CAPCO

a wipro company

# THE CAPCO INSTITUTE JOURNAL OF FINANCIAL TRANSFORMATION

REGULATION

An emergency health financing facility for the European Union: A proposal

SIMON ASHBY | DIMITRIOS KOLOKAS
DAVID VEREDAS

INSURANCE

#54 NOVEMBER 2021

# THE CAPCO INSTITUTE

## JOURNAL OF FINANCIAL TRANSFORMATION

RECIPIENT OF THE APEX AWARD FOR PUBLICATION EXCELLENCE

# CONTENTS

# RISKS

# TECHNOLOGY

# REGULATION

# DEAR READER,

Welcome to edition 54 of the Capco Institute Journal of Financial Transformation.

In this edition we explore recent transformative developments in the insurance industry, through Capco's Global Insurance Survey of consumers in 13 key markets, which highlights that the future of insurance will be personalized, digitalized, and connected. Other important papers cover topics high on global corporate and political agendas, from ESG and climate change to artificial intelligence and regulation.

The insurance industry has been undergoing transformation in recent years, with insurers responding to the needs and expectation of tomorrow's customers, for products that were tailored, flexible, and available anytime, anyplace, and at a competitive price.

COVID-19 has accelerated such change, forcing insurers to immediately implement programs to ensure they can continue selling their products and services in digital environments without face-to-face interaction. New entrants have also spurred innovation, and are reshaping the competitive landscape, through digital transformation.

The contributions in this edition come from a range of world-class experts across industry and academia in our continued effort to curate the very best expertise, independent thinking and strategic insight for a future-focused financial services sector.

As ever, I hope you find the latest edition of the Capco Journal to be engaging and informative.

Thank you to all our contributors and thank you for reading.

Lance Levy, **Capco CEO**

# AN EMERGENCY HEALTH FINANCING FACILITY FOR THE EUROPEAN UNION: A PROPOSAL

**SIMON ASHBY** | Professor of Financial Services, Vlerick Business School, Ghent University
**DIMITRIOS KOLOKAS** | Doctoral Fellow, Vlerick Business School, Ghent University
**DAVID VEREDAS** | Professor of Financial Markets, Vlerick Business School, Ghent University[1]

## ABSTRACT

The unprecedented public health crisis caused by COVID-19 overstretched the structures and mechanisms of the European Union (E.U.), in particular those that deal with emergencies. To be ready for the next health emergency, we propose the creation of the Emergency Health Financing Facility. In its broader version, this facility integrates some of the existing E.U. emergency structures and adds a new layer for the most extreme emergencies that does not increase the burden on public finances. This new layer essentially consists of securitizing health emergency risks in the form of fixed income securities that are sold to institutional investors. The facility follows the growth of market-based risk financing facilities across global and regional initiatives, led by the World Bank.

## 1. INTRODUCTION

### 1.1. The problem

Systemic crises can have significant political consequences, though in Europe they have often been resolved through a strengthening of the European Union (E.U.).

The last systemic crisis was in 2008-2011 and brought several E.U. countries to the brink of default. Pre-existing structures were not sufficient to avert disaster, lessons were learned, and the E.U. adopted new regulatory and supervisory arrangements for financial institutions, as well as the implementation of E.U.-wide contingency funds. The flagship is the European Stability Mechanism (ESM), established in 2012 for providing emergency funding to countries in the euro area that are in financial difficulty – i.e., the ESM is a crisis fighting mechanism. The ESM has about €80 bln of paid-in capital from euro area countries and the capacity to raise hundreds of billions by issuing fixed income securities that are sold to institutional investors.[2]

The Great Lockdown Crisis of 2020 [as coined by the IMF (2020a)] was also a systemic event, but of a very different nature: public health. The magnitude was of a higher order than that of the financial crisis and the eurozone sovereign crisis that followed. The 2020 contraction was more like the Great Depression of the 1930s. But, just as in 2008-2011, the E.U. systems for dealing with this emergency were not enough, or they did not work efficiently. And, also as in 2008-2011, the crisis was resolved with an unprecedented E.U.-debt funded recovery fund and the largest E.U. budget ever.

While E.U. leaders, like those of any government, were aware of the risk of global disease epidemics [WEF (2020), WHO (2016)], and the viral epidemic episodes in Africa and Asia over the past decade (e.g., Ebola, SARS, and MERS) represented a strong early warning sign of the dangers to come, COVID-19 caught E.U. institutions and member states off guard. This resulted in one of the biggest economic, social, and financial crises since the beginning of the 20th century. Paradoxically,

[1] We thank numerous policy officers of the European Commission for insightful remarks on the E.U. structures for health emergencies and risk financing. Dimitrios Kolokas acknowledges funding from Vlerick Business School Academic Research Fund.
[2] https://bit.ly/3F6EMcC

the E.U. has a network of institutions, coordination centers, mechanisms, authorities, and funds related to food safety, monitoring of diseases, and environmental threats (see Section 2 for details). Despite this network, and the fact that many E.U. countries score highly in international health regulations with potent health systems [Tandon et al. (1990)], member states were overwhelmed when taking care of large numbers of severely ill patients.

## 1.2 The proposal

A key lesson that needs to be learned from the Great Lockdown Crisis is the need for a deeper union across the European healthcare sector. Although we do not know when the next health crisis will strike, COVID-19 is unlikely to be the last. Climate warming, the emergence of new pathogens, and the reemergence of others poses significant risks to the health security of the E.U. In addition, there are chemical, radiological, and nuclear risks to be considered, risks that demand a similar response.

To be ready for the next health emergency, the E.U. needs an effective mandate, unified health emergency response arrangements, and operative collaboration between member states.[3] It also needs a significant financial cushion (while keeping public finances under control) for rapid and predictably increasing funding.

We propose the creation of an Emergency Health Financial Facility (EHFF). The EHFF could provide the aforementioned financial cushion and would complement existing structures like rescEU and the Emergency Support Instrument. It is important to note that the EHFF is not an aftermath recovery facility for the social and economic costs associated with the health emergency, such as aid to businesses and to workers. Instead, the EHFF is used when the crisis starts and funds are needed quickly for ramping up medical supplies, testing kits, building infrastructures, and sudden increases of personnel, amongst others.

The EHFF will enhance cooperation and solidarity within the E.U., which is essential to overcome the effects of a systemic health emergency, without increasing the burden on member state finances. In addition, it could be used to increase the E.U.'s capacity to assess, report, and respond to health threats in a timely manner. In this article, we propose a design for the EHFF, focusing on its potential financing structure, leaving most of the technical aspects for further analysis.

In a nutshell, the EHFF is a financial mechanism that allows the E.U. to obtain large amounts of money from financial markets by means of the securitization of health emergency risks, similar to the securitization of catastrophe risks in the insurance industry. Health emergency risks are converted into fixed income securities that are sold to institutional investors. If a health emergency risk materializes, the principal (or a part of it) of the fixed income securities is used to cover the funding needs of the member states. The amount of principal used depends on the severity of the emergency.

