disaster, the total amount of premiums might simply be too low to cover the totality of the damage caused by a climate change disaster. Reinsurance can partially deal with this problem, but also has its limitations.[191]

However, the literature has also developed solutions for these problems. As far as the problems on the demand side are concerned, already in 1968, Kunreuther pleaded in favour of a comprehensive system of disaster insurance. More particularly, he supported a mandatory add-on for disaster cover in addition to a voluntarily concluded insurance.[192] The advantage of this model would be that when disaster cover is combined with insurance against more usual risks (for example a fire in a house), there would also be a greater willingness on the part of the insured to accept this type of cover.[193]

As far as the limited supply of disaster cover is concerned, it has been suggested that the government should intervene in a different way in the compensation of (climate change) disasters. This implies that the government would no longer provide *ex post ad hoc* compensation (leading to the charity hazard), but would rather act as a reinsurer of last resort. That is the last model, to be discussed in the next section.

Summarising, first-party disaster insurance can be an adequate instrument to compensate damage suffered as a result of climate change disasters. However, it is important that the government facilitates this insurance by: 1) creating a mandatory comprehensive cover for disasters (to deal with demand-side problems), and 2) intervening as reinsurer of last resort (to deal with supply-side problems).

4.3.6. Government intervention as reinsurer of last resort

- **What is?**

Under this approach, the government (the state) assumes at least part of the risk of losses resulting from catastrophes. Some refer to this role of the government as a "private and public insurance response"[194] whereas others refer to it as "public-private partnerships", consisting of various layers to provide insurance against natural disasters.[195] Although, in practice, there are many different mechanisms in which the government could play this particular role.[196] The core, however, is that the state (in one form or another) supports the failure of traditional insurance markets, given their inability to supply full coverage in case of disasters of a large scale.[197]

- **Compensation**

When the government plays a role as reinsurer of last resort, it does not directly provide the compensation for the victims. That will usually be done by the primary insurer. However, this role of

[190] Priest 1987.

[191] See further on these problems with the supply of disaster insurance, Faure & Bruggeman 2008.

[192] Kunreuther 1968.

[193] See further on this issue, Slovic et al. 1977, 60-61 and 70-71.

[194] Levmore & Logue 2003, 278.

[195] Kunreuther & Pauly 2006, 112-113.

[196] Bruggeman, Faure & Heldt 2012.

[197] See further Bruggeman, Faure & Fiore 2010.

the government is of crucial importance for the simple reason that it can increase the capacity to provide compensation and in that sense it plays a crucial role in guaranteeing that compensation can also be provided for larger losses, i.e. in the case of climate change disasters.

One advantage of government intervention is that the government has the capacity to diversify the risks across the entire population and to spread past losses to future generations. The government can thereby create a form of cross-time diversification which the private market would not be able to achieve.[198] Another advantage of government intervention is that, to some extent, the occurrence of the disaster may be in the government's control. After all, the government can take measures (such as building levies and dykes) aiming at the prevention or mitigation of losses.[199]

- **Effect on prevention**

There are different ways in which this role of the government can be viewed. Some economists are very critical of this type of government intervention, based on the fear that the government would act as reinsurer and charge a lower price than the market price.[200] They argue that the lower-price signal would lead to market distortion. They would therefore even be in favour of *ad hoc* solutions where compensation is provided to accident victims on an *ex post* basis, thus avoiding victims being aware that the government will guarantee compensation. The criticism is in fact not directed towards the intervention of the government as such, but it is rather based on the assumption that the government will not charge premiums that reflect market prices. A similar criticism is shared by Levmore and Logue, who argue that such a regime (the government acting as reinsurer of last resort) may lead to substantial subsidies from the government.[201] They are sceptical of these types of government interventions in the market and argue that without government intervention "the market would probably have been able to provide the necessary coverage".[202]

These arguments against government intervention are mainly based on the assumption that the government will not charge a competitive premium for its reinsurance. That would amount to a subsidy for catastrophe insurance. They are also based on the belief that without government support the insurance coverage would have been provided by the market anyway. However, the reality in the case of natural disasters is that without government intervention the capacity of insurance and reinsurance markets is *de facto* limited. This means that, if a disaster of a magnitude larger than the available insurance cover were to occur, the government might have to intervene anyway, with *ad hoc ex post* compensation. This has, as noted earlier, the major disadvantage of diluting incentives for prevention.

The major advantage of the government acting as reinsurer of last resort therefore is that *ex post* compensation through the public purse (with negative incentive effects) can be avoided. When the government acts as reinsurer of last resort, at least those exposed to risk can still be charged an actuarially fair premium. At the same time, potential victims are made aware of their exposure to the disaster risk. It is for this reason that others argue that the government's role in assisting the supply side of insurance precisely allows for avoiding the inefficiencies and inequities associated with disaster assistance.[203]

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198 Kunreuther & Michel-Kerjan 2004, 210.

199 Kunreuther & Michel-Kerjan 2005.

200 See especially Gron & Sykes 2002 and 2003.

201 Levmore & Logue 2003, 304.

202 Levmore & Logue 2003, 311.

203 This is especially argued by Kunreuther & Pauly 2006, 113.

- **Suited for climate change damage**

Given the fact that climate change damage is often of a catastrophic nature, it is very likely that it will be of a magnitude largely exceeding the possibilities of the insurance and reinsurance market. The fact that the government would in that case play a role as reinsurer (*de facto* adding a third layer in addition to compensation provided by the insurer and reinsurer) could have the advantage that the total amount of compensation would be larger and that the beneficial incentive effect of insurance on prevention would still be safeguarded. In that sense, this type of government intervention should be welcomed, as it is to be preferred to *ad hoc ex post* compensation. However, it is important to structure this type of government intervention in such a way that the positive incentive effects can indeed be safeguarded.[204] For this type of government intervention to be efficient, the following conditions would have to be met:

- it should be clear that there is an absence of market solutions, in other words: there is no cover available beyond the capacity provided on the insurance and reinsurance market;
- the government should charge risk-based premiums for its intervention, thus avoiding a situation where the government-provided reinsurance would amount to a subsidy;[205]
- the reinsurance by the government should be organised in such a way that market solutions are stimulated, for example by charging a high premium for its reinsurance, thus stimulating the development of market solutions;
- insurers should obviously be left free to choose state reinsurance; and
- the government's intervention as reinsurer of last resort should, in principle, also have a temporary character (i.e. there should be so-called "sunset provisions"), again in order to provide incentives for the market to develop its own solutions.

4.4. Summary

Looking once more at the five instruments discussed, more particularly from the perspective of their ability to provide adequate and certain compensation on the one hand, and incentives for prevention on the other, the following can be concluded as far as their ability to provide compensation for climate change damage is concerned:

- Liability rules are not an ideal instrument for providing compensation for climate change disasters. They can provide high compensation if all the conditions for liability are met, but the liability system is seen more as a lottery and may therefore not provide certain compensation for victims. In the case of natural disasters it is, moreover, only public authorities that could be targeted as a defendant, which means a high threshold for liability often applies.
- *Ex post* government compensation is not attractive from two points of view: first, it cannot provide certainty of compensation for victims (as it may depend on a political decision to compensate or not) and, second, often no full compensation, but rather a limited lump sum amount is provided. Moreover, this type of *ex post* compensation has negative effects on incentives for prevention or mitigation of losses.
- The same problems arise in the case of compensation through a government-financed compensation fund. This usually does not provide incentives for prevention. Compensation may be more certain than in the case of *ad hoc* compensation, but compensation will always be limited, and the negative effects on incentives for prevention remain.

[204] See Bruggeman, Faure & Fiore 2010, 377-379.

[205] Levmore & Logue 2003, 304.

- The best instrument to provide certain and adequate compensation for potential victims of climate change disasters is first-party insurance. This also has positive effects on the incentives for prevention. Given the low demand, this type of insurance requires government intervention in order to make comprehensive insurance mandatory, and it may also require government intervention to deal with supply side shortages.
- For this reason, the government can support the mandatory first-party insurance system by intervening as reinsurer of last resort. In that way, compensation can also be guaranteed for larger losses (like in the case of disasters). Provided that the government charges a (risk-based) premium for its intervention (rather than providing a subsidy), government intervention as reinsurer of last resort could be a smart public-private (government and insurers) partnership that provides adequate and certain compensation on the one hand, and incentives for prevention on the other.

5. COMPENSATION MECHANISMS FOR NATURAL DISASTERS IN SELECTED MEMBER STATES

KEY FINDINGS

- Belgium traditionally had a government compensation fund to deal with victims of natural disasters. Since legislative changes in 2003 and 2005, it has moved to a system of mandatory insurance which is added on to voluntary fire insurance policies. The disaster fund (government-financed) only intervenes where the insurance is not able to fully cover the loss.
- France is one of the rare countries where public authorities have been held liable for damage caused by a natural catastrophe.
- France introduced a system of a mandatory add-on for natural catastrophes in addition to voluntary insurance (*multi-risques habitation*).
- In France, reinsurance is provided for this cover through the Caisse Centrale de Réassurance (CCR), which is fully controlled by the French state.
- Germany largely relies on *ad hoc* government compensation based on specific statutes. This model has been criticised in various studies. There have been proposals to introduce mandatory comprehensive disaster insurance in Germany, but so far these proposals have not been accepted.
- The Netherlands also largely relies on *ex post ad hoc* government compensation and on a government-financed compensation fund (WTS). However, this is applied only in rare cases. Although there have been many discussions, as yet there is no system of comprehensive insurance for natural catastrophes in the Netherlands. In fact, the insurance situation is complex, and recent disasters showed that little insurance coverage was available.
- Romania has a system of mandatory insurance against earthquakes, landslides and floods. However, notwithstanding the compulsory insurance, less than 20% of homes in Romania are insured against natural disasters. The main problem is that the duty to obtain insurance coverage is not enforced.
- Spain has created a Consorcio to handle extraordinary risks, including earthquakes, flooding, and volcanic eruptions. Cover under the Consorcio is mandatory. The Consorcio receives unlimited state-guaranteed cover for these extraordinary risks.
- Sweden relies heavily on first-party insurance to also deal with the consequences of natural disasters. The penetration rate of insurance in Sweden is very high, even without an obligation.

As promised in the introduction, the way in which compensation for victims of natural disasters takes place in seven Member States will be reviewed. Thus, an examination is made of the extent to which the five compensation instruments presented in the previous chapter play a role in a particular Member State. In this way, it is clear that if a Member State does not have a particular compensation mechanism in place (for example a compensation fund), then on that point the description will necessarily be brief.

The analysis is based on particular comparative studies related to the compensation for victims of catastrophes.[206] No detailed references for every statement made will be provided, but rather reference is made to literature where a comparative overview of the compensation mechanisms has been provided.[207]

4.5. Belgium

The Belgian case is interesting. As will be explained below, Belgium has been going through a transition. The compensation system in Belgium originated from a government-sponsored compensation fund, but has recently (as a result of legislative changes in 2003 and 2005) moved to a system of mandatory first-party insurance.[208]

4.5.1. Liability rules

Liability rules do not play any role of importance in compensating victims of natural disasters in Belgium. Several strict liability rules have been created, *inter alia* for the guardian of a defective object (Article 1384, al. 1 of the Civil Code). Also, specific statutes introduce strict liabilities, *inter alia* with respect to damage caused by mines, the transport of gas, damage caused by toxic waste, fire or explosions in public buildings, and nuclear accidents.[209] Belgian law also contains a large amount of mandatory solvency guarantees, such as compulsory liability insurance.[210] However, all those instruments are only relevant in the case of technological disasters and have not been applied to natural disasters. After the 2019 flood, which caused severe damage (and casualties) in the Walloon Region of Belgium, people began to ask whether there could be any liability of the public authorities that might have taken a wrongful decision by not releasing a large amount of water from a basin preceding the heavy rain that was announced. However, to the best of our knowledge, this type of liability suit was not brought.

4.5.2. *Ex post ad hoc* government compensation

In fact, there is also little room for this model in Belgium. Until 2003/2005 *ex post* compensation was provided through a structural compensation fund, but the importance of that fund was reduced to a large extent when in 2003/2005 Belgium introduced a comprehensive insurance mechanism for natural disasters. There is still a (modest) role for the compensation fund, but there is in fact no need to provide *ex post ad hoc* compensation.

4.5.3. A government financed compensation fund

After a whirlwind caused considerable damage in some parts of Belgium in January 1976, an Act (of 12 July 1976) on the repair of certain damage caused to private goods by natural disasters created a so-called disaster fund as a part of the national cash-registry for disaster damage. The disaster fund was financed in the aftermath of a natural catastrophe by advances from the treasury, loans and, where necessary, allocations drawn from the state budget as well as gifts, legacies, and profits from the national lottery. The federal disaster fund was used to compensate, in instalments, for direct material damage caused by a natural disaster, up to the amount of EUR 64,800, while a deductible of EUR 250 was applied on the condition that the total direct damage to private goods amounted to at least EUR

[206] Such as Faure & Hartlief 2006a and Faure & Hartlief 2006b.

[207] Such as for example also Bruggeman 2010.

[208] The Belgian model is also discussed in the recent book by Dubuisson & Quistrebert 2022.

[209] Bruggeman & Faure 2019, 278.

[210] Ibidem.

1,250,000 and the average damage amounted to at least EUR 5,000 per family. The money granted has to be used for restoration or construction works within the following three years.

The disaster fund was not a great success, since citizens had to wait for a considerable period of time before receiving financial compensation. A formal requirement also is that the government has to recognise the event as a natural disaster. This is a political decision. Moreover, the application procedure is very complex.[211] Financial compensation is only granted up to a certain limited amount. For example, the disaster fund paid out EUR 15,284,632 of compensation after storm Daria hit Belgium in 1990.[212] Through the creation of insurance solutions since 2003, the scope of the disaster fund has been reduced to an important extent. The fund only continues to exist for events and property which are not insured due to low financial capabilities of the victim, and for agricultural damage.

Summarising, the disaster fund has the disadvantage of having a long and complicated administrative procedure. Moreover, the damaging natural event needs to be declared a natural catastrophe by the council of ministers. Through the creation of insurance solutions, the role of the disaster fund has now been substantially reduced.

4.5.4. First-party insurance for disasters

An Act of 21 May 2003 introduced flood coverage as a mandatory extension to the fire insurance policies covering simple risks. This mandatory extension would, however, only apply to property situated in flood-prone areas, which had to be demarcated by the country's three regions. However, the Act of 21 May 2003 never came into force, mainly due to political difficulties with regard to the demarcation of flood-prone areas.[213] The Act was subsequently amended by a new Act of 17 September 2005. The legislator now introduced a mandatory extension for all citizens who purchased fire insurance for the so-called simple risks. The extension would also cover flooding (referring to water that comes from below), earthquakes, the over-flowing or the blocking of public sewers, and landslides or subsidence. As a result, all direct damage to an insured property caused by a natural disaster is compensated by insurance. For the victims, the advantage of the insurance solution is that the complicated and long procedure via the disaster fund can now be avoided. For the Belgian state, the obvious advantage is that the role of the disaster fund will be much more limited, as a result of which there will be a less heavy burden on the public budget.

4.5.5. Government intervention as reinsurer of last resort

The insurance solution created by the Act of 2005 created a limit per insurance company of EUR 280 million generally, and EUR 700 million for earthquakes (for each specific event). Since these amounts would not be sufficient to provide full compensation for the victims, the above-mentioned disaster fund would intervene. The role of the disaster fund is therefore now limited to a role in providing compensation as a last resort (i.e. when the damage is higher than the insured limits).[214]

The disaster fund therefore now has a different, complementary role in providing supplementary compensation to the compensation provided by insurers. Note, however, that this supplementary compensation by the disaster fund is not really structured as a reinsurance of last resort.

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[211] Durand 2006, 37 and 72-73.

[212] Bruggeman & Faure 2019, 271.

[213] See Termote 2003 and Hartlief & Faure 2015, 1027-1028.

[214] The disaster fund would also still play a role if individuals had not concluded a fire insurance or cover for agricultural damage. The disaster fund would also intervene if the damaged property had not been insured due to the financial position of the victim. See Bruggeman & Faure 2019, 275 and Hartlief & Faure 2015, 1029.

4.6. France

4.6.1. Liability rules

As in the case of Belgium, the scope of liability rules in providing compensation for climate change disasters in France is obviously limited. But in addition France created a liability for the guardian of a defective object and also has separate statutes laying down strict liability in various areas.[215] It should be noted that France is one of the rare countries where public authorities have been held liable in a case of a natural catastrophe. The case concerned a disastrous flood at Grand-Bornand, on 14 July 1987, which caused the death of 23 persons and substantial property damage. In that particular case, a joint liability of the French state and the municipality was accepted.[216] It is perhaps no surprise that this example comes from France, as France has a very far-reaching liability for public authorities.[217] However, these types of cases are still rather exceptional, as a result of which liability rules cannot be used to provide compensation in a structural manner.

