STUDY

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EU tools to respond to natural disasters

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RESEARCH FOR REGI COMMITTEE

EU tools to respond to natural disasters

Abstract

This study provides an analysis and assessment of EU tools to respond to natural disasters. Particular attention is paid to the European Union Solidarity Fund and the potential synergies and overlaps with other EU instruments including the Emergency Aid Reserve, the EU Civil Protection Mechanism as well as Cohesion Policy. Also, the recent modifications to the EUSF including the extension to address major public health emergencies as well as the modifications linked to the 2021-2027 programming period are examined. Based on this assessment, policy recommendations are put forward.

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

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LIST OF ABBREVIATIONS

EAFRD	European Agricultural Fund for Rural Development
EAR	Emergency Aid Reserve
ERCC	Emergency Response Coordination Centre
ERDF	European Regional Development Fund
EU	European Union
EUSF	European Union Solidarity Fund
ESF	European Social Fund
GDP	Gross Domestic Product
GNI	Grosss National Income
MFF	Multiannual Financial Framework
NUTS	Nomenclature of territorial units for statistics
RescEU	European reserve of resources
SDGs	Sustainable Development Goals
SEAR	Solidarity and Emergency Aid Reserve
UCPM	Union Civil Protection Mechanism

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EXECUTIVE SUMMARY

EU tools to respond to natural disasters

The number of natural disaster events as well as their associated losses have been increasing in Europe over time. Importantly, such disaster events can have profound impacts on both the public and private sector and especially for the most vulnerable. In addition, natural disaster events can also cause large opportunity costs including the reduction of planned spending for development projects or a deterioration in a country's fiscal position and debt situation. Enhancing disaster resilience can support the mitigation of these disaster impacts. Resilience can be understood as multi-dimensional including physical, social, financial, human and natural resilience components, which can complement each other. Increasing resilience can take the form of structural measures (e.g. physical constructions such as dams against flooding, or building earthquake resistant houses) as well as non-structural ones (e.g. early warning systems, or risk awareness education). The European Union has special tools and mechanisms to respond to natural disasters enhancing resilience including the Union Civil Protection Mechanism (UCPM), the Emergency Aid Reserve (EAR), the European Union Solidarity Fund (EUSF) as well as the Cohesion Policy.

The EAR and the EUSF belong to the so-called special instruments which ensure the flexibility of the EU budget and which enable the EU to mobilise the necessary funds to react to unforeseen events. As these instruments can solicit additional financial support, they are above the expenditure ceilings of the long-term budget. Nevertheless, the amounts reserved for flexibility instruments cannot surpass their own resources ceiling. In the latest EU long-term budget plan – the Multiannual Financial Framework 2021-2027 – one important change made to the existing tools in the disaster response context was merging the EUSF and EAR into the new Solidarity and Emergency Aid Reserve (SEAR). This study examines the advantages and disadvantages of this change as well as the changes made in 2020 to extend the EUSF to cover losses incurred due to major public health emergencies such as the COVID-19 pandemic. Additional issues addressed are related to other instruments, such as the Union Civil Protection Mechanism and the Cohesion Policy.

Extending the scope of the EU Solidarity Fund to include major public health emergencies

Due to the COVID-19 pandemic and as a part of the EU coordinated package responding to it, the scope of the European Union Solidarity Fund was extended by a modifying regulation which was adopted on 1 April 2020. EUSF contributions to help states cope with public health emergencies have accumulated to around EUR 530 million of assistance since 2020. We found that given the COVID-19 pandemic and the high disbursements that significantly depleted the EUSF, the need for assistance from the EUSF in the event of a natural disaster would be much higher due to the decrease in fiscal resources as a result of the COVID-19 pandemic. Meanwhile the available funding from the EUSF would be significantly lower. We, therefore, conclude that support for natural disasters and large-scale public health emergencies from the same fund is diametrically opposed to the concept of solidarity, as the two are inextricably linked. When a public health emergency occurs, resources are drawn from the EUSF while at the same time the need for assistance from the EUSF increases in countries affected by a disaster. At the same time, the risk increases that the EUSF will not be able to provide the appropriate assistance (and vice versa) due to limited funding availability. With respect to the capitalization of the EUSF, we showed that the past performance of the EUSF

does not indicate adequate capitalization and that several plausible scenarios of past weather events in the EU outermost regions could put the EUSF under severe pressure. Therefore, a significant change in the capitalization of the EUSF would be required to address pay-outs for hazards in the outermost regions and for hazards occurring simultaneously in continental Europe, such as flooding.

Merging the EUSF and EAR under the new MFF 2021-2027 to create the Solidarity and Emergency Aid Reserve

Under the new MFF 2021-2027, the SEAR is responsible for both the former EUSF coverage and EAR obligations. As shown in our study, the new distribution of the fund is now very complicated, missing flexibility and causes dangers to receive necessary resources given large events happened in previous years. We conclude that merging the EUSF and the EAR into SEAR significantly increases the uncertainty of possible capital shortfalls for the EUSF and makes it virtually impossible to determine adequate funding requirements for solidarity in the event of current and future natural disasters. This brings us to one of the most important findings of the study: The risk of losses due to natural disasters is measurable. This is not the case for major public health emergencies and emergencies as set out in the EAR.

More specifically, contingent liabilities due to natural disasters and severe public health emergencies and emergencies covered under the EAR are different in nature, including the assessment of potential cost. Therefore, they should not be managed with the same tool. We argue that, particularly in the case of natural disasters, there is an untapped potential to transform these contingent liabilities into direct obligations that can then be incorporated into EU budgetary practice. Natural disasters, while inherently random, can be assessed using probabilistic approaches, and losses can be quantified in the necessary detail. If this were not the case, there would be no form of insurance for natural disaster risk. In contrast to natural disasters, the assessment of risks associated with public health emergencies such as the COVID-19 pandemic is of a very different nature, particularly with respect to the possibility of detailed probabilistic assessment. Compared to natural disasters, such large-scale public health emergencies or emergencies as defined in the EAR are more difficult to quantify and may be considered more unpredictable (at least from a quantitative risk perspective). They should, therefore, be addressed accordingly through a flexible budget or tools, such as the dedicated instruments.

Policy recommendations and links with other EU instruments and mechanisms

Based on our analysis, we recommend separating the EUSF from coverage of large-scale public health emergencies and emergencies covered under the EAR. In addition, we recommend establishing a new flexibility instrument to cover public health emergencies as well as EAR emergencies, as they are unpredictable and therefore require a more flexible approach. Given the measurability of the risk of losses due to natural disasters, we also recommend that the EUSF be incorporated into the MFF to more clearly link it to risk reduction efforts, including the ability to make successes more tangible. Due to the availability of advanced risk assessment approaches for hazards in Europe, it is also recommended that capitalization levels be estimated based on the risk to which the EUSF is exposed now and in the future. In the event that no changes are made to the SEAR, we recommend that the budget allocation and payment rules of the SEAR be further clarified

through amendment documents. Specifically, we propose improving the flexibility of the SEAR by allowing repayment of overdrafts through annual surplus. We also suggest implementing risk mitigation and awareness programs under the UCPM and Cohesion Policy that can be linked to the EUSF. The link between the EUSF and possible other disaster risk reduction tools can be made through various cohesion policy investments, particularly reducing risk and building back better that could reduce the future need for the EUSF.

1. INTRODUCTION

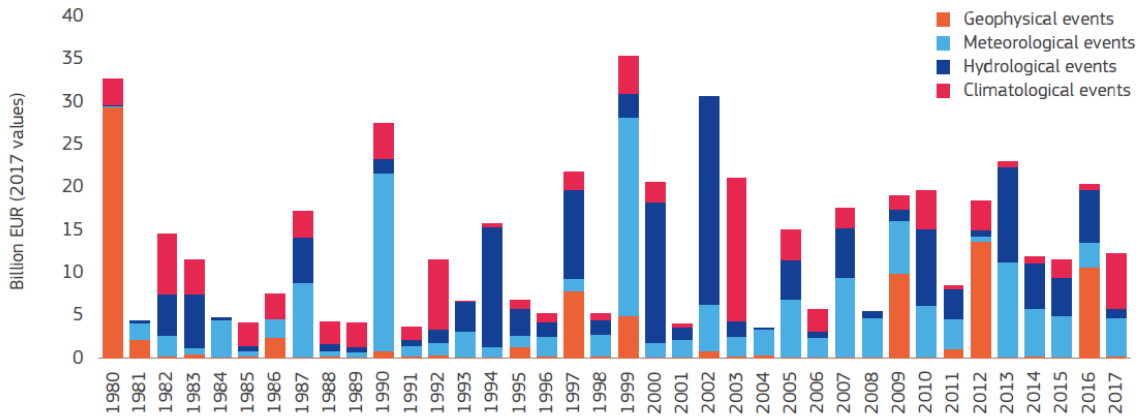
KEY FINDINGS

- Natural disaster events have increasingly profound impacts on both the public and private sectors and especially for the most vulnerable.
- The European Union has implemented multiple frameworks and guidelines for promoting disaster resilience and mitigating the impacts of climate change.
- Special tools and mechanisms of the EU to respond to natural disasters include, for example, the Union Civil Protection Mechanism (UCPM), the Emergency Aid Reserve (EAR), as well as the European Union Solidarity Fund (EUSF).
- Due to the COVID-19 pandemic, the scope of the EU Solidarity Fund was extended to cover losses incurred due to major public health emergencies.
- In 2021, the EUSF and EAR were merged into the Solidarity and Emergency Aid Reserve (SEAR) to provide funds for natural disasters, large public health emergencies and unforeseen events.

The number of natural disaster events as well as their associated losses have been increasing globally over time (Munich Re 2018). Worldwide, more than 7,200 events were recorded between 1998-2017 alone, 91 % of them were climate related (Wallemacy and House, 2018). In the European Union (EU), natural disasters affected nearly 50 million people between 1980-2020 with an average economic loss of around EUR 6.68 billion per year (World Bank, 2021). Figure 1 shows in more detail the past economic losses from disasters caused by different natural hazard types. Importantly, disaster events can have profound impacts on both the public and private sector and especially for the most vulnerable. As a case in point, losses from natural disaster events in low-income countries were estimated at approximately US$ 21 billion between 1998 and 2017, making up on average 1.8 % of the Gross Domestic Production (GDP). Meanwhile, total reported losses amounted to around US$ 1,432 billion in high-income countries, equalling 0.4 % of the GDP (Wallemacy and House, 2018). In addition, natural disaster events can also cause large opportunity costs including the reduction of planned spending for development projects or a deterioration in a country's fiscal position and debt situation (World Bank 2021). The same pattern can be found when looking at the number of people affected or the number of deaths due to natural hazards (Wallemacy and House, 2018; Munich Re, 2018): Impacts are much more profound for the most vulnerable.

Increasing disaster resilience can support the mitigation of these disaster impacts. Resilience can be understood as multi-dimensional, encompassing the physical, social, financial, human and natural dimension (also sometimes called resources or capacities), which can be complementary to each other (World Bank 2021, Hochrainer-Stigler et al., 2021). Enhancing resilience can be accomplished by means of structural measures (e.g. physical constructions such as dams against flooding, or building earthquake resistant houses) as well as non-structural ones (e.g. early warning, risk awareness education). Multiple important global agreements, i.e. the Paris Agreement, Sustainable Development Goals (SDGs) as well as the Sendai Framework for Disaster Risk Reduction 2015-2030, have provided frameworks and guidelines for promoting disaster resilience and mitigating the impacts of climate change. Aligned with these guidelines and recommendations, the EU has

accordingly introduced policies and frameworks such as the 2021 EU Climate Adaptation Strategy, the EU Floods Directive, and the European Green Deal (see World Bank, 2021).



Source: EEA 2020.

Special tools and mechanisms of the EU to respond to natural disasters include, amongst others, the Union Civil Protection Mechanism (UCPM, under Heading 3: Security and Citizenship, and Heading 4: Global Europe), Humanitarian Aid, the Emergency Aid Reserve (EAR) as well as the European Union Solidarity Fund (EUSF). Other tools such as the European Solidarity Corps and the EU Aid Volunteers Initiative, though not exclusively serving the purpose of disaster events, also share the function of natural disaster prevention, relief, recovery and/or reconstruction. The following is a brief overview of some of the important instruments already in place in the EU which the report will examine (see EC 2021).

- **The Union Civil Protection Mechanism (UCPM)** under Heading 3 (Security and Citizenship) aims to support, coordinate and supplement the actions of the Member States in the field of civil protection. Additionally, it seeks to increase the effectiveness of systems for preventing, preparing for and responding to natural and human-made disasters. When activated, the mechanism coordinates assistance or expertise by way of the Emergency Response Coordination Centre (ERCC) of the European Commission.
- Under heading 4 (Global Europe), the **Union Civil Protection Mechanism** supports rapid and efficient disaster response interventions in the event of a major disaster in a non-EU country. It also supports disaster prevention and preparedness activities in eligible non-EU countries.
- The **Emergency Aid Reserve (EAR)** was designed to finance humanitarian, civilian crisis management and protection operations in non-EU countries in order to quickly respond to unforeseen events. The Multiannual Financial Framework (MFF) regulation for 2021-2027 has merged the Emergency Aid Reserve and European Union Solidarity Fund.
- The **European Union Solidarity Fund (EUSF)** follows the specific objective of granting financial assistance to Member States (or countries negotiating their accession to the EU) in the event of a major natural disaster with serious consequences.

It is important to note that the EAR and the EUSF belong to the so-called special instruments which ensure the flexibility of the EU budget and allow the EU to mobilise the necessary funds to respond to unforeseen events. As these instruments can solicit additional financial support, they are over and above the expenditure ceilings of the long-term budget. Nevertheless, the amounts reserved for flexibility instruments cannot go above their own resource ceilings (EC 2022).

In the latest EU long-term budget plan – the Multiannual Financial Framework (MFF) 2021-2027 – the most important change made to the existing tools in the disaster response context was merging the EUSF and EAR to form the new Solidarity and Emergency Aid Reserve (SEAR). This report will examine the advantages and disadvantages of this change as well as the changes made to extend the EUSF to cover losses incurred due to major public health emergencies such as the COVID-19 pandemic. Additional issues addressed in this report are how these tools can be related to other instruments, such as the Union Civil Protection Mechanism or the Cohesion Fund. An additional, major focus will be put on the EUSF. Moreover, the report provides policy recommendations about how to move forward with regard to the challenges identified. Finally, the use of these instruments for major disaster events in recent years are examined.

In the following section, we introduce the instruments in more detail and present an overview of their performance in the past and an outlook on the future. Section 3 then discusses some major events in the past which partly triggered the use of the EUSF and other instruments. In section 4, we provide an assessment of the EUSF with regard to past changes. This analysis forms the basis for a set of policy recommendations which are presented in section 5. Section 6 ends with a conclusion and outlook on the future.

2. TOOLS AND MECHANISMS FOR NATURAL DISASTERS

KEY FINDINGS

- EAR was designed to finance humanitarian, civilian crisis management and protection operations around the world in order to quickly respond to unforeseen events.
- The EUSF follows the specific objective of granting financial assistance to Member States (or countries negotiating their accession to the EU) in the event of a major natural disaster with serious consequences, as well as major public health emergencies.
- UCPM aims to strengthen cooperation between the EU Member States and 6 participating states on civil protection to enhance prevention, preparedness and response to disasters. Additionally, the mechanism should assist in the coordination of disaster preparedness and prevention activities of national authorities and facilitate the exchange of best practices.
- The cohesion policy is the main investment policy of the European Union. It should contribute to strengthening economic, social and territorial cohesion in the European Union.

This section will focus on a discussion of four EU tools and mechanisms which are used to combat losses due to natural disasters. These tools and mechanisms include the European Union Solidarity Fund (whose performance in the past, current form and use during the COVID-19 pandemic will be discussed in detail), the Emergency Aid Reserve, the Union Civil Protection Mechanism and the Cohesion Policy.

2.1. The European Union Solidarity Fund

The 2002 Central European floods triggered an unprecedented political will to institutionalize financial compensation for disaster-stricken EU Member States. This led to the establishment of the European Union Solidarity Fund (EUSF), an ex-post loss-financing vehicle for Member States and candidate countries. The EUSF officially entered into force on 15 November 2002 and has undergone several changes until now.

2.1.1. Initialization period 2002 and time until 2014

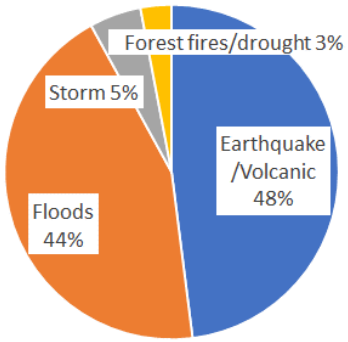
In the event of a major natural disaster, European Union Member States and countries negotiating their accession to the EU can request aid from the EUSF (for an in-depth discussion we refer to Hochrainer et al. 2010). Originally, the fund provided financial aid for emergency measures in the event of a natural disaster causing direct damages above EUR 3 billion (at 2002 prices) or 0.6 % of Gross National Income (GNI) (Council regulation 2002, Article 2(2)). Furthermore, 25 % of the fund had to have been available for allocation during the last quarter of the year (Council regulation, 2002: Article 4(2)). Even if these thresholds were not met, the fund could be mobilized, for instance, when neighbouring states were affected by the same major natural disaster or in case of extraordinary regional disasters which affected the majority of the population of a region and which had serious effects on the region's economic stability and living conditions (Council regulation, 2002).