Generally speaking, the EHFF is framed within the topic of "disaster risk financing" (DRF) [World Bank (2018a), Mutenga and Staikouras (2008), Cummins and Weiss (2009)]. DRF is a way to "increase financial response capacity in the aftermath of disasters and to reduce the economic and fiscal burden of disasters by transferring excess losses to the private capital and insurance markets" [Clarke and Mahul (2011)]. DRF is often layered into three categories depending on the frequency and severity of the risk. The funding of disaster risks with the highest frequency and lowest severity comes from allocated budgets. In contrast, the funding of disaster risks with the lowest frequency and highest severity are securitized and sold to institutional investors. Funding for risks in between typically comes from a contingency budget. The EHFF falls within the low frequency, high severity category. However, we also propose a version of the EHFF that integrates the "emergency support instrument" that lies in the (medium frequency and severity) contingent budget category.

Though both the European Stability Mechanism and the EHFF are E.U.-wide financing mechanisms for crisis fighting (sovereign and health respectively), there are important differences between them. First, the EHFF will be used exclusively for funding health emergencies. These emergencies are not necessarily medical, as with COVID-19, but any health emergency that is potentially systemic (such as chemical, biological, radiological, and nuclear incidents), in line with the existing health-related structures in the E.U., namely rescEU and the "crisis management framework". Second, in principle, the European Stability Mechanism lends money to countries subject to conditions, asking them to implement tough macroeconomic and fiscal reforms. A principle underpinning this conditionality is that shocks that require a bailout by the European Stability Mechanism are endogenous. In the case of the EHFF, shocks are exogenous and, therefore, funding will be provided when health-related conditions are triggered, and

[3] Paul Hudson, chief executive of Sanofi said in April 24, 2020 to reporters after first-quarter results that "There has been a lack of co-ordination at a European level […] It's starting to move now but the level of pandemic preparedness is very, very low." Source: Financial Times article "Sanofi warns Europe on Covid-19 vaccine", April 24, 2020, https://on.ft.com/3ijstQk

without conditionality. Third, the European Stability Mechanism provides lending, i.e., countries that receive money have a debt that must be repaid. In the case of the EHFF, funding for health emergencies will come from the principal of the fixed income securities that would not be repayable.

Facilities for disaster risk financing exist or are being considered in other parts of the world. The most prominent cases are the Pandemic Emergency Facility of the World Bank and the ASEAN+3 Disaster Risk Insurance Facility, that we explain in detail in Section 4. Another facility worth mentioning is the Pacific Alliance Catastrophe Bonds that offers earthquake coverage to four South American countries.[4]

The securitization of risk goes back to the early 1990s. The insurance industry (reinsurers in particular) were pioneers due to the hurricanes in the Caribbean. Securities that result from risk securitization are known as insurance linked securities, or ILS for short [Barrieu and Albertini (2009)]. Catastrophe bonds are the predominant form of ILS, though there are others like sidecars. The value of ILS has increased steadily since the mid-1990s: from U.S.$785.5 million in 1997 to U.S.$41.8 billion in 2020. The predominant risks covered are natural catastrophes, like named storms and earthquakes, though they also cover mortgage, operational, and mortality risks, among others. ILS have an average maturity of between three to five years, do not have investment and default risks, and hence the only risk covered is the insurance risk. The average annualized expected loss is around 2% and the average annualized coupon is about 6%; the average multiple is therefore about three.

### 1.3 The value of the proposal

The EHFF will have positive spillovers on the public finances of E.U. countries, in the sense that member states will be better off, as part of the EHFF, than managing the risk of a health emergency individually. If member states had to unilaterally manage the risk of the next health emergency, they would each be required to allocate, and lock-in, significant heath sector funding for an unknown time period. Since this funding might not be used for many years, such a move would represent a significant opportunity cost, by preventing the funds from being spent on other much needed public services or social security projects (e.g., education and social care). On the other hand, if member states do not lock-in funding for public health emergencies and the emergency materializes, public finances would suffer great stress and volatility, as we have witnessed with the COVID-19 crisis. The EHFF is, therefore, a cost-effective solution that protects national budgets from the impacts of health emergencies.

The IMF (2020b) estimates that, on average, advanced economies have pledged an additional 0.5 percent of GDP to healthcare. Since the GDP of the E.U. is about €18.3 trillion, the additional expenditure to healthcare due to COVID-19 is about €91.5 billion. More concretely, in above-the-line fiscal measures, France, Germany, Italy, and Spain spent €5.5 billion, €11.2 billion, €3.2 billion, and €3.9 billion in the health sector, respectively. The European Commission (E.C.) also pledged €3 billion from the E.U. budget to fund the Emergency Support Instrument and RescEU's common stockpile of equipment. E.U. budget was also allocated to research. The Commission joined forces with global partners in the Coronavirus Global Response and raised €9.8 billion in pledges from donors worldwide (including a pledge of €1.4 billion from the Commission, as at early July 2020) for universal access to coronavirus treatments, tests, and vaccines. In parallel, between January and June 2020, it mobilized €546.53 million to develop vaccines, new treatments, diagnostic tests, and medical systems.[5]

A key feature of the proposal is that the EHFF is pre-loss. We acknowledge that post-loss financing is also possible. Indeed, the E.U. has issued €14 billion of bonds, backed by all member states, to help finance COVID-19 recovery efforts across the Union.[6] These bonds were issued to help fund the Support to mitigate Unemployment Risks in an Emergency (SURE) initiative to help E.U. member states that are faced with a sudden increase in public expenditure to protect jobs.[7] Though it is possible to raise cost-effective finance post-loss, as in the case of the E.U. SURE bond issue, the timing of funds is also critical. Sole reliance on post-loss funds may mean that there are delays in the provision of funds, especially if there are political disagreements regarding the cost and allocation of funds, or where potential creditors are unwilling or unable to invest, because of a credit crunch, for example. In the case of pre-loss financing such delays are avoided, ensuring that funds are released immediately. This is especially important in the case of major crises like pandemics, where research has shown that delays can have significant consequences, preventing jobs from being saved or delaying expenditure in other areas like medical response [Bryce et al. (2020)].

[4] https://bit.ly/3opX9Do
[5] The E.U. budgets mentioned do not include the measures to recover the economy, such as SURE and the Recovery Plan. https://bit.ly/2ZOKJL5
[6] https://bit.ly/3AV0OMS
[7] https://bit.ly/3l08yrA

In short, the proposal has value as a complementary mechanism to post-loss financing. The proposal allows funds to be raised pre-loss, ensuring the fastest possible response. Post-loss finance can subsequently be used to help reinforce the available funds, for example, where additional funds are required, or the cost of finance is especially low.

### 1.4 Hurdles

The implementation of the EHFF faces several hurdles. First, E.U. countries hold primary responsibility for organizing and delivering health services and medical care. Joint initiatives, like the common ordering of vaccines, are exceptions and further integration with respect to the healthcare sector might be controversial. However, integration in the E.U. has always been controversial and subject to political compromises. A case in point is debt financing, which was taboo until the COVID crisis. NextGenerationEU will issue up to €800 billion of common debt.