4.6.2. *Ex post ad hoc* government compensation

Here the same applies as to Belgium: as the legislator has worked out specific solutions to compensate victims of natural disasters (more particularly comprehensive insurance coverage), there is no need to provide *ex post ad hoc* compensation for victims. Of course, there may still be intervention by the government, but that would then be in order to repair (state-owned) critical infrastructure, such as dykes, rather than to provide compensation for individual victims. The case of the Rhone flood of December 2003 can provide an illustration.[218] In December 2003, the Rhone flooded, leading to an estimated loss of EUR 800 million. A total of 80,000 claims were dealt with by the insurance companies, 90% of which were filed by private individuals. The provincial authorities still created an *ad hoc* fund (of EUR 15 million), and so did the region Provence-Alpes-Côte d'Azur (EUR 20 million). Victims could, in principle, call immediately on their property insurance. The additional financial help was provided to re-establish the supply of drinkable water, electricity, and the train service. This shows that in France, in principle, victim compensation takes place via the structural insurance solution. When *ad hoc* funds are called upon, this is for the most part in order to finance repairs of critical infrastructure.

4.6.3. Government-financed compensation fund

France has a variety of compensation funds, such as a fund to compensate farmers in case of damage to property, and a fund for victims of terrorist attacks.[219] Also, a compensation fund was created, by decree on 27 November 2020, for the victims of pesticides.[220] But none of those funds seems directly relevant for natural disasters. An Act (of 30 July 2003) created a specific arrangement for property damage caused by technological disasters (except terrorist attacks). In the case of a technological catastrophe causing damage to a large number of buildings, the coverage of the first-party motor vehicle and housing insurance will extend to risks linked to these technological catastrophes. For uninsured victims a compensation fund is created.[221] But again, this compensation fund is relevant for

[215] Bruggeman & Faure 2019, 302.
[216] See further on this case Bruggeman 2010, 297-298.
[217] See De Mot & Faure 2016, 605-608.
[218] See Cannarsa, Lafay & Moréteau 2006, 116.
[219] For an overview see Cannarsa, Lafay & Moréteau 2006, 89-91.
[220] See Knetsch & Jacquemin 2021, 183-185.
[221] Bruggeman & Faure 2019, 303-304.

technological catastrophes (and only in cases where there is no insurance cover), but not for natural disasters.

4.6.4. First-party insurance for disasters

France has created an elaborate system of first-party insurance for property damage. This system has *de facto* been the example that has been followed by many other countries, for example Belgium. The French model is linked to the first-party insurance for property damage. This is a voluntary insurance (so-called *multi-risque habitation*) which 85% of all inhabitants of France have taken out.

Through the Act of 13 July 1982 on all (voluntary) first-party insurance covering damage against property, a mandatory additional cover is provided for the consequences of natural disasters. There is therefore no generalised duty to insure against natural disasters. The compulsory coverage extension applies to voluntarily subscribed property insurance contracts. Insurers are only held to compensate the damage if the government declares a certain incident a natural disaster. From that moment, the victim can file a claim with his insurer. According to the Code des Assurances, the insurer must make an offer of financial compensation within 3 months after the victim's claim. Agricultural damage is excluded.[222] The supplementary coverage for natural catastrophe is financed through an additional premium of 12% on all insurance contracts. The mandatory coverage applies to all insured, irrespective of whether they are particularly vulnerable to natural disasters and thus exposed to the insured risk. Certain deductibles apply, and these are higher in case a community did not adopt a risk prevention plan. The idea is that this would provide a financial incentive for citizens to pressure their local community to adopt such a plan.

An example of the application of this French model can be seen in the way in which the 2016 flooding of the Seine (and Loire) was dealt with.[223] 182,000 claims were reported, leading to a cost for insurers of more than EUR 1.4 billion.

4.6.5. Government intervention as reinsurer of last resort

Reinsurance for the French insurers is provided through the Caisse Centrale des Réassurances (CCR). The CCR is fully controlled by the French state. Reinsurance through the CCR is not compulsory. Insurers are therefore free to contract with other private reinsurance companies. However, reinsurance with the (state-owned) CCR is particularly attractive given the relatively low premiums it charges and because it can offer unlimited coverage resulting from a state guarantee in the event that the CCR exhausts its resources.[224] In this case, the state intervenes as a reinsurer of the CCR. In exchange, the CCR pays a premium to the state. As a result of this state intervention (through the CCR), the CCR for example intervened in the above-mentioned 2016 floods. Of the total costs of EUR 1.4 billion, the CCR intervened for an amount of EUR 623 million.[225] The CCR does not charge premiums which correctly reflect risk to insurers, as a result of which reinsurance by the CCR could be considered state aid. However, the European Commission approved the principles and the terms of the natural disaster reinsurance scheme operated in France by the CCR. The Commission considered that this guarantee did not constitute state aid which would be incompatible with the European internal market rules, given that

[222] But a recent act created a similar compensation model for agricultural damage as well.

[223] Bruggeman & Faure 2019, 301.

[224] Bruggeman, Faure & Heldt 2012, 227.

[225] Bruggeman & Faure 2019, 301.

the "French natural disaster compensation system is proportionate", and that "it enables each household and business to be insured against these risks".[226]

4.7. Germany

4.7.1. Liability rules

Germany too has a wide variety of strict liability statutes, for example in the Environmental Liability Act, the Gene Technic Act, and other pieces of legislation. Technological catastrophes (such as a derailed train or a train burning in a tunnel) would be subject to a strict liability regime.[227] However, those strict liability regimes are considered insufficient in scope[228] and will usually not apply to the case of natural disasters. As far as we can see, there are no cases in Germany where liability rules have been used to obtain compensation for natural disasters.

4.7.2. *Ex post ad hoc* government compensation

In Germany there is no single instrument that deals in a structural manner with financial compensation for victims of natural catastrophes.[229] As a result, potential victims of a natural disaster have to rely on (voluntarily concluded) private insurance. In exceptional cases (such as when there is large wide-spread damage resulting from a disaster), either the federal government or individual *Länder* may intervene with *ad hoc* legislation to provide *ex post ad hoc* compensation.[230] This *ad hoc* compensation based on specific statutes is characterised as "rather insecure, often inadequate, but sometimes 'overgenerous'".[231] The German system of *ad hoc ex post* compensation has been heavily criticised in various studies, mainly for creating the so-called charity hazard.[232] Empirical research indicated that the charity hazard in Germany caused a substantial market failure in terms of insufficient insurance demand.[233]

In some cases, *ad hoc* legislation is created (e.g. after the 2002 Elbe flood). In other cases, the federal and state leaders simply agree to provide compensation for victims. For example, after the 2013 floods, a package of EUR 8 billion of assistance was made available to repair the damage caused by the flood.[234] Also, after the 2017 summer floods, the German government announced hundreds of millions of euros in emergency relief for flood victims, and announced a package of tax breaks to ease the clean-up. Also, the *Länder* set up a variety of compensation programmes.[235] In sum, Germany lacks a structural solution, but simply provides generous *ad hoc ex post* compensation which is, however, heavily criticised in the literature.

4.7.3. Government-financed compensation fund

Germany does not have a structural compensation fund to deal with natural disasters (comparable for example to Belgium). It is only *ad hoc* and *ex post* that in some cases a fund is created. This was, for

[226] Bruggeman & Faure 2019, 301. See further for an analysis of this French model from a competition law perspective Van den Bergh & Faure 2006.

[227] Bruggeman & Faure 2019, 317.

[228] See Magnus 2006, 124-127.

[229] Magnus 2006, 121.

[230] Schwarze & Wagner 2004, 159.

[231] Schwarze & Wagner 2004, 154.

[232] See Raschky & Weck-Hannemann 2007.

[233] Raschky, Schwarze, Schwindt & Weck-Hannemann 2009, 20.

[234] Bruggeman & Faure 2019, 315.

[235] Bruggeman & Faure 2019, 316.

example, the case after the 2002 flood when the *Flutopferhilfesolidaritätsgesetz* was created to establish a fund in order to support the victims of the flooding.[236] It led to an amount of EUR 8.1 billion which was distributed by the local communities. The fund was mainly directed at providing compensation for property damage caused by the 2002 flood. Claimants could apply for financial support and receive a first, limited immediate payment (*Soforthilfe*) and then medium-term reconstruction support (*Aufbauhilfe*).[237] Again, it should be stressed that in Germany there is no structural compensation fund to deal with (climate change) disasters. It is only when the government decides *ex post* and *ad hoc* that a fund will be created for a specific disaster that the victims can receive compensation.

4.7.4. First-party insurance for disasters

Given the criticism of the current system, numerous reforms to the German system were formulated, the most important ones being related to the introduction of mandatory comprehensive disaster insurance, based on the French model.[238] Political debates took place in 2004, but they did not lead to action at the legislative level. Schwarze and Wagner show that political considerations played an important role in rejecting the comprehensive insurance scheme. "*Ad hoc* aid gives the decision-makers greater discretion in their response to natural disasters than regulated benefits".[239] This failure is in line with the analysis made by the Depoorter, who argues that there will often be systematic under-investment in *ex ante* prevention and over-investment in *ex post* recovery, for the simple reason that politicians can obtain larger political rewards from *ex post* recovery payments than from investments in *ex ante* prevention, which may pay off only after their term of office.[240] The case of the Elbe flood in 2006 illustrates that point: "Chancellor Schröder's energetic and sympathetic efforts to help Saxony during the floods led to the governing parties' renewed popularity, helping the social democrats to win the 2006 election".[241] This refusal to introduce mandatory disaster insurance in Germany once more underscores the difficulty of introducing mandatory insurance, given the political rewards that can be gained through (largely inefficient) *ex post ad hoc* compensation.[242]

4.7.5. Government intervention as reinsurer of last resort

As far as this point is concerned, we can be relatively brief: as there is no structural comprehensive insurance programme in Germany, there is also no role for the state as reinsurer of last resort. However, a similar model does exist in Germany (but, for that matter, also in other Member States) with respect to terrorism. In response to 9/11, many insurers in Europe decided to exclude losses due to an act of terrorism. This led to the creation of so-called terrorism pools in many Member States. In Germany, this took the form of Extremus, a pool of 17 insurers and reinsurers. This pool covers a total of EUR 2.5 billion, but on top of that the German state provides additional coverage up to an amount of EUR 10 billion for excess losses.[243] For this guarantee, the German state receives a payment of 12.5% of the premiums collected by Extremus. In other words, Extremus is a multi-layered insurance pool consisting of insurers and reinsurers which, with reinsurance by the state, can provide a total capacity of EUR 10 billion.[244] It

[236] Magnus 2006, 121.
[237] Magnus 2006, 133-134.
[238] See for example the proposal made by Schwarze & Wagner 2004 and see Endres, Ohl & Rundshagen 2003.
[239] So Schwarze & Wagner 2007, 413.
[240] Depoorter 2006.
[241] Schwarze & Wagner 2007, 413.
[242] Bruggeman & Faure 2019, 314.
[243] Schwarze & Wagner 2004, 163.
[244] Bruggeman & Faure 2019, 321-322.

should be recalled, however, that Extremus does not apply to natural disasters and that in other Member States similar pooling constructions to deal with the terrorism risk exist.

4.8. The Netherlands

4.8.1. Liability rules

The Netherlands has, in addition to the general negligence rule, a large amount of strict liabilities. For example, Article 6:175 of the Civil Code includes strict liabilities for damage caused as a result of dangerous substances and waste sites. Those liabilities could, in theory, be applied in the case of a disaster. However, liability rules would then mostly be applied in cases of technological (man-made) disasters rather than natural disasters. Moreover, the question of whether the injurer can effectively provide compensation arises very often. The reason for this is that the strict liabilities are not linked to any compulsory liability insurance. Dutch legislation does not provide a large amount of mandatory solvency guarantees.[245]

There have been cases in the Netherlands were the application of liability rules to natural disasters has been explored. This mainly concerned the potential of liability of public authorities. For example, on the occasion of several floods, at the beginning of the 1990s, the possibilities of the liability of public authorities were examined.[246] Various shortcomings of public authorities were mentioned, more particularly:

- lack of maintenance of rivers, canals, and mechanisms to prevent flooding;
- insufficient warning for flooding;
- issuance of licences to build in flood-prone areas; and
- failure to act where there was reason to take measures based on previous floods.[247]

However, given the fact that public authorities have discretionary power to act and usually only limited means at their disposal, there is often a restrictive application of liability of public authorities.[248] The reason why in the Netherlands victims often try liability claims against public authorities, is that they do not have adequate compensation through first-party insurance. As in the case of natural disasters, there may simply not be a liable injurer, as a result of which victims seek recovery through liability of public authorities, although generally the case law in the Netherlands does not award those claims.[249] This issue was addressed in particular in a decision by the Dutch Supreme Court (Hoge Raad) of 17 December 2010. As a result of high water, a dyke had collapsed causing substantial damage, *inter alia* in the local community where the disaster occurred, the village of Wilnis. The community brought a liability suit against the water board, arguing that the water board would be liable for the results of the flooding. Both the Tribunal and the Court of Appeals held the water board liable for the damage, but that decision was quashed by the Hoge Raad.[250] Interestingly, it has been held that authorities in the Netherlands may be inclined to organise *ad hoc* compensation for victims precisely to reduce the likelihood of liability claims against public authorities.[251]

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[245] Bruggeman & Faure 2019, 334-335.

[246] See Hartlief 1995.

[247] Faure & Hartlief 2006c, 200.

[248] Ibidem.

[249] Faure & Hartlief 2006c, 201.

[250] Hoge Raad, 17 December 2010, Nederlands Jurisprudentie 2012/155, with case note by T. Hartlief.

[251] Ibidem.

4.8.2. *Ex post ad hoc* government compensation

The Netherlands has suffered various types of natural disasters, including an earthquake in Southern-Limburg (1992), severe storms (1997, 2002, 2007, 2013), and heavy rain and flooding in the south-east (1993, 1995, 2021). Victims frequently approached the government for compensation and, as a result, the government of the Netherlands intervened on various occasions by using the public budget to provide *ad hoc* compensation for victims.[252] For example, after the flood that took place in the province of Limburg in 1995, *ad hoc* compensation was provided given the fact that insurance for flooding was not available at that time.[253]

Another example arises from an infection caused by the Legionella bacteria at a 1990 exhibition organised by the Westfriese Flora in Bovenkarspel as a result of the presence of this bacteria in some whirlpools. Visitors of the exhibition suffered from infection and 28 persons died. Even though a variety of claims were initiated against the operator of the whirlpool stand (Jan Jong Holding BV), against the state, and against the organiser of the exhibition (Westfriese Flora), as well as against the whirlpool sellers, most of the claims were denied.[254] As a result, the government decided on 18 February 2002 to make a gesture to the victims and their families in the form of a lump sum payment from an *ad hoc* created fund for a (total) amount of 2 million Dutch guilders. The reasoning was that the outbreak of Legionella was a unique event and that the unforeseeable nature, the shocking emotional effects, and the large number of victims made this outbreak so exceptional that it warranted financial intervention by the state. The victims (or their families) could receive a lump sum payment of 4,000 guilders. In the case of the death of a victims, the family received 10,000 guilders.[255]

4.8.3. Government-financed compensation fund

After the floods in the 1990s, a debate took place in the Netherlands on financial compensation for victims of catastrophes, more particularly of flooding. Originally, an insurance solution with the French model in mind was presented. However, the government was against this model because of fears that free consumer choice would be limited and that a compulsory system would increase costs for citizens. The Dutch government was confronted with various types of natural disasters, such as earthquakes, severe storms, and heavy rain and decided to introduce an act whereby the public budget would be used to compensate victims of catastrophes and severe accidents. This act was called Wet Tegemoetkoming Schade bij Rampen en Zware Ongevallen (WTS). Its objective was to provide a structural solution for financial compensation for victims of catastrophes, rather than the *ad hoc* responses that had been in place until then.[256] The WTS is applicable in the case of an event classified as a disaster, such as freshwater flooding, earthquakes or large accidents which cause damage of at least similar amounts. Large accidents only fall within the scope of the WTS if the accident is declared a large accident by royal decree. The WTS has a subsidiary character, meaning that victims will receive financial compensation only for particular types of damage. Victims are not entitled to financial compensation when the damage was reasonably insurable or when the victim was able to obtain compensation from another source.

When the WTS is applicable or declared applicable by royal decree, a ministerial regulation will elaborate the detailed rules concerning the compensation. The WTS mainly applies to damage caused by heavy rain. In those cases, the WTS needs to be declared applicable by royal decree, because heavy

[252] Bruggeman & Faure 2019, 325.

[253] Faure & Hartlief 2006c, 209.