The payments from the EUSF were limited so as to finance operations undertaken by the public authorities alleviating non insurable damages (e.g. putting infrastructures back in operation) (Council regulation, 2002: Article: 3). The European Commission decided the amount of aid to be granted and proposed its mobilization. During this period, the maximum annual budget was EUR 1 billion per year while the amount annually available for extraordinary regional disasters was limited to 7.5 % of the EUSF's annual budget (Council regulation, 2002: Article: 3). However, the amount actually spent varied from year to year depending on the occurrence of natural hazards. A country affected by a disaster received a lower rate of aid of 2.5 % for the part of total direct damage below the "major disaster" threshold and a higher share of aid of 6 % for the part of the damage exceeding the threshold (Commission Report, 2004).

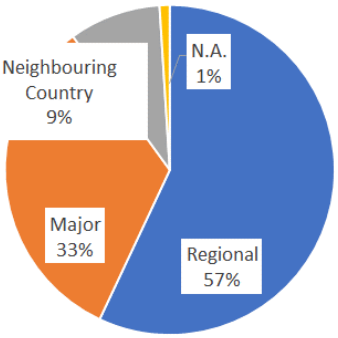
The procedure of applying for the fund was as follows: National authorities submitted an application to the European Commission no later than 10 weeks after the first damage had occurred. Afterwards, the Commission assessed the application and made a decision as to whether or not and how much of the fund was to be used. The agreed-upon aid was paid out in a single instalment after signing an implementation agreement with the beneficiary state and was to be used within one year after the date of receipt. Any part of the grant remaining unused by this date was to be recovered by the Commission. The beneficiary state was to present a report on the financial execution of the grant no later than six months. No changes were made to the regulations governing the EUSF until the beginning of 2014.

For indication reasons of the use of the EUSF, we present some overall information in that regard already here (detailed information will be provided in Section 3). The left-hand side of Figure 2 shows the percentage of the total EUSF support from 2002 to 2020 according to disaster types. As one can see, especially floods and earthquakes/volcanic eruption types of disasters received the most funding from the EUSF. However, it should also be noted that the number of flood events over these years was much higher (over 60 flood events were supported by the EUSF) compared to earthquake/volcanic events (with 10 events supported by the EUSF). This indicates that the latter were much more devastating in terms of losses, while the former were much more frequent in terms of needed support. The right-hand side of Figure 2 shows the different categories eligible for funding from the EUSF. As one can see, the majority of events fell into the regional disaster category followed by major disasters. Also here it should be mentioned that the majority of funding was in relation to the major disaster category. These observations already point to the fact that the EUSF was used for very diverse sets of disaster events in regard to their frequency, magnitude of losses as well as spatial extent. We discuss these issues in more detail in section 3.

Figure 2: Percentage of total EUSF support (2002-2020) per disaster type and according to disaster category (i.e. magnitude).



Percentage of total EUSF support per disaster type between 2002-2020.



Percentage of each category (magnitude) of hazard event the EUSF supported between 2002-2020.

Source: ESIF (2020)

2.1.2. Reform of the Fund 2014-2020 Period

The need to revise the EUSF in time for the new financial period of 2014-2020 was already recognized some years before (A7-0398/2012 report). One emerging problem for the EUSF was the increase in the number of applications and rejections (the following discussion is based on Hochrainer-Stigler et al. 2017). This was not only due to the increase in disaster events but also due to the exceptional rules for funding for "extraordinary regional disasters". This ambiguous term and unclear rules for funding such disasters created biased expectations among Member States applying for aid and resulted in a relatively large number of rejected applications. In the period between 2002–2012, the commission rejected 45 out of 61 requests for aid in this category (including withdrawn applications). This was the main motivation behind the reforms in 2014 and led the Commission to propose the following, more precise definition of a regional disaster: Those regional events, whose damages exceed 1.5 % of regional GDP at the NUTS 2 level are to be considered regional disasters (NUTS 2 refers to regions with an average population size between 800 thousand and 3 million). Furthermore, a threshold of damages equalling 1 % of GDP was set for EU outermost regions.

Another concern was the long delay in financial assistance. Before aid could be granted, several separate commission decisions were required for the finalization, which could take at least 2 to 3 months. The revised regulation simplified the administrative process and allowed advanced payments of up to 10 % of the expected aid. In addition, eligible states had more time (12 weeks after the disaster) to submit their applications and the commission was to have a period of 6 weeks to assess them.

The third reformation concerned the linkage of the assistance to risk reduction efforts. The initial EUSF regulation required the beneficiary state to detail the measures introduced or proposed to limit damage and to avoid, if possible, a recurrence of a similar disaster in the implementation report. This included details relevant within EU legislation on assessment, management and disaster prevention, lessons learned and ways to ensure climate change and disaster proven resilience.

The reforms have strengthened the link between the EUSF and other EU objectives, in particular with regard to climate change and disaster risk reduction. Where applicable, operations financed by the fund shall contribute to the "financial management, public procurement, environmental protection, natural disaster risk prevention and management, climate change adaptation including, where appropriate, ecosystem-based approaches, and with preaccession assistance instruments" (Regulation 2014, p. 10).

In a separate process, and perhaps more importantly, the EUSF funding rules were changed in the EU budget (MFF 2014-2020). Until 2014, the annual amount available was EUR 1 billion; in the MFF 2014-2020; this was reduced by half to a ceiling of EUR 500 million (2011 prices). On the 1st of October each year, at least one quarter of the annual amount is to remain available in order to cover any needs arising for the remainder of that year. Those funds not allocated may be used in the following year, but not thereafter. In exceptional cases, the new legislation also allowed the use of funds allocated for the following year. A summary of changes can be found in Table 1 below which is based on the analysis by Bachtler et al. 2018.

Table 1: Changes from the pre-2014 to post-2014 EUSF reforms

Arrangements, post 2014 reform	**Change from original (2002) framework**
Categories, thresholds for applications:	
Major natural disaster (damage over EUR 3 billion at 2011 prices or over 0.6% MS GNI);	Previously: calibrated to 2002 prices;
Regional natural disaster (damage >1.5% NUTS 2 GDP (1%, for outermost regions);	No explicit threshold for regional or outermost regions, but share for "regional" limited to 7.5% of total damages;
Neighbouring eligible country (threshold not specified, but based on damage in neighbour).	No change
Application process:	
Required elements of application form	Minor revisions
Deadline of 12 weeks from occurrence of disaster (potential extensions)	Previously: 10 weeks
Stipulates shared-decision making between the EC, EP and Council	Previously: two stages of final decision
Describes decision-making process with expectation of six-week timeframe 'counting from the date of receipt of the complete application and excluding the time needed for translation'	Previously: 'as quickly as possible'; no mention of 'complete application'
Art. 4a Outlines rules for advance payment on request of beneficiary State, not exceeding 10% of anticipated grant	Previously: No advance payment

Implementation arrangements: Shared management between EU and beneficiary States EU: manage and financially control the operations and conduct checks MS: implementation of assistance, including selection of operations Candidate country in accession talks: delegation agreement	Minimal changes
Implementation and closure: Deadline for implementing EUSF: 18 months Requirements for implementation report to be produced after six months Must provide information on preventive measures	 Previously: 12 months No change Less extensive information required
"**Borrowing**" from following year`s budget if funding exhausted and carrying over of unspent amounts to next year	Previously: less flexible, albeit higher budget ceiling
Budgetary Ceiling: Up to a maximum annual total of EUR 500 million at 2011 prices since the start of the 2014-2020 multi-annual financial framework. On the 1st of October each year, at least one quarter of the annual amount of the fund should remain available in order to cover needs arising until the end of the year	Previously: up to a maximum annual total of EUR one billion (at current prices)

Source: Bachtler et al. (2018)

No further changes were made after the 2014 reform up until 2020, when the COVID-19 pandemic started. However, several studies looked at the EUSF performance after the post 2014 reform (see Hochrainer-Stigler et al., 2017; Bachtler et al., 2018 and in regard to policy related topics, we especially refer to van Lierop 2021).

2.1.3. The coronavirus pandemic and EUSF

Due to the COVID-19 pandemic and as a part of the EU coordinated package responding to it, the scope of the EU Solidarity Fund was extended by a modifying regulation which was adopted on 1 April 2020. The amendment includes public health crises within the scope of the EUSF to allow its mobilization, i.e.

> "a major public health emergency having taken place on the territory of the same eligible State". The definition of a "major public health emergency" includes any life-threatening or otherwise serious hazard to health of biological origin in an eligible

> State seriously affecting human health and requiring decisive action to contain further spreading, resulting in a public financial burden inflicted on the eligible State for emergency response measures estimated at over EUR 1 500 000 000 in 2011 prices, or more than 0,3 % of its GNI" (REGULATION 2020/461).

Similar to the threshold approach for financing public spending for natural disasters, also for major public health emergencies a threshold approach was adopted, i.e. a country affected by a major public health emergency receives a lower rate of aid of 2.5 % of the total amount of public spending below the EUR 1.5 billion threshold (or below 0.3 % of its GNI) and a higher share of aid of 6 % of the total amount of public spending above the same threshold. The Commission received 22 applications for financial support from the EUSF including 19 Member States and three accession countries by the deadline of 24 June 2020 (the following information is based on European Court of Auditors 2021). Eligible expenditures included medicines, equipment and medical devices, laboratory analyses, personal protective equipment, special assistance to the population and development of vaccines or medicines. Around 17 Member States plus three candidate countries received EUSF payments. In October 2020, the European Parliament and the Council approved the Commission's proposal to provide advance payments to the following countries, Germany, Ireland, Greece, Spain, Croatia, Hungary and Portugal which summed up to around EUR 132.7 million for support. This was followed by the adoption of a further package of financial support of EUR 385.5 million under the EUSF. Table 2 below shows the actual costs and EUSF payments for all seventeen Member States and the three accession countries which received assistance from the EUSF that cumulated to around EUR 530 million of assistance.

Table 2: EUSF contribution to states due to major public health emergency since 2020

Beneficiary State	Occurrence	Total eligible public expenditure (million EUR)	EUSF aid (million EUR)
Albania	March 2020	54.8	0.9
Austria	February 2020	1798.9	31.8
Belgium	February 2020	2132.1	37.3
Croatia	February 2020	358.5	7.6
Czech Republic	March 2020	959.2	17.4
Estonia	February 2020	171.9	3.6
France	January 2020	4284.6	91.4
Germany	January 2020	2079	29.1
Greece	February 2020	623.9	8.5
Hungary	March 2020	1633	39.7
Ireland	February 2020	1996.3	43.8
Italy	February 2020	3749.6	76.2

Latvia	March 2020	91.9	1.2
Lithuania	February 2020	176.9	2.8
Luxembourg	February 2020	168.2	2.9
Montenegro	March 2020	15.3	0.2
Portugal	March 2020	2318.9	55.6
Romania	February 2020	841.4	13.9
Serbia	March 2020	495.4	11.9
Spain	January 2020	2941.7	53.5
Sum		**26891.5**	**529.3**

Source: European Commission (2022b)

Table 2 already indicates that public expenditure mobilized for responding to the COVID-19 pandemic were enormous with up to EUR 26.9 billion in total for all states receiving assistance from the EUSF. As has already been noted, the amendment was part of the overall package proposed by the Commission to tackle the effects of the coronavirus crisis also known as the Coronavirus Response Investment Initiative (CRII) (see European Commission 2020a).

Before moving forward about the most recent changes within the multiannual financial framework 2021-2027, where the EUSF was merged with the Emergency Aid Reserve, we discuss this tool first.

2.2. The Emergency Aid Reserve

Unlike other EU instruments, surprisingly little information can be found about the Emergency Aid Reserve (EAR) including an assessment of its performance in the past. To start with, the Emergency Aid Reserve, like the EUSF, is a special instrument outside the multiannual financial framework and is designed to allow the EU to mobilise the necessary funds to react to unforeseen events such as crises or emergencies. It is supposed to facilitate rapid response to specific aid requirement of third countries following unforeseen events. First and foremost, resources are to be used for humanitarian operations but also for civil crisis management and protection as well as particular pressures resulting from migratory flows at the EU's external borders. The annual budget for the EAR amounted in the period 2014-2016 to EUR 280 million (2011 prices) and may be used up to n+1 year. Furthermore, the amount from the previous year is to be used first and the annual amount from year n not used in year n+1 is to lapse.

Table 3: Emergency Aid Reserve Use and Further Information

Year	2014	2015	2016	2017	2018	2019	2020
Annual amounts (in 2011 prices)	280	280	280	300	300	300	300
Annual amounts in current prices	297	303	309	337.8	344.6	351.5	358.5
Carried over from the previous year	0	198.9	219.4	98.6	61.7	34.1	45.6
Annual usage	98.1	282.5	429.8	374.7	372.2	340	
Carried over to the following year	198.9	219.4	98.6	61.7	34.1	45.6	
Lapsed	0	0	0	0	0	0	0

Source: European Commission (2020b)

In the period between 2007-2013, the annual fund was smaller at about EUR 221 million and was increased afterwards. The amount was further increased in 2017 (mid-term revision) to about EUR 300 million per year in 2011 prices (or EUR 358,5 million in 2020 current prices). Table 3 above provides some related information of the fund's usage between 2014 and 2020. It can be read as follows: In 2014, no money was carried over from the previous year. The annual usage of the fund that year was EUR 98.1 million, which resulted in a carried-over amount of about EUR 198.9 million, i.e. EUR 297 million minus EUR 98.1 million, to the following year. Hence, in 2015 there were EUR 501.9 million available (i.e. EUR 198,9 million plus EUR 303 million, in current prices). The annual use of the fund for 2015 was EUR 282.5 million, which resulted of a carried-over amount of about EUR 219.4 million to the next year. The following years can be read in a similar fashion. Note that the carried-over amount was always smaller than the actual usage for the next year. As the carried-over amount is to be used first, no money was lapsed in the period between 2014-2020.

In the same period, the EAR was mobilised, for instance, when funding was needed for healthcare, nutrition and food security, sanitation and water in Rohingya refugee camps in Bangladesh in 2017/2018. It also provided medicines, food and protection for Venezuelan people affected by this crisis.

As will be discussed in the following section, the emergency aid reserve will continue to play an integral part under the new multiannual financial framework. It will address extraordinary situations that cannot be tackled by the emergency funding within specific programmes. More importantly, however, the reserve will now also be used for emergencies within one of the Member States.

2.3. Merging the EUSF and EAR: The MFF 2021-2027

The most recent MFF for the period of 2021-2027 has an overall ceiling for commitments set at EUR 1,074.3 billion. As already indicated, this period saw the merging of the EUSF and EAR to create the **Solidarity and Emergency Aid Reserve (SEAR)**. The new SEAR will have a maximum annual budget of € 1.2 billion, of which a maximum of 50 % may be mobilised to finance assistance for emergency situations resulting from major disasters covered by the EUSF. Where the remaining resources

available in the SEAR are insufficient to cover the amounts necessary for EUSF assistance in the year of the disaster, the Commission may, in exceptional circumstances, draw on the annual amounts available for the SEAR in the following year up to a maximum of EUR 400 million. More specifically, it is stated that the SEAR 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." (Council Regulation, 2020/2093)

It should be noted that under a) this also includes major public health emergencies having taken place on the territory of the same eligible state as discussed in section 2.1.3.

Similar to the previous EUSF procedure, general capitalization rules state that the portion of the annual amount not used in year n may be used up in the next year and that the portion of the annual amount stemming from the previous year shall be drawn on first. Similarly, these resources shall lapse if they are not spent the following year. Hence, the absolute maximum of SEAR funding for a given year is EUR 2.4 billion. As for capitalization levels throughout the year, the procedure is quite complicated (and will be discussed in more detail in section 4).

Furthermore, it is stated that "[o]n 1 October of each year, at least one quarter of the annual amount referred to in paragraph 2 shall remain available in order to cover needs arising until the end of that year. Without prejudice to the first subparagraph, the following maximum percentages of the overall amount available until 1 September of each year may be mobilised:

- 50 % for assistance under point (a) of paragraph 1; the amount resulting from that calculation shall be reduced by any amount mobilised in the previous year in application of paragraph 5,
- 35 % for assistance to third countries under point (b) of paragraph 1,
- 15 % for assistance within the Union under point (b) of paragraph 1" (Council Regulation, 2020).

The introduction of maximum percentages of the overall amount available for the use of the SEAR until 1 September already causes some uncertainties in regard to possible funding levels as this will be also dependent on the previous year mobilization of the fund.

However, it is further stated that "[i]n exceptional cases and if the remaining financial resources available in the Solidarity and Emergency Aid Reserve are not sufficient to cover the amounts considered necessary for assistance under point (a) of paragraph 1 in the year of occurrence of a disaster as referred to in that point, the Commission may propose that the difference be financed through the annual amounts available for the Solidarity and Emergency Aid Reserve in the following

year, up to a maximum amount of EUR 400 million (in 2018 prices)" (Council Regulation, 2020). As at least one quarter of the annual amount shall remain available until October, there may be the case that some part of the annual amount in the following year needs to be used for financing eligible losses in the current year.