Second, in some states, private or public healthcare or insurance systems exist that are clearly separated from general government finances, whereas healthcare costs of other states are financed by general tax revenues. The different national healthcare systems may have different needs and abilities for refinancing. That said, in times of E.U.-wide health crises, the needs are the same for all member states regardless of their healthcare structures.

Third, funding through the EHFF must be complemented with logistical planning. As we witnessed in 2020, many of the health challenges faced by governments were logistical, (e.g., lack of ventilators, hospital beds, healthcare workers in certain geographic regions, and bottlenecks in the production of vaccines). Consequently, developing emergency plans to address these logistical challenges complements its financing (Bryce et al. (2020)].

## 2. EXISTING HEALTH-RELATED E.U. STRUCTURES

### 2.1 Overview

The European Commission currently finances the strengthening of the healthcare systems of its member states via the E.U. Health Programme.[8] This is a funding instrument to support cooperation among E.U. countries and develop health activities. Strong healthcare infrastructure is the basis of an effective response to widespread life-threatening challenges, such as pandemics, and the E.U. Health Programme serves this goal. The third and latest E.U. Health Programme lasted seven years (2014-2020) and the budget was approximately €450 million. The next 2021-2027 program is EU4Health, with an estimated budget of €1.7 billion [European Council (2020)].

When a serious cross-border health threat at the E.U. level emerges, the Health Programme becomes overstretched. Figure 1 schematizes the E.U. structures for dealing with a health threat/emergency. The figure is divided into three parts, each one identified with a color. Blue represents monitoring and management of a health emergency, where the crisis management framework of the Directorate-General for Health and Food Safety is the cornerstone. Green concerns the active prevention preparedness and response of E.U.-wide risks, all integrated in the Directorate-General for European Civil Protection and Humanitarian Aid Operation (ECHO). Purple shows funding through the legal framework, Emergency Support Instrument. These structures relate to a 2005 set of International Health Regulations signed by all countries in the World Health Assembly. The new regulations were motivated by SARS in 2003 and the avian influenza outbreak of 2004-2005, and the aim was to "prevent, protect against, control and provide a public health response to the international spread of disease."[9]

### 2.2 DG health and food safety

The health security framework allows member states to coordinate preparedness activities and response planning to strengthen their capacities for the monitoring, early warning, assessment, and response to health emergencies [European Parliament (2013)]. This framework provides a backbone for developing national plans to address different types of health threats – e.g., pandemic, events caused by biological or unknown agents, accidents caused by chemical agents, natural events of environmental origin, and deliberate acts.

The health security framework is operationalized through the Health Security Committee (HSC), an expert group responsible for coordinating preparedness, response, and international cooperation. The HSC is supported by the Early Warning and Response System (EWRS), a confidential computer system that allows member states to exchange risk assessments and information, as well as sending alerts about events with a potential impact in the E.U..

[8] https://bit.ly/3m8nkLW
[9] https://bit.ly/3D0uTuZ

The HSC can request risk assessments to two E.U. agencies and a scientific committee, depending on the type of threat. The European Centre of Diseases and Control (ECDC) provides risk assessment services if the threat is an infectious disease. The European Food Safety Authority (EFSA) covers all matters with a direct or indirect impact on food and feed safety. The Scientific Committee on Health, Environmental, and Emerging Risks (SCHEER) covers emerging or newly identified health and environmental risks outside the remit of all other European Union risk assessment bodies.

## 2.3 DG ECHO

Although the crisis management mechanism is crucial when a healthcare crisis occurs, it has a role that does not actively improve the health emergency capacity of member states.

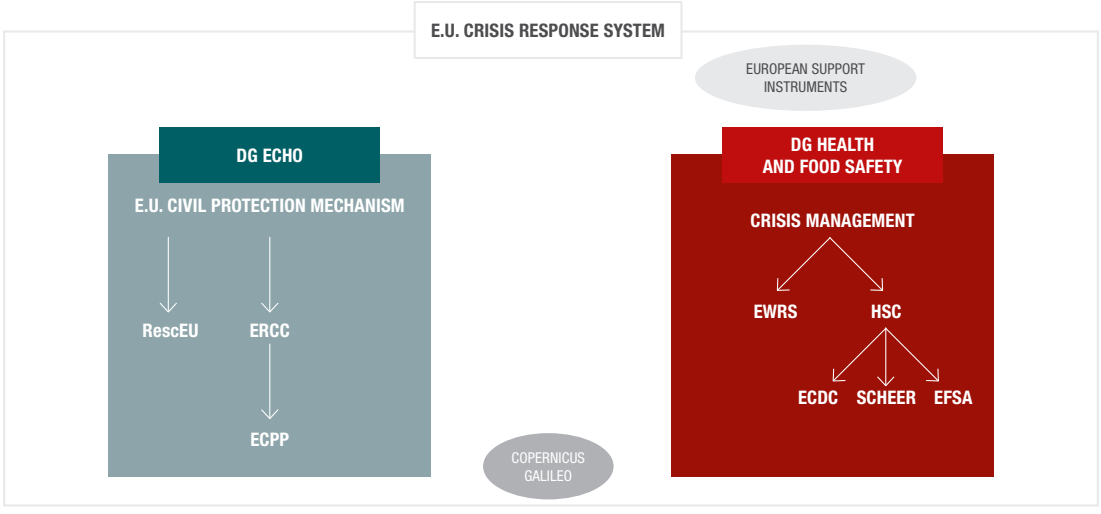
In 2013, the E.U. established the E.U. Civil Protection Mechanism (EUCPM) to support the management of crises. The EUCPM is a solidarity instrument and member states participate on a voluntary basis. The EUCPM serves as a platform to mutualize resources (or, more precisely, certified capacity such as forest fighting airplanes, medical corps, firefighters, expert teams, etc.) and is designed to provide an E.U.-wide response to support the management of disaster risks in member states.

The list of risks covered by the EUCPM is mostly based on the National Risk Assessments (NRAs) of member states. NRAs screen and report the potential risks that a country might face in the next five years. Disaster risks vary significantly across the geography of Europe and include various types. The most prominent ones range from meteorological (flooding, extreme weather), climatological (forest fire, drought), geophysical (earthquake, landslide, volcano) and biological (pandemic, epizootic, animal, and plant diseases) natural disaster risks, to human-made disaster risks of technological origin (industrial accident, radiological accident, critical infrastructure disruption).

The EUCPM is effective when emergencies affect one or a few member states. When emergencies are E.U.-wide, and given the voluntary aspect of the Mechanism, the EUCPM is not always fit for purpose. This is why rescEU was created in 2019. RescEU is a mechanism of last resort. It provides financing (from the E.U. budget) for the procurement of capacity to help respond to and recover from E.U.-wide disasters. In return, the European Commission has the right to allocate this capacity across the E.U. Put it differently, while in the EUCPM solidarity is the keyword and member states can refuse to share capacity, under RescEU, the European Commission holds the deployment rights over the capacity that is bought directly from the E.U. budget.

The coordination of all the teams and the communication between member states is managed by the Emergency Response Coordination Centre (ERCC). The ERCC coordinates the delivery of assistance to disaster-stricken countries, such as relief items, expertise, civil protection teams, and specialized equipment. The ERCC works around the clock and uses monitoring and surveillance tools like EWRS, Copernicus, and Galileo.[10] The ERCC acts as a coordination hub between all member states and six additional participating states, the affected country, and civil protection and humanitarian experts.