[254] For details Faure & Hartlief 2006c, 216-217.

[255] Faure & Hartlief 2006c, 217.

[256] Bruggeman & Faure 2019, 329-330.

rain is not formally a serious incident in the sense of Article 1 of the WTS. So far, the WTS has been applied six times. Most recently, it was applied in the aftermath of the flooding that took place in July 2021. A ministerial regulation of 2 September 2021 provided the conditions for compensation as well as the amounts. Individuals received 90% of the damage to their home and 90% of the damage to the goods inside the home with a maximum of EUR 36,000.

The WTS has been criticised in the literature, as it has not succeeded in becoming the exclusive arrangement for government contributions in the event of natural and technical disasters. The WTS also has severe consequences for the public budget. For example, it is estimated that the government intervention for the flooding of July 2021 has cost the Dutch government EUR 1.1 billion.[257] Also, from the victims' perspective, the WTS did not provide a full guarantee of compensation. When a disaster is not covered by Article 1 WTS (for example in the case of heavy rainfall), a victim will still have to wait to see whether the government will bring the particular disaster under the scope of the WTS.[258] In the case of smaller incidents with less victims, there is a serious risk that the WTS will not be applied (as a result of less political pressure), meaning that victims will not be compensated.

It is indeed striking that, notwithstanding the existence of the WTS, in particular cases *ad hoc* compensation still takes place, for both man-made and natural disasters. For example, after serious catastrophes, such as the explosion of a fireworks factory in Enschede on 13 May 2000, and a large fire in a café in Volendam on New Year's Eve 2000-2001, the government again provided substantial funds on an *ad hoc* basis outside the scope of the WTS.[259] The WTS has therefore not been able to provide structural arrangements for victims of catastrophes. Still many *ad hoc* compensation funds were created. For example, after a catastrophic air crash with an El Al airplane which flew into an apartment building in the Amsterdam neighbourhood of Bijlmer, the government created the Stichting Hulpfonds Gedupeerden Bijlmerramp (Foundation Compensation Fund for Victims of the Bijlmer Catastrophe), as a result of a demand of the parliament to provide help for the victims. And, as mentioned earlier, often *ad hoc* funds were created to deal with particular disasters. For example, in the case of above-mentioned Legionella outbreak in Bovenkarspel, the government created a fund to provide compensation for the victims.[260]

In the literature, many critical voices are heard with regard to those compensation funds. The crucial question that is often asked is why the government would install a particular compensation fund for particular types of victims. This leads to preferential treatment for a specific category of victims for which the legal basis seems doubtful.[261]

4.8.4. First-party insurance for disasters

Insurance for natural disasters has quite a history in the Netherlands. In the 1950s Dutch insurers issued so-called binding decisions, applying to all their members, prohibiting them from insuring flood and earthquake risks.[262] The argument of the insurers was that these risks were technically not insurable and that, therefore, all of their members should refrain from covering them.[263] The insurers feared adverse selection because of concerns about occurrences of natural disasters which could result in billions of euros of damage, and because of an insufficient amount of statistical material required for

[257] Hartlief 2021, 49.
[258] Hartlief & Faure 2015, 1032.
[259] Faure & Hartlief 2006c, 209.
[260] Faure & Hartlief 2006c, 210-211.
[261] See Faure & Hartlief 1998.
[262] Hartlief 1995, 142-143.
[263] Faure & Hartlief 2003, 223-225.

the calculation of premiums. As a result, victims affected by a natural disaster could not receive coverage, simply because insurers had agreed not to cover those risks.

After the flooding of the River Meuse in 1993, the binding decisions were quickly withdrawn due to concerns of the European Competition Authority, since binding decisions clearly violated European Competition Law. After the withdrawal of the binding decisions in 1998, negotiations took place between the government and insurers on a new system of coverage for natural disasters, and the French model was used as an important example. As mentioned earlier, these debates did not lead to a comprehensive insurance scheme but, instead, to the introduction of the WTS 1998, which provides for public compensation for disasters falling within its scope.

From the end of the 1990s until today, negotiations have been taking place between the Dutch government and insurers, but have not led to a structural insurance solution.[264] When the insurers again introduced a proposal for flooding insurance based on the French model in 2013, they encountered difficulties with the Netherlands' Competition Authority (Autoriteit Consumenten Markt (ACM)). The ACM criticised the fact that consumers would no longer have a choice and doubted whether there was a societal need for disaster insurance. The Authority also argued that consumer interest groups would not support flooding insurance. As a result, the insurers withdrew their initiative.[265]

Despite long negotiations, reports from various commissions and support in academia, flooding insurance still remains largely unavailable in the Netherlands. Reluctance to seek insurance solutions was also apparent in the reaction of the Netherlands to the Green Paper on the insurance of natural and man-made disasters.[266] In its reaction, the Dutch government claimed to be against European regulations that increased the insurability of natural disasters. The government argued that a larger involvement of the government would lead to moral hazard. It also opposed mandatory disaster insurance, arguing that this would lead to negative redistribution and to the French model of a mandatory add-on in addition to voluntarily purchased insurance.[267]

Today, the insurance situation has slightly improved. Previously, there were two insurance pools specifically for agricultural damage, more particularly for crop damage due to heavy rain.[268] However, at the beginning of 2008, these pools had ceased their activities.[269] Today, there is some insurance coverage available for flooding, but it is difficult to draw an accurate picture of the situation.[270] The difficulties in coverage became clear again after the recent floodings of July 2021. Again, it became apparent how little insurance coverage was in fact available. The Association of Insurers made clear that when damage is caused by extreme rainfall, cover would be available. However, when damage is caused by flooding, coverage is much more complex. For example, damage caused by salt water (for example a flooding of the sea) is systematically excluded from cover. But even when freshwater is concerned, the situation is not clear. Damage caused by the failure of so-called primary dykes (for example the dykes of the River Meuse) would not be covered, whereas damage caused by the failure of other dykes (for example particular canals) would be covered. However, a comprehensive flooding insurance is still not available in the Netherlands today.

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264 See on some of these evolutions Bruggeman & Faure 2019, 327-329.

265 Bruggeman & Faure 2019, 332.

266 Green Paper on the insurance of natural and man-made disasters, COM(2013) 213 final (April 16, 2013).

267 Bruggeman & Faure 2019, 333.

268 See on those agricultural pools, Bruggeman & Faure 2019, 327-329.

269 Hartlief & Faure 2015, 1034.

270 See Dingemans 2020 and Dingemans 2022.

4.8.5. Government intervention as reinsurer of last resort

In this respect the situation in the Netherlands is comparable to the situation in Germany. That is to say, as there is no comprehensive insurance cover (as in France and Belgium), there is also no role for the government as reinsurer of last resort in the case of natural disasters. However, for the specific case of terrorism such a scheme exists in the Netherlands (as is the case in many other European countries). Since 1 July 2003, more than 185 insurance companies joined forces in the Dutch terrorism risk reinsurance company (*Nederlandse Herverzekeringsmaatschappij voor Terrorismeschade*, NHT). This company provides insurance against terrorist acts. The pool provides a capacity of EUR 1 billion consisting of four layers:

- EUR 300 million provided by primary insurers;
- EUR 100 million provided by international reinsurers;
- EUR 550 million provided by international reinsurers;
- EUR 50 million provided by the Dutch government.

The Dutch government charges a premium at a level intended to price itself out of the market when terrorism risk insurability is restored. The government charged EUR 20 million on a yearly basis for its cover of EUR 50 million. This high premium clearly provides an incentive to stimulate the development of commercial insurance.[271]

4.9. Romania

4.9.1. Liability rules

Provisions on tort liability can be found in the Romanian Civil Code. However, in the case of natural disasters, there is no liable tortfeasor, and therefore liability rules do not play a role in compensation for victims of natural disasters.

In Romania, the government is not legally bound to provide financial compensation for homeowners to rebuild their properties after natural disasters such as floods, earthquakes, and landslides.[272]

Law No. 260/2008 (amended by Law no. 191/2015) established compulsory home insurance against earthquakes, landslides and floods. Article 22 (1) of the Law states that 'the natural or legal person owners who do not have their dwellings insured under the terms of this law, shall not receive, where any of the natural disasters defined under this law occur, any compensation from the state or local budget for the damage caused to dwellings'.[273]

Law No. 260/2008 also established the Pool Against Natural Catastrophes (PAID), a public-private partnership. It aims to link homeowners, insurance companies, and local and central authorities. Its role is to manage the financial risk associated with natural disasters through insurance (see further below (5.7.4.)).[274]

4.9.2. *Ex post ad hoc* government compensation

Ex post compensation is uncertain since it is highly discretionary.[275]

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[271] Bruggeman & Faure 2019, 348.

[272] Hochrainer-Stigler et al. 2016, 257.

[273] Law No. 260/2005, amended by Law No 191/2015, Art, 22 (1).

[274] Hochrainer-Stigler et al. 2016, 257.

[275] Paleari 2019, 7.

4.9.3. Government-financed compensation fund

Romania uses a combination of *ex ante* and *ex post* disaster financing mechanisms.

Romania has a Government State Reserve Fund and a Government Intervention Fund, dedicated to *ex post* disaster expenditure. The Reserve Fund aims to support the budgets of local authorities for urgent or unexpected expenditure needs during the budget year. The Intervention Fund aims to support the budgets of any public authority in case of natural calamities, and to assist affected persons. If disaster costs exceed the allocation made to the Intervention Fund at the start of the fiscal year, it can be supplemented from the government State Reserve Fund (Article 30 of Law No. 500/2002).[276]

Furthermore, compared to other countries, Romania has an additional *ex ante* disaster risk financing instrument. International funding is an *ex ante* financing option of disaster risk that cannot be transferred to the insurance market. Romania has a *catastrophe deferred drawdown option* (CAT-DDO), which is a loan from the World Bank amounting to EUR 400 million. The loan makes emergency funds immediately available for an imminent threat or in the aftermath of a disaster, and enables the government to focus on restoring services, supporting affected families, and rebuilding communities, without redirecting funds from other important development efforts. The loan was called upon in line with the national legal provisions in order to help the response to Covid-19.[277]

Among the Member States, only Romania has such an instrument in place since 2018.

4.9.4. First-party insurance for disasters

In Romania, there is a dual insurance scheme for residential buildings. This is made up of two complementary categories of products: a compulsory insurance and a voluntary insurance.[278]

In 2008, Romania introduced compulsory insurance against earthquakes, landslides and floods, by means of Law no. 260/2008 (now amended by Law no. 191/2015), which requires all private owners to insure their property against these three types of disasters. The same law established the Pool for Insurance against Natural Disasters (PAID). PAID is a privately-managed pool of twelve insurance companies that are licensed to underwrite natural disaster risks. PAID is subject to public regulation and supervision. It was designed to provide simple and affordable coverage for all residential properties. The insurance companies in the pool contribute to the enforcement of the law by reporting to the municipality on uninsured property.[279]

The Pool for Insurance against Natural Disasters (PAID) has only one insurance product, the Natural Disaster Insurance Policy (PAD), which covers flood, earthquakes, and landslides. PAD is a first risk insurance which means that the amount of the compensation is established at the level of the actual damage, within the limits of the insured amount. The system has two types of policies. Type A, intended for houses built with robust construction materials (for example built with a reinforced concrete, metal or wood structure, or with exterior walls made of stone), has a policy limit of EUR 20,000 and an insurance premium of EUR 20/year. Type B, generally for houses with a more basic construction, has a

[276] European Commission, Disaster Risk Financing: Main Concepts & Evidence from EU Member States, Diana Radu, Discussion Paper 150, October 2021, p. 26.

[277] European Commission, Disaster Risk Financing: Main Concepts & Evidence from EU Member States, Diana Radu, Discussion Paper 150, October 2021, p. 26. See also https://www.worldbank.org/en/news/feature/2019/11/25/in-europe-disaster-risk-capital-romanians-turn-to-technology.

[278] Radu & Alexandru 2022, 59.

[279] European Commission, Disaster Risk Financing: Main Concepts & Evidence from EU Member States, Diana Radu, Discussion Paper 150, October 2021, p. 22-23; Radu & Alexandru 2022, 59; Paleari 2019, 6; https://www.eiopa.europa.eu/tools-and-data/dashboard-insurance-protection-gap-natural-catastrophes_en; https://www.paidromania.ro/what-is-pad/, last assessed on 10 February 2023.

policy limit of EUR 10,000 and an insurance premium of EUR 10/year. The premium thus depends on the construction type and not on hazard probability or exposure. Nevertheless, buildings classified in seismic risk class 1 (very high risk of collapse) are excluded. For persons receiving social allowances, payment of the insurance premiums is made by the local authorities. Homeowners without compulsory home insurance are, in theory, subject to a fine, which is collected by the local public authorities.[280]

PAD insurance is thus a unique product, with a mandatory nature. Taking out (facultative) voluntary insurance is conditional on the existence of PAD insurance. This means that if no PAD insurance is taken out for a particular property, the other facultative home insurance policies in Romania cannot be taken out. Facultative home insurance policies are sold with a deductible excess equal to the PAD limits for earthquake, flood, and landslide risks.[281] The voluntary home insurance policies may go beyond the mandatory one. They can cover the risk of fire and burst pipes, or compensation for damage to household goods like furniture. They can also cover the entire value of the insured home.[282]

In practice, Romania has a very low insurance penetration rate, despite the compulsory insurance rule. Only 1.9 million (20%) out of the nearly 9.6 million homes in Romania are insured in case of natural disaster. This means that in Romania, four out of five homes do not have any kind of protection against natural disasters.[283] Although homeowners who do not have a compulsory insurance can be fined up to between 100-500 RON, no fine has been given so far.[284]

There are multiple reasons for this low insurance penetration rate, and these lie with the public authorities, the insurance companies, as well as with the homeowners themselves.[285]

First, the low insurance rate might be influenced by the passive attitude of local public administrations. Even though Law 260/2008 foresees that the mayor of each city/village, as a member of public administration, must note the lack of this mandatory insurance and give a fine of between 100 and 500 RON, mayors do not act. This may be because local authorities do not want to lose their possible future electors in local elections, there are no references in the law about the procedures to establish the fine at between 100-500 RON, there is not enough personnel to handle the fines, or there are costs attached to collecting the fine (for instance mailing fees).[286]

Second, the earnings for insurance companies that sell PAD insurances are quite insignificant. The commission for selling PAD contracts is 10%, thus 1 or 2 euros (tax included), whereas the gathering of the information needed might be time consuming. Therefore, insurance companies prefer to sell other insurances, or to combine PAD insurance with facultative house insurance, although this practice is not recognised officially.[287]

Finally, homeowners, especially in rural areas (which may have a high risk of natural disasters), are not inclined to take out PAD insurance. This might be because of a lack of information on the mandatory

[280] Art. 4 and Art. 12 of Law No. 260/2005, amended by Law No 191/2015; Radu & Alexandru 2022, 59.; Paleari 2019, 6; https://www.eiopa.europa.eu/tools-and-data/dashboard-insurance-protection-gap-natural-catastrophes_en; https://www.paidromania.ro/what-is-pad/, last assessed on 10 February 2023.

[281] Radu & Alexandru 2022, 59.

[282] https://www.romania-insider.com/home-insurance-rates-romania-june-222, by Dumitrescu, R., 29 June 2022, last assessed on 10th February 2023.

[283] https://www.romaniajournal.ro/society-people/social/only-one-home-out-of-five-is-insured-against-earthquakes-or-floods-in-romania/, last assessed 10 February 2023.

[284] https://www.romania-insider.com/home-insurance-rates-romania-june-222, by Dumitrescu, R., 29 June 2022, last assessed on 10th February 2023.

[285] Gavriletea 2017, 761-776.

[286] Gavriletea 2017, 761-776.

[287] Gavriletea 2017, 761-776.

nature of the PAD insurance, or ignorance of the risks. Furthermore, in rural areas, there are no subsidiaries of any insurance companies and hence practical barriers might deter homeowners from buying the insurance.[288]

This situation highlights the failure of PAID, whose sole purpose is to increase the rate of insured homes. Furthermore, the case of Romania demonstrates that compulsion by itself is not enough to ensure high insurance penetration rates. Monitoring and enforcement mechanisms are also important, and a working system for collecting the insurance premiums (e.g. by means of a property tax) needs to be put in place.[289]

4.9.5. Government intervention as reinsurer of last resort

The Romanian government does not intervene as reinsurer of last resort. Article 24 2(b) of Law No. 260/2005 (amended by Law No 191/2015) foresees that PAID must conclude the reinsurance. For the period 15 July 2022 - 14 July 2023, PAID has a reinsurance programme with a capacity of EUR 1,000,000,000 to cover the risks of earthquake, flood, and landslide, with a maximum retention of EUR 11 million for earthquake risk, and EUR 9 million for the risks of floods and landslides. This reinsurance program is supported by a panel of 49 reinsurers. Top reinsurers participating on the reinsurance program are: Swiss Re, Munich Re, Tokio Marine Europe SA, XL Re, Scor, Hannover Re, and VIG Re.[290]

4.10. Spain

4.10.1. Liability rules

The Spanish Civil Code (SCC) stipulates that a person who causes damage must be liable for the damage caused. In Art. 1902, the SCC foresees a fault-based liability system, thus requiring fault or negligence of the tortfeasor. Specific legal provisions may stipulate strict liability for certain cases (such as strict liability for the owner of an animal under Art. 1905 of the SCC). In these cases, the victim is not required to prove the negligence of the tortfeasor in order to be entitled to compensation by the tortfeasor.