A further complication arises due to the fact that it is stated that "[w]ithout prejudice to the first subparagraph, as of 1 September of each year, the remaining part of the amount available may be used for any assistance referred to in the second subparagraph to cover needs arising until the end of that year." (Council Regulation, 2022). Hence, the remaining amount after the 1st of September can be used for either EUSF or previously EAR related activities. This again creates uncertainties in regard to available funding for each of them as this also depends on the sequence of emergency or disaster events until the end of the year.

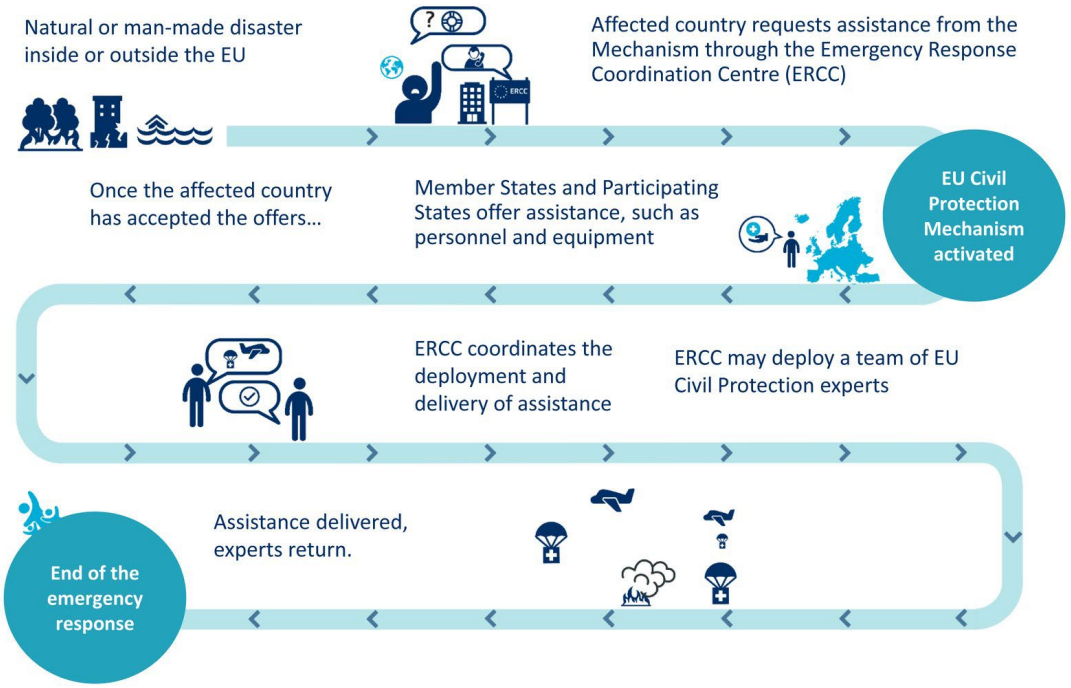
It was already pointed out by van Lierop (2021) that in regard to financial resources, the European Parliament voiced its concerns regarding the merger of the EUSF with the EAR, especially as the allocation of the EUSF remains uncertain since it depends on the amounts of allocation under the EAR (see section 4 for more details). Additionally, the Parliament called for the latest risk prevention principles to function as the criteria for determining the eligibility of projects for assistance and hence asked that the 'Build Back Better' principle be fully integrated into Article 3 of the EUSF Regulation. Lastly, while the extension of the fund's scope to cover health emergencies was welcomed, as van Lierop (2021) pointed out, the Parliament took the view that the broadening of the EUSF's scope will require a larger budget. Additionally, the importance of informing the public of the EUSF's tangible benefits was stressed. We discuss these issues in more detail in section 4.

2.4. EU Civil Protection Mechanism

The EU Civil Protection Mechanism was established in October 2001. The main aim was to strengthen cooperation between the EU Member States and six participating states (Iceland, Norway, Serbia, North Macedonia, Montenegro, and Turkey) on civil protection to enhance prevention, preparedness and response to disasters. Additionally, the mechanism should assist in the coordination of disaster preparedness and prevention activities of national authorities and facilitate the exchange of best practices.

As already indicated in the introduction, any country in the world (but also the United Nations and agencies or a relevant international organisation) can ask for assistance from the UCPM. In case that an emergency overwhelms the response resources of a country in Europe and beyond, the affected country can request assistance by means of the Mechanism as depicted in Figure 3. The Emergency Response Coordination Centre (ERCC) is usually mobilized for assistance or expertise following a request for assistance. As an additional asset to the Mechanism, also a European reserve of additional capacities (the rescEU reserve) was established. The reserve can be used for firefighting planes and helicopters or medical equipment. Budget allocation for the 2014- 2020 period (under heading 3) was EUR 766.5 million and EUR 157.7 million (under heading 4). The mechanism is seen to be performing strongly over the recent years (EC 2021): The mechanism has, for instance, been instrumental in fostering a culture of prevention among Member States. The Eurobarometer survey measuring risk awareness levels revealed a positive trend between 2015 and 2020.

Figure 3: Union Civil Protection Mechanism Assistance Procedure

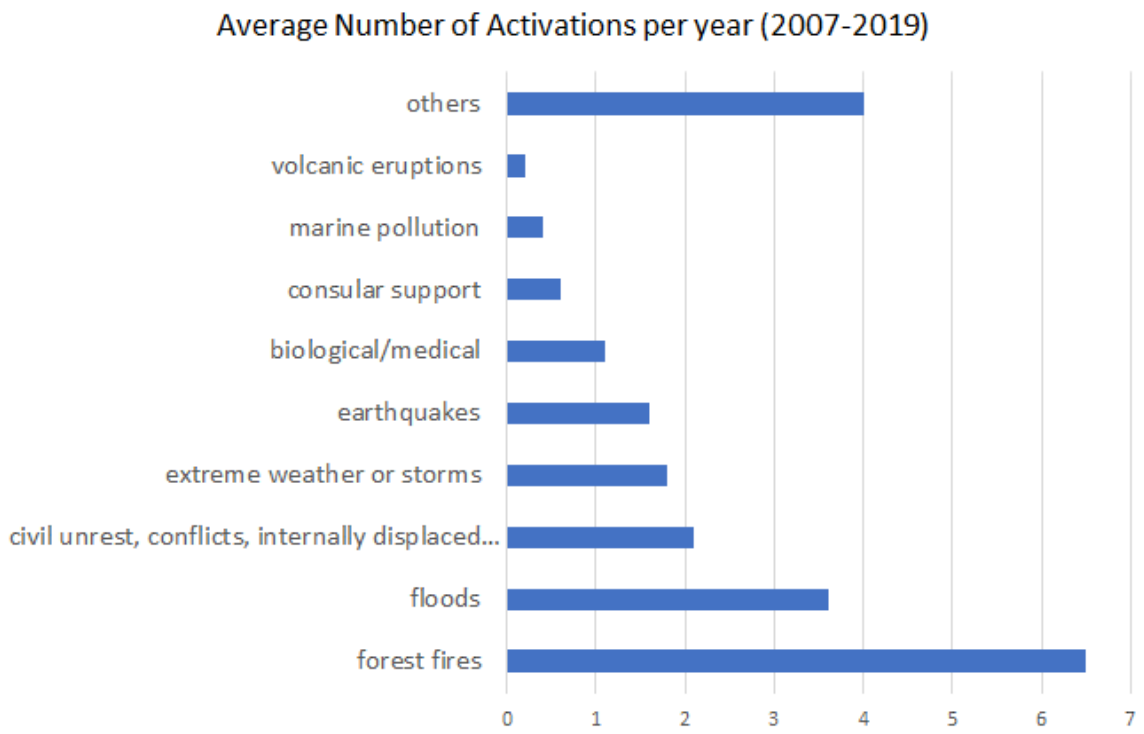


Source: https://ec.europa.eu/echo/what/civil-protection/eu-civil-protection-mechanism_en

In 2020, the Mechanism was activated 102 times, compared to 20 times in 2019. The sharp increase in activations from 2020 to 2021 was mainly due to the COVID-19 pandemic. In 2021, 84 countries and international organisations requested assistance from the EU Civil Protection Mechanism. From a total of 114 activations, 36 were required inside the EU while 78 were needed outside its territories. Similarly to 2020, the EU Civil Protection Mechanism was mostly used to combat COVID-19 in 2021. However, the mechanism was also activated to help countries deal with natural disasters. The Mechanism was, for instance, activated due to floods in Belgium, forest fires in the Mediterranean, the Western Balkans and Austria, repatriations from Afghanistan and the earthquake and hurricane in Haiti.

Looking further back in time, the UCPM was activated more than 500 times between 2007 and 2019. Figure 4 below indicates the average activations in the last decade and shows that it was especially forest fires as well as floods for which most often support was needed. Nevertheless, all other types of hazards including earthquakes as well as storms were also represented.

Figure 4: Union civil protection mechanism activations by hazard type



Source: Infographics 2022

For the new MFF 2021-2027, the Union Civil Protection Mechanism budget amounts to EUR 3.3 billion. This includes the MFF allocation of EUR 1.263 billion and the additional Next Generation EU allocation of EUR 2.056 billion as a temporary reinforcement addressing recovery needs as a result of the COVID-19 crisis (EC 2021). Furthermore, a newly revised legislation on civil protection was adopted in May 2021 with the aim of strengthening the Mechanism and putting in place a reinforced and more ambitious crisis management system (see REGULATION (EU) 2021/836).

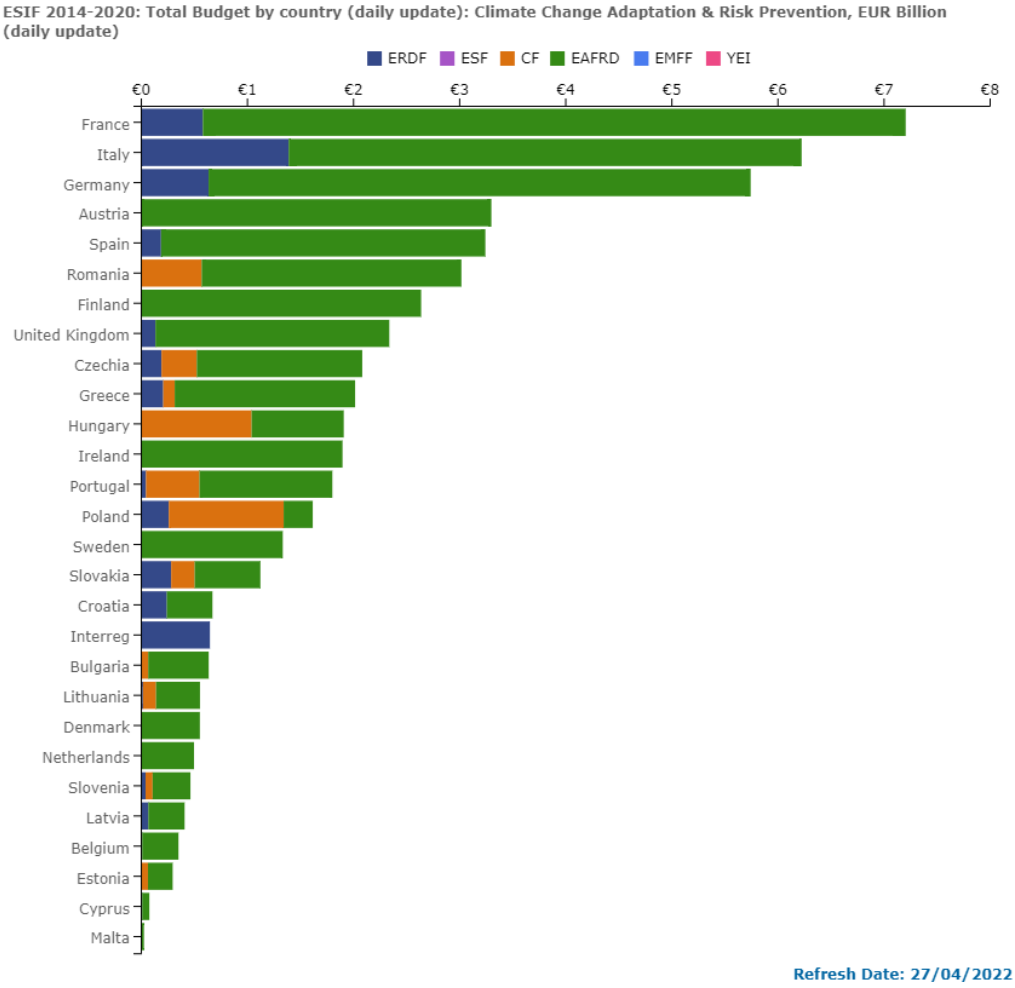
2.5. Cohesion Policy

The Cohesion Policy is the main investment policy of the European Union. It should contribute to strengthening economic, social and territorial cohesion in the European Union. Its focus is to correct imbalances between countries and regions. The Cohesion Policy is delivered through specific funds, the so-called European Structural and Investment Funds (ESIF), including the European Social Fund (ESF), the European Regional Development Fund (ERDF), the Cohesion Fund (CF), the European Maritime and Fisheries Fund (EMFF), the European Agricultural Fund for Rural Development (EAFRD). Here we restrict our attention to disaster related dimensions.

The EU Cohesion Policy protects citizens through investments, for example, in forest fire prevention, flood risk management and resilience against multiple disaster risks including weather events that very often go beyond national borders (e.g. the flood events in 2002) and are aggravated by climate change. Specific challenges due to different hazards are also related to the geographic position of the Member State, e.g. southern and central Europe experiencing more heat waves, forest fires and droughts while northern and north-eastern Europe faces heavier rain fall and flooding as well as sectoral challenges, for example, in tourism and agriculture. As local and regional authorities are the

very first ones to be confronted with the impacts of a disaster event, the EU Cohesion Policy is key to disaster risk management. Figure 5 provides some information in regard to EU funding under the different ESIF between 2014 to 2020.

Figure 5: Total EU financing under the different ESIF (2014-2020) in current prices



Source: https://cohesiondata.ec.europa.eu/themes/5

It is worthwhile noting that, compared to the EUSF, which focuses on the immediate aftermath of a disaster, ESIF funds usually take a more long-term perspective of investments in civil protection, preventive infrastructure and strengthened administrative capacity for all stages of the disaster circle, e.g. preparedness, prevention and management (EC 2019). For the MFF 2021-2027, EU funds allocated to the Cohesion Policy amount to EUR 392 billion. Additionally, the Just Transition Fund was included which should support regions most affected by the transition towards climate neutrality .

3. RECENT USE OF THE EUSF

KEY FINDINGS

- Large fluctuations in the number of applications and funding from the EUSF could be observed in recent years.
- Europe was exposed to very different kind of disaster events in the last 4 years including large scale earthquakes, cross-border flood events as well as volcanic eruptions in outermost regions.
- Not all countries affected make use of all available instruments.

In this section, we provide some overall information on the EUSF's use in the recent past including some more detailed case specific analyses. As will be seen, the number of applications as well as funding levels can change quite significantly from one year to another. In 2019, the Commission received four applications for assistance after natural disaster events. States applicating for assistance included Austria with regard to extreme weather conditions in October 2018, Greece due to the storm in Crete in early 2019, Portugal regarding hurricane Lorenzo in the Azores and Spain regarding extreme weather phenomena. A rather modest payment of EUR 78 million was paid out in total for applications received in 2019, while some follow-up payments for disasters that year were received in 2020 (EC 2021).

In 2020, the Commission received nine applications for natural disaster assistance. Applicants included Italy regarding extreme weather damage culminating in the flooding of Venice in late 2019, Austria following the extreme weather events of November 2019, Spain following the damage caused by storm Gloria in January 2020, Croatia following the devastating earthquake on 22 March 2020 that hit the city of Zagreb and the surrounding area, Poland regarding the floods in Podkarpackie region in June 2020, Greece regarding the floods in the region of Sterea Ellada in August 2020 as well as the damage caused by Mediterranean cyclone Ianos in September 2020, France due to the damage caused by storm Alex in October 2020 and Italy which was hit by storm Alex in the Piedmont, Liguria and Valle d'Aosta regions in October 2020. The applications from Spain and Italy's second application did not exceed the national and regional disaster thresholds and were, therefore, rejected. Contrary to the 2019 situation, around EUR 900 million were paid out for applications received after natural disasters in 2020 (EC 2021).

As already indicated in section 2.1.3, due to the COVID-19 outbreak, the scope of the EUSF was extended in March 2020 to cover major public health emergencies. The Commission received 22 applications for financial support from the EUSF before the deadline of 24 June 2020. Based on a preliminary assessment in 2020, the Commission provided EUR 133 million in advance payments to Germany, Ireland, Greece, Spain, Croatia, Hungary and Portugal. At the beginning of January 2022, the Commission completed the payments of the EUSF assistance to 20 countries for a total amount of EUR 385 million (recipients included Austria, Belgium, Croatia, Czechia, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Portugal, Romania, Spain, and the three candidate countries Albania, Montenegro and Serbia).