**Figure 1:** Overview of health emergency systems at the European Commission




[10] Copernicus is the E.U. earth observation program and Galileo is the E.U. global navigation satellite.

While the ERCC coordinates the delivery of assistance to a disaster zone at short notice, the European Civil Protection Pool (ECPP) brings together resources that are ready for deployment. A member state calling the ECPP is like a citizen of an E.U. country calling 112 for the emergency services. One recent example of the action of the ECPP is the forest fires in north Europe in 2018, where the ECPP coordinated various resources across Europe that assisted Sweden during this catastrophic event.

Last, the European Commission launched a proposal for reforming the EUCPM.[11] The keyword of the proposal is flexibility, especially in the budget. Currently, the budget is divided in fixed ratios across "preparedness", "prevention", and "response" classes. Under the proposal, this categorization is canceled, and the budget might be used with greater flexibility based on the ongoing needs of the member states and the severity of the emergency. It is also proposed to enhance the role of the ERCC by strengthening its cooperation with E.U.-level entities involved in crisis management and its monitoring and early warning functions.

## 2.4 The last resort funding: ESI

From a financing perspective, the funding provided by rescEU is limited in amount and scope (e.g., it only applies to certain types of natural disasters). Though the budget was increased twice during the pandemic, first to €80 million and then to €300 million, as implementing acts were recently approved on health emergencies, this remains well below the multi-billion Euro fiscal spending of member states on the pandemic.[12]

Additional, last resort, funding is provided by the Emergency Support Instrument (ESI). The ESI is a legal framework created in 2015 and must be activated by the European Council upon proposal of the European Commission. The ESI was activated for the first time in 2016-2019 during the immigration crisis. Due to the COVID-19 pandemic it was activated again in April 2020 for 24 months.[13]

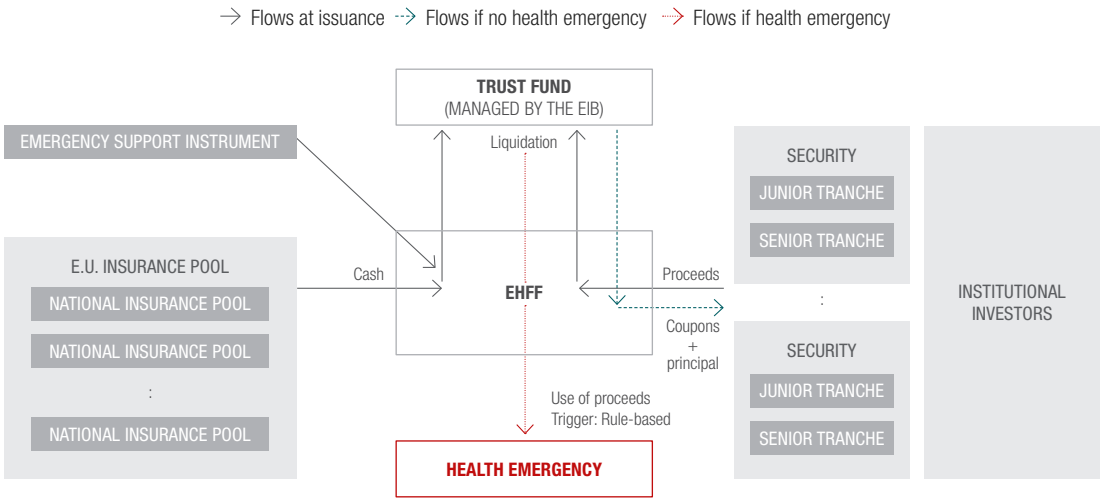
Currently, the ESI manages €2.7 billion funded by the E.U. budget. During the COVID-19 pandemic, the ESI initially focused on the supply of medical equipment. Then, in June 2020, when the European Commission announced its COVID-19 vaccination strategy [European Commission (2020)], it was decided to use a significant proportion of the €2.7 billion ESI fund to support Advanced Purchase Agreements (APAs) with the pharmaceutical industry to ensure the rapid deployment of vaccines, once developed. It is important to note that an APA is not a forward contract and, therefore, does not involve the advance purchase of any vaccine that is developed (the WHO estimates that the international cost for vaccine testing, development, and treatment will be about U.S.$31.3 billion in 2021, so the purchase costs will be much higher). Instead, these APAs work like a call option that confers a right for member states to buy a vaccine with priority over third-party countries. In this way, the APAs funded through the ESI function as a form of insurance policy. Funds are provided to the pharmaceutical industry to guarantee the supply of a vaccine to member states.

Though the ESI is a strong last resort funding instrument and with the right focus, it can lack speed and flexibility. The ESI is funded by the E.U. budget only when it is activated by the European Council. As a result, its funding is not secure and must be negotiated, as must the activities that may be underwritten. Moreover, the European Commission needs to cooperate and coordinate with member states and with the European Parliament, which can be time consuming. Indeed, in the vaccine strategic communication, the Commission acknowledges that €2.7 billion might not be enough and that "Member States will have the possibility to top-up the ESI to make up any financing gap." In addition, the Commission considers exploring alternative avenues to attracting funding, such as individuals, foundations, and crowd funding.

Last, the European Investment Bank has contributed to the research and development of a vaccine through the Horizon 2020 InnovFin Infectious Disease Finance Facility. This facility is 100% guaranteed by the European Commission. The EIB provides debt and equity-type financing.[14] Though this is not a financing instrument for emergencies, currently the facility is exclusively allocated to COVID-19 projects.

[11] https://bit.ly/3kVMgqQ
[12] NextGenerationEU and the 2021-2027 MFF allocate to RescEU €1.9 bln and €1.1 bln, respectively [see European Council (2020) for more details]
[13] At the level of the E.U. political leaders (i.e., the European Council), there is also a mechanism that can be activated for crisis response: The Integrated Political Crisis Response (IPCR). It was created in 2013 and activated for the first time during the refugee and migration crisis. More details can be found here https://bit.ly/3AUpMfn
[14] https://bit.ly/3okJ760

**Figure 2:** Complementary architecture of the EHFF




## 3. THE EHFF

The Emergency Health Financial Facility (EHFF) is a health risk management tool that provides liquidity when it is most needed and without allocating large amounts of cash in advance. The EHFF gives financial firepower, covering the possibility that the budget allocated in the ESI is not enough and without member states being forced to top up the ESI with billions of extra euros.

### 3.1 Architecture

The architecture of the EHFF can take two forms, depending on its relationship with the Emergency Support Instrument. The first possibility is complementary, while the second is integrative.

#### 3.1.1 OPTION 1: EHFF COMPLEMENTS ESI

Under this option the EHFF acts as a special purpose vehicle, or a legal entity entirely devoted to deal with financing the costs of health emergencies and managed by the European Commission. Such a facility is represented by the big blue rectangle in the middle of Figure 2.