Based on Art. 1902, the victim may claim compensation directly against the tortfeasor. However, compensation may be granted through different means that aim to compensate the victim, for instance in cases of unidentified or insolvent tortfeasors.[291]

Thus, in Spain, compensation may be granted through the following different mechanisms:[292]

- Traditional compensation through a direct claim against the tortfeasor, based on Art. 1902 of the SCC or on special regulations relating to civil liability. This would hold true for both liability requiring fault (negligencia) and strict liability (responsabilidad objetiva).
- *Ad hoc* compensation. The government may provide *ad hoc* compensation for certain cases. This is for example the case for compensation paid to victims of terrorism. Sometimes, this compensation may oblige the victim to waive his/her right to claim compensation against the tortfeasor. Another case where the Spanish government compensated victims, was the

[288] Gavriletea 2017, 761-776.
[289] Paleari 2019, 7; Gavriletea 2017, 761-776.
[290] https://www.paidromania.ro/reinsurance/
[291] Garcia Teruel 2020, 136-158.
[292] Garcia Teruel 2020, 136-158.

Thalidomide case, which caused severe malformations and health problems to more than 500 victims, who received (partial) compensation from the public budget.[293]

- Compulsory and optional insurance. The victim may, in case of an accident, claim compensation directly from the insurer.
- Compensation funds (fondos de compensación). Compensation funds are generally created to provide compensation in cases of mass torts, and are seen as a way for society to share the burden of this damage. The victims are fully compensated, while judicial costs are reduced.

Increasingly, it is recognised that natural disasters are seldom completely "natural". It is often as a result of the decision of man that a natural phenomenon turns into a disaster. Moreover, sometimes it is industrial operations by man that trigger natural disasters. A case in point is the extraction of shale gas. This technique known as hydraulic fracture, or fracking, can cause increased seismic activity and even earthquakes. This problem also arose in Spain, as a result of which the Spanish government decided to put a halt to particular fracking activities near Castellon and Tarragona. This led to a case in the Spanish Constitutional Court concerning the compensation awarded to the operator who lost the value of its investment as a result of the necessity to terminate its activities.[294]

In the case of climate change disasters, traditional liability rules do not play any role of importance in compensating victims of natural disasters in Spain. Extraordinary risks, as natural disasters are called, cannot be compensated through traditional mechanisms of tort law, since there is no liable tortfeasor. The Insurance Compensation Consortium (in Spanish Consorcio de compensación de seguros, CCS[295]) deals with these extraordinary risks (see below).

4.10.2. *Ex post ad hoc* government compensation

Ex post ad hoc compensation is possible in Spain but, as will be shown below, this is not the standard way in which victims of natural disasters are compensated.

4.10.3. Government-financed compensation fund

In Spain, government-financed compensation funds are created by special rules, on a case-by-case basis, and with different requirements and characteristics, depending on the situation.[296] Yet, Spain has a special mechanism for the compensation of victims of natural disasters (see below).

4.10.4. First-party insurance for disasters

Spain has a dual system for damage caused by extreme weather events. Damage caused by weather events such as hail or other direct effects of precipitation, landslides, snow avalanches, or damage caused by wind with speeds below 120 kph, are directly covered by the private insurance market. Weather events with wider potential impacts are covered by the so-called Extraordinary Risk Scheme.[297]

The Extraordinary Risk Scheme is managed by the Consorcio de Compensación de Seguros (CCS), a public business institution that, apart from handling the Extraordinary Risk Scheme, also performs other duties at the service of the Spanish insurance industry.

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[293] For a discussion see Ruda 2019, 630-632.

[294] See for a critical analysis of this decision of 21 December 2017, Ruda 2018, 600-605.

[295] See https://www.consorseguros.es/web/inicio.

[296] Garcia Teruel 2020, 136-158.

[297] https://www.wfcatprogrammes.com/spain-description, last assessed on 20 February 2023.

Risks included under the Extraordinary Risk Scheme can be both natural (earthquakes, floods, volcanic eruption, atypical cyclonic storms, and the fall of astral bodies and meteorites), and man-made (terrorism).

The CCS was initially created to cover riot risks during the Spanish Civil War (1936–1939), and was set up permanently in 1954. The CCS has its own legal entity and is attached to the Ministry of Economy and Competitiveness, under the Directorate-General for Insurance and Pension Funds.[298]

The Spanish Extraordinary Risk Scheme is the result of an agreement between the private and public sectors, and participation of both is necessary to make the scheme work.

Essential to understanding the scheme is that it is compulsory for insurance companies to extend the cover of ordinary insurance policies to also cover the extraordinary risks. Policyholders pay a surcharge for this cover, and this surcharge is transferred to the CCS by the insurance companies. The CCS will then compensate policyholders directly for damage caused by extraordinary risks. Only policies in third-party liability and other insurance classes such as transport, aircraft, marine, agricultural, and travel insurance are excluded from this obligation.

Thus, property insurance against disasters is optional, but all private insurance policies underwritten by insurers for risks located in Spain must include a mandatory clause covering extraordinary risks.[299] The scheme is financed through a surcharge applied to the ordinary insurance policies. The policyholder will pay a surcharge on the commercial premium paid to the insurance company issuing the policy. The insurance company transfers the surcharges collected to the CCS.[300]

The CCS covers personal and property damage caused by extraordinary risks on the condition that the victim has an ordinary insurance policy (property, life, or accident insurance, meaning that the surcharges to the CCS have been paid), and that this policy does not cover the extraordinary risks.[301] Thus, in practice, it is necessary to have an insurance policy to be compensated for natural disasters. When this policy does not cover these risks (which is standard practice), or the insurer is bankrupt, the CCS will cover this damage.[302] This type of cover is separate from any other public aid.

It should be noted that, although almost all insurance policies in Spain have the extraordinary risks covered by the CCS, the CCS is not a monopoly, and CCS cover is a default one. All or any of the extraordinary risks can be covered by the private company issuing the original policy. However, as the overarching principles of the Extraordinary Risk Scheme are solidarity and mutualisation of these extraordinary risks among all policyholders, this would not exclude the policyholder from paying the surcharge. In this way, adverse selection is avoided and widespread penetration of catastrophe insurance is achieved. The CCS pools very different risks under a single scheme in order to provide an affordable cover to all policyholders.[303]

[298] RDL 7/2004, of 29 October, on the Statues of the Insurance Compensation Consortium. BOE No. 267, 5.11.2004

[299] https://www.wfcatprogrammes.com/spain-description, last assessed on 20 February 2023; European Commission, Disaster Risk Financing: Limiting the Fiscal Cost of Climate-Related Disasters, Diana Radu, Discussion Paper 174, November 2022, p 17.

[300] https://www.wfcatprogrammes.com/spain-description, last assessed on 20 February 2023.

[301] Art. 6 of RDL 7/2004.

[302] Art. 8.1 of RDL 7/2004.

[303] https://www.wfcatprogrammes.com/spain-description, last assessed on 20 February 2023.

The CCS may compensate a victim when she/he cannot be compensated through a direct claim against the tortfeasor or through the insurance policy. Hence, it can be argued that the Spanish state acts as an insurer for these extraordinary risks.[304]

The CCS compensates policyholders directly on the terms and conditions, and for the same amounts contracted with the private company with which the policyholder underwrote the original policy. To file a claim, policyholders can contact the CCS directly, or through the insurance company. Cover is automatic. No declaration of disaster by the authorities is needed, and it has no upper or lower limit. The CCS applies some deductibles to commercial and industrial properties, as well as to civil works, but does not apply any to residential properties, motor vehicles, or for personal injury. As for business interruption, the CCS applies the same deductibles that were stated in the original policy.[305]

As an illustration, in 2021, 110,036 claims were filed due to extraordinary risks, with a total cost (payments plus technical provisions) of EUR 519.8 million. The most significant event in 2021 was the Cumbre Vieja volcanic eruption on the island of La Palma in the Canary Island archipelago. Indemnities paid out to victims of this eruption amounted to EUR 80.7 million by the end of 2021, with an estimated total cost to the Consorcio of EUR 185.2 million. The average indemnity paid out was EUR 175,000 for homes, EUR 260,000 for business and office premises, EUR 83,000 for factories, and EUR 4,800 for vehicles. Yet, flooding still represents the largest cumulative amount by cause of loss, with the largest floods in 2021 being those which took place in Navarre in December, in western Andalusia in September, in Asturias and Cantabria in November, in Castilla La Mancha in August, and in eastern Andalusia in January. The total sum of the cost of compensation pay-outs for flooding that happened over the year 2021 amounted to EUR 265.3 million.[306]

4.10.5. Government intervention as reinsurer of last resort

The CCS provides, with no limitations, a state-guaranteed cover for extraordinary risks, both when the insurance company is unable to meet its payment obligations (due to bankruptcy, insolvency, etc.), and when it opts out (i.e. it does not assume the coverage for extraordinary risks). This is the only example of a purely government insurance programme, i.e. a programme where the private insurance market may pass the whole risk to the government.[307] There is also the possibility of CCS being reinsured, although the current level of its reserve is deemed to be enough to face the risks of its responsibility.[308]

The system is designed to be self-sustaining. The CCS has operated for over 60 years without the need for funding from the government for losses beyond its capacity to pay.[309]

The question obviously arises of whether this still will be possible when certain extraordinary risks do not become extraordinary anymore due to climate change.

[304] Consorcio de Compensación de Seguros, Summary of the activity 2021, p. 4.

[305] https://www.wfcatprogrammes.com/spain-description, last assessed on 20 February 2023.

[306] Consorcio de Compensación de Seguros, Summary of the activity 2021, p. 5.

[307] Paleari 2019, p. 6.

[308] https://www.wfcatprogrammes.com/spain-description, last assessed on 20 February 2023.

[309] European Commission, Disaster Risk Financing: Limiting the Fiscal Cost of Climate-Related Disasters, Diana Radu, Discussion Paper 174, November 2022, p. 18.

4.11. Sweden

4.11.1. Liability rules

Just as for the other Member States selected for this study, liability rules do not play a significant role in the compensation for victims of climate change disasters in Sweden. A key characteristic of the Swedish model is the importance that is attached to the possibility of insurance for compensating the victim and distributing the risk of damage among a collective of persons.

Furthermore, the Swedish natural hazard management regime is based on the principle of responsibility: whoever is responsible for an activity in normal conditions maintains that responsibility during exceptional conditions.

The responsibility for natural hazard management is distributed over three levels of government: the national level, the regional level, and the local level.

At national level, the overall political responsibility for disaster preparedness lies with the Ministry of Justice. At regional level, the 21 counties are responsible for the coordination of natural hazard management, including risk and vulnerability analyses. However, the main responsibility for crisis preparedness rests at the local level, i.e. the largely autonomous municipalities. Swedish municipalities have primary responsibility for planning and implementing risk reduction and crisis management. The municipalities also have a broadly defined responsibility to take natural hazards into account in their land use planning. Only when it is no longer possible for the local level to manage a situation, the responsibility is transferred to the regional and national level.[310]

In Sweden there is a national subsidy scheme for preventive measures undertaken by municipalities for built-up areas. Municipalities can apply for a subsidy from an annual budget allocation, for example to construct embankments and dykes, install pumping equipment, or stabilise slopes to prevent landslides. Compensation for recovery measures is also possible. A municipality hit hard by a natural disaster, has the right to claim state compensation if the costs exceed the capacity of the municipality.[311]

The overarching Swedish Civil Contingencies Agency (MSB) provides guidelines and financial support for municipal adaptation measures, and has coordinating responsibility with other authorities. In addition, the MSB collects information on and analyses past hazardous events. The agency maintains databases that combine the description of the event with the response information and damage data (including economic losses). These analyses do not directly result in any binding decisions, but are used in risk and vulnerability assessments and preparedness work.[312]

According to Swedish legislation, the responsibility for safeguarding property lies first of all with the property-owner (this holds true for individuals and businesses, as well as for local and national

[310] Van Well et al. 2018, 1283-1294. See also Nordress (Nordic Centre of Excellence on Resilience and Societal Security), Resilience to natural hazards: An overview of institutional arrangements and practices in the Nordic countries, WP6.1 report 3.6.2016, p. 45-49.

[311] https://www.klimatanpassning.se/en/roles-and-responsibilities.

[312] Van Well et al. 2018, 1283-1294. See also See also Nordress (Nordic Centre of Excellence on Resilience and Societal Security), Resilience to natural hazards: An overview of institutional arrangements and practices in the Nordic countries, WP6.1 report 3.6.2016, p. 45-49.

authorities).[313] Citizens' responsibility hence is to be individually organised, in such a way that they do not require municipal resources to protect their properties in the case of an extreme event.[314]

4.11.2. *Ex post ad hoc* government compensation

In Sweden, *ex post* government compensation for damage incurred by households is provided only exceptionally.[315] Only in case of terrorist crimes compensation is paid by the state if the victim cannot get full compensation for injuries by any other means (damages or insurance payments).[316] Victims of HIV infection also received compensation from the government.[317] With respect to natural hazards, state compensation is rare. One example is the support of the Swedish central government for forest owners and farmers after the storm Gudrun in 2005.[318]

4.11.3. Government-finance compensation fund

Sweden has a compensation fund (Brottsskademämnden) for victims of violent crime.[319] Sweden has no government post-disaster relief in place for damage caused by natural hazards.[320]

4.11.4. First-party insurance for disasters

In Sweden, victims of natural disasters must rely on private insurance for compensation of their damage, as there are no national compensation schemes for individuals or industries. In principle, insurance schemes are voluntary, but insurance is required by banks, as mortgage lenders. The availability of insurance coverage is high, and insurance penetration is high as well. 96% of households in Sweden have some form of insurance protection against natural disasters, in principle through home insurance. Premiums are risk-based.[321]

The Swedish example thus shows that high insurance penetration rates are not necessarily associated with compulsory insurance.[322]

Sweden has collected information on natural hazards since 1985, and the incidence of different types of natural damage varies considerably from year to year. In 2020, almost 14,600 natural damage claims were covered by insurance, of which the majority (10,000 claims) were caused by storms. In total, the insurance companies paid approximately SEK 489 million in compensation for natural damage. The most dramatic year since 1985 was 2005, when the storm Gudrun in Småland caused more than 90,000 claims, with compensation from insurance companies of almost SEK 3.8 billion. Between 2015 and 2020, an average of 13,300 natural disasters happened per year. These could be storms, floods,

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313 Government offices of Sweden, Ministry of the Environment, Sweden adaptation Communication, A report to the United Nations Framework Convention on Climate Change November 2022, p. 28.

314 Van Well et al. 2018, 1283-1294. See also Nordress (Nordic Centre of Excellence on Resilience and Societal Security), Resilience to natural hazards: An overview of institutional arrangements and practices in the Nordic countries, WP6.1 report 3.6.2016, p. 45-49.

315 Paleari 2019, 6.

316 https://www.brottsoffermyndigheten.se/other-languages/english/terrorist-crimes/you-may-be-entitled-to-compensation/, last assessed on 21 March 2023.

317 Ammerlaan 2006, 78.

318 https://www.climatechangepost.com/sweden/insurance-and-business/, last assessed on 23 February 2023.

319 Ammerlaan 2006, 76-77.

320 EIOPA dashboard, Sweden.

321 Paleari 2019, 6. EIOPA Dashboard, Sweden, and Insurance Sweden, https://www.svenskforsakring.se/en/the-insurance-industry/almost-everyone-in-sweden-has-home-insurance/.