In 2021, severe natural disaster events happened in Europe including earthquakes in Croatia, large scale flood events in July in Germany, Belgium, France, Luxembourg and the Netherlands, forest fires

across much of the Mediterranean region in August 2021, and the volcanic eruption in La Palma, Spain. Due to these events taking place very recently, only limited information is yet available in regard to EUSF applications and other EU tools used to respond to these disasters, e.g. on the 18 March 2021, the Commission received an EUSF application from Croatia in relation to a series of earthquakes. On 3 December 2021 the Commission received an application from Spain in regard to the eruptions of the volcano Combre Vieja on the island La Palma. While some countries requested assistance from the Union Civil Protection Mechanism or EUSF, others affected by the same disasters did not.

In what follows, we focus on some specific case studies of selected disaster events which have happened recently to demonstrate the diversity in magnitude of losses, the different types of hazard events that can realize as well as the different socioeconomic backgrounds under which such disasters occur.

3.1. Case Studies

As stated by Lierop (2021), the July 2021 floods hitting Belgium, France, Germany, Luxembourg and the Netherlands as well as the forest fires in Cyprus, Greece and Italy have highlighted how vulnerable the EU is to the forces of nature. Therefore, the following section takes a closer look at very recent disaster events within Europe and the damages they caused. The disaster events in question are the earthquakes in Croatia in 2020/2021, the flooding in Belgium, the Netherlands, Germany, France and Luxembourg in 2021, and the volcanic eruption in La Palma, Spain. Each subsection starts with some overall information of the country.

3.1.1. Croatia Earthquake 2020/2021

Croatia covers around 1.3 % of the EU area with a land areas of approximately 56 600 km^2. It has a population of roughly 4.1 million which is approximately 0.8 % of the EU total population. Its share in EU GDP is around 0.3 % and its GDP per capita of roughly EUR 13 460 is below the EU27 average of EUR 27 810 (Eurostat 2022). The country is exposed to various natural hazards including earthquake and flooding. The earthquake event on 28 December 2020 with a seismic magnitude of 5,0 ML which hit the Petrinja area, was just the foreshock of the earthquake that took place the following day which reached a magnitude of 6,2 ML and caused casualties and significant damages. After the initial shock, a series of aftershocks affected the epicentre area including more than 4000 aftershocks in the first few months.

The Republic of Croatia applied for financial assistance from the European Union Solidarity Fund on the 18 March 2021 related to this series of earthquakes occurring between 28 December 2020 and 21 February 2021. With an estimated total direct damage of around EUR 5.5. billion, the event again showed the devastating large losses that earthquakes can cause (RDNA 2021). The damages exceed the GNI threshold (10.21% of GNI) as well as the major disaster threshold and, therefore, qualified as a major natural disaster. Croatia estimated that the cost of emergency and recovery operations amounted to around EUR 1.66 billion, most of it in regard to costs for temporary accommodation (EUR 368 million), immediate restoration of affected natural zones (EUR 304 million) and cleaning activities (over EUR 228 million). It was decided that the EUSF would allocate EUR 319 million to Croatia with an advanced payment of around EUR 41 million. Note that the advance payment was accepted on 23 June 2021 and the remaining amount of EUR 277 million was transferred from the SEAR.

Additionally, the Croatian Government activated the Union Civil Protection Mechanism to provide rapid and effective assistance to the affected population. Following the activation and communication with the Emergency Response and Coordination Center, 15 member countries - as well as the United States, and Montenegro bilaterally provided support. This included immediate assistance such as housing containers, winter tents, sleeping bags, beds and electric heaters. This should exemplify that less wealthy countries in the EU (compared to the average in the EU) can also experience large losses and can also receive exceptional large payments from the EUSF. It should further be mentioned that for the 2014-2020 programming period, Croatia was allocated around EUR 8.6 billion (2014 prices) in total for 2 operational programmes under the EU Cohesion Policy (EC 2014a).

3.1.2. Western Europe Flooding 2021

In the middle of July 2021, areas of Western Europe that included parts of Germany, Belgium, the Netherlands, France and Luxembourg experienced extreme rainfall that led to severe flooding causing catastrophic consequences both in human and economic terms. We take a look at some most impacted countries and provide a snapshot of the socio-economic situation of these countries.

Belgium covers a land area of 30 689 km^2, which are a mere 0.73% of the total land area of the EU. Its population of 11.6 million (January 2021) makes up 2.6% of the population of the EU27 with a population density of 377.3 per km^2.^{2}. Its unemployment rate lies at 6.3% at the beginning of 2021 (Eurostat 2022). Compared to the average of EUR 27 810 GDP per capita in the EU-27, Belgium's GDP per capita is higher at EUR 35 850. Belgium has dedicated funds to cover disaster costs at the local level and reserve and contingency funds are quite high according to some estimates, i.e. EUR 1.191 billion (World Bank 2021).

Prior to 2017, Belgium did not receive any financial aid from the EUSF, neither did it apply for such. In 2020, as a response to the major public health crisis due to the COVID-19, Belgium applied for financial assistance from the EUSF and in 2021 it received EUR 37.3 million for coping with the effects of the COVID-19 pandemic. With regard to the flood events in 2021, damage estimates are not fully available yet. However, as a reference, insurance companies received claims for a total amount of EUR 2.164 billion by 30 September 2021, with Wallonia recording EUR 2.07 billion of insured losses alone. Belgium did not apply for funds from the EUSF but it requested assistance from the Union Civil Protection Mechanism on 14 July 2021. Assistance took the form of, for instance, flood rescue teams and helicopters and over 150 rescue workers from France, Italy and Austria which supported the disaster response in Belgium. For the 2014-2020 programming period, Belgium was allocated around EUR 2.28 billion in total for eight operational programmes via the Cohesion Policy (EC 2014b).

With 357 600 km^2, **Germany** shares 8.5% of the EU's land area. It has 83.2 million inhabitants, which amount to 18.6% of the total population of EU27 and a population density of 235.2 per km^2. Its unemployment rate lies at 3.6% in 2021 (Eurostat 2022) and with EUR 35 290, its GDP per capita lies above the EU-27 average of EUR 27 810. While Germany imported goods and services worth EUR 1 497 044 million, its exports were valued at EUR 1 694 583 million.

In 2020, Germany, among other countries, requested financial aid from the EUSF to assist in managing the damages caused by the COVID-19 pandemic and it also applied for advance payments of parts of this amount. Around EUR 15.5 million were paid out in advance and Germany received additional financial aid from the EUSF in 2021 of about EUR 13.6 million. Regarding natural

disasters during 2021, the flood events in July caused overall losses of about EUR 33 billion. However, the insured portion was small due to uninsured infrastructure losses and limited insurance density (around EUR 8.2 billion of insured losses). It was the costliest natural disaster in Germany to date. While Germany considered applying for assistance by the EUSF, no final decision has yet been made. Furthermore, Germany did not indicate need for assistance from the Union Civil Protection Mechanism. For the 2014-2020 programming period, Germany was allocated around EUR 19.2 billion in total via the Cohesion Policy which funded 32 operational programmes (EC 2014c).

With a land area of 41 543 km^2, the **Netherlands** make up for approximately 1% of the land area of the EU. It has a population of roughly 17.5 million, which constitutes 3.9% of the population of EU27, and a population density of 507.3 per km^2. [2]. Its unemployment rate lies at 4.2% (Eurostat 2022). Compared to real GDP per capita of EUR 27 810 in the EU-27, the GDP per capita in the Netherlands amounts to EUR 41 970. Exports amount to EUR 721 851 million, while its imported goods and services are valued at EUR 625 887 million.

The Netherlands did not apply for financial aid from the EUSF prior to 2018 and did not apply for financial aid from the EUSF due to the COVID-19 pandemic. Regarding the flood event in 2021, costs are still unclear with estimates ranging from EUR 300 to EUR 600 million in damages (Jonkman 2021). Neither assistance from the EUSF nor the Union Civil Protection Mechanism was requested. Between 2014 and 2020, the Netherlands were allocated around EUR 1.4 billion in total Cohesion Policy funding for five operational programmes (EC 2014d).

Luxembourg is a small country with a total land area of about 2 586 km^2 and a population of about 634 730. The population density is around 239.8 per km^2. Its unemployment rate lay at around 5.3% in 2021 and its GDP per capita is very high with around EUR 86 550 compared to the EU-27 average of EUR 27 810 (Eurostat 2022). Luxembourg has received around EUR 2.9 million from the EUSF to support emergency measures against the COVID-19 pandemic since 2020. The extreme flood events across Western Europe also had severe impacts on Luxembourg with the highest rainfall being recorded on 14 July 2021 since the start of recordings nearly 170 years ago. Around 1000 people needed to be evacuated and material damage was estimated to be around EUR 125 million (Ambiental 2021). Yet, Luxembourg did not apply for assistance from the EUSF due to a natural disaster event. For the 2014-2020 programming period, Luxembourg was allocated EUR 59.7 million in total and manages two operational programmes under EU Cohesion Policy (EC 2014e)

By surface area, **France** is the largest EU country with about 633 186 km^2 and a population of about 67.7 million and population density of 106.1 per km^2. Total unemployment rate is higher than the EU27 average of 7.0% with around 7.9% in 2021 (Eurostat 2022). Compared to real GDP per capita of EUR 27 810 in the EU27, the GDP per capita is larger in France with around EUR 32 650.

Like the other countries presented so far, also France requested assistance from the EUSF due to the COVID-19 pandemic and received around EUR 91 million. Additionally, France received assistance from the Fund (around EUR 53 million) to recover from the storm Alex during October 2020. However, for the 2021 summer flood events no application for assistance from the EUSF has yet been submitted. It should be noted that for 2014-2020, France was allocated around 15.9 billion in total Cohesion Policy funding for 41 operational programmes (EC 2014f).

3.1.3. Spain: La Palma Volcano 2021

Spain's land area covers 505 990 km^2, which amounts to roughly 12% of the total land area of the EU. Its 47.4 million inhabitants make up 10.6% of the population of EU27. Spain's population density lies at 93.8 per km^2. Total unemployment rate was 14.8% in 2021 (Eurostat 2022). With EUR 23 510, the GDP per capita in Spain lies below the average GDP of EUR 27 810 of the EU27. The goods and services exported from Spain are valued at EUR 415 801 million, while its imports are worth EUR 398 297 million. This case study is especially interesting as it hit a so-called outermost region (geographically very distant from the European continent), i.e. the Canary Island, and, more specifically, the island of La Palma.

La Palma is a volcanically active area which experienced an eruption of the Cumbre Vieja volcano from 19 September to 15 December 2021. Around 1200 hectares of land were devastated due to this event, which caused large damages especially to network infrastructure, residential assets and the agricultural sector. Spanish authorities estimated around EUR 662 million of total direct damages, which is considerable given the small size of the region. Note that for regional disasters, the EUSF intervenes when the total direct damage exceeds 1.5% of GDP of a region. For outermost regions, however, this threshold is lower at 1% of the regional GDP. Assistance from the EU Solidarity Fund were granted to Spain as an advance payment and amounted to about EUR 5.4 million. These fundings were aimed at covering the costs of immediate emergency and recovery operation. This advance payment was made after Spain submitted the application for the EUSF on 3 December 2021 (European Commission, 2022). For the 2014-2020 program, around EUR 28.6 billion were allocated to Spain from the Cohesion Policy funding 22 operational programmes (EC 2014g).

The selected examples indicate that Europe is indeed exposed to very different kinds of disaster events, including large scale earthquakes, cross-border flood events as well as volcanic eruptions within outermost regions. These events also show that while losses can be very high (especially also in wealthy regions of the EU), not all countries affected actually make use of all available instruments. The EUSF or the Civil Protection mechanism, for instance, may not always be called upon in the affected regions. Their application is, therefore, case specific. This can be due to several reasons which will be discussed in the next sections in more detail.

4. ASSESSMENT OF THE SOLIDARITY AND EMERGENCY AID RESERVE

KEY FINDINGS

- In contrast to major public health emergencies and emergencies as set out in the EAR, the risk of losses due to natural disasters is measurable.
- Contingent liabilities due to natural disaster events and major public health emergencies are different in nature, including the assessment of possible costs. Therefore, they should not be managed using the same instrument. Natural disasters have the potential to be transformed from a contingent obligation to a direct obligation and, thus, can be included in regular budget practices. This is not the case for major health emergencies.
- If a public health emergency occurs, it drains resources from the EUSF while, at the same time, the need of assistance from the EUSF increases in countries in the event of a disaster. Simultaneously, the risk increases that the EUSF is not able to provide the assistance to do so due to limited funding availability (and vice versa). Therefore, providing financial assistance from the same fund in case of natural disaster events and major public health emergencies is diametral to the concept of solidarity as both are intrinsically related.
- Past performance of the EUSF is not indicative of adequate capitalization levels as we show that the EUSF would be under severe stress and default under various plausible scenarios of past weather events in the EU's outermost regions.
- Merging the EUSF and the EAR into SEAR considerably increases the uncertainty of possible shortages in capitalization for the EUSF and makes it essentially impossible to determine appropriate funding requirements for current and future natural disaster events.
- The link between the EUSF and possible other instruments in regard to disaster risk reduction can be established through different cohesion policy investments. Especially risk reduction and building back better may reduce future EUSF needs.

We have introduced some important tools and mechanisms on how the EU can respond to natural disasters (section 2) and how these tools were used in the recent past (section 3) under quite different circumstances. In what follows, we take a closer look at these tools, especially the EUSF within the SEAR. Various and quite comprehensive major assessments and performance reviews for the EUSF were done in the past which led to some reforms with regard to different aspects the EUSF should cover, e.g. solidarity aspects, advanced payments or timely pay-outs (Hochrainer-Stigler et al. 2017, Bachtler et al. 2018, EC 2021). For example, a very comprehensive evaluation of the European Union Solidarity Fund was done in 2019 (EC 2019). There it was found that the EUSF is effective in responding to requests for aid as well as that the EUSF's support is considered relevant for post-disaster needs. Quite importantly, also the media image of the EUSF support is predominantly factual or positive with around 60 % of the people in the EU being aware of the existence of the EUSF. Other studies focused on quite specific topics such as financial resilience and the EUSF (e.g. Hochrainer-Stigler et al. 2017). A World Bank study (2021), for instance, found that the sum of the EUSF, reserve funds and contingency funds available to Member States covers, on

average, less than 4% of the total government liabilities each year when analysed from an EU perspective. The report recommended incentivizing insurance to encourage higher uptake by households that can halve government liabilities. A recent analysis by Lierop (2021) focuses on more policy relevant aspects and emphasises the role of stakeholders, advisory bodies and the European Parliament.

In this section, we first take a look at the new structure under the MFF 2021-2027 and some specific challenges not yet addressed in the past. The starting points of our assessment are the recent reforms made including the expansion of the cover of the fund to include public health crisis as well as the merging of the EUSF with the Emergency Aid reserve. In more detail, in this section we want to take a look at

- the argument that because the EUSF had sufficient resources in the past, the capitalization levels currently set out in the MFF 2021-2027 are appropriate. Using a storyline approach, we show that such perceptions should be extended by considering realistic what-if scenarios from the past.
- the argument that the EUSF is intended for unforeseeable natural disaster events and therefore should not be included in the MFF budget. We show and argue that this argument is not valid and that the EUSF could be included in the MFF from the perspective of contingent liabilities that are normally incurred by governments in relation to the fiscal risk they face.
- the new difficulties arising due to the SEAR structure, especially with regard to the uncertainty of funding levels available over the years. We are doing this by showing the quite complex payments and payment structures which could arise and which could create unnecessary uncertainty.
- the difficulty of including health emergencies in the EUSF in terms of the nature of the risks covered, which is fundamental to disasters that are inherently random but can be incorporated within a contingent liability risk perspective.
- the difference in the essential mechanisms of the EUSF and the EAR.
- ways forward as to how the EUSF and the SEAR could be streamlined with other tools such as the Union Civil Protection Mechanism, risk reduction efforts and the Cohesion Policy.

Since it is important to understand how contingent liabilities can be managed with different tools, we introduce the concept in the first section and then relate it to the SEAR. As the MFF is essentially a European-level budget, one can use the ideas from the analysis of government liabilities to discuss issues related to the SEAR and other instruments for the EU budget examined above.

4.1 Contingent Liabilities of the EU Budget

The identification of possible liabilities for governments due to natural disaster events is a pre-requisite towards understanding the risk to its fiscal stability and for achieving short- and long-term goals (e.g. as set out in global agendas such as the Sendai Framework for Risk Reduction 2015-2030, the Sustainable Development Goals as well as the Paris Agreement). The same is true for the European budget for the same reasons (the following discussion is based on Mechler and Hochrainer-Stigler 2014). Usually, government's plan and budget for direct liabilities, that is, liabilities that manifest themselves through certain and annually recurrent expenditures. These

liabilities can be termed explicit (as recognized by law or contract). However, also implicit liabilities (e.g. due to moral obligations or public expectations) must be assumed. The same can be argued in regard to the EU budget. In contrast to direct liabilities, costs associated with disaster event losses enter the government balance sheet as *contingent liabilities* (Table 4), i.e. obligations that arise only when an event occurs. Here, one can also distinguish between explicit and implicit liabilities. Explicit contingent liabilities are those costs that deal with the reconstruction of infrastructure destroyed by events for which the government is explicitly responsible. In contrast, disaster related implicit contingent obligations are associated with providing relief and ensuring that affected communities and economies continue to function well. These are commonly considered as a moral liability for governments.