Once the EHFF is created, the next step is to decide the risks covered and their price. Both are required for the issuance of fixed income securities. As the right-hand side of Figure 2 shows, there can be as many issuances as risks covered and, for each issuance, there can be different tranches that cover different severities of the emergency. Though the figure shows a junior and a senior tranche, there can be many more (e.g., a mezzanine). We cover this issue more in detail below.

To pay the coupons to investors, the price of the risks (the premium in insurance jargon) must be transferred to the EHFF. This is a cash transfer that can come from the ESI and/or from a newly created E.U. health emergency insurance pool (we explain this point further below), as shown in the left-hand side of the figure. Cash is then transferred to a trust fund, as shown by the solid black arrows.

Once the fixed income securities are sold to institutional investors (typically bonds with a duration of three to five years), proceeds are transferred to the trust fund, which are invested. The issuance and the management of the trust fund would happen under the auspices of the European Investment Bank (again, more on this below).

If during the lifetime of the securities there is no health emergency, investors receive their coupons and upon maturity the principal is returned, as shown by the green dashed arrows. Cash transferred to the trust fund is used to pay the coupons, while the investment return (which is not significant since cash and proceeds must be invested in safe assets) is typically used to cover administrative costs.

If a health emergency that meets certain criteria occurs, then the investments (in whole or part) are liquidated and transferred to finance the emergency, as shown with the red dotted line. As a consequence, in the case of a severe emergency, institutional investors can forego future coupons and the principal. The above-mentioned triggering criteria must be unambiguous, measurable (to gauge the scale of the emergency), and clearly specified in advance. Liquidated

funds are transferred to member states or to organizations with requisite expertise. Below we expand on the triggering mechanism and how it should look like.

To sum up, under the complementary form, the EHFF is a sort of reinsurer of the ESI and the associated risks are transferred to financial market investors.

### 3.1.2 OPTION 2: EHFF INTEGRATES ESI

Figure 3 shows the integrative approach, in which the ESI is upgraded to the EHFF. Such a facility would consist of two elements: cash and fixed income. While the cash element plays the same role as the current ESI, the fixed income element is like the architecture in Figure 2. The difference between Figures 2 and 3 is that in Figure 3 the ESI is integrated into the EHFF. The advantage of this integration is that only one legal framework is required for funding E.U. health emergencies.

Under the integrative architecture, cash comes from the E.U. health emergency insurance pool and from the E.U. budget (similarly to today's funding of the ESI comes from the E.U. budget). The issuance of securities and the triggering criteria are the same as in Figure 2. Cash can also be used in the case of a triggering event, just like the European Commission (2020) is using cash in the ESI to finance APAs of vaccines. The main difference between the triggering criteria in the fixed income and the cash elements is that, in the former the trigger is based on rules, while in the latter an expert committee decides.

## 3.2 RELEVANT ASPECTS OF THE EHFF

To implement the EHFF in one of the forms just explained, several further issues must be addressed. The most important is the risks to be covered and how they are priced. Second, the criteria to trigger the (partial) liquidation of investments for funding the health emergency. Third, the mechanics for the E.U. insurance pool. In this section, we explore these issues. It is not our aim to provide a detailed implementation and operational guide. This is beyond the scope of this article and will require detailed risk and financial analysis.

We conclude the section with some remarks on the role of the European Investment Bank and its experience in running trust funds, as well as remarks on the EHFF's lack of default and investment risks.

### 3.2.1 WHICH RISKS AND HOW?

As mentioned in Section 2, the E.U. Civil Protection Mechanism deals with a diverse array of disaster risks, both natural (meteorological, climatological, geophysical, and biological) and man-made (e.g., chemical, radiological, and nuclear). If they were to materialize, each of these risks can lead to a health emergency, and hence potentially fall under the architecture of the EHFF. Social, economic, and financial losses due to the realization of such risks (business interruption, non-paid wages, etc.) are not covered by the EHFF.

Though the EHFF can cover many infrequent risks, the severity of an emergency must be considered. As mentioned earlier, the EHFF naturally links with the Emergency Support Instrument, an instrument used only where there is an E.U.-

**Figure 3:** Integrative architecture of the EHFF

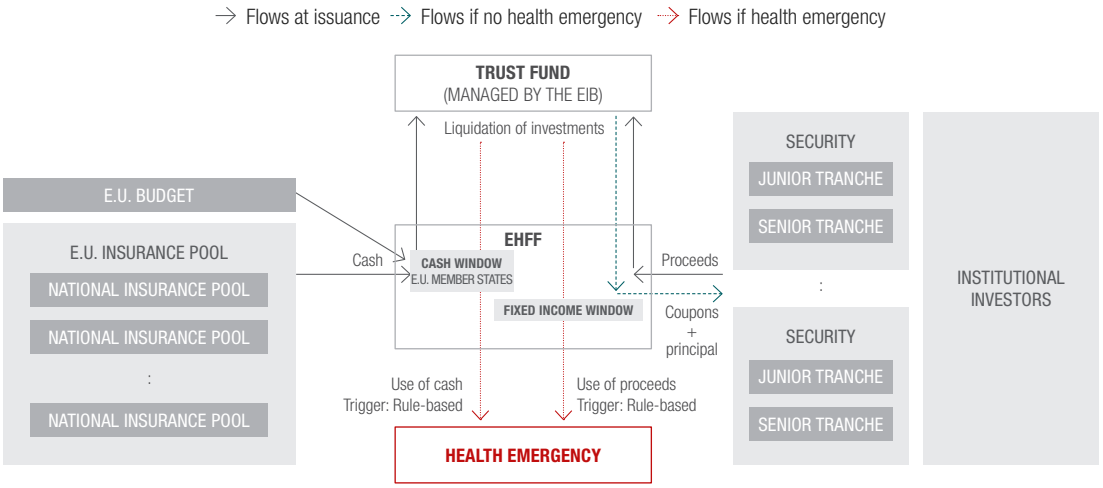
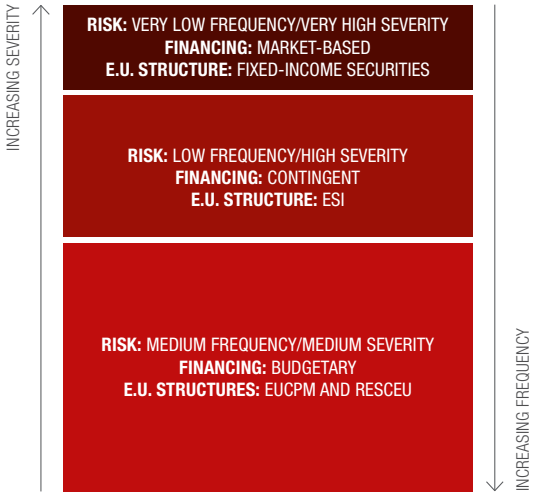


**Figure 4:** Risk structuring




wide emergency. This is typically in the case of (very) low frequency/(very) high severity events. For risks with higher frequency and lower severity, other tools such as rescEU and EUCPM can be used.