322 Paleari 2019, 7.

landslides, rock falls, earthquakes, avalanches or other natural disasters. The claim amounts reached a total of just over SEK 3.5 billion, which is approximately SEK 586 million per year on average.[323]

The number of natural disasters is expected to rise as the effects of climate change become more apparent. The insurance sector already sees a statistically significant increasing trend in the number of incidents due to extreme weather events. However, insurance covers citizens and businesses only against unpredictable events. If an event is no longer unpredictable, it does not qualify for insurance cover. Although home insurance in Sweden typically covers flooding, this practice might become difficult to maintain if the risk of reoccurring flooding is high. On the one hand, this might result in increased insurance premiums, on the other, when the risk of damage is deemed too high, it might become impossible to insure property. Already in 2018, the Länsförsäkringar insurance company announced that it would no longer be able to insure a coastal property in Kristianstad. Furthermore, one national insurance company in Sweden has stated that it will no longer offer insurance for new development in areas the local County Administrative Board has considered unsuitable due to the risk of climate change effects.[324]

Especially in major cities, climate change disasters may cause damage that goes beyond individual homeowners. Cloudbursts or flooding could impair important societal functions, including critical infrastructure or health care facilities, leading to huge damage costs for society. In this respect, it is Interesting to note that in Sweden municipalities are liable for water management in drainage systems. According to Sweden's Planning and Building Act, municipalities are responsible for ensuring that buildings continue to function for ten years after the establishment of the detailed plan. The service provider for water and drainage, furthermore, has ongoing responsibility for ensuring that this service is fully functioning. In the event of damage from flooding, possibly caused by a cloudburst, an insurance company may demand compensation from the service provider responsible for water and drainage to cover its own payment of compensation for individual property owners, if it can prove that the damage was caused by insufficient technical preparedness of the municipality. This provides both municipalities and those with responsibility for water and drainage with incentives to adapt to climate change and take preventive measures.[325]

4.11.5. Government intervention as reinsurer of last resort

In Sweden, there is no government intervention as reinsurer of last resort. Reinsurance will happen on the private insurance market.[326]

[323] https://www.svenskforsakring.se/en/the-insurance-industry/large-variations-in-the-number-of-natural-damage-claims-over-the-years/

[324] Government offices of Sweden, Ministry of the Environment, Sweden adaptation Communication, A report to the United Nations Framework Convention on Climate Change November 2022, p. 28; https://www.klimatanpassning.se/-en/effects/impacts-by-sector/insurance-1.166044, 10 Feb. 2021, last assessed on 23 February 2023.

[325] https://www.klimatanpassning.se/en/effects/impacts-by-sector/insurance-1.166044, 10 Feb 2021, last assessed on 23 February 2023; Nordress (Nordic Centre of Excellence on Resilience and Societal Security), Resilience to natural hazards: An overview of institutional arrangements and practices in the Nordic countries, WP6.1 report 3.6.2016. p. 48.

[326] Eiopa, Dashboard, Sweden.

6. CRITICAL ANALYSIS OF THE COMPENSATION MECHANISMS AT EU AND MEMBER STATE LEVEL

KEY FINDINGS

- Funding solutions at EU level (more particularly through the EUSF and the ERDF) do not constitute payments directly to victims of disasters, but rather to governments.
- There is certainly a funding gap between what is provided through the EU funds and what would be needed for reconstructing critical infrastructure within the Member States. Yet, one should be cautious with an over-generous *ex post* funding of Member States, given the potentially distorting effects on incentives for prevention this may have.
- The EU could take action to stimulate the insurability of disasters.
- The EU could facilitate the exchange of information on the probability of disasters, in order to facilitate insurability, either by acquiring this information itself and providing it to the insurance market, or by allowing (cautious) information exchange between insurers.
- The EU can also stimulate insurability by allowing Member States to act as reinsurers of last resort, i.e. by declaring such an intervention as compatible with internal market rules.
- The Member States examined showed a wide variety of instruments employed.
- Liability rules do not seem to play any practical role, as was predicted in the theoretical framework.
- Some Member States do provide *ad hoc ex post* compensation, but in those Member States, that type of compensation is often criticised (in line with the theoretical framework) for diluting incentives for prevention and seeking insurance.
- The optimal solution, from a theoretical perspective and as apparent in the Member States, is first-party insurance, such as provided *inter alia* in France, Belgium and Spain. This also is a best practice for dealing with climate change disasters. Mandating a supplement for climate change disasters could deal with demand-side problems.
- Supply-side problems could be remedied by allowing the government to act as reinsurer of last resort, thus creating larger capacity on the insurance market for disasters.
- There is *de facto* a clear division of labour between EU level and Member State level, as the EU's funding mechanisms are basically focused on financing the Member States, whereas solutions within the Member States are geared towards financing compensation for individual victims.
- Given the large differences in compensation mechanisms between the Member States, there is no reason to harmonise financial compensation for victims of climate change disasters in the Member States - neither from a theoretical perspective, nor for practical reasons.
- Nevertheless, the EU can, in different ways (e.g. through information exchange and facilitating reinsurance), play an important role in stimulating insurability of disasters, and thus stimulate the implementation of the optimal solution in the Member States.

After having described the EU's policies and mechanisms for dealing with climate change disasters (Chapter 3) as well as the compensation mechanisms in selected Member States (Chapter 5), now the compensation policies at EU level (6.1) and at Member State level (6.2) will be critically reviewed (based on the theoretical framework outlined in Chapter 4). Finally, a brief analysis will be given of how the EU and Member State levels interact (6.3).

4.12. EU policies and mechanisms: critical analysis

At European level, a wide range of policies and instruments are already in place to stimulate climate change adaptation and to minimise the risk and impact of climate change related disasters. Also, policies and instruments are in place to ensure compensation for victims after a climate change related disaster. As it is likely that climate change disasters will increase in the future, the question to be raised here is whether current EU policies and instruments are adequate. We will explore the role the EU can play with respect to the compensation of victims of climate change disasters.

First, in section 6.1.1., the EU policies and mechanisms in place to react to natural disasters, and in particular the *ex post* compensation provided by the European Union Solidarity Fund (EUSF) now under SEAR and the Cohesion Policy (ERDF)) are assessed on the basis of the lessons learned in the theoretical framework (Chapter 4). Next, again using the insights of the theoretical framework, recommendations are provided on what the EU could do to improve compensation for victims of climate change disasters. Attention will be drawn in particular to disaster insurance and the role the EU could play in this (section 6.1.2).

4.12.1. EU *ex post* compensation policies and mechanisms

Climate change induced natural disasters may cause significant economic losses, as indicated in detail in Chapter 2. Consequently, there will be a strong demand for compensation for victims in the aftermath of a climate change disaster. At European level, funds (such as the EUSF, or funding through the ERDF) were created to fulfil the need to show solidarity with victims.

Funding solutions have been strongly criticised in the literature, as discussed in detail in the theoretical framework,[327] for not stimulating insurability. The question arises whether, given their particular shape, the same criticism applies to the European funds.

In the law and economics literature generally strong criticism has been formulated with respect to *ex post* compensation by governments, be it through structural compensation funds (such as the EUSF) or *ad hoc* solidarity payments. Generally, there three problems are identified in the literature, and these were summarised in Chapter 4.[328]

The first major disadvantage of lump sum payments in government relief is that no incentives are provided for potential victims to take effective preventive measures. Since the payments under government relief do not usually relate to risk, they offer no incentives for taking preventive action. Of course, it very much depends on the nature of the disaster whether it is realistic to assume that victims were able take preventive measures. Preventive measures which need major infrastructural *ex ante* disaster management will, for the reason of the public good discussed above, be primarily undertaken by government. Taking structural measures, e.g. to protect a country against climate change disasters, will primarily be a government task. Nevertheless, there are certainly measures individual potential victims can take, not so much in order to prevent a climate change disaster, but rather to limit its impact

[327] See *supra* 4.3.3.

[328] See *supra* 4.3.3.

and damage. The problem is that *ex post* recovery by government may not provide incentives to take such appropriate preventive measures.[329] In that respect, in the theoretical framework it is argued that competitive insurance markets are better able to deal with moral hazard and adverse selection through risk differentiation.[330]

A second problem is that victims may be counting on government compensation, which may even create an incentive to not purchase insurance.[331] The problem of government-provided compensation is indeed that it may dilute incentives to purchase insurance, since victims could simply free ride on the state.[332] As indicated in the theoretical framework in Chapter 4, this problem has been referred to as the 'charity hazard'.[333]

A related problem is that there may be negative distributional effects, since some victims (e.g. those who may have purchased houses at low prices in flood-prone areas) may free ride on other individuals (the general tax payers) who finance the *ex post* recovery.

There are, however, some reasons to re-think this criticism of the European compensation mechanisms.

The most important reason is that payments from the EUSF and the ERDF are not made directly to victims of disasters, but rather to governments. The question therefore arises whether the same type of moral hazard that may occur with victims of disasters in *ex post* compensation schemes by governments, could also play a role with the EUSF. A second issue is that payments from the EUSF are not so much geared towards *ex post* compensation for victims (usually called recovery), but rather towards immediate relief. The same seems to be the case for the European Regional Development Fund (ERDF). In fact, this fund complements (although very generously) the means available under the EUSF, and provides additional assistance directly to Member States, but not to victims.

In the literature it has been argued that much of the criticism with respect to *ex post* intervention by the government in cases of (natural) disasters applies to recovery. As indicated in the theoretical framework,[334] recovery is an *ex post* intervention needed to return the social welfare trajectory to where it would have been had the disaster never occurred.[335] Recovery consists of two kinds of efforts: reconstruction activities and victim compensation. Reconstruction activities are typically aimed at restoring public services and a country's infrastructure such as roads, harbours or railways. Compensation is usually intended to compensate victims for property losses. Recovery is to be distinguished from relief. Relief efforts consist of executing an effective, damage-limiting response, immediately after an event.[336] The literature indicates that the moral hazard which arises in case of *ex post* actions by the government may play a role in the case of recovery, but less so in the case of relief. Also, the general point has been made that a too generous intervention *ex post* will affect incentives for prevention *ex ante*, to the extent that victims' expectations of political intervention to provide recovery reduce the incentives for victims to take precautions. The situation is different, however, with respect to the effects of relief on precautions. Relief interventions are quick and tailored to the situation.

[329] For further examples see Bruggeman, Faure & Haritz 2011.

[330] See *supra* section 4.3.5 and especially Priest 1996.

[331] Levmore & Logue 2003, 281 and Kaplow 1991.

[332] Gron & Sykes 2002, 2003 and Endres, Ohl & Rundshagen 2003, 290.

[333] More particularly by Raschky & Weck-Hannemann 2007.

[334] See *supra* 4.2.2.

[335] Leonard & Howitt 2010.

[336] Sugarman 2007, 32.

For relief activities moral hazard is less of a problem, as relief does not provide full compensation but merely mitigates further damage.[337] This was also explained in the theoretical framework.[338]

At first sight, the EUSF seems to focus strongly on relief efforts. Council Regulation 2012/2002 of 11 November 2002 establishing the European Union Solidarity Fund, discussed above, makes it *inter alia* clear in its Article 3 that the essential aim of the EUSF is "to help the beneficiary state to carry out the following essential emergency operations, depending on the type of disaster".

Now that the EUSF focuses more strongly on relief than on recovery, it would seem, at first sight, that payments by the EUSF would not necessarily negatively affect incentives, as is the case with recovery. However, this (positive) conclusion may come too soon. The conclusion in the literature that relief efforts do not generally affect *ex ante* precautionary efforts, may be correct as far as the potential victims exposed to natural disasters are concerned. However, the situation may be different with respect to the governments that are the beneficiaries of the EUSF. In this respect, research by Depoorter, discussed in the theoretical framework, should be remembered, as it indicates that incentives for investments in disaster prevention by politicians are often distorted, because politicians often tend to over-supply *ex post* recovery and under-invest in precaution.[339] Politicians receive too little reward from *ex ante* disaster management policies, and as a result such policies may be under-supplied. In contrast, the political rewards for *ex post* compensation may be very big, and as a result *ex post* relief is likely to be over-supplied.[340] In this respect, the situation with the ERDF is far more problematic. The ERDF goes much further than merely providing immediate relief after a disaster and also aims at *ex post* reconstruction. The criticism formulated in the literature with respect to *ex post* recovery therefore fully applies to the ERDF.

The literature obviously also has important consequences for the analysis of the EUSF and the ERDF. In fact, just as there may be perverse incentives for governments to grant *ex post* recovery to victims of natural disasters, as well as under-investment by victims who count on *ex post* recovery, the same effect may occur in the relationship between the EUSF, the ERDF, and the governments that benefit from the payments.

The general problem remains that governments, obviously up to EU level, systematically under-invest in precaution against disasters because of the lack of political rewards. The major reason for this is a time-inconsistency problem: investments in precaution against future disasters may lead to costs to current tax payers, whereas benefits will only be provided to potential victims in a distant future. Politicians suffering from the NIMTOF (Not In My Term of Office) syndrome[341] will therefore not benefit from investments in precaution, as these investments will only deliver benefits to future voters. The fact that the EUSF and the ERDF now make it possible for EU governments to call on these solidarity funds in fact rewards these governments' under-investment in precaution, and therefore contributes to the distorting effects of solidarity payment, as in the case of charity hazards with victims of natural disasters. Moreover, just as domestic governments have a tendency to over-supply *ex post* recovery because of the political rewards it provides,[342] it can be argued that the EUSF provides an excellent legitimising function for the EU authorities to showcase their interventions and necessity in times of

[337] See Dari-Mattiacci & Faure 2015, 199.

[338] See *supra* 4.2.2.

[339] Depoorter 2006.

[340] *Ibidem*.

[341] Not in my term of office.

[342] See already Hirshleifer 1953.

disaster. However, in the end, both the EUSF and the funding mechanism via the ERDF are financed by the other Member States.

Looking at the history of the EUSF, it becomes clear that in practice it is a large redistribution mechanism. Since its creation in 2002, most of the in total EUR 6.5 billion has been paid to particular Member States. Whether this is the most suitable way of providing immediate funding to governments is of course doubtful, in particular when the governments that benefited most from the EUSF are typically the larger Member States, such as Italy (EUR 3,080.878 million), Germany (EUR 1,644.193 million), Croatia (EUR 1,033.415 million), or France (EUR 403.304 million).[343]

Looking at these numbers, it is hard to escape the impression that it may effectively be a mechanism that on the one hand gives legitimacy to the EU institutions and on the other leads to some redistribution from smaller (newer) to larger (older) Member States. It is therefore questionable whether these types of direct solidarity payments to Member State governments are the most appropriate manner of providing incentives for adequate investments in disaster risk reduction. As in the case of the victims of natural disasters at domestic level, where the conclusion was that solidarity payments provide perverse incentives for precaution and where insurance was considered to be a more appropriate incentive mechanism,[344] the same could hold true for the payments made by the EUSF. All of the problematic aspects of the EUSF are in fact re-enforced in the ERDF, since the latter provides even more generous compensation (up to 95%) and also pays for reconstruction.

If particular Member States, when a natural disaster occurs, encounter immediate financing problems, an alternative would obviously be to consider sovereign insurance. The World Bank has examined the possibility of sovereign natural disaster insurance, especially for developing countries, to solve the short-term liquidity needs.[345] Whereas insurance (through risk differentiation) always provides incentives for disaster risk reduction,[346] unconditional solidarity payments do not.

In sum, as regards the structure and payments of the European solidarity funds, salient lessons on solidarity payments by governments to victims of disasters could be learned from the literature. Important elements in the literature, e.g. criticism of *ex post* recovery and emphasis on the perverse incentives of politicians to under-invest in precaution and over-invest in recovery, may, to some extent, play a role with respect to these European solidary funds as well.

Hence, caution should be exercised with over-generous *ex post* funding of Member States, given the potentially distorting effects on incentives for prevention. It is therefore not recommended to expand the funding mechanisms at EU level. Member States will have to take measures at the national level to finance losses resulting from climate disasters and to close the climate change funding gap. One of the instruments to achieve this could be (first-party) insurance. In the next section the role the EU could play in this respect is examined.

4.12.2. A role for the EU: stimulating insurability

As stated in Chapter 3, besides the Green Paper on the Insurance of natural and man-made disasters, and the recent EIOPA dashboard, no European initiatives have been taken with respect to insurance for natural disasters.

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[343] See these data on the factsheet of the EU Solidarity Fund on their website, providing an overview of EU Solidarity Fund interventions since 2002, last assessed 21 March 2023.

[344] See especially Kunreuther 1968.

[345] For Ghesquiere & Mahul 2007.

[346] See Priest 1996.