Table 4: Governments' explicit and implicit, direct and contingent liabilities

Liabilities	**Direct obligation in any event**	**Contingent obligation if a particular event occurs**
Explicit Government liability recognized by law or contract	• Foreign and domestic sovereign borrowing, • Expenditures by budget law and budget expenditures	• State guarantees for non-sovereign borrowing and public and private sector entities • Reconstruction of public assets
Implicit A "moral" obligation of the government	• Pension and health care expenditure • Future recurrent costs of public investment projects	• Default of subnational government or public or private entities, • Banking failure • Disaster relief and recovery assistance • Ensuring that affected economies continue to function well

Source: Adapted based on Mechler and Hochrainer-Stigler 2014.

If a disaster event occurs, the government can expect contingent explicit and implicit liabilities (either due to direct or indirect losses), which it needs to finance through ex-post measures such as budget diversion. Also public health emergencies and related costs, such as experienced with the COVID-19 pandemic, can be related to contingent liabilities including moral obligations (e.g. to lessen the impacts to very vulnerably parts of the society) as well as to ensure functioning of markets and society (e.g. economic or health related). Emergencies, such as related to the Emergency Aid Reserve, can be seen as contingent as well, e.g. mass migration due to unrest and war.

It is an important fact that contingent liabilities, such as the one from the COVID-19 Pandemic, are fundamentally different to contingent liabilities stemming from natural disaster events. While natural disasters are indeed inherently random in nature, corresponding contingent explicit and implicit liabilities (at least partly but especially related to damages to assets such as infrastructure or houses) can be assessed with probabilistic approaches and losses are quantifiable in necessary detail. If that were not the case, there would not exist any form of insurance for natural disaster risk

(for a detailed discussion see for example OECD 2021). Hence, contingent liabilities from natural disaster events are possible to be transferred into regular budget practice (i.e. direct explicit and implicit obligations, see Table 4) given an appropriate estimate of risk needed for insurance applications is available, e.g. such as average annual losses expected from natural disasters which is also a key risk estimate (among others) (we discuss related details in section 4.5). As the EUSF focuses on such losses, its related risks are also quantifiable and can, therefore, be embedded in the regular EU budget.

In contrast, the assessment of risks related to public health emergencies such as the COVID-19 pandemic are quite different in nature especially in regard to the possibility of a detailed probabilistic assessment (Peleg et al. 2021). Compared to natural disaster events such large scale public health emergencies are more challenging to be quantified and can be seen as rather unpredictable (at least from a quantitative risk perspective). Therefore, they should be dealt with accordingly by means of a flexible budget or instruments, such as the special instruments.

We conclude that contingent liabilities due to natural disaster events and major public health emergencies are different in nature, including their assessment of possible costs. Therefore, they should not be managed using the same instrument. This is due to the fact that natural disasters have the potential to be transformed from a contingent obligation to a direct obligation and therefore can be included in **regular budget practices** whereas this is not the case for major public health emergencies.

Beyond the contingency perspective, there is a second problem that arises from extending the EUSF to public health emergencies: In the event of a public health emergency, countries' fiscal risk from natural disasters also increases and EUSF support could fail in precisely that moment when it is needed most. The next section examines this problem in more detail, using the current Covid 19 pandemic as an example.

4.2. The EUSF and COVID-19

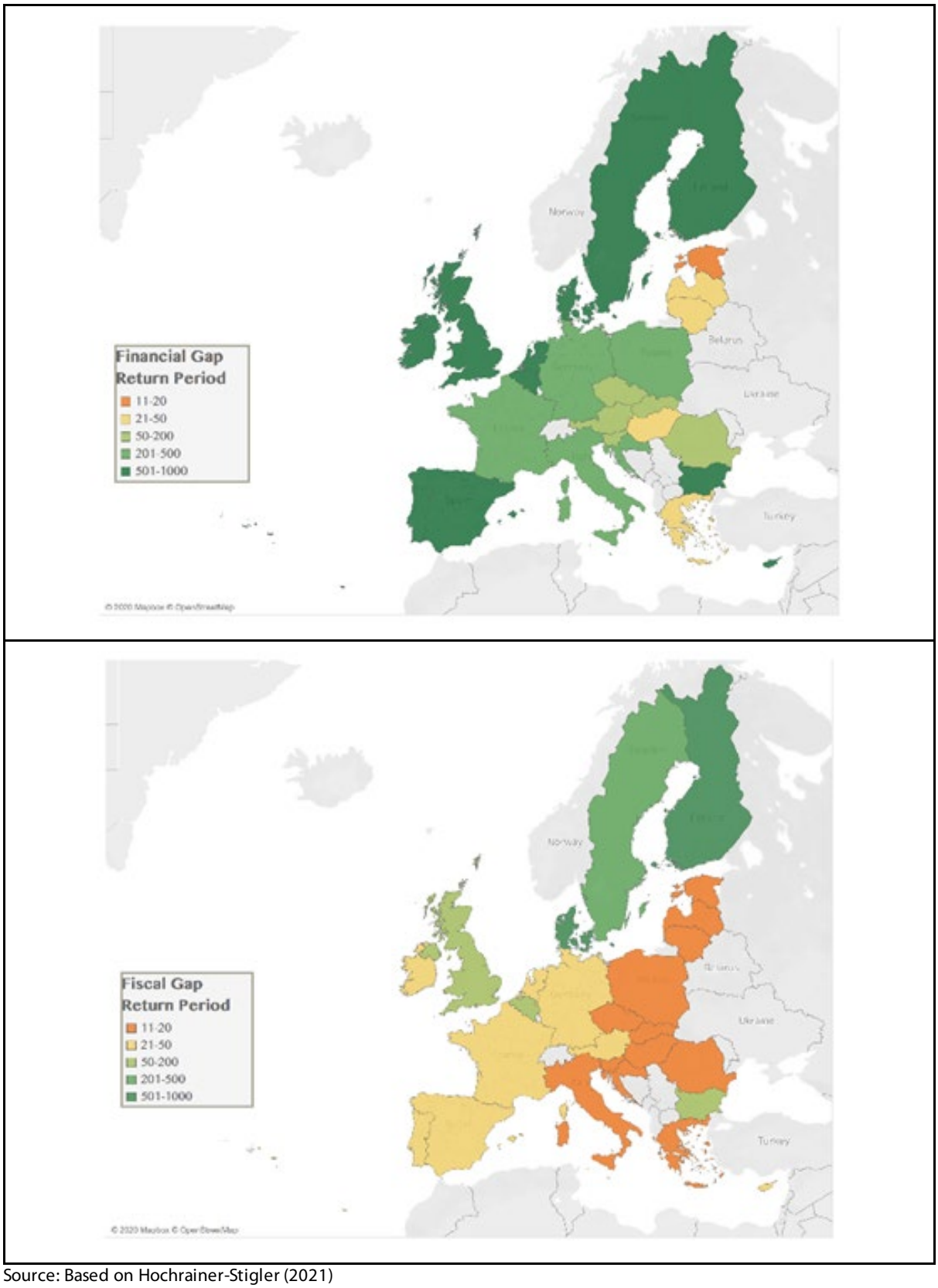
It should be recalled that the underlying reason for the establishment of the EUSF was to show practical solidarity in case a Member State's own capacity to cope with a disaster event is exceeded (Commission Report 2004). According to Hochrainer-Stigler et al. (2010, 2017) and consistent with the Commission's wording, an appropriate indicator for a country's own capacity should be the government's ability to finance emergency operations and mitigate uninsurable losses. We do not go into a detailed analysis of the issue about the EUSF's funding needs for each European country (a detailed analysis can be found, for example, in World Bank, 2021) but simply acknowledge that the EUSF threshold levels for natural disaster losses established in the past (see section 2.1) implicitly assume a solidarity aspect related to the ability of a country to cope with a disaster. It was already discussed in Hochrainer-Stigler et al. (2017) how the EUSF thresholds could be based on the individual coping resources of a Member State.

We extend this previous analysis and recalculate and update these results under a COVID-19 scenario. This is not done for the purpose of recalculating the specific fiscal needs for each country under the COVID-19 situation but to illustrate the importance in separating the use of the fund for natural disaster related and public health related emergencies. To lay out the argument, we employ the so-called CatSim (Catastrophe Simulation) approach which is quickly introduced in the following section. The technical details can be found in Annex A.

In the CatSim approach, fiscal resources a government may use to deal with natural disaster events are calculated. Resources include various measures, such as budget diversion, outside assistance, domestic credits, taxation and international borrowing. If the resources to cope with the event are exceeded, a fiscal gap will occur. In such a case, it could be argued that the EUSF may be used to finance part of this gap. It is important to note that depending on the economic situation, different risks have to be expected as different amounts of resources are available, e.g. less resources are available during recessions or if resources are already used for dealing with other contingent risks such as the COVID-19 pandemic (Table 4). In our analysis, the Covid-19 scenario keeps the hazard risk, exposure and responsibilities of the government due to natural disasters the same but significantly changes the resilience sources. Summarizing for the Covid scenario, it is assumed that no resources are available through budget diversion and outside assistance is limited due to fiscal stress (details can be found in the Annex).

Figure 6 below shows the results for the pre-Covid situation as well as during the COVID-19 years in terms of fiscal gap return period, a simple risk metric that indicates funding problems of countries in regard to disaster events. The redder a country in Figure 6, the higher the risk of the government of not being able to finance all losses it is responsible for in case of a disaster event. In more detail, the fiscal or also-called financing gap is a simple risk metric and indicates funding problems for contingent obligations according to return periods. A return period of 10 means that problems arise on average every 10 years while a 100-year-event means that financing problems arise less likely, on average every 100 years.

Figure 6: Fiscal Gap Return Period for the baseline 2018 scenario (above, a) and Covid scenario 2021 (below, b)



Source: Based on Hochrainer-Stigler (2021)

As one can see in Figure 6a, European countries seemed quite resilient against disaster events with regard to fiscal risk. However, it should also be acknowledged that the countries shown as less risky

may still have problems to finance losses due to indirect effects which are not included in this analysis but are now one of the primary concerns for governments in wealthier countries (for indirect effects we refer to the study of World Bank 2021).

It is no understatement that the COVID-19 pandemic has significantly increased the fiscal risk to governments against natural disasters (Figure 6b). However, it can also be acknowledged that not all countries were affected in the same way. Generally speaking, Figure 6 shows strong indications that many EU countries are now more vulnerable to fiscal problems resulting from natural disaster events than they were in pre-COVID times. Consequently, the need for assistance during a disaster event from the EUSF are now much higher than before, due to the decrease in own fiscal resources as a result of the pandemic. However, the increase in need for assistance goes hand in hand with a decrease of available funding levels from the EUSF. It should be recalled that around EUR 530 million were used from the EUSF to assist with the COVID-19 pandemic. Therefore, the funding availability has decreased significantly.

The main argument to stress here is that given the COVID-19 pandemic and the high disbursement, which considerably depleted the EUSF, the need for assistance from the EUSF in case of a natural disaster would be much higher due to the decrease in fiscal resources as a result of the pandemic, while the available funding would be even lower. In that sense, the public emergency inclusion within the EUSF not only counteracts the need for having enough funding for natural disasters as vulnerability is higher, it also makes it much more likely that there will not be enough funding because if a disaster happens, there will be less resources available.

We, therefore, conclude that assistance to natural disaster events and large scale public health emergencies **from the same fund is diametral to the concept of solidarity as both are intrinsically related**. If a public health emergency occurs, it drains resources from the EUSF while, at the same time, the need of assistance from the EUSF increases in countries in the event of a disaster. Simultaneously, the risk increases that the EUSF is not able to provide the assistance to do so due to limited funding availability (and vice versa).

It is worth noting that the EUSF was never depleted. However, it also needs to be acknowledged that capitalization levels in the past were stretched thin (Lierop 2021). In the next section, we will show and conclude that the fund's past performance, including past capitalization levels, does not give any evidence about the adequacy of its current funding levels. As already indicated above, we are using the outermost regions of Europe for laying out our arguments.

4.3. Past Performance of the EUSF and Storylines

In the past, the EUSF funding levels were never exceeded, however, they were already put under severe stress (the following discussion is based on Lierop 2021). Especially the earthquake in the central Apennines region of Italy in 2016 and 2017 was dramatic. The assistance from the EUSF, which exceeded two full annual budgetary allocations, was only possible by using unused funding of the previous year as well as part of the following year's allocation. More specifically, in February 2017, when Italy completed its final application, the entire 2016 allocation of the EUSF had remained unspent which made it possible to add it to the available 2017 allocation. Nevertheless, the amount of funding was not sufficient to cover the costs. However, due to the 2014 revision of the EUSF Regulation, which enabled the use of part of the following year's allocation, this difference could be covered by frontloading more than half of the annual amount available for 2018. Table 5 shows more detailed information about the fund's allocation from 2014 to 2020.

The previous EUSF structure before the SEAR already created some complex payment situations over several years in the past. We, therefore, explain Table 5 in some detail next. In 2014, there was no carried-over amount from the previous year. Thus EUR 530.6 million were available from the fund and around EUR 126.7 million were used. Hence, around EUR 403.9 million were carried over to the next year. In 2015, the capitalization of the fund was EUR 403.9 million plus EUR 541.2 million. Of these sums, around EUR 82 million were used from the previous remaining capital of EUR 403.9 million. The remainders amounting to EUR 321.1 million lapsed. In 2016, the carried-over amount was EUR 541.2 million plus EUR 552 million of which only EUR 33.1 million were used. These were taken from the carried-over amount. Therefore, EUR 508 million lapsed and around EUR 552 million were carried over to the next year. To these EUR 552 million, an additional EUR 563.1 million were added in 2017. Total use of the fund that year was EUR 1,268.2 million, which was made possible by frontloading EUR 294 million from 2018. Ultimately, not the total funding was needed and EUR 140.8 million were carried over to the following year. In 2018, these EUR 140.8 million and an additional EUR 574.3 million of funding were available. The EUR 140.8 million minus the frontloaded amount from the previous year (EUR 294 million) resulted in a deficit which was paid from the annual amount of 2018, i.e. EUR 574.3 million. This left an amount of EUR 421.1million in the fund, of which EUR 155.9 million were used. The remaining EUR 265.3 million were carried over to 2019.

Payments from the fund were mainly allocated to countries of mainland Europe while only small payments were made to outermost regions. These regions were not explicitly considered in the analysis of the EUSF before, however, the La Palma volcanic eruption highlighted the need to do so.

Table 5: Detailed Information on the EUSF payments between 2014 and 2020

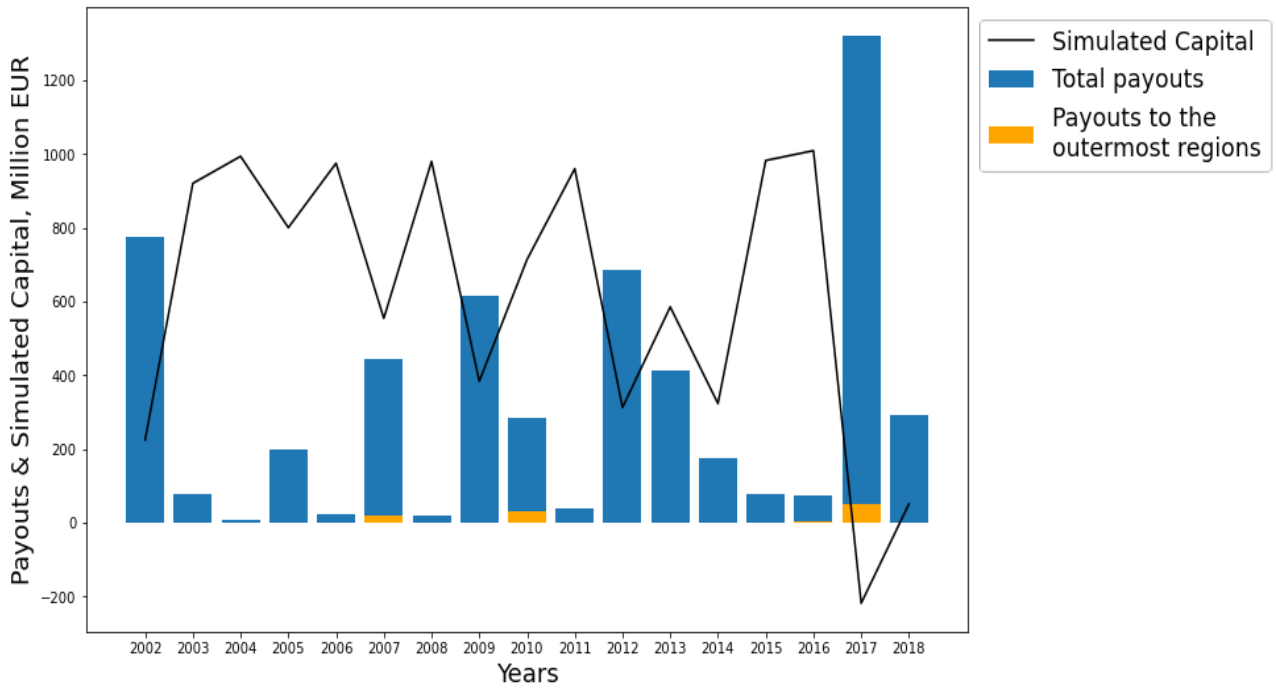
Year	2014	2015	2016	2017	2018	2019	2020	Total
Annual amounts in 2011 prices	500	500	500	500	500	500	500	3500
Annual amounts in current prices	530.6	541.2	552	563.1	574.3	585.8	597.5	3944.7
Carried-over from previous year	0	403.9	541.2	552	140.8	265.3	553	
Frontloaded from the following year	0	0	0	294	-294	0	0	
Annual usage	126.7	82.8	33.1	1268.3	155.9	298.1		1964.9
Carried-over to the following year	403.9	541.2	552	140.8	265.3	553		
Lapsed	0	321.1	508.1	0	0	0		829.2

Source: European Commission (2021)

We now take a look at the argument that because the EUSF had sufficient resources in the past the capitalization levels currently set out in the MFF 2021-2027 are appropriate. Looking back at the previous EUSF period, there were indeed natural disasters that could possibly have occurred. A so-called storyline approach, as proposed in the Horizon 2020 RECEIPT project, can highlight possible and plausible scenarios of the past. In doing so, one can demonstrate the need to look at the past not only as an indication of the critical performance of the Fund, but also of alternative realities that could have occurred. Because of their importance to our argument, we provide some detailed examples below.