To put it another way, the severity and frequency of a given event can be structured in three tranches, as shown in Figure 4. The risks at the bottom tranche (medium frequency/medium severity events) are covered by the pre-existing EUCPM and rescEU mechanisms. The intermediate tranche is covered by the ESI, with funding contingent on the activation of ESI by the European Council. The last tranche (very low frequency/very high severity events) is covered by fixed income securities, and hence financing comes from financial markets. A similar classification is used for assessing the use of financial instruments in risk financing [Clark et al. (2017)], as well as for insuring risks with reinsurance and ILS [Cummins and Trainar (2009)].

Focusing on the last tranche, it can be further divided into sub-tranches, as already showed in Figures 2 and 3, whereby the higher the risk of each sub-tranche, the higher the coupon. Coupons would be equal to a prespecified interbank interest rate (e.g., LIBOR or EURIBOR), plus the price of the emergency risk, which acts as a risk premium. Issuance of the sub-tranches could be done in collaboration with a global (re)insurance company, serving as a financial market intermediary, similar to an investment bank (for instance, the insurance tranche of the WHO's Pandemic Emergency Facility was structured by MunichRe and SwissRe).

Last, a thorough risk analysis is essential for investors to buy the securities from one sub-tranche or another. Investors typically care about three risk measures: i) the probability that a fixed income security will experience losses during a given period (known as the probability of attachment), ii) the likelihood of suffering a total loss (known as the exhaustion probability), and iii) the expected loss relative to capital invested. This risk analysis is done in collaboration with specialized disaster modeling companies that function as independent reviewers and offer confidence to institutional investors.

### 3.2.2 THE TRIGGERING CRITERIA

The choice of trigger is a central component of any securitization mechanism for emergency funding, as it determines the scope of indemnification for the occurrence of the emergency.

Theoretically speaking, the ideal outcome is an indemnity trigger equal to the funding needs of the emergency. This is the standard outcome in the ILS industry, and currently it accounts for about 65% of outstanding capital.

Unfortunately, for the EHFF, an indemnity trigger approach is not viable. When the emergency strikes, funds need to be readily available. With an indemnity trigger, the funding needed for the emergency is subject to verification processes, which can be complex and opaque, ending up with investors demanding a higher coupon or further delaying the release of funds through legal challenge. Furthermore, indemnity triggers are subject to information asymmetries [Finken and Laux (2009)].

Instead, the EHFF should opt for a parametric trigger [Teh and Woolnough (2019)], where the European Commission defines criteria under which investments in the trust fund are (partially) liquidated. For instance, in the case of the Pandemic Emergency Facility of the World Bank, the criteria were based on the cases, deaths, and geographical spread of the pandemic (as explained in the next section). The higher the number of cases, deaths, and spread, the higher the proportion of liquidated investments. Generally speaking, a parametric trigger is insensitive to information asymmetry and, in the E.U. context, should not depend upon approval of the European Parliament and the European Council (in contrast to the ESI).

Figure 5 shows a diagrammatic representation of a parametric trigger, measured with an index of base 100 (horizontal axis). The fixed income security has two tranches, as in Figures 2 and 3. The vertical axis shows the principal of the securities: 100% means that investors recover all the principal, while

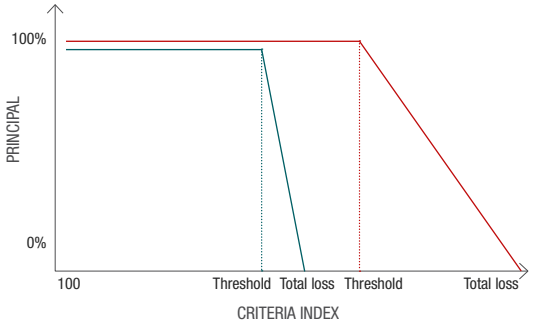
0% means that all the investments in the trust fund are fully liquidated and investors lose everything. The percentage of principal recovered depends on the index, which is verified on a regular basis since the emergency strikes. Because the junior tranche is riskier than the senior, the former starts to liquidate the principal earlier.

Currently, the European Commission already uses triggering criteria for emergency funds. The Directorate-General for Regional and Urban Policy oversees the E.U. Solidarity Fund (EUSF).[15] The main goal of this fund is to financially assist member states to cope with emergency operations due to natural disasters and health emergencies. The EUSF can mobilize up to €500 million (plus any unspent money from previous years) from the E.U. budget. To trigger the release of funds, the following criteria must be met. First, the level of the direct damage caused by the natural disaster should exceed €3 billion or more than 0.6% of GNI (these number change to €1.5 billion and 0.3% of GNI in case of a health crisis). In the case of a regional disaster, the percentage is 1.5% of the regional GDP. Second, approval of the European Parliament and the European Council is needed.[16] The European Council (2020) is considering the creation of a new €1.2 billion Solidarity and Emergency Aid Reserve envelop that covers the EUSF among others.

### 3.2.3 THE E.U. HEALTH EMERGENCY INSURANCE POOL

This pool would be a new creation, though based on existing national pools. Almost all member states have at least one insurance pool to cover the occurrence of very large risks, such as nuclear, environmental hazards, and terrorist threats [DG Competition (2014), OECD (2016), Skogh (2008)].

**Figure 5:** A typical example of parametric trigger




Insurance pools are a form of co-insurance. All pool partners contribute and share the risk without limited responsibility, on the grounds that when very large risks occur, it affects all partners, and hence they are better off mutualizing the risk in the pool. In addition, an insurance pool allows contributing partners to take on risks that they could not otherwise afford to underwrite, by reducing their individual liability and sharing the costs of any legal disputes about the nature and extent of cover. COVID-19 is a good example of such a situation. Though insurance companies claim that the fine print of insurance contracts rule out many pandemic related claims, legal actions against this by policyholders have commenced in numerous jurisdictions. It is very likely that COVID-19 will be the costliest event in history for the insurance industry.[17]

By including E.U.-wide health emergency risks in the list of pooled risks and transferring an appropriate premium to the E.U. health emergency insurance pool, insurance companies and governments of the member states could take these risks off their balance sheets [see De Mot and Faure (2019), for the role of governments on the cost of disasters]. This would have advantages for the insurer's solvency ratios and release more capital for business development. At the time of writing, similar ideas are being debated in the U.S. and in the U.K.[18]

Note that we are not proposing to merge national insurance pools across member states, but to include E.U.-wide health risks to help supplement national pools and transfer only low probability, high impact health risks to the E.U. insurance pool.

Premiums transferred by the national pools to the E.U. health emergency insurance pool could be proportional to the risks covered by each national pool. However, this can be cumbersome, difficult to compute, and highly political. Instead, once risks are priced, premiums transferred can be on the same proportions as the contributions of the member states to the Multiannual Financial Frameworks (aka the E.U. budget).[19]

### 3.2.4 TRUST FUNDS AND THE EIB

Since the cash and proceeds of the EHFF are placed in a trust fund at the European Investment Bank (EIB), it is worth remembering that the EIB has much experience managing trust funds.[20]

[15] https://bit.ly/3meDGTr
[16] See Faure and De Smedt (2019) on the role of the E.U. as facilitator of insurance or if it includes ex-post compensation as well
[17] https://bit.ly/39Sa88m
[18] See the Financial Times article: "Insurers plan to include pandemics in UK terror scheme" (https://on.ft.com/3AYX39n)
[19] See here for the last available https://bit.ly/2ZODPpa
[20] https://bit.ly/3menvFR

Currently, the EIB deploys trust funds to promote sustainable development within and outside the European Union. These trust funds not only ensure the financial feasibility and sustainability of these projects, they also add capacity and expertise through technical assistance.