Yet, the benefits of insurance solutions to disasters have been well documented in the literature. As explained in detail in the theoretical framework provided in Chapter 4, insurance can boost resilience to natural hazards.[347] Insurance can reduce financial burdens and uncertainty, and assist economies in dealing with the negative long-term impacts of natural hazards, such as flooding.[348] Risk pricing may encourage the reduction of exposure and lead to lower damage costs.[349] As was made clear in the theoretical framework, the major advantage of an insurance solution (especially when compared to solidarity payments) is that it can promote disaster risk reduction and thus have positive incentive effects for taking precautions.[350]

The question therefore arises whether specific actions could be undertaken at EU level to stimulate the insurability of disasters. Two examples are provided, without working them out in full detail.

a. Information exchange

One first important aspect in the supply of disaster insurance is obviously that insurers need to have adequate information on the probability of particular disasters occurring. Predictability of the risk is a key element to guarantee insurability.[351]

For example, to some extent the EU itself, through its Joint Research Centre (JRC), could provide information on the probabilities of disasters to insurers. This information could subsequently be used in providing offers to the market. Another possibility for insurers is to collaborate in exchanging data, although this is a difficult subject for competition authorities. Competition authorities often fear that information exchange, more particularly on data, could endanger competition in (insurance) markets.[352] The EU competition authorities accommodated the concerns of insurers by granting block exemption regulations in 1992 and 2003. Those regulations applied to four types of agreements and granted exemptions from competition law under certain conditions. The block exemption regulations applied to: a) the establishment of common risk premium tariffs, based on collectively ascertained statistics or on the number of claims, b) the establishment of standard policy conditions, c) the common coverage of certain types of risks, and d) the establishment of common rules on testing and acceptance of security devices. This, therefore, allowed insurers to collaborate and exchange information on statistics.

In 2010, following a consultation and evaluation process, the Commission decided to renew the block exemption. However, the renewal only applied to two of the four types of agreements that had been covered by the previous block exemptions: a) joint compilations, tables and studies, and b) co-insurance and re-insurance pools. On 31 March 2017, the insurance block exemption regulation expired and it has not been renewed.[353] Since the EU insurance block exemption regulation has not been renewed. This implies that from 1 April 2017 insurers have had to check their own compliance with competition law. This raises the question whether insurers still have the possibility to collaborate, for example as far as data exchange and statistics are concerned, without running the risk of getting into difficulties with the competition authorities. If such difficulties would arise, the alternative could be a more prominent role for the JRC in providing basic data enabling the insurability of disasters. Here

[347] See *supra* 4.3.5 and *inter alia* Faure and Heldt 2017.

[348] Surminski et al. 2015, 1453.

[349] Kunreuther 1996.

[350] See *supra* section 4.3.5.

[351] See Faure & Hartlief 2003, 81-87.

[352] See Faure & Van den Bergh 1995.

[353] European Commission Press Releases Anti-trust: Commission publishes report on functioning of insurance block exemption regulation, 17 March 2016, available at: http://europa.eu/rapid/press-release_IP-16-861_en.htm.

it should be noted that there is a difficult trade-off between, on the one hand, the need for insurers to be able to rely on statistics and data in order to make catastrophic risks insurable and, on the other, the justified desire of competition authorities to apply competition law.

b. The government as reinsurer of last resort

The supply of catastrophe insurance has another feature which may endanger insurability, namely the fact that the magnitude of disasters often is so large that it may be impossible even for the traditional re-insurance market to cover the risk. In order to deal with that problem, an interesting model has been developed in which the government acts as reinsurer of last resort, and the state assumes at least part of the risk for losses from catastrophes. It has been argued in the literature and in the theoretical framework[354] that, provided particular conditions are met, such re-insurance by the government could indeed positively stimulate the insurability of catastrophes.[355]

This type of intervention by the government is far preferable to solidarity payments, as it is a way to stimulate the functioning of the insurance market. In this respect as well the question arises whether the EU could play a facilitative role. The first role that could be considered, would be to have the EU institutions fulfil the role of reinsurer of last resort. However, given the framework of fiscal federalism,[356] one wonders why this task should be fulfilled by EU institutions rather than the governments of Member States. There may, however, be another role for the EU. Whenever a government intervenes as reinsurer of last resort, this could be subject to scrutiny by the EU (competition) authorities, since this kind of support could be considered a prohibited form of state aid.

It should be noted that in the past, in particular cases, the state aid procedure was followed, with Member States' authorities arguing that taking up the role of reinsurer was an intervention which was not distortive, precisely because it supported the functioning of the insurance market. This situation arose *inter alia* when the Dutch government decided to intervene in the creation of a pool for damage to agricultural property in the Netherlands as a result of heavy rainfall. A second layer was provided by the Dutch government as reinsurer of last resort, which was duly reported to the European Commission in the framework of the state aid procedure and which was granted authorisation by the European Commission.[357]

This example again shows that in particular circumstances an intervention by a government, more particularly as reinsurer of last resort, may be desirable in order to stimulate the functioning of the insurance market. In fact, it may even be important, because it allows for the good functioning of the insurance market and helps avoid distortive solidarity payments. In this respect, it is important that the EU authorities (as in the Dutch example) realise the significance of such an intervention as stimulating rather than distorting the insurance market, and thus facilitate those particular solutions. It is in this sense that the EU can play a facilitative role with respect to insurance. As indicated in Chapter 3, the provisions on state aid do exactly that by largely exempting compensation mechanisms for natural disasters from the state aid rules.[358]

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[354] See *supra* 4.3.6.

[355] See Bruggeman, Faure & Fiore 2010, 369-390.

[356] See for an application of that framework to a task for Europe with respect to disaster insurance, Faure & De Smedt 2019.

[357] For details see Bruggeman, Faure & Heldt 2012, 185-241.

[358] See *supra* 3.4.

4.13. Compensation mechanisms in selected Member States: critical analysis

In this section, first the wide variety of different compensation mechanisms in the seven selected Member States will be discussed (section 6.2.1). Next, the four compensation mechanisms described in section 4.3 will be addressed in more detail, and examined as to the extent to which they can be found in the selected Member States (section 6.2.2). Finally, an analysis is provided of the question whether, based on the experience in the Member States and in light of the theoretical analysis, there are Member States whose compensation mechanisms could be considered best practice (section 6.2.3).

4.13.1. A wide diversity

A first look at the different compensation mechanisms from the perspective of which mechanism is the most prominent one in a specific Member State shows that several groups of Member States can be formed.

There are some Member States that still rely to an important extent on *ex post* government compensation, either *ad hoc* or through a fund. This is the case for example in Germany, where there is, in fact, no single instrument that deals with financial compensation for victims of natural catastrophes in a structured manner. Either the federal government or individual *Länder* can, mostly on an *ad hoc* basis, decide to provide compensation. In some cases the *ad hoc* compensation takes the form of creating a fund (for example after the 2002 flood).

This situation is largely comparable to the situation in the Netherlands. That country is supposed to have a structural solution via the WTS, which can provide financial compensation for victims of catastrophes. Yet, the scope of application of the WTS is rather limited. And in practice, notwithstanding the existence of the WTS, the Netherlands mainly relies on *ex post* and *ad hoc* compensation with the government generously intervening. The situation in both the Netherlands and Germany is also comparable in the sense that in both countries discussions were held about introducing a (mandatory) first-party insurance model, but that these discussions never led to a legislative change. In other words, both countries remain largely reliant on government compensation and did not introduce a structural first-party insurance solution.

By contrast, Sweden seems to rely more strongly on first-party insurance, but in exceptional cases *ad hoc* compensation can still be provided. This was the case for example with the compensation for forest owners and farmers after storm Gudrun in 2005.

Some countries, like Belgium, the Netherlands and, to some extent, Romania rely on more structural government compensation. In the Netherlands, the public budget is used to provide financing through the WTS, but *de facto* the WTS is not applied very often. Belgium has traditionally relied on compensation through a disaster fund, but moved to the introduction of an insurance model, as a result of which the role of the disaster fund was reduced substantially. The disaster fund in Belgium now only intervenes in cases where insurance is not available. It therefore functions as a layer of last resort (after insurance).

A larger group of countries seems to rely on insurance solutions in various forms. The country which in fact was the first to introduce a comprehensive disaster insurance, is France. Here, in 1982, the legislator created a model in which cover for natural disasters is mandatorily added on to all voluntarily concluded first-party insurance. As a result, France now relies mainly on this insurance model, and cases of *ex post ad hoc* government compensation are in fact quite rare.

Belgium was strongly inspired by the French example and introduced a similar system after legislative changes in 2003 and 2005. Belgium now also has a mandatory extension of disaster risk cover which is

added onto voluntarily concluded fire insurance. A similar model exists in Spain, where a *consorcio*, a public institution, provides cover. Here also, the scheme is compulsory and it extends the cover of ordinary insurance policies. As a result, extraordinary risks are also covered by the *consorcio*. Again, this is a voluntary insurance policy, but the inclusion of cover for extraordinary risks is mandatory. Similarly, Romania relies largely on compulsory insurance for residential buildings. In 2008, Romania introduced compulsory insurance against earthquakes, landslides and floods. However, notwithstanding the duty to purchase insurance, the rate of coverage is only 20%. This shows that in Romania there is a low penetration of insurance as a result of a lack of enforcement of the duty to take out insurance.

Sweden also relies on first-party insurance as the most important instrument to provide compensation for victims of disasters. Yet, in contrast with the other countries mentioned, in Sweden disaster cover is not made mandatory. Apparently the coverage is already high, and therefore there was no need to introduce a duty to cover disasters. The introduction of (comprehensive mandatory) insurance was discussed in Germany and the Netherlands, but for a variety of (political) reasons, this has not yet resulted in the introduction of a similar scheme in those countries.

Looking at the countries discussed, it can therefore be argued that whereas, perhaps historically, there were not many structural solutions and *ad hoc ex post* government intervention was the most important instrument, the trend nowadays is certainly towards the use of (compulsory) first-party insurance. France has been a leading example, since it introduced such a first-party insurance model already as early as 1982, and the French model has inspired legislators in other Member States (such as Belgium and Spain) to introduce such a model as well. In this respect, interesting legal transplants between some Member States can be observed. In addition, it should be mentioned that some of the countries that rely on first-party insurance (such as France and Belgium) also have models whereby the government plays some role as reinsurer of last resort, for example through the Caisse Centrale de Réassurance (CCR) in France, or the disaster fund in Belgium.

4.13.2. The compensation mechanisms

In this section the mechanisms used in some of the Member States are reviewed again, but this time not from the perspective of which instruments are primarily used in a particular Member State, but rather from the perspectives of the mechanisms themselves. Section 4.3 provided an overview of the various compensation mechanisms and discussed the advantages and disadvantages of those mechanisms as well as the extent to which they can be used as instruments to compensate victims of climate change related disasters. Here, the five specific mechanisms will reviewed and examined once more as to their suitability (given the criteria of prevention and effective compensation) in light of the experiences in the Member States.

- **Liability rules**

The first instrument presented was the use of liability rules. It has already been noted that from a theoretical perspective in fact not much is to be expected from liability rules as far as compensation for victims of climate change related disasters is concerned. In most cases, it will be next to impossible to identify a specific injurer against whom a liability suit could be brought, so it was considered doubtful that liability rules could play any meaningful role in this particular domain. When discussing the liability rules in the Member States, it was regularly stressed that several of them (for example, Germany, but others as well) had introduced a variety of strict liability statutes, but that these usually applied to so-called man-made (technological) disasters, not to technological disasters.

The only actor against whom a liability suit could be addressed in the case of natural disasters would be public authorities. This would, for example, be the case if it could be held that an authority had issued a permit for construction in a flood-prone area, or had neglected to take adequate measures

aiming at the prevention of a disaster or at mitigation of damage. It is therefore not surprising that almost no cases have been reported in the analysed Member States where liability rules were applied to obtain compensation for damage caused by natural disasters.

In the Netherlands there have been cases where the liability of public authorities was examined, for example in the case of a flooding, but there were no cases in that country where liability of public authorities was accepted. The only country reporting a case of liability of public authorities for a natural disaster was France. But even in that country only one case was reported. As a result, it can be held that liability rules cannot really constitute an effective compensation mechanism for victims of climate change related disasters, as was predicted by theory.

- ***Ex post* government compensation**

The theoretical framework was equally critical towards *ad hoc ex post* compensation, for the reason that such a system would not provide adequate incentives to victims for investments in optimal prevention measures. It was also considered to be ineffective, as it would not provide a structural guarantee of effective compensation for victims. Both criticisms found in theoretical literature have also been recognised in the literature describing the compensation for victims of disasters in the Member States. One can indeed notice that the Member States that do not have a structural solution (such as comprehensive mandatory first-party insurance) do often rely on *ex post ad hoc* government compensation. It is, more particularly, in those Member States that one can also notice the criticisms related to the distorting incentive effects created by *ex post* government compensation.

For example, in Belgium *ex post ad hoc* compensation is rarely used, as previously there was a structural compensation fund, and since 2003/2005 there has been an insurance solution, as a result of which victims do not really have a need to call on *ex post ad hoc* government compensation. In France also *ex post ad hoc* government compensation is only used to compensate those aspects of the losses that do not fall within the comprehensive first-party insurance model. This applies, for example, to critical infrastructure in France. Victim compensation takes place, in principle, using the structural insurance solution (created by the Act of 1982). *Ad hoc* compensation is only used to repair critical infrastructure damage which is not compensated through insurance solutions.

Germany relies to a large extent on *ex post ad hoc* compensation. This is understandable, as the country lacks a structural (insurance) solution. The German *ad hoc* compensation model is criticised in the literature as being "insecure, often inadequate, but sometimes over-generous". Moreover, empirical research in Germany confirmed the dangers of the *charity hazard*, i.e. that over-generous *ex post ad hoc* compensation can in fact increase the risk because it dilutes incentives for prevention. As mentioned earlier, the Netherlands largely followed the German model, as the Netherlands also lacks a structural insurance solution. As a result, victims can *de facto* only call on the (often rather generous) *ex post ad hoc* government compensation. This situation is criticised in the Netherlands for the same reasons as in Germany.

In Spain, *ex post ad hoc* compensation is not the standard model to compensate victims, for the simple reason that victims in Spain can rely on insurance via the *consorcio*. The same can be said for Sweden, where *ex post ad hoc* government compensation is rather exceptional given the large insurance coverage. Finally, in Romania, *ex post ad hoc* government compensation is considered uncertain and highly discretionary.

- **Government finance compensation fund**

The criticism formulated in the theoretical literature with regard to *ex post ad hoc* government compensation to a large extent applies to government-financed compensation funds as well. Such funds amount *de facto* also to a model whereby taxpayers' money is used to provide compensation for

victims. The only difference with *ex post ad hoc* compensation is that in the case of a compensation fund, the conditions for the intervention can be stipulated *ex ante*, and therefore a compensation fund can have a more structural character.

Until the legislative changes of 2003/2005 in Belgium the disaster fund was the main instrument used to compensate victims. It was criticised, however, as it led to a long and complicated administrative procedure and victims had to wait a long time before receiving compensation. The introduction of an insurance model substantially reduced the role of the disaster fund in Belgium.

France does not have a compensation fund for the compensation of victims of natural disasters. This can be understood given the insurance solution adopted in that Member State. In Germany, funds are created, but not in a structural manner. In some cases a specific disaster fund will be created in an *ex post* and *ad hoc* manner, as a result of which there is no substantial difference with the previous model. In the Netherlands the WTS functions - or is supposed to function - as a structural disaster fund. However, the WTS has been subject to serious criticism for providing no incentives for prevention to victims, for giving uncertain compensation to victims, and for creating a heavy pressure on public budgets.

In Spain, the situation is comparable to France. As there is an insurance solution (via the *consorcio*), there is no need for any government-financed compensation fund for natural disasters. The same is the case in Sweden.

Romania has a government state reserve fund, but the fund is largely focused on supporting the budgets of local authorities in case of a disaster. In addition, there is a World Bank financed emergency fund, aimed at enabling the government to restore services and rebuild communities, but not at awarding direct compensation for victims.

- **First-party insurance for natural disasters**

As mentioned earlier, from a theoretical perspective, the optimal solution (both for providing incentives for prevention and as a guarantee of effective compensation for victims) is first-party insurance. This model was created in France and takes the form of a mandatory add-on to voluntary housing insurance. The French model therefore seems to comply largely with the theoretical predictions.[359] The only problematic aspect is that the premium to be charged for the supplementary coverage for natural catastrophes has been regulated by statute and thus potentially restricts competition. Also, there is the question whether under the French model insured citizens who are not exposed to a disaster risk are forced to purchase disaster cover. This could potentially lead to an undesirable redistribution whereby those not exposed to a disaster risk would still pay the additional disaster premium and would thus cross-subsidise the insured who are exposed to disaster risk. Belgium tried to solve this problem with the Act of 2003, in which the mandatory extension would only apply to property situated in flood-prone areas. However, the Belgian example shows the (political) difficulties in demarcating those areas, as the Act of 2003 could never enter into force. As a result, the Belgian legislator, with a new Act (in 2005), opted for a mandatory extension of fire insurance policies to include specific natural disasters. This model is, to a large extent, followed in Spain with the so-called extraordinary risk scheme covered by the *consorcio*. The consorcio system is financed by a surcharge on the commercial premium that policy holders pay for a voluntarily concluded private insurance policy. As in the French model, these policies mandatorily include cover for extraordinary risks.