Figure 7 shows pay-outs and simulated capital since the start of the Fund up to 2018. Pay-out data are taken from the official list of the EUSF interventions since 2002, available on the EU Commission website (EC 2022c). Available capital is simulated based on these pay-out data and following the rules described in section 2. In simulating capital it is assumed that pay-out is made in the same year as the event takes place. The yellow bars indicate pay-outs to the outermost regions while blue bars all other pay-outs.

Figure 7: Historical EUSF pay-out data (bars) and simulated capital (black line) for the 2002–2018 period in million Euros.



Source: Adapted from Ciullo et al. (2020)

As already indicated, 2017 registered the highest pay-outs since the fund was established. These high pay-outs resulted from a devastating earthquake in central Italy which took place between August 2016 and January 2017. As discussed above, this event resulted in an overall pay-out of EUR 1.2 billion – more than double the annual capitalization of EUR 500 million. In order to cope with this, the allocation of the following year, i.e. 2018, was used for the first time. In the same year, the French islands – and EU outermost regions – of Saint-Martin, Guadeloupe and Martinique were hit by hurricanes Irma and Maria, causing a total damage of around EUR 1,956 million which resulted in a pay-out of EUR 48.9 million. This was the largest payout ever paid to the outermost regions, although it is still quite minor when compared to pay-outs made to mainland Europe (see extent of orange bars and blue bars in Figure 7). Pay-outs to the outermost regions were triggered only a few times in the period between 2002 and 2018: in 2007 after cyclone Gamède hit la Réunion (EUR 5.3 million) and hurricane Dean hit Martinique (EUR 12.8 million), in 2010 after floods and landslides caused devastation in Madeira (EUR 31.3 million), in 2016 after fires in Madeira (EUR 3.9 million) and in 2017 after hurricanes Irma and Maria hit Guadeloupe and especially Saint-Martin (EUR 48.9 million).

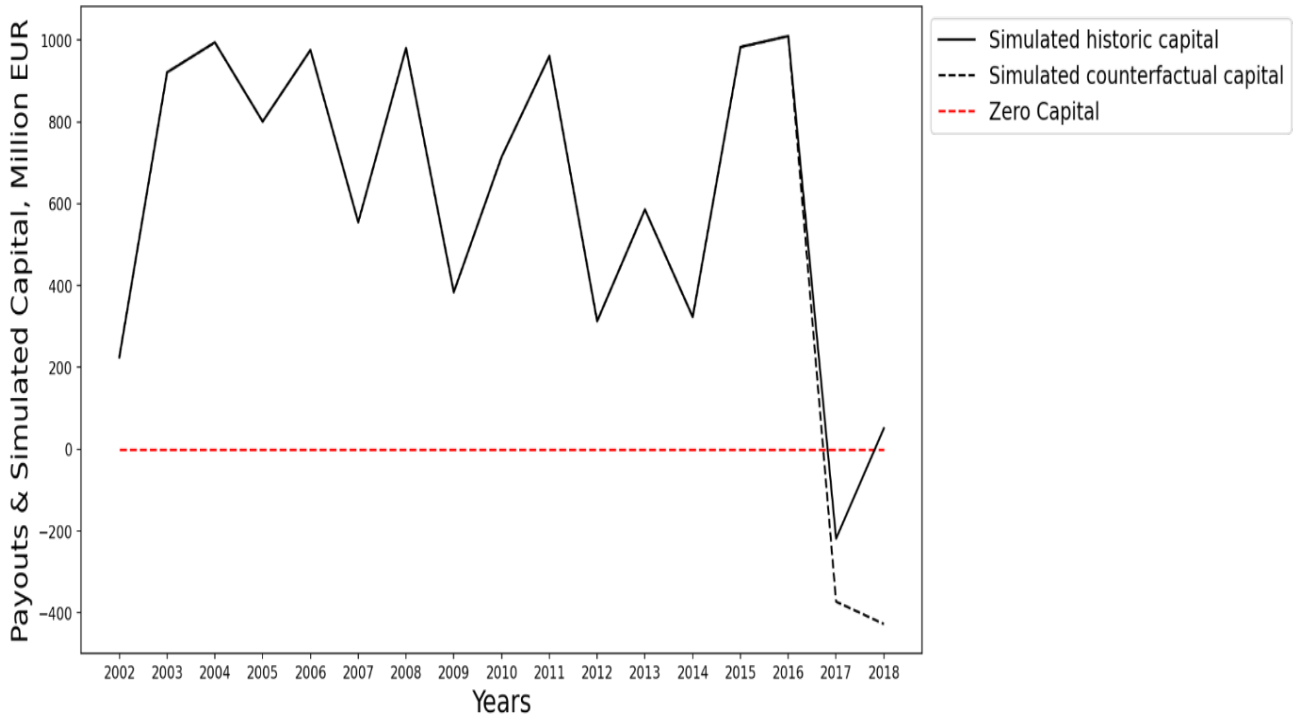
The limited number and size of pay-outs to the outermost regions could indicate that these cannot undermine the stability of the EUSF. However, the pay-out data considered cover too short a period (16 years), and only pay-outs made after 2014 (two pay-outs in 2016 and 2017) were triggered according to clearly defined rules for regional disasters such as those involving the outermost regions. Such limited record prevents any meaningful statement on the contribution of these regions to the overall stability of the fund and also makes any robust probabilistic risk assessment impossible.

Recently, various authors (see e.g. Shepherd et al., 2018; Sillman et al., 2019) have introduced the climate impact storyline approach as an alternative to probabilistic analyses in assessing the impacts

of extreme natural events. Under the climate impact storyline approach, storylines are defined as "a physically self-consistent unfolding of past events, or of plausible future events or pathways". Unlike the conventional probabilistic approach, the climate impact storyline approach does not aim at making predictions nor at assigning probabilities to these predictions. Rather, the climate impact storyline approach focuses on identifying which plausible factors (i.e., climatic and socio-economic) bring the system under severe stress. The climate storyline approach, thus, provides solid evidence even when the historic record is scarce and is appropriate for exploring the boundaries of what is plausible.

For our case. Ciullo et al. (2021) applied a climate impact storyline approach to assess whether and to what extent pay-outs to the outermost regions due to extreme tropical cyclones could compromise the stability of the fund. In particular, Ciullo et al. (2021) reconstructed a series of plausible downward counterfactual tropical cyclones, i.e. tropical cyclones which plausibly could have been worse than they were and assessed their impact on the EUSF in terms of pay-outs and resulting capital losses.

Figure 8: Simulation of capital using historical (solid black line) and downward counterfactuals pay-outs (dotted black line). The dotted red line indicates zero capital levels.



Source: Adapted from Ciullo et al. 2021

Figure 8 shows capital simulations using pay-outs only from historical tropical cyclones as well as downward counterfactual tropical cyclones. In particular, the latter are constructed by considering alternative, physically plausible paths of tropical cyclones Ophelia and Enawo in 2017 and Berguitta in 2018. In reality, these cyclones had no impact on the outermost regions but could have resulted in significant damages and impacts to Réunion (Enawo in 2017 and Berguitta in 2018) and the Azores (Ophelia in 2017). The fact that they took a different, less damaging path for the outermost regions was purely coincidental. Results show that capital losses could have been much higher in 2017 and that prevented recovery could have occurred the next year, potentially requiring further exceptional budget anticipation from the year 2019.

In Annex B we present some detailed findings in regards to the impact of the counterfactuals on the EUSF capitals. The results show that the largest assumed increase in tropical cyclone intensity and GDP could result in significant negative capital, leading to losses twice the current capitalization amount. However, an annual capitalization increase of 70% would allow such worst-case scenarios to be managed and sufficient capital to be maintained. However, only increases in stresses to the outermost regions are considered here. Hochrainer et al. (2010,2017) found that the EUSF might have been undercapitalized for flood-related losses in continental Europe even before the 2013 reform. Therefore, a significant change in the way the EUSF is capitalized would be needed to cope with pay-outs for perils occurring in the outermost regions and those that occur simultaneously in continental Europe, such as flooding.

We therefore **conclude** that the past performance of the EUSF is not indicative of adequate capitalization levels as we have shown that **the EUSF would be under severe stress and default under various plausible scenarios of past severe weather** events in the **EU's outermost regions**.

So far, we have not addressed the potential interactions between the EUSF and the Emergency Aid Reserve which both were merged into the SEAR. The following section is dedicated to a discussion on this topic.

4.4. Capitalization Levels and Risk of SEAR

The new capitalization levels as well as payments under the EUSF, the EAR and the respective important dates during the year were already provided. We now discuss these aspects in more detail as there are several complications that have not yet been adequately addressed in other discussions (see for example the assumptions about the EUSF capitalization levels in SEAR within World Bank 2021). Recall that the availability of funds for use as described in previous EUSF regulations depends not only on the current year's disasters, but also on those of the previous year. In a year of few disasters, the unused budget could be carried over to the next, with an upper bound of EUR 1.2 billion (in 2018 prices, same in the following prices). However, in case of insufficiency, the fund could also overspend next year's appropriations up to a maximum amount of EUR 0.4 billion. Under current rules, scenarios are conceivable in which overdraft and surplus occur in the same year. These scenarios, along with other notable ones, are specifically examined in this section.

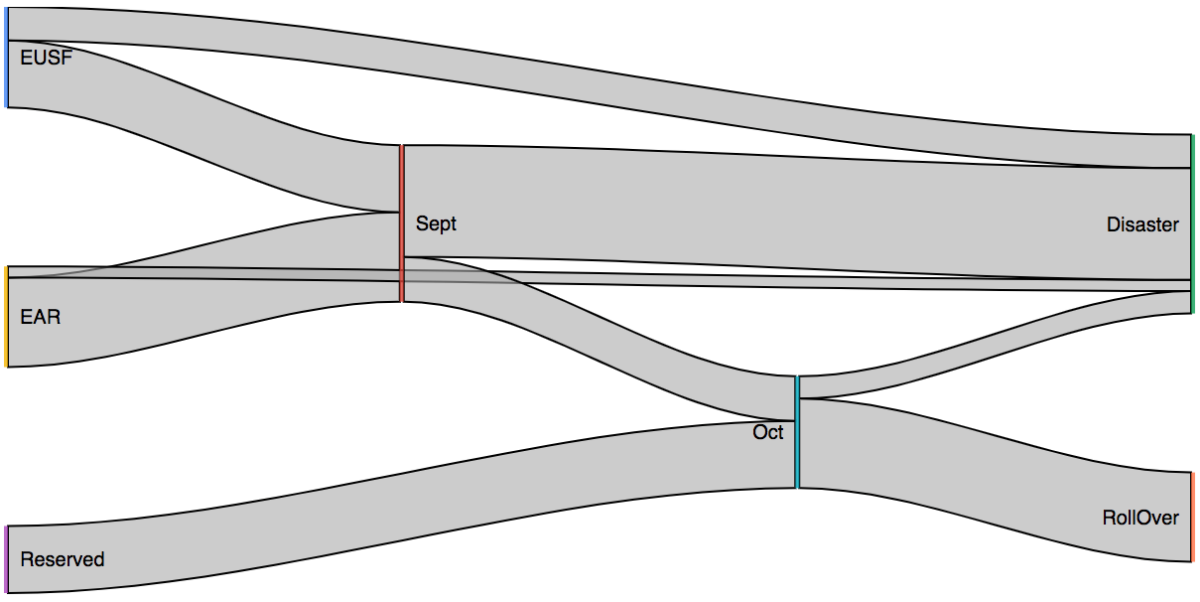
It is important to understand the new Solidarity and Emergency Assistance Reserve funding allocation mechanism before going into the various scenarios where the funding is depleted. As the SEAR is responsible for both former EUSF coverage and EAR obligations now, the distribution of the fund is much more complicated: First, in order to guarantee that the applications being filed later in the year have access to the funds, a quarter of the annual budget is frozen and only becomes available after October 1st. This means only 75% of the budget is usable in the first three quarters of each year. Second, to constrain the level of competence over the limited budget between EUSF coverage and EAR obligations, it is further required that until September 1st, the available 75% of annual budget need further dividing. Half of this amount would be exclusively reserved for EUSF coverage while the other half is reserved only for EAR obligations. Third, the budget division between EUSF coverage and EAR obligations is no longer valid from September of each year. Whatever amount is not used will then be available to both channels. Last, in case that the budget reserved exclusively for EUSF coverage before September is not sufficient, SEAR is allowed the overdraw up to EUR 0.4 billion from the succeeding year. This amount of overdraft will be subtracted

from the EUSF exclusive budget calculation next year. This means that it leaves less available funds for the EUSF and makes it more vulnerable before September in the coming year.

Based on this allocation rule, we define three key periods of annual budget: Period 1: 01/Jan - 01/Sept; Period 2: 01/Sept - 01/Oct; and Period 3: 01/ Oct to the end of the year. To better understand the complicated budget calculation mechanism, Figure 9 illustrates a common case. With a total 75% of annual budget at the starting of a year, EUSF and EAR share half of the available funds. Part of the funds are used before September for disaster coverage. What is unused rolls over to Period 2. In Period 2, there are no more strict distinctions between EUSF and EAR, so the budget could be called upon from either channel. From October on, the once-frozen 25% annual budget becomes available and adds up to the total usable budget. At the end of the year, what is left of the budget rolls over to next year (up to EUR 1.2 billion).

Clearly, EAR's annual budget and the availability of funds for the EUSF in Period 1 are highly dependent on the use of the budget in the previous year. Therefore, in discussing the possibility that the EUSF will not have access to funds, we focus on different scenarios for two consecutive years for illustrative purposes. Year 1 is always a regular year with a budget of EUR 1.2 billion, while the situation in year 2 depends heavily on budget consumption in year 1. The more technical details of these scenarios and the necessary assumptions can be found in Appendix C.

Figure 9: SEAR budget allocation illustration



In Year 1, the EUSF would always have at least EUR 0.45 billion available before September. Depending on the amount used by EAR, the funds available to EUSF vary from EUR 0 to EUR 0.75 billion afterwards. In addition, SEAR can still call up to EUR 0.4 billion to cover the EUSF in case of a major event or if the budget for the EAR's commitments is exhausted. Therefore, the availability of EUSF funds in a year like Year 1 is quite well guaranteed.

However, there are some undesirable situations for year 2. These scenarios occur when year 1 is overspent, i.e. a catastrophic previous year. If there is a EUR 0.4 billion overspend, the budget reserved for the EUSF in period 1 of year 2 (i.e., before September) is EUR 0. This means that SEAR

may not spend any funds on EUSF coverage during this period unless there are additional overspends in the next year. Under current budget calculation rules, this inter-annual overdraft could be extremely damaging, which is explained Annex C. In summary, once a catastrophe triggering an overdraft occurs next year, EUSF coverage becomes very vulnerable, and under the current rule, these negative effects could continue in future years. Such a situation could be significantly reduced by improving and clarifying the budget calculation. One possibility would be to increase budget flexibility. In the current situation, it is very likely that there will be both an overdraft and a budget surplus in a given year. However, the surplus may not be offset against the overdraft, at least this is not clearly stated in the regulation. If this offsetting against annual surpluses is possible, budgetary commitments will not be affected, but the available budget for the EUSF in vulnerable period 1 will increase.

Another policy options is to reduce the amount of exclusive EAR funding before September. As proposed in Table 3, the average EAR drawdown from 2015 to 2019 is less than EUR 370 million. This means that for a normal year (with no overdraft or surplus from the previous year), the exclusive EAR budget before September is already more than the average annual requirement. Compared to the limited nature of the EUSF, it is likely that the EAR would leave some funds untouched. Therefore, it would be beneficial to limit the portion reserved exclusively for the EAR before September and also to establish an overdraft mechanism based on the proposal mentioned in the previous paragraph. As indicated earlier, the new system is very complicated, lacks flexibility, and risks not having the necessary funds in light of major events in previous years. In addition, as mentioned above, the risk of natural disasters is measurable, so the funding needs for the EUSF can be assessed, whereas this is not the case for events that the EAR has to deal with.

We therefore **conclude** that merging the EUSF and the EAR into SEAR **significantly increases the uncertainty of possible capital shortfalls** for the EUSF and makes it **virtually impossible to determine adequate funding requirements** for solidarity in the event of current and future natural disasters.