Trust funds are co-created with the EIB, the European Commission, and most of the member states that act as donors. These donors enter into a partnership with the EIB because they have an interest in delivering sustained impacts across developing countries. On the other hand, the long-term goal of the EIB is to initiate actions and projects that will attract further investments from other institutions and organizations.

Eight trust funds have been created so far, supporting projects in 75 countries. The size of the funds varies significantly. The smallest is the Water Sector Fund and accounts for €2 million. The largest is the E.U.-Africa Infrastructure Fund, which raised €815 million.

#### 3.2.5 EHFF DOES NOT HAVE DEFAULT AND INVESTMENT RISKS

The fixed income securities issued by the EHFF solely contain the health emergency risk. There is no default risk since the European Commission has the highest credit worthiness. But even in the case that it would default, investors would still recover the principal since it is in a trust fund of the EIB, and hence is legally separate.

Similarly, these securities would not have any investment risk, since the trust fund would only invest in safe assets that provide a return sufficient to cover administrative costs. Alternatively, the trust fund can enter in a total return swap with a triple A rated counterparty. This eliminates the investment risk, but creates a residual counterparty credit risk, in the unlikely event that the counterparty was to default on its payment obligations.

We close this section with a note on why investors would be willing to buy securities issued by the EHFF. In the ILS market, typically there is more demand than supply. This is because investors find these securities attractive as they offer a high coupon (relative to the average of fixed income products) and they are uncorrelated with other asset classes, which is good for diversification.

## 4. PRECEDENTS OF GLOBAL AND REGIONAL EMERGENCY RISK MANAGEMENT

In this section, we survey the most relevant (for this article) emergency risk financing initiatives taken globally and regionally; and we use Figure 3 as reference. Not all are covered in detail, but only those that are the closest to the EHFF and that are operational (i.e., we do not cover projects under development because of lack of information) – we refer readers to ODI (2020) for a comprehensive overview of the available risk financing tools.

Regarding the fixed income window in Figure 3, the World Bank (through its treasury and the IBRD) is the leading international organization for the securitization of disaster risk financing, not only because of the already mentioned PEF (Pandemic Emergency Financing Facility, and explained in detailed here below), but also the Pacific Alliance Catastrophe Bond for Earthquake Risk that covers four countries in the American Pacific Coast [IBRD (2018)], and the Catastrophe-Deferred Drawdown Option that can trigger a loan at very favorable conditions in case of natural disasters and/or health-related events in any IBRD country [World Bank (2018b)].

As for the cash window, sovereign disaster risk insurance is of interest. This type of insurance typically operates as a regional insurance pool and the trigger is parametric. Examples include the African Risk Capacity (ARC), Caribbean Catastrophe Risk Insurance Facility (CCRIF SPC), Pacific Catastrophe Risk Insurance Company (PCRIC), and the Southeast Asia Disaster Risk Insurance Facility (SEADRIF). We treat the latter in detail.

### 4.1 Pandemic Emergency Financing Facility

This is the most similar structure to the integrative architecture of the EHFF. On July 2017, the World Bank Group (in consultation with the World Health Organization) created the Pandemic Emergency Financing Facility (PEF).[21] The mission of the PEF is to provide emergency financing to the poorest countries (International Development Assistance – IDA – members) after an initial epidemic outbreak. More specifically, the risks covered are flu pandemics, coronavirus, filovirus (e.g., Ebola), Crimean Congo haemorrhagic fever, Rift Valley fever, and Lasa fever.

The PEF has two windows: cash and insurance. Cash comes from country donors (Germany, Japan, Australia) and IDA itself. The insurance window issued the so-called pandemic bonds and swaps agreements with a global reinsurer.

[21] See PEF (2018) for the operations manual

Pandemic bonds were structured by two leading and global reinsurers. They had a maturity of three years and an outstanding principal of U.S.$320 million.[22] There was a very high demand from institutional investors (specialized hedge funds, endowments, asset managers, and pension funds) with an oversubscription of 200%. Senior and junior tranches were issued, the latter covering more risks. The PEF sold U.S.$225 million in senior tranches and U.S.$95 million in junior tranches, with annualized coupons if there is no major pandemic outbreak of 6.9% for senior and 11.5% for junior tranches.

The definition of a "major outbreak" is that of a global pandemic, specifically the multiple sustained transmission of a highly infectious agent in multiple regions of the globe. This definition has three dimensions (size, growth, and spread) that, in the case of the pandemic bonds, are measured with the number of confirmed cases, the growth rate of cases and deaths, and the geographical spread. These parameters are calculated by an independent agent (the disaster modeler). If the agent confirms that the outbreak is "major", the trigger is met and the principal of the bonds is reduced, eventually to zero. This reduction is transferred to the World Bank Treasury, which distributes the funds, upon application, to eligible nations.

The PEF was first used in May 2018 with a U.S.$12 million grant towards the "2018 Équateur province Ebola outbreak" in the Democratic Republic of the Congo (DRC). The cash window was used since the parameters for triggering the pandemic bonds were not met. In June 2018, the World Health Organization warned that there was "significant risk" that the outbreak would spread to neighboring countries, placing pandemic bonds into focus, but in July 24 the WHO declared the outbreak over. There were 54 cases (38 confirmed and 16 probable) and 33 deaths.

The PEF was used for a second time in August 2019 with a U.S.$31 million grant (from the cash window) to the "2018 Kivu Ebola outbreak". This outbreak started in August 2018. In September, the WHO raised the risk assessment at the national and regional level from "high" to "very high", partly because of the local military conflict and civilian distress. There were 3850 cases and 2272 deaths. The outbreak spread to Uganda, as family members residing in Uganda traveled to Congo for the burial of a relative. This is the second largest Ebola outbreak in recorded history.

The PEF was used a last time with COVID-19. This time the triggering criteria were met (in April 2020) and junior tranche investors lost 100% of the principal, while senior tranche investors lost 16.7% of the principal.

The PEF was criticized because the payouts did not occur as fast as they should, either because the committee in the cash window waited too long, or because the triggering conditions in the insurance window were too restrictive [Brim and Wenham (2019)]. In July 2020, the World Bank announced that it would shelve plans for a second sale of the pandemic bonds.[23]

### 4.2 ASEAN+3 Disaster Risk Insurance Facility

The Association of Southeast Asian Nations is a regional intergovernmental organization comprising ten countries in Southeast Asia.[24] ASEAN+3 incorporates China, Japan and South Korea.