Sweden has a different model. In Sweden, there is high penetration of first-party insurance, but no mandatory insurance. Home insurance in Sweden automatically also covers flooding. However, there

[359] Made in the theoretical framework in section 4.3.5.

is some concern in Sweden that natural disasters (like flooding) could increase as a result of climate change, which would jeopardise insurability. Romania introduced compulsory insurance against earthquakes, landslides and floods in 2008. The cover is provided through a pool for insurance against natural disasters (PAID). Premiums are risk-related and could thus provide excellent incentives for prevention. Non-compliance with the compulsory insurance gives rise to a fine. The problem is that, notwithstanding the insurance being mandatory, there is a coverage of only 20% of eligible citizens, which shows a situation of serious under-enforcement.

The example of Sweden shows that enforcement problems especially arise when a direct duty to purchase disaster insurance is introduced. Especially when local authorities are relied upon to enforce the duty to insure, problems may arise when (as in the case of Romania) local authorities do not want, for political motives, to act against their residents. Enforcement is easier in the French/Belgian model, as in these countries insurance companies are forced to automatically add a disaster cover to voluntarily concluded insurance. In other words: in Romania enforcement needs to address homeowners, whereas in the French/Belgian model enforcement is addressed at insurers, which is obviously easier.

In other countries, more particularly Germany and the Netherlands, the introduction of compulsory first-party insurance has also been advocated and propagated in the literature, but so far without success. Interestingly, in Germany the introduction of compulsory first-party insurance failed because politicians wanted to keep their hands free to award *ad hoc* compensation and enjoy the related political benefits. In the Netherlands, attempts have been made to introduce a comprehensive insurance model, but the government is afraid that it might lead to moral hazard, and the Dutch competition authority feared it would force consumers to purchase a product for which there was no demand.

- **Government intervention as reinsurer of last resort**

The model of mandatory comprehensive insurance is often used in combination with government intervention as reinsurer of last resort. The example here is the Caisse Centrale de Réassurance (CCR) in France. The CCR is a state-controlled mechanism that provides reinsurance. Even though the mechanism could be considered to constitute state aid, the European Commission considered it proportionate, as this type of state intervention enables insurance of households against the risk of natural disasters. Belgium operates a similar model in which the reinsurance function is *de facto* fulfilled by the disaster fund. In Spain this is done through the *consorcio*, a public institution providing state-guaranteed cover for extraordinary risks. In Romania the reinsurance is provided through a pool for insurance against natural disasters (PAID).

As mentioned in the theoretical framework, intervention by the government as reinsurer of last resort has the advantage that it solves the capacity problem and allows for market intervention (through insurance). This produces positive incentive effects on prevention (through risk differentiation) as a result of which the negative effects on prevention (related to *ex post ad hoc* government compensation) can be avoided.

4.13.3. Best practice?

When presenting the theoretical framework it was held that *ex post* government compensation is not attractive - neither for providing effective compensation to victims, nor for providing incentives for optimal prevention. It was argued that the same problems arise in the case of compensation through a government-financed compensation fund. From a theoretical perspective, therefore, it was held that the preferred instrument is first-party insurance, as this model provides positive effects on the incentives for prevention and guaranteed compensation for victims (by the commitments of insurers

in the insurance policy).[360] It was also argued that, in order to solve potentially low demand, a comprehensive mandatory disaster cover would have to be introduced and, in order to solve the capacity problem, the government would have to intervene as reinsurer of last resort.

These features can be seen specifically in the model that was developed in France in 1982, and was introduced in Belgium and Spain as well. As the experiences in those countries show, the regulation has *de facto* created a market solution whereby victims can count on compensation for (climate change induced) natural disasters from insurers. As insurers have to control the moral hazard risk, they will engage in risk differentiation, as a result of which adequate incentives for taking optimal preventive measures are provided. Intervention of the government as reinsurer of last resort has, moreover, the advantage that insurance cover remains possible, even for relatively large amounts that go beyond the capacity of the insurance and commercial reinsurance market.

The advantage of the model of comprehensive mandatory first-party insurance combined with the state as reinsurer of last resort, is that it can avoid the negative effects of providing compensation from the public purse. The experience in the Member States analysed shows, moreover, that in those countries insurance markets (combined with reinsurance by the state) are *de facto* largely able to provide compensation. As a result, in those Member States there is no longer a need to call on the public budget to compensate victims of natural disasters.

Obviously, it is easy to find fault with the existing models as well. For example, the fact that in France the premium for the mandatory supplementary cover for natural catastrophes is regulated, has the disadvantage of restricting competition. In Belgium there is no such regulatory intervention and insurers are free to determine their premiums. From a competition perspective this is obviously the preferred solution. Also, mandating insurance cover for all insured may have the disadvantage that those who are not exposed to a risk are forced to purchase insurance and pay the mandatory premium. That problem could be avoided if it would be possible to identify areas and residences which are more exposed to a specific risk than others and, consequently, to impose the additional charge only on the residences exposed to the risk (of a particular natural catastrophe) in question. However, the example of Belgium shows that the political costs of determining those areas may simply be too high.

Also, lessons can be learned from some Member States. For example from Sweden, where it is apparently possible to have a wide cover for natural catastrophes without mandatory insurance. This is probably the result of the culture in Sweden, where insurance is a widespread instrument used to cover a wide variety of risks. If that is the situation, there is no need for the legislator to mandate the purchase of insurance. However, this may only be applicable to Member States where there is a strong culture among the population of voluntarily purchasing first-party insurance for a wide variety of risks.

The example of Romania shows that there may be a danger in simply mandating the purchase of insurance cover for natural catastrophes if, for a variety of reasons, enforcement is lacking. This leads to the paradoxical situation that the only Member State examined where the purchase of insurance against natural disasters is compulsory, has a coverage of only 20%. The better alternative in this case is to add cover for natural catastrophes to voluntarily purchased housing insurance, as was done in Belgium and France. It is obviously easier to impose on insurers a duty to extend the cover of housing or fire insurance to include cover for natural catastrophes, than to enforce a duty for homeowners to purchase such additional cover.

[360] See *supra* 4.3.5.

4.14. The EU and Member State level compared

In section 6.1 a critical analysis of the involvement of the EU in compensation for victims of disasters was provided, and in section 6.2 the same was done for the Member States. This section brings both analyses together and briefly summarises how the involvement of the EU is seen in light of the analysis of best practice in the Member States.

First the differences between the engagement of Member States (largely focusing on compensation for individual victims) versus the involvement of the EU (largely focusing on providing support to Member States) will be analysed. Next, the question whether the wide variety of solutions found in the Member States should give rise to a call for harmonisation, will be addressed. After having argued that this is not necessarily the case, the question arises what role the EU could play in promoting the implementation of the optimal solution in the Member States, more particularly, the implementation of first-party insurance with government support as reinsurer of last resort.

4.14.1. An effective division of labour

The analysis of the efforts at EU level (Chapter 3), and the analysis of compensation for natural disasters in some Member States (Chapter 5), shows that there is, to some extent, a division of labour between the EU and the Member States, as far as compensation for victims of climate change disasters is concerned.

Individual victims will have to call for compensation directly from the Member States. The structural arrangements worked out at EU level (see Chapter 3) are not geared towards providing compensation for individual victims directly. Individual victims will therefore have to make use of the arrangements made available in the specific Member States (see Chapter 5).

After a disaster, the EU provides funding to Member States rather than to individual victims. This is more particularly the case with regard to the most important mechanisms, such as the EUSF (see Chapter 3).[361] As indicated in section 6.1, the IBRD/World Bank in its study showed that there is a significant funding gap between the compensation provided from the EU level and the available national reserves for covering disaster costs. Indeed, the study makes it clear that the EU in fact only finances a small fraction of the structural response costs that Member States incur. The impression the study gives is that the IBRD/World Bank is in fact suggesting a larger involvement of the EU in the provision of financial support, for example for rebuilding critical infrastructure in the Member States. If this is how the IBRD/World Bank study should be understood, it is a suggestion that we do not follow.

As indicated in section 6.1.2, the potential distorting effects of *ex post* compensation do not only affect the incentives for prevention for individual victims (if *ex post* compensation is provided by Member States), but are equally problematic where incentives for Member States themselves are concerned if the EU intervenes too generously towards them. Given the tendency of politicians at Member State level to systematically under-invest in the prevention of disasters, this tendency could even be reinforced if these politicians count on *de facto* being bailed out *ex post* by the EU. For this reason, it should be recognised that there is a funding gap between what the EU provides and what may be needed for reconstruction after a disaster in a Member State. Yet, in order to keep optimal incentives for investing in prevention in the Member States, we are not in favour of a more generous use of redistributive instruments such as the EUSF or the ERDF.

Therefore, the conclusion after comparing intervention at EU level and at Member State level is that both levels have, in principle, instruments geared towards different target groups (for the EU the target

[361] See *supra* 3.3.4.

group is the EU Member States, and for the Member States the target group is individual victims). As a result of this allocation of the target demographic there is no danger of overlap or conflict as far as the mechanisms developed at the two levels are concerned.

4.14.2. A need for harmonisation?

As second question that could be asked in this respect is what can be concluded from the "praise of diversity" that was observed in the analysis of the compensation mechanisms in the seven Member States (see Chapter 5)? Even if more Member States had been included in this analysis, the conclusion would be the same: comparative studies have shown that the approaches followed in the Member States are very country-specific and, therefore, show a wide diversity.[362] Some Member States have structural solutions in the form of a compensation fund. Others have no specific structural solution in place but compensate (more or less generously) *ex post,* and others again have created structural solutions by means of mandatory insurance.

This wide variety leads to the obvious question whether it would be appropriate to strive for harmonisation of the compensation mechanisms employed in the Member States. In an earlier study,[363] we have used the economics of federalism to ask exactly that same question, and concluded that there is no strong argument for a formal harmonisation at EU level - neither from a theoretical, nor from a practical point of view. The traditional arguments developed in the economics of federalism in favour of a strong competence at the central level (such as interstate spill-overs or a race-to-the-bottom), do not play a major role in the case of climate change disasters, and do, therefore, at first glance not justify a role for the EU - neither in harmonising the mechanisms for compensation at EU level, nor for providing direct compensation for victims. This is also supported by the observation of the wide variety of instruments in the Member States.

This leads to the simple conclusion that, given the large differences between the solutions in the Member States, the costs of harmonisation would undoubtedly be high. Also from a practical perspective there is reason for caution with respect to a strong role for the EU. Yet, we also argued that there may be a case for collaborative governance, i.e. a hybrid solution of collaboration between the central EU level authorities and local authorities in the Member States. Such a hybrid solution could from a theoretical perspective lead to optimal decision-making in a multi-level governance framework, like the EU.[364]

More practically, this means that there could be an argument for a facilitative role for the EU, for example in facilitating the insurability of disasters in the different Member States, as this has been identified as the best practice, both from a theoretical[365] and a practical perspective[366]. This is also largely in line with the 2013 Green Paper on the insurance of natural and man-made disasters, on which the European Parliament took a position. Given the wide variety of systems in the Member States, it was argued that it would not be prudent to strive for unification.[367]

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[362] See for example Faure & Hartlief 2006a.

[363] Faure & De Smedt 2019.

[364] *Ibidem*.

[365] See the summary in section 4.4 of the theoretical framework.

[366] See section 6.2.3 *supra*.

[367] See *supra* 3.2.2.

4.14.3. The EU facilitating insurability

This leads to the third aspect of a possible integration between the EU and the Member State level, which is the possibility of the EU facilitating the both theoretically and practically optimal solution, namely the use of first-party insurance for natural disasters. As was argued earlier, in this situation the most important task of the EU would be to take action to stimulate insurability of climate change disasters within the Member States.[368]

This idea is, to some extent, also taken up in the 2013 Green Paper, albeit that the Green Paper argues in favour of a flexible natural catastrophe insurance in a non-mandatory framework. We believe, however, that account should be taken of the empirical evidence, which shows that in legal systems where catastrophe insurance is not mandated, there will be systematic insufficient demand for this type of insurance. This resulted in the observation, e.g. after hurricane Katrina or after the Elbe flooding, that only a relatively small percentage of victims had purchased catastrophe insurance. It is precisely because of the psychological biases underlying the lack of demand that the literature has generally argued in favour of a mandatory comprehensive insurance framework.[369]

There are ways in which the EU can further facilitate the insurance solution. As indicated above, insurability is crucially dependent on availability of information. It is precisely for that reason that we identified facilitating information exchange in order to stimulate insurability as an important task for the EU.[370] A second potential role for the EU relates to the role of the government as reinsurer of last resort. We recall that given potential supply-side problems with catastrophic risks, an intervention by the state as reinsurer of last resort can be seen as a form of smart regulation, as it stimulates the functioning of the market mechanism. A first step for the EU could be to facilitate the role of the Member State governments in this respect via the state aid regime. The example of France showed that reinsurance provided by the state through the CCR was considered compatible with the internal market.

Going one step further than allowing Member States to engage in this type of support the EU could - given the problems that government reinsurance could cause within the Member States - also consider acting as reinsurer of last resort itself, thus further stimulating the market mechanism. In a reaction to the Green Paper, the European Parliament took the view that Member States could participate in compensation by providing reinsurance.[371] However, a case could also be made for the EU itself engaging in reinsurance of last resort given its larger financial possibilities, particularly when Member States would have difficulties in doing so.

[368] See *supra* 6.1.1.

[369] See further for the arguments, *supra* 4.3.5.

[370] See *supra* 6.1.1.

[371] See *supra* 3.2.2.

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1. Main findings

Chapter 2 indicated that climate change is already a reality in Europe, as temperatures in the EU have increased more than twice the global average over the last 30 years. Europe will suffer serious consequences from climate change, such as *inter alia* heatwaves, droughts, wildfires, heavy rainfalls, floods, and rising sea-levels. Yet, there are important distributional differences, as not all regions will suffer from climate change to the same extent. The largest negative impacts are expected in southern Europe, more particularly an increase in extreme heat, water scarcity, droughts, and wildfires.

Climate change is also expected to deepen inequalities, not only between Member States, but also between regions, cities, and coastal areas. There is a danger that specifically vulnerable groups and those practising traditional livelihoods could be most exposed to climate risks. Climate change has already led to high costs in the EU. The economic losses related to weather and climate-related events amounted to EUR 450-520 billion between 1980 and 2020, which is on average EUR 12 billion/year. Only between 1/4 and 1/3 of the climate-related losses were covered by insurance. Thus, there is a considerable climate protection gap, as many losses are not covered by insurance. It was also established that there is a lack of data on the measures Member States have taken for disaster response, more particularly measures to close the climate protection gap.

Given these findings, Chapter 3 addressed how the EU has been preparing itself for climate change. The EU has a wide range of policies and instruments in place to strengthen its resilience against climate change disasters. The most important formal framework is the EU adaptation strategy. In addition there is a wide range of specific sectoral legislation addressing separate disasters. With respect to natural disasters, the EU Floods Directive of 2007 is a key risk-management instrument. The EU also has a wide variety of instruments in place to finance adaptation to climate change. The most important ones are the Recovery and Resilience Facility, the European Regional Development Fund, and the Cohesion Fund.

Moreover, the EU has several mechanisms in place to react to natural disasters. Emergency management is regulated through the EU Civil protection mechanism. Financing (most particularly focused on reconstructing critical infrastructure in the Member States) is provided through the European Union Solidarity Fund and the emergency aid reserve. These have now been merged into the SEAR.

Notwithstanding the large amount of instruments available, there is still uncertainty about whether the amount of funding available will be sufficient in the case of major disasters. In fact, a World Bank study argues that this will certainly not be the case, and there might be a climate change funding gap.

Furthermore, the EU has particular policy documents in place to facilitate financing of losses caused by climate change disasters in the Member States. In this respect, especially the Green Paper of 2013, which focusses on stimulating the insurability of natural disasters, is of importance, as well as the regulations concerning state aid, which show a large amount of flexibility to facilitate state intervention in financing disasters.

Chapter 4 addressed compensation for victims of climate change disasters from a theoretical perspective. It concluded that even though, from an economic perspective, the question arises why there should be state intervention (regulation) with respect to compensation for victims, the argument could be made that disasters have a systemic nature. As a result, they could lead to disruption of society and cause even further losses if no measures are taken. This justifies the need to put in place structural instruments in order to facilitate compensation of losses caused by climate change disasters.

Chapter 4 also reviewed a variety of instruments that could, theoretically, be used to provide this compensation. Liability rules were quickly discarded, for the simple reason that natural disasters often do not have one identifiable injurer to whom liability could be attributed.

Ex post government compensation, although often used in practice (given the high political benefits), is not desirable, as it may have negative effects on the incentives for victims to take preventive action or mitigate losses, as well as on their demand for insurance. Moreover, *ex post* government compensation is often uncertain, which is why it does not provide a structural solution for victims.