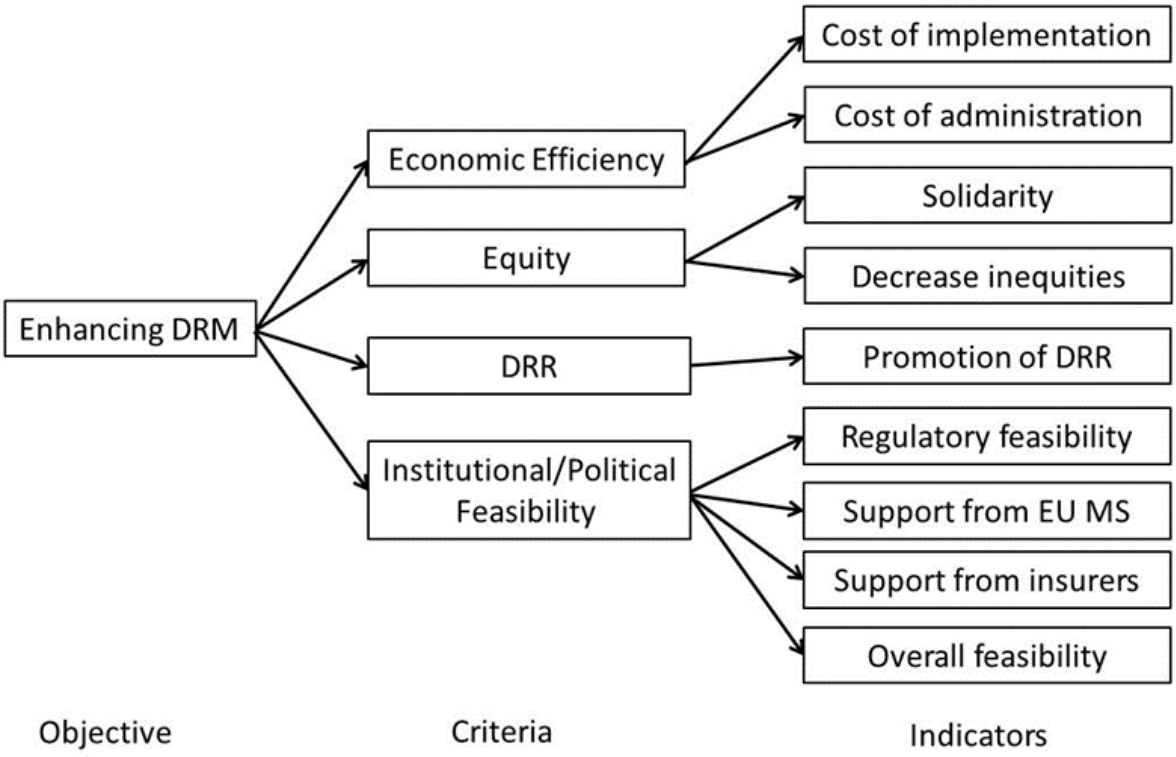
We discussed the capitalization levels for various possible scenarios for the SEAR and included some policy implications. We also introduced possible changes due to the extension of the EUSF to include public health emergencies. In a next step we relate the EUSF to other disaster risk management options, beginning first with a qualitative discussion of some general options, including risk reduction and insurance.

4.5. SEAR and Other Instruments

The benefits of a clear risk and capitalization assessment, including quantitative ones, as in the case of the former EUSF, should not be underestimated. The study by Hochrainer-Stigler and Lorant (2018) is one of the few studies looking at the EUSF and the possibility of explicitly linking it to other instruments, in particular insurance and risk reduction from a multi-stakeholder perspective. Jongman et al. (2015) already explored possible quantitative combinations of these three tools (EUSF, risk reduction, insurance), and although this can be considered important information for risk takers, the quantitative assessment did not take into account additional aspects relevant to the possible decision makers involved, including political and institutional feasibility considerations. Hochrainer-Stigler et al. (2018) focused on the EUSF and combined the quantitative analysis of Jongman et al. (2015) with a more nuanced approach that takes the views and preferences of key stakeholder groups explicitly into account. The overall selection criteria and corresponding

indicators for the assessment were adopted based on Bräuninger et al. (2011) and adapted to the specific overall objective of how to enhance disaster risk management through new partnerships (Figure 10).

Figure 10: Selected Criteria and Indicators



Source: Hochrainer-Stigler and Lorant (2018)

To briefly explain the key concepts: Economic efficiency refers to the cost implications of operationalizing and running the instruments while equity is concerned with how strongly the instrument promotes solidarity and creates inequities (winners and losers). Disaster risk reduction (DRR) refers to the extent to which the instruments are able to reduce risk, and feasibility refers to the instrument's coherence with other policy instruments and the regulatory environment, as well as its acceptability to key stakeholders. Regarding the EUSF in Hochrainer-Stigler et al. (2018), the following three options were developed and evaluated with key stakeholders (in a workshop) from the European Commission, Governments, Insurance Companies, NMOs and scientist:

- eliminate the upper limit of the fund with the aim of responding to all eligible disasters.
- further strengthen the link between the EUSF and Disaster Risk Reduction (DRR). In addition to the economic performance of Member States, contributions to the fund would also take into account risk reduction measures implemented by the country.
- completely or partially transform the EUSF into a pre-disaster instrument that backs-up (reinsures) the national (public/private) insurance system (a Multi-Stakeholder Partnership, MSP).

These options can be more specifically linked to other instruments such as the Cohesion Policy investments in the preparedness for, prevention of and response to disaster risks that are very likely

to benefit the EU Solidarity Fund as well. For example, a stronger link between the EUSF and DRR would also reduce the need for EUSF support in the future. Option 3 could achieve a reduction in the EU Solidarity Fund's capitalization by reducing reliance on government assistance following disasters. Important in our context is that the study of Hochrainer-Stigler et al. 2018 found that the most feasible option for all stakeholders was to enhance the link to DRR options. The enhanced link to DRR was also seen to be the best way to incentivize DRR and, surprisingly, the best option across all the sub-groups.

We **conclude** that the link between the **EUSF** and possible other instruments in regard to **disaster risk reduction** can be established through linking it with **cohesion policy investments**.

Regarding the link between the EUSF and other disaster risk reduction activities it should, however, be noted that the way how assistance is given through the SEAR is fundamentally different in the case of the EUSF and for the EAR. For the former, a country must pro-actively apply for funding from the fund while in the latter case, the EU decides if assistance should be granted irrespective of any requests. This has important consequences with regard to how the tools can be used for aligning it with other policy processes For example, while acknowledging the lack of alignment between the EUSF`s eligibility conditions and the window of opportunity to "Build Back Better" in order to make the infrastructure more resilient to natural hazard events, it is in principle possible to relate the eligibility conditions for the EUSF operations with the practices of disaster risk management and post-disaster reconstruction (EC 2020). Note that the extension to public health emergencies makes it difficult to bring the concept of "Building Back Better" forward as this is less likely a possibility for such events and rather needs different kinds of approaches. Additionally, contrary to the EUSF, there is no incentive structure for reducing risk related to funding from the EAR as there are no eligible criteria which need to be met to receive potential funding from countries as well as how to actually reduce such types of risk.

The Build Back Better approach is related to issues after a disaster event has hit and especially in the context of the EUSF on the short-term. At least equally importantly is the need to prepare for and prevent natural disaster risks. A study by the EC (2019) indicated considerable synergies between the Structural and Investment Funds for cohesion policy (ERDF and Cohesion Fund) as well as the Union Civil Protection Mechanism. Based on EC (2019) the priorities of the Cohesion Policy closely match the disaster risk identified by the Member States in their national risk assessment. Some of the Member States are now using Cohesion Policy funds to address identified risk in the national risk assessment, however, these Member States have a low allocation of EU funds and rather invest in disaster risk management using national means (Austria, Denmark, Finland, Ireland, the Netherlands and Sweden). Be that as it may, Cohesion Policy investments in preparedness for prevention and response will very likely also benefit the EUSF as well since risk of losses are reduced due to these efforts.

We, in principle, also agree with the previous mentioned report that the ERDF and Cohesion Fund investments can significantly improve Member States' capacity for preparedness and prevention and, therefore, prepare the ground for more effective EUSF operations in the future. However, it should also be mentioned that there are limits to such instruments as some countries rather rely on their own resources. Hence, enough flexibility is necessary as there is no one-size-fits-all approach due to the history of disaster risk management in a respective country. Governance practices for the ESI Funds, including lessons learned in monitoring operations and financial control, can benefit countries for the EUSF in terms of requesting and submitting damage estimates. Similar procedures

could be established with respect to the expansion of the EUSF for public health emergencies. However, it should be kept in mind that the time horizon for the EUSF is typically much shorter compared to ESI funds, which focus on long-term goals. Therefore, governance structures cannot be aligned.

Regarding the EU Civil Protection Mechanism, which also provides emergency assistance, there is no direct correspondence with requests for assistance from the EUSF: According to EC (2019), for example, 11 countries received assistance from the EUSF between 2002 and 2016 and also activated UCPM emergency assistance in 20 cases of natural disasters, representing 26% of all cases supported by the EUSF during this period. UCPM assistance differs in nature from that of the EUSF: emergency assistance provided through the UCPM included firefighting resources (aircraft, helicopters), equipment (water pumps, power generators, water treatment plants, rope hauling equipment, etc.), medical items, and personnel (technical experts, firefighters, and other response personnel). This is not particularly problematic, as various forms of assistance are needed after disaster events. Important in this context is the establishment of rescEU, a reserve of civil protection capacities at the EU level, to be used as a last resort when Member States cannot cope with a disaster on their own and the capacities in the volunteer pool are not sufficient. The question arises whether such additional capacities could also be created for the EUSF. Be that as it may, this mechanism also requires a proactive approach by the Member States, which also opens up the possibility of linking it to incentives whether in terms of assistance or risk reduction.

5. POLICY RECOMMENDATIONS

KEY FINDINGS

- We recommend separating the EUSF from the coverage of large-scale public health emergencies and the emergencies covered in EAR. In its stead, we suggest establishing a new flexibility instrument that covers emergencies such as public health related ones as well as the ones within the EAR as these are unpredictable and, therefore, need a more flexible approach.
- We recommend that the EUSF should be incorporated within the MFF to connect it more clearly with risk reduction efforts including the possibility to make achievements more tangible which, on the other hand, provides new linkages with other instruments and mechanisms.
- Given the availability of advanced risk assessment approaches for hazards in Europe, it is recommended to estimate capitalization needs based on the risk the EUSF is exposed to today and in the future.
- In case of no changes of the SEAR, we recommend to further clarify the SEAR's budget allocation and payment rules through amendment documents.
- We suggest improving the flexibility of SEAR by allowing the repayment of overdrafts using the annual surplus. Additionally, implementing risk reduction and awareness raising programs through the UCPM and Cohesion Policy should be linked to the EUSF.

Many challenges identified for the EUSF in the past (such as the level of capitalization and the extension to major public health emergencies, as well as the new challenges under the new SEAR structure) can be addressed if the corresponding risks can be quantified in the required detail. If this is the case such risks can be transferred from a contingent liability to an explicit one and therefore can be incorporated into EU budget planning processes. However, as shown in this study, disaster events and public health emergencies as well as emergencies eligible for funding from the Emergency Aid Reserve are very different in nature. While disaster events can be assessed using risk approaches allowing them to be explicitly incorporated into government budget and planning processes, this is less the case for other risks considered now in SEAR. Given these fundamental differences, we suggest separating the EUSF from the coverage of large-scale public health emergencies and the emergencies covered in EAR.

Furthermore, the budget allocated to COVID-19 would largely crowd out the financial resources that could be used for disaster relief and reconstruction. Although assistance for pandemics in Member States also reflects the principle of solidarity, it undermines the resilience of the SEAR fund to natural disasters. In light of other public health emergencies, it is therefore highly recommended that a special fund be established for the exclusive purpose of addressing the pandemic issue. One way forward would be to create essentially one new flexibility instrument that covers emergencies such as the public health related one as well as the ones within the EAR as these are emergencies are indeed rather unpredictable and therefore need a more flexible approach.

The EUSF related structure before the expansion to health emergencies was quite a success story and many ways forward how to relate it with other instruments can be found in related performance reports. In case that the EUSF is incorporated within the MFF, there are also new ways forward for how to connect it more clearly with risk reduction efforts. These include the possibility to make achievements more tangible which on the other hand provides new linkages with other sectors that can be established. However, one should also acknowledge the fact that such strategies have to recognize that there is probably no one-size-fits-all approach from the European to the individual Member State level possible. This is due to the fact that each EU country has its own 'history' in managing the risks which is difficult to be changed and streamlined to a general structure. On the EU level, providing instruments that require a pro-active approach from Member Countries to activate assistance is one possible way forward to take this reality into account (such as the EUSF as well as within the Union Civil Protection Mechanism and the Cohesion Policy).

The EUSF fund can only be used to restore damaged infrastructure to pre-disaster conditions and therefore cannot be used directly to mitigate risk. However, if the government earmarks a portion of its budget for disaster, it could use that money for better reconstruction after the EUSF funds have been used to restore the original condition (an important point in the Sendai Framework, 2015). Therefore, a direct link between the EUSF, state risk, and risk reduction could be established if risk is explicitly addressed in the state budget and some other conditions (e.g., flexibility, clear responsibilities, long-term commitment) are met.

We indicated that the capitalization of the EUSF is too low and should be increased. The analysis using the storyline approach has already addressed this issue and shows in Annex B the changes in EUSF capital levels with future changes in risk, which presents a worrying picture for the future. Given the availability of advanced risk assessment approaches for hazards in Europe, it should be possible to estimate capital levels in the necessary detail based on the actual risk to which the EUSF is exposed.

We also recommend that the rules for budget allocation and disbursement of SEAR funds be clarified. As explained above, it is highly uncertain how the SEAR annual budget will actually evolve, especially the part reserved exclusively for EUSF coverage before September 1. Detailed calculation rules regarding the order of processing and handling of overruns should be included in the existing document. In the meantime, SEAR payments under the so-called Emergency Aid Reserve are still heavily dependent on the decision of the European Commission. This leads to great ambiguity in deciding how much funding should be spent on which event. Standards such as the EUSF should be introduced when applying for support from the original EAR reserve.

Based on these suggestions, it is proposed to improve the flexibility of SEAR by allowing repayment of overdrafts from the annual surplus. If the demand for SEAR funds is concentrated in a few months prior to September, it is very likely that the Reserve will overdraw funds from the following year. This overdraft should be able to be offset with that year's surplus, if available, to avoid limiting the EUSF budget before September of the next year. Similar to the traditional coverage by the Emergency Aid Reserve, the overdraft mechanism should also be introduced for humanitarian crises.

Finally, risk reduction and awareness programs should be introduced under the UCPM and cohesion policies. Data to date has shown that purely financial instruments are still inadequate in the face of disasters. Incorporating risk reduction into development is key to minimizing the impact of natural disasters. These measures include improving building codes, building gray/green infrastructure,

establishing early warning systems and raising public awareness, etc. These projects could be financed through the Union Civil Protection Mechanism and under the Cohesion Policy principle. Only through the synergy of risk mitigation and financial instruments can current and future climate risks be adequately addressed.

6. CONCLUSION

Natural disasters have caused major human and economic losses in Europe and around the world. To cope with the increasing challenges, the EU has established numerous instruments and mechanisms to provide material and financial assistance in the event of a disaster. The important ones looked in this study are the European Union Solidarity Fund, the Emergency Aid Reserve and the Union Civil Protection Mechanism, and the Cohesion Policy. These instruments have successfully helped EU Member States, as well as some non-EU countries, when affected by disasters such as earthquakes, storms and floods. The EUSF is an important tool to show practical solidarity and has mobilized a total of more than EUR 6.5 billion for interventions in 96 natural disasters between 2002 and 2020. When COVID-19 broke out in Europe, the EUSF provided an additional more than EUR 500 million in emergency financial assistance.

Although the EUSF has managed to raise funds for disbursement to disaster-affected countries, its capital base has become very thin. This problem may worsen in the future, as the EUSF has been merged with the EAR in the Solidarity and Emergency Aid Reserve (SEAR). Under this new mechanism, the budget is divided between the EUSF and the EAR. A large portion is reserved exclusively for the EAR, which severely limits the EUSF's funding options. The arrangement for SEAR's cross-year use of funds also remains unclear and could affect the level of capitalization of the existing EUSF coverage. Taking into account the impacts of climate change, the humanitarian crisis, and COVID-19, the funds reserved for natural disasters in the new SEAR system are very tight. We focused in particular on two related issues, expanding the scope of the EUSF and merging the EUSF and EAR into SEAR, which are summarized below.

Extending the scope of the EU Solidarity Fund to include major public health emergencies

Due to the COVID-19 pandemic and as part of the coordinated EU response package, the scope of the European Union Solidarity Fund was extended through an amending regulation adopted on 1 April 2020. EUSF contributions to states receiving assistance due to public health emergencies total approximately EUR 530 million since 2020. It was noted that given the COVID-19 pandemic and the high disbursements that significantly depleted the EUSF, the need for assistance from the EUSF in the event of a natural disaster would be much higher due to the decrease in fiscal resources as a result of the COVID-19 pandemic. Meanwhile the available funding from the EUSF would be significantly lower. We, therefore, conclude that support for natural disasters and large-scale public health emergencies from the same fund is diametrically opposed to the concept of solidarity, as the two are inextricably linked. When a public health emergency occurs, resources are drawn from the EUSF while at the same time the need for assistance from the EUSF increases in countries affected by a disaster. At the same time, the risk increases that the EUSF will not be able to provide the appropriate assistance (and vice versa) due to limited funding availability. With respect to the capitalization of the EUSF, we showed that the past performance of the EUSF does not indicate adequate capitalization and that several plausible scenarios of past weather events in the EU outermost regions could put the EUSF under severe pressure. Therefore, a significant change in the capitalization of the EUSF would be required to address pay-outs for hazards in the outermost regions and for hazards occurring simultaneously in continental Europe, such as flooding.

Merging the EUSF and EAR under the new MFF 2021-2027 to create the Solidarity and Emergency Aid Reserve

In the new MFF 2021-2027, the SEAR is responsible for both former EUSF coverage and EAR obligations. As shown, the new division of the Fund is very complicated, lacks flexibility, and risks not having the necessary resources in the face of major events in previous years. We concluded that merging the EUSF and EAR into the SEAR significantly increases the uncertainty of potential capital shortfalls for the EUSF and makes it virtually impossible to determine adequate funding needs for solidarity in the event of current and future natural disasters. This brings us to one of the most important findings of the study: the risk of losses due to natural disasters is measurable, but this is not true for public health emergencies and emergencies as defined by the EAR. More specifically, contingent liabilities due to natural disasters and severe public health emergencies are different in nature, including the assessment of potential cost. Therefore, they should not be managed with the same tool. We argue that, particularly in the case of natural disasters, there is an untapped potential to transform these contingent liabilities into direct obligations that can then be incorporated into EU budgetary practice. Natural disasters, while inherently random, can be assessed using probabilistic approaches, and losses can be quantified in the necessary detail. If this were not the case, there would be no form of insurance for natural disaster risk. In contrast to natural disasters, the assessment of risks associated with public health emergencies such as the COVID-19 pandemic is of a very different nature, particularly with respect to the possibility of detailed probabilistic assessment. Compared to natural disasters, such large-scale public health emergencies are more difficult to quantify and may be considered more unpredictable (at least from a quantitative risk perspective). They should, therefore, be addressed accordingly through a flexible budget or tools, such as the dedicated instruments.

Based on our analysis, we recommend separating the EUSF from coverage of large-scale public health emergencies and emergencies covered under the EAR. In addition, we recommend establishing a new flexibility instrument to cover public health emergencies as well as EAR emergencies, as they are unpredictable and therefore require a more flexible approach. Given the measurability of the risk of losses due to natural disasters, we also recommend that the EUSF be incorporated into the MFF to more clearly link it to risk reduction efforts, including the ability to make successes more tangible. Due to the availability of advanced risk assessment approaches for hazards in Europe, it is also recommended that capitalization levels be estimated based on the risk to which the EUSF is exposed now and in the future. In the event that no changes are made to the SEAR, we recommend that the budget allocation and payment rules of the SEAR be further clarified through amendment documents. Specifically, we propose improving the flexibility of the SEAR by allowing repayment of overdrafts through annual surplus. We also suggest implementing risk mitigation and awareness programs under the UCPM and Cohesion Policy that can be linked to the EUSF. The link between the EUSF and possible other disaster risk reduction tools can be made through various cohesion policy investments, particularly reducing risk and building back better that could reduce the future need for the EUSF.

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ANNEX A: CATSIM METHODOLOGY

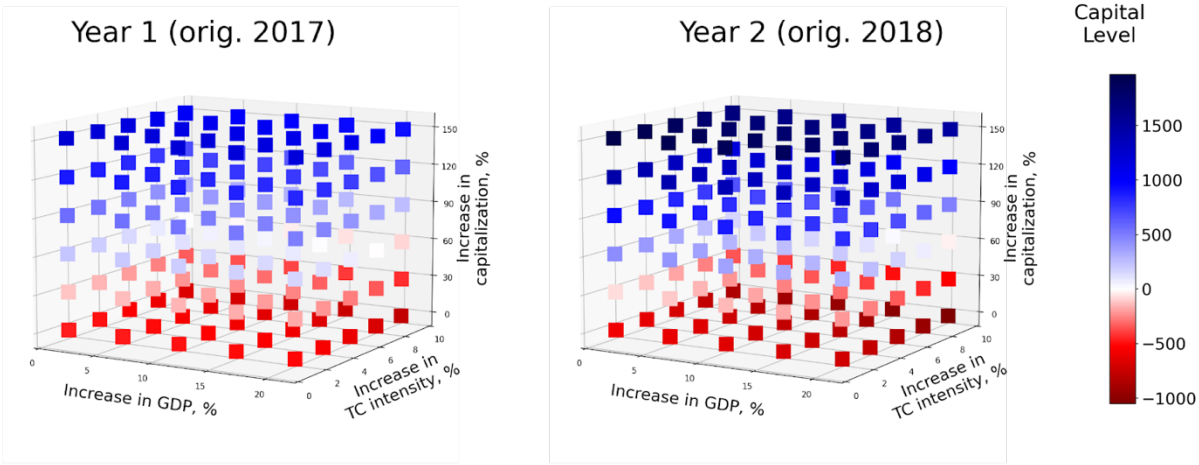
The CatSim approach calculates the fiscal resources that a government can use to cope with natural disasters. Resources include various measures such as budget detour, external assistance, domestic borrowing, taxation, and international borrowing. (For details on how to estimate resources for each of these measures, see Hochrainer-Stigler et al. 2014.) For example, if a government runs a budget deficit of more than 5%, no budget detour capacity is assumed. Otherwise, a maximum of 10% of total revenues can be diverted to finance losses. Such information can be related to a country's contingent liabilities, e.g., for country X in a given year, there is a 90% chance that contingent liabilities will exceed EUR 1 billion, and the budgetary resources to deal with these losses are about EUR0.9 billion. In this case, the funds to cope with the event are exceeded and a budget gap is created. In such a case, it could be argued that the EUSF could be used to finance part of this gap. It should be noted that different risks should be expected depending on the economic situation, as different amounts of funds are available, e.g., fewer funds during recessions or when funds are already being used to address other contingency risks such as the COVID-19 pandemic (Table 4).

In the Hochrainer-Stigler (2021) analysis, which is also used here for the pre-Covid baseline scenario, i.e., the situation before the onset of the Covid 19 pandemic, the hazard risk, exposure, and fiscal sources of resilience were assumed to be the same as in 2018. The resilience parameters were recalculated based on the work of Markanday et al. (2020). The loss distribution used represents a multi-hazard distribution for 5 different hazards (flood, earthquake, wind, storm surge, and tsunami) and is based on data from the 2018 GAR report (see Hochrainer-Stigler et al. 2020 for details). The other additional assumption relevant here is the explicit and implicit government obligations described earlier, which are set at 50% of total losses. In the Covid 19 scenario, the hazard risk, exposure, and responsibilities of the state remain the same, but the sources of resilience are significantly altered. Due to data limitations, it was not possible to use the CatSim process to estimate sources of resilience for 2020/21 because not all of the variables needed for the calculations were available and therefore the estimated numbers were based on heuristic arguments. Details can be found in Hochrainer-Stigler (2021), but in summary, the Covid scenario assumes that no resources are available through budget detour and that external support is limited due to the tight fiscal situation. Borrowing is also severely constrained, but in the absence of reliable estimates of the potential current borrowing buffer (e.g., how much money a country can borrow), it was further assumed to be possible at 2018 levels. The Covid scenario is, therefore, still a fairly optimistic scenario given the high level of debt today and the very likely high level of debt in the near future.

ANNEX B: IMPACT OF STORYLINES ON THE EUSF CAPITAL

Figure B1 below shows projections of the impact of historical and counterfactual tropical cyclones on EUSF capital. The results show that the largest assumed increase in tropical cyclone intensity and GDP could result in significant negative capital, leading to losses twice the current capitalization amount. However, a 70% annual increase in capitalization would allow such worst-case scenarios to be managed and sufficient capital to be maintained. Such an increase in capitalization could be considered affordable and feasible given that the annual capitalization was reduced by half in 2014. However, only increases in loads in the outermost regions are considered here. Hochrainer et al. (2010,2017) noted that the EUSF may have been undercapitalized for flood-related losses in continental Europe even before the 2013 reform. Therefore, a significant change in the way the EUSF is capitalized would be needed to handle pay-outs for hazards occurring in the outermost regions and those occurring simultaneously in continental Europe, such as floods. A full probabilistic assessment would be feasible and recommended fo this purpose.

Figure B1: Effects on EUSF capital if historic and counterfactual tropical cyclones happened in a hypothetical future. The two 4D heat-maps show the effect of future possible climatic (tropical cyclone intensity), socio-economic (GDP) and policy changes (annual capitalization) changes on capital levels (positive and negative capitals are shown in blue and red)



Source: Adapted from Ciullo et al., (2021).

ANNEX C: SCENARIO DESIGN FOR SEAR

In creating the various scenarios discussed, a number of assumptions were made because the rule for the use of funds remains unclear. First, payments are made immediately after the disaster occurs. If a disaster occurs and the conditions for establishing the fund are met, compensation must be paid immediately to the affected countries. Second, during the period when funds are available for both the EUSF and the EAR (Periods 2 and 3), applications are processed in the order in which they occur. In addition, a disaster can only draw down available funds from the period in which it occurs or carry over funds from the following year. This ensures that funds are available for disasters that occur later in the year. Finally, we assume that the first year (Year 1) is a normal year in which the budget is EUR 1.2 billion with no overspending because the annual budget at the beginning of the year depends on the surplus and overspending from the previous year.

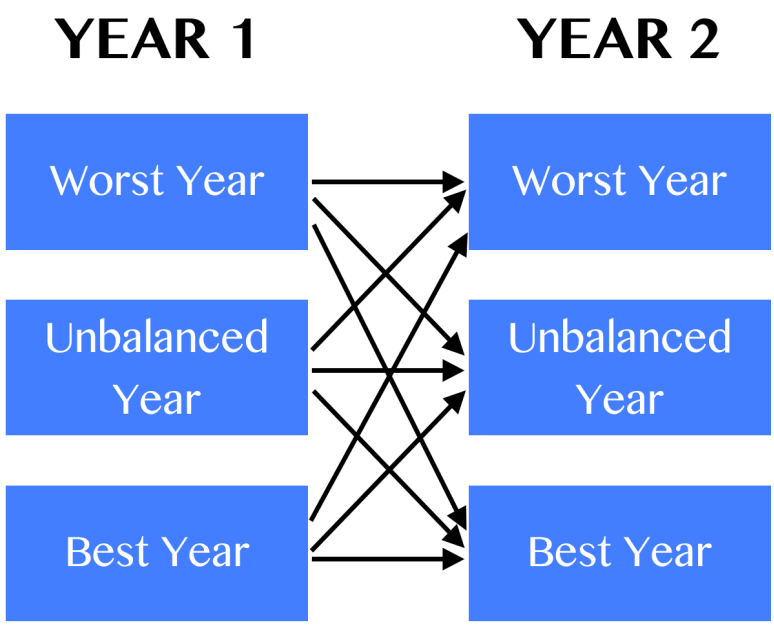
Because of this interannual dependence, two consecutive years are considered. Table C1 shows the three cases for the first year. The starting point for the best year scenario is quite clear: no disasters occur, leaving a budget of EUR 1.2 billion for the next year. In the worst year (WY), the EUSF has a total of EUR 0.85 billion available (EUR 0.45 billion from the annual budget, EUR 0.4 billion from overdrafts). In period 1, there is one extreme event that requires assistance of more than EUR 0.85 billion from the EUSF. The EUSF budget is limited to EUR 0.45 billion in this period, which means that it must overdraw EUR 0.4 billion from the following year. In the meantime, there are two disasters that trigger payments from the EAR, periods 1 and 3, which depletes all available funds. In the case of the unbalanced year (UY), an overdraft is also required in period 1, as a major disaster requires assistance from the EUSF. However, no further disasters occur in that year, leaving a surplus of EUR 0.75 billion that is carried over to the second year. This means that the annual budget for Year 2 would be EUR 1.55 billion. There is a surplus in both WY and UY that would severely limit the availability of EUSF funds in Year 2.

Given the various surplus and overdraft conditions of the preceding year, the annual budget of Year 2 would differ from case to case. Based on each case in Year 1, the Worst Year," Unbalanced Year and Best Year scenarios were created for the following year, as shown in Figure C2. To avoid redundancy, only the representative and extreme cases were selected to construct the storyline, as given in C1.

Table C1: Details of three scenarios of Year 1

Year 1						Note for year 1		
01/01 - 01/09		01/09 - 01/10		01/10 - 31/12		Surplus	Over-draft	
EUSF	EAR	EUSF	EAR	EUSF	EAR			
0.85	0.45	0	0	0	0.3	0	0.4	• Worst Year (WY) for EUSF; • Major disasters in Period 1 for both EUSF and EAR, causing EUR 0.4 billion overdraft; • Another major disaster for EAR Period 3 exhausts the funds;
0.85	0	0	0	0	0	0.75	0.4	• Unbalanced Year (UY); • Only one major disaster occurs which requires EUSF coverage, causing an overdraft of 0.4 billion; • No other disasters occur the rest of the year, leaving EUR 0.75 billion to roll over to Year 2;
0	0	0	0	0	0	1.2	0	• Best Year (BY); • No disaster takes place and, therefore, no payment from the fund is needed; • The entire EUR 1.2 billion budget rolls over to Year 2;

Figure C2: Sketch showing the design of 9 scenarios of SEAR budget plan over two years



A total of 5 scenarios were examined. In the worst case scenario, the EUSF could not use a regular annual budget in year 2. This is because the overdraft in year 1 reduces the budget reserved for the EUSF in period 1 of year 2 to 0, as foreseen in paragraph 9(4) (European Council, 2020). This means that the EUSF can use the overdraft from the following year (maximum EUR 0.4 billion) in the first period if the previous year was a "worst year". This makes the coverage of the EUSF for eight months of a year extremely vulnerable.

Similar problems are observed in scenarios 2 and 3, where EUR 0.4 billion was carried over from year 2 in year 1 and a surplus of EUR 0.75 billion was carried over to the next year in the meantime. Due to the overspending, the funds available for the EUSF in period 1 year 2 would be limited to less than EUR 0.2 billion. In other words, only up to EUR 0.6 billion in losses could be covered by the EUSF if the overrun from year 3 is taken into account.

EUSF funding is much more robust in storyline 4 and 5 when the first year was not overdrawn. Due to the ample annual budget at the beginning of Year 2, the EUSF is able to cover EUR 1.3 billion with its regular budget, adding up to EUR 1.7 billion if an overdraft is needed. In summary, the availability of EUSF funds in period 1, i.e., the first eight months of year 2, would be significantly affected if funds from the following year are overdrawn in year 1 (worst year scenario or unbalanced year scenario).

To better understand the negative consequence caused by interannual overdraft, a detailed calculation is shown for storyline 2, i.e. Unbalanced Year 1 and Worst Year 2. According to Table C2, Unbalanced Year 1 would have a surplus of EUR 0.75 billion and an overdraft of EUR 0.4 billion. Therefore, the starting annual budget for Year 2 would be EUR 1.55 billion. With 25% reserved for the last quarter of Year 2, the available budget before October is EUR 1.1625 billion. Theoretically, 50% of this budget is exclusively reserved for the EUSF before September of Year 2, namely EUR 0.58125 billion. However, due to the overdraft, EUR 0.4 billion would be removed from this budget, leaving only EUR 0.18125 billion as the regular budget plan for the EUSF in the first eight months of

the EUSF. If needs exceeds EUR 0.18125 billion during this period, an overdraft from the following year would again be needed to cover a loss of up to EUR 0.4 billion.

Table C2 Selected scenarios of SEAR budget plan

Storyline index	YEAR 1	YEAR 2	EUSF budget in Period 1 Year 2	Note on Year 2 and the overall storyline
1	WY	WY	0	• Worst-case scenario: The annual budget amounts to only EUR 0.8 billion; • EAR uses up resources in each period of Year 2
2	UY	WY	EUR 0.18125 billion	• Three major events for EAR in each period; • EAR uses up resources
3	UY	UY	EUR 0.18125 billion	• One major event (larger than EUR 0.6 billion) to be covered by EUSF in Period 1; • EUR 1.2 billion roll over to next year. But with EUR 400 million overdraft, the annual budget of Year 3 would be EUR 2.0 billion
4	BY	WY	EUR 1.3 billion	• Annual budget is EUR 2.4 billion in Year 2; • EAR uses up resources in each period of Year 2 (causing more than EUR 1.5 billion in total damages)
5	BY	BY	EUR 1.3 billion	• Best-case scenario: The annual budget is EUR 2.4 billion in Year 2; • Annual budget for next year is EUR 2.4 billion

This study provides an analysis and assessment of EU tools to respond to natural disasters. Particular attention is paid to the European Union Solidarity Fund and the potential synergies and overlaps with other EU instruments including the Emergency Aid Reserve, the EU Civil Protection Mechanism as well as Cohesion Policy. Also the recent modifications to the EUSF including the extension to address major public health emergencies as well as the modifications linked to the 2021-2027 programming period are examined. Based on this assessment, policy recommendations are put forward.

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