The optimal instrument, from a theoretical perspective, is first-party insurance by victims. The advantage of it is that it also provides incentives for prevention (through the risk differentiation applied by insurers in order to control moral hazard). However, without regulatory intervention there may be insufficient demand for insurance (given particular psychological biases). Regulatory intervention mandating the purchase of catastrophe insurance may solve this market failure on the demand side. However, there could also be a shortage of catastrophe insurance, given the large amounts of financial capacity needed to cover catastrophic risks and the potential correlation between the losses. Larger capacity could be generated when governments act as reinsurer of last resort, and thus stimulate the market solution of first-party insurance.

Subsequently, Chapter 5 verified to what extent the solutions advocated in the theoretical framework could actually be found in seven selected Member States. It was shown that in those Member States there is a wide variety of solutions and that the issue is in full evolution. Legislative changes have either just taken place or have been suggested in the academic literature or at the policy level.

It appeared that some Member States still largely rely on *ex post* government compensation, either *ad hoc* or through a fund. This is for example the case in the Netherlands and Germany. Other Member States, such as Belgium, have a structural compensation fund. But the role of that disaster fund was reduced to an important extent as a result of recent legislative changes. The largest group of countries now relies on various forms of insurance solutions.

The country which is often cited as an example is France, where the legislator in 1982 mandated cover for natural disasters as a supplement to voluntarily concluded first-party housing insurance policies. Belgium has copied the French model, and a similar model exists in Spain. Romania has had compulsory insurance providing cover against a variety of natural disasters for residential buildings since 2008. However, due to enforcement problems, the effective coverage in that country is low. Sweden also relies on first-party insurance. In that country, even in the absence of a regulatory duty, there is apparently already a large insurance coverage. This could be explained by the culture in Sweden, where the use of insurance is widespread. In addition, many of the countries that have first-party insurance (such as France and Belgium) also have a role for the government as reinsurer of last resort.

Chapter 6 provided a critical analysis of both the EU policies and the arrangements at Member State level in light of the theoretical framework provided in Chapter 4. It was argued that the EU can take, and has taken, various steps to promote insurability at the level of the Member States, for example by promoting information exchange, or by stimulating the role of the government as reinsurer of last resort.

However, there was more criticism in the analysis of the *ex post* compensation provided to the Member States through the EU funds. The criticism in the theoretical framework towards *ex post* compensation not only applies to the Member State level, but also to European funds, such as the ERDF. There is a great danger that *ex post* compensation will lead to under-investment in the prevention of disasters at EU level. Currently, the World Bank has argued, there is a climate change financing gap between the EU and the Member States. However, from a theoretical perspective, this certainly does not mean that

the EU should be more generous with *ex post* compensation for the Member States, as this could potentially further dilute the incentives for Member States to invest in prevention of climate change related disasters.

The compensation mechanisms in the selected Member States were also critically analysed in light of the theoretical framework. In this exercise, it was argued that, just as in the case of the policies and arrangements, the result of the theoretical analysis was that first-party insurance by victims is definitely the preferred solution.

First-party insurance can provide both a guarantee of compensation for victims (through the contractual engagement by insurers) and adequate incentives for prevention (through risk differentiation applied by insurers who are specialised in risk management).

However, given systematic under-estimation of the catastrophe risk (as well as other biases), insurance will not emerge spontaneously without a regulatory duty. The only Member State where this was the case was Sweden. However, Sweden is atypical, as that country, in contrast with other Member States, has a strong culture of relying on first-party insurance. For other Member States, a regulatory intervention mandating the purchase of catastrophe insurance seems necessary. This was actually introduced in France in 1982, and for that reason the French model was identified as best practice. Still, there are some features of the French model (for example the fact that the premium for the mandatory catastrophe add-on is fixed) that could be improved. The experience in Romania also shows that it may not be sufficient to generally mandate the purchase of disaster insurance (rather than adding it to voluntarily concluded housing insurance), because in that case the duty will have to be enforced on homeowners which, as the Romanian example showed, can be highly problematic.

Chapter 6, finally, addressed the relationship between the EU and the Member States and concluded that there is no danger of overlap, as both levels engage with compensating climate change related losses in a different manner. Where the Member States focus on working out solutions aimed at financing losses incurred by individual victims, the EU is more focused on providing financing to the Member States. It was also established that, even though there are many differences between the Member States in the way they have regulated the compensation of climate change related losses, there is not necessarily a reason for harmonisation.

The economics of federalism do not provide indications that this would be an area where there might be cross-border spill-overs, or a race-to-the-bottom. And, practically, it could be argued that, precisely because the experiences in the Member States are so different, the potential costs of harmonisation might be prohibitive. Yet, there can be an important role for the EU in stimulating effective solutions at Member State level. As we argued that this solution basically consists of mandating catastrophe cover in addition to voluntarily concluded insurance, the facilitative role of the EU could be geared towards stimulating this model. In addition to stimulating information exchange, the EU could also facilitate a role for government (either the governments of the Member States or the EU itself) as reinsurer of last resort, thus facilitating the insurance solution by increasing the capacity of the insurance market.

5.2. Recommendations

We will now formulate several recommendations based on the main findings just presented. We will also take into account a study on the preparedness for disasters in the EU, which was carried out by the IBRD and the World Bank in 2021. This study contains specific recommendations that we will

incorporate as far as they correspond with our own findings.[372] First, we will formulate some general recommendations concerning optimal compensation mechanisms, mostly focused on the Member State level. Next, we will address the EU level and, more particularly, the potential role of the EU in stimulating effective compensation in the Member States. Each recommendation will be followed by a brief explanation and motivation.

1. Member states should develop a comprehensive national disaster financing strategy.
This is a recommendation made by the IBRD/World Bank which is in line with the results of our study.

Member States could consider the introduction of a comprehensive national DRF strategy to ensure financial preparedness for disasters. In a first step, Member State-specific priorities would have to be determined. This could be a focus on households, on the poorest members in society, on the government budget, etc.

Next, understanding how much financing is needed and for what purpose it should be spent is key to understanding how to structure a country's financial response capacity. Member States can then compare the different instruments (capital market instruments, catastrophe insurance, reserve funds, …), as each instrument has its own costs and benefits, and instruments should therefore be carefully examined and combined. A risk-layering approach is advised. Furthermore, some funds must be immediately available in case of a disaster.

2. *Ex post* government funded compensation for recovery should be avoided.
The reasons for this recommendation have been explained in detail in section 4.3.3 of the theoretical framework. Using tax payers' money to finance recovery will provide negative effects on the incentives for prevention and mitigation by victims. It will also negatively affect the incentives to seek insurance cover, and it may cause negative redistribution. Note that this recommendation to avoid the public purse only applies to recovery, not to relief. As explained in section 4.2.2, relief efforts in the immediate aftermath of the disaster will not negatively affect *ex ante* incentives for prevention.

3. Stimulate the development of comprehensive mandatory first-party insurance for losses caused by (climate change) disasters.
National governments should consider options for increasing catastrophe household insurance, possibly based on data and information provided by the EU, so that Member States can learn from each other. Yet, once again, the strategy for how to increase penetration of household insurance will have to be tailor-made for the specific Member State.

The main advantage of insurance is that it can provide a tailor-made solution for potential victims in which cover is adapted to the specific demand and protection preferences of the particular victim. Moreover, in order to control the moral hazard risk, insurers will apply risk differentiation as a result of which incentives for prevention and mitigation of losses are created.

However, given market failures on the demand side, there may be considerable under-insurance for disaster. This therefore requires government intervention aimed at mandating the purchase of disaster cover.

4. Mandatory disaster cover should be structured in such a way that it is added on to other, voluntarily concluded, insurance.
First of all, mandating disaster cover is obviously only necessary in Member States where demand for disaster insurance would not automatically be generated. In the case of Sweden for example, there is

[372] International Bank for Reconstruction and Development / The World Bank, Economics for Disaster Prevention and Preparedness Financial Risk and Opportunities to Build Resilience in Europe, 2021.

already large cover even without a regulatory duty to purchase insurance. But for all countries where disaster cover is *de facto* not available, the purchase of disaster cover has to be made compulsory. The purchase can best be structured as a supplement to voluntarily concluded insurance, such as fire insurance. This has the major advantage that insurers will, whenever they conclude voluntary housing insurance, automatically add disaster cover to the insurance package. The example of Romania shows that when the purchase of disaster cover is mandated directly, this duty has to be enforced upon households directly. This can create enforcement problems as a result of which there could still be too little disaster cover.

5. Structure the mandatory supplementary disaster cover in such a manner that it corresponds with market principles to the largest extent possible.

This recommendation implies - to the extent to which this is possible - that the mandatory supplementary disaster cover should only apply to households that are actually exposed to the disaster risk. If the duty is formulated in such a way that those who are not exposed to the disaster risk at all would have to purchase disaster cover as well, this could lead to negative redistribution.

Also, even though the government may prescribe the conditions for the mandatory supplementary disaster cover, market principles should, to the largest extent possible, still be respected. There is therefore no need to regulate the premium charged for the disaster cover (as is the case in France). The example of Belgium shows that it is possible to mandate the purchase of disaster cover, but to leave the determination of the premium to the insurance market.

6. In order to solve supply-side problems, the government can intervene as reinsurer of last resort in order to stimulate the capacity of the insurance market.

As disasters can generate demand for a large capacity, traditional insurance and reinsurance markets may not be capable of fully covering the risk. In that case, the government could intervene as a market player, providing reinsurance of last resort. The major advantage of this structure is that the government can stimulate the market mechanism (insurance), thus avoiding the potentially negative effects of using the public purse to compensate victims of disasters (more particularly the emergence of the charity hazard).

7. Apply market principles when the government acts as reinsurer of last resort.

The government should obviously only intervene as reinsurer of last resort when it is clear that the market is not able to provide the necessary capacity. Government intervention should in that respect always have a subsidiary character. Moreover, for the same reason, government intervention should, in principle, also be temporary, in order to stimulate the market to generate its own solutions. Precisely for this reason, the government should also charge a premium which reflects the risk to which it is exposed, in the same way commercial reinsurers would do. In the absence of charging risk-based premiums, government intervention would amount to an undesirable subsidy.

8. Stimulate the development of an over-arching strategy for integrating resilience investment at EU level as part of the greening of the EU.

This is a recommendation made by the IBRD/World Bank which is in line with the results of our study.

Climate change adaptation is essential to minimise the expected costs of climate change disasters. The first recommendation therefore is to continue, and to accelerate, the EU's efforts to protect EU citizens and the environment against the impacts of climate change by means of the different already existing funding programmes mentioned in section 3.2.4.

Financial resilience against disasters needs to be complemented by investment in green and resilient infrastructure. The EU is following this idea with the new adaptation strategy, and this fits in with the

European Green deal. However, a greater effort might be needed. A combined, holistic approach of, on the one hand, investment in green and resilient infrastructure, and, on the other, disaster risk financing, can help the EU to be prepared for climate change.

9. Stimulate insurability through EU action.

This is a recommendation made by the IBRD/World Bank which is in line with the results of our study.

Damage to residential or public buildings and infrastructure forms a significant part of economic loss from natural disasters. Yet, the IBRD/World Bank finds that currently across the Member States, disaster risk financing arrangements and strategies to cover the loss are limited. Insurance penetration rates for public and residential assets are low, only a few Member States have reserve funds, and the IBRD/World Bank study did not identify any sovereign insurance or capital market instruments.

Hence, this points to an urgent need to increase access to and uptake of catastrophe insurance by households, as well as public asset insurance.

With respect to public assets insurance, the IBRD/World Bank found that information on public asset insurance is largely unavailable and that public asset insurance, especially for infrastructure, might be largely unavailable. Therefore, it is important to take up the dialogue on public asset insurance and to explore solutions with insurance companies and capital markets. The EU can play a facilitative role in this.

10. Facilitate the development of insurance for climate change related disasters at Member State level through flexible application of state aid rules.

In general, state aid rules are flexible when it comes to using the public budget for compensating victims of disasters. We argue in favour of the same type of flexibility regarding insurance solutions and, more particularly, government intervention as reinsurer of last resort. As this type of intervention stimulates the functioning of insurance markets, state aid rules can be applied in a flexible manner, especially when recommendation 7 (applying market principles) is followed.

11. Stimulate information exchange concerning the risk of climate change disasters from the EU level.

A crucial condition of insurability is the availability of information on risk. The prediction of the incidence of particular disasters may be extremely difficult, but it is necessary for premium calculation. The EU could facilitate insurability in the Member States, for example by using its superior capacity in research and making the results of that research available to the market. The alternative would be that exchange of information between insurers would be facilitated, although it remains important to operate with caution, in order to avoid restrictions of competition.

12. Be cautious with strengthening EU funding of losses caused by disasters in Member States, in particular through the EUSF.

We argued that *ex post* funding has negative effects on incentives for prevention by households in the Member States. However, the same can apply when Member State governments are (partially) bailed out by the EU through funding of recovery after a disaster. In section 6.1.2., we indicated that such an approach may have the danger of possibly negatively affecting incentives for effective preparedness for disasters within the Member States. We recall that such negative incentive effects mostly apply to recovery and not to relief. Therefore, the working of the EUSF could be improved to act fast and to ensure immediate disaster relief. Furthermore, the funding percentages could be adapted so that funding is geared towards Member States that are most vulnerable to climate change disasters, in order to ensure solidarity in the EU. This does not seem to be the case nowadays.

Finally, the merger of EUSF and EAR in SEAR might be re-evaluated, with respect to the criticisms raised in this respect (see section 3.3.4).

13. Do not consider harmonisation of the compensation schemes to deal with losses caused by climate change disasters in the Member States.

We do not argue for any harmonised system. Each Member State has its own unique set of circumstances, and making insurance mandatory may not be feasible for all Member States. Moreover, in some countries a political decision may be made on providing different ways of supporting households after disasters, for example through public compensation. Reinforcing sustainability, predictability, and transparency of public compensation schemes is also important. Therefore, a decision on how to increase the penetration of household insurance will be context-specific (IBRD/World Bank).

14. Improve data on disaster risk and disaster risk financing.

This is a recommendation made by the IBRD/World Bank which is in line with the results of our study.

In order to inform decision-making on disaster risk financing at EU level, but also at Member State level, it is important to have reliable data, both on the magnitude of the loss and on disaster risk financing strategies.

The EU could play an important role in providing data, information, and knowledge on multi-hazard disaster and climate risks. It could play a role in providing:

- Catastrophe modelling data: regionally consistent catastrophe risk modelling with respect to climate change hazards over a longer time horizon could improve the accuracy of potential losses faced by the EU.

- Data on Disaster Risk Financing (DRF): the IBDR/World Bank study indicated that data on DRF is limited and that there is no comprehensive understanding of how the Member States manage disaster costs. We examined seven Member States and found that it is indeed difficult to obtain all information and to get insight into the large variety of instruments that is being used in these Member States. Therefore, comprehensive data on the uptake of household and public asset insurance could be collected to clarify how much risk is retained, as opposed to transferred in the EU. With this data, it would be possible to develop an informed approach, or guidelines on addressing potential funding gaps. The EIOPA dashboard might be a first step.

15. Develop an overarching disaster risk financing strategy at EU level.

This is a recommendation made by the IBRD/World Bank which is in line with the results of our study.

On the basis of the data collected, the introduction of a comprehensive EU-wide policy on disaster risk financing - such that common priorities and practices are defined, and the level of loss that can be covered by EU level instruments is clarified - could be considered in order to reinforce the application of the 2021 EU Climate Adaptation Strategy. Simple and clear messaging at EU level could incentivise Member States' investments in disaster risk management, including disaster risk finance.

Finally, our recommendations have taken into account the fact that climate change impacts will be unequally distributed across Europe and risk deepening (already existing) inequalities. In Chapter 2, we indicated that especially cities and coastal areas in southern Europe will be mostly affected and are projected to become hotspots of multiple risks. Also, socially vulnerable groups in particular might be more affected by climate change. These distributional impacts can, to some extent, be addressed with recommendations 1, 8, and 15, which specifically emphasise the need to develop an over-arching

European strategy for integrating resilience investment as part of greening the EU. Both the EU and the Member States should therefore, as suggested in this recommendation (15), develop comprehensive disaster risk financing strategies, and these should take into account in particular the inequalities we mentioned.

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This study, commissioned by the European Parliament's Policy Department for Citizens' Rights and Constitutional Affairs at the request of the Committee on Petitions (PETI), analyses the kinds of compensation available to victims of climate change disasters in the EU. The study outlines the dangers and effects of climate change in the EU as well as the EU policies and mechanisms to deal with climate change disasters. A theoretical framework is developed to determine appropriate compensation mechanisms to deal with climate change disasters. Also, the compensation mechanisms for natural disasters in a representative selection of Member States are discussed. Furthermore, a critical analysis of the compensation mechanisms at EU and Member State level is provided, and policy recommendations are formulated.

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