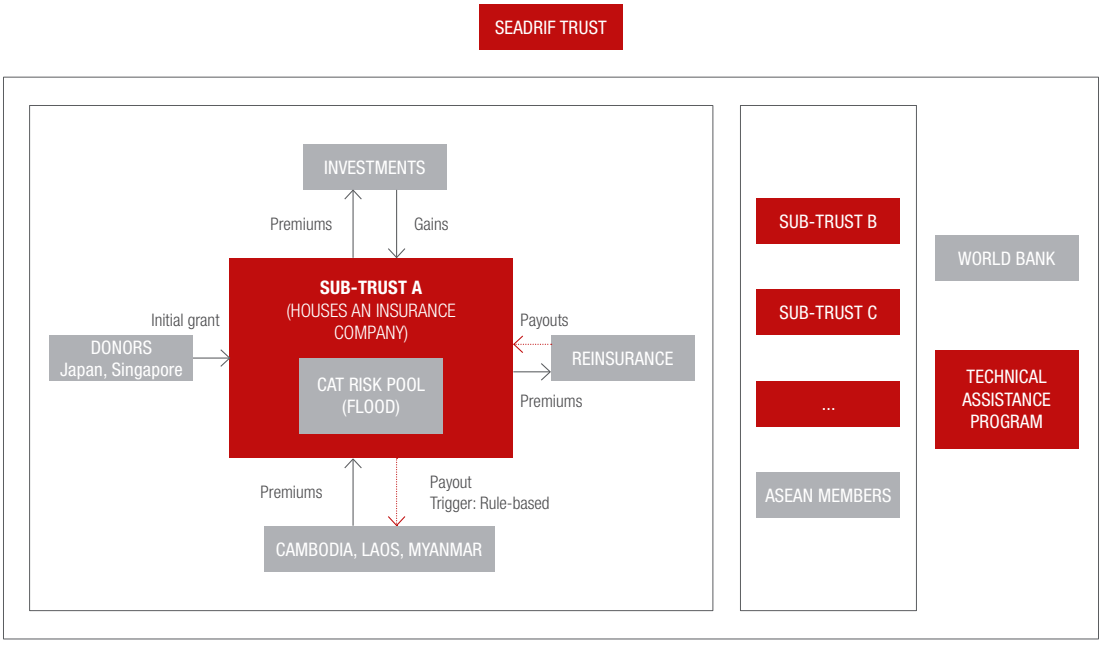
Southeast Asia is one of the worst hit regions by extreme natural phenomena. According to the United Nations, in 2018, about 8% of losses are covered by insurance and the economic toll from disaster is estimated to increase by U.S.$160 billion per year until 2030.[25]

For this region to have the capacity to address the sudden consequences of disasters, while preserving the stability of public finances, the ministers of finance and central bank governors from ASEAN+3 created the Southeast Asian Disaster Risk Insurance Facility (SEADRIF) in 2019. SEADRIF is a regional approach to disaster risk finance that aims to increase governments' fiscal capacity to manage the financial impact of natural disasters and improve access to rapid response financing for emergency response.

Figure 6 shows the basic structure of SEADRIF. It is a trust that contains sub-trusts and a technical assistance program led by the World Bank. Currently, there is only one sub-trust (A) that houses an insurance company. This company pools the parametric catastrophic flood risks of three ASEAN members (Cambodia, Laos, and Myanmar). Sub-Trust A functions like any insurance company: it invests the premiums and reinsures a significant part of the risk. The initial grant by the donors is to get the sub-trust up and running (i.e., for rapid payouts that are subsequently reimbursed by the reinsurer, retain a part of the risk in the pool, and earn income on the investments).

[23] https://on.ft.com/39VzX7C
[24] The ASEAN countries are Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam
[25] https://bit.ly/2Y4i83E

**Figure 6:** Diagrammatic structure of SEADRIF




Premiums in the sub-trust are sufficient to cover, in full, a 1-in-200-year insured loss. If the catastrophe occurs and if it fulfills the triggers given by the parametric criteria (which are based on a Flood Risk Monitoring Tool co-developed with the World Bank), then payouts are transferred to governments of the corresponding countries within 30 days of the occurrence.

By pooling together their risks, ASEAN countries significantly reduce the cost of insurance coverage. The likelihood that all the countries face simultaneously severe floods is limited. Hence, insurers can dedicate fewer resources to the coverage of these regions. The pooling of the risks increases the scale of the insurance project substantially, which makes it more attractive to the (re)insurers. Also, the transaction costs are reduced since all countries purchase one product to cover their respective risk exposures.

## 5. CONCLUSIONS AND LIMITATIONS

The EHFF complements existing structures in the E.U. without compromising the E.U. budget or the public finances of member states, which are going to be under serious strain for many years to come. The EHFF draws on thirty years of experience of the insurance industry on modeling and securitizing catastrophe risks, as well as recent experiences from international and regional organizations.

This article is a first proposal and it is subject to a number of limitations. To make the EHFF operational, the main hurdle is defining the risks to be securitized. This is easier said than done, as there is a great deal of E.U.-wide risks that can lead to an emergency. Furthermore, inside every type of risk, there are many risks that can be securitized (think of all the risks inside the wide group of "infectious diseases"). Another limitation is the loss calculation of the risks. The risks that the EHFF deals with are infrequent and hence there is not much information for risk analysis, which in turn determines the price of the securities. That said, the first limitation can be solved with the National Risk Assessments, and the second can be solved by using global information (as opposed to E.U.-only) since the effects of most of the risks are the same in the E.U. and in the rest of the world.

## REFERENCES


Barrieu, P., and L. Albertini, 2009, The handbook of insurance-linked securities, Wiley Finance

Brim, B., and C. Wenham, 2019, "Pandemic Emergency Financing Facility: struggling to deliver on its innovative promise," British Medical Journal, https://bit.ly/3me37Ez

Bryce, C., P. Ring, S. Ashby, and J. Wardman, 2020, "Resilience in the face of uncertainty: early lessons from the COVID-19 pandemic," Journal of Risk Research 23:9, 1-8

Clarke, D., and O. Mahul, 2011, "Disaster risk financing and contingent credit," World Bank, https://bit.ly/3in00qW

Clarke, D., O. Mahul, R. Poulter, and T. The, 2017, "Evaluating sovereign disaster risk finance strategies: a framework," Geneva Papers 42, 565–584

Cummins, J. D., and P. Trainar, 2009, "Securitization, insurance, and reinsurance," Journal of Risk and Insurance 76, 463-492

Cummins, J. D., and M. A. Weiss, 2009, "Convergence of insurance and financial markets: hybrid and securitized risk-transfer solutions," Journal of Risk and Insurance 76, 493-545

De Mot, J., and M. Faure, 2019, "Public authority liability and the cost of disasters," Geneva Papers on Risk and Insurance – Issues and Practice 44, 760–783

DG Competition, 2014, "Study on co(re)insurance pools and on ad-hoc co(re)insurance agreements on the subscription market," European Commission, https://bit.ly/3kXoNFG

European Commission, 2020, "Strategy for COVID-19 vaccines," Communication 245, https://bit.ly/2Y4jICC

European Council, 2020, "Conclusions meeting of the European Council July 17-21," https://bit.ly/3FansDq

European Parliament, 2013, "Decision 1082/2013/E.U.," https://bit.ly/3F8YAvJ

Faure, M. G., and K. De Smedt, 2019, "Compensation for victims of disasters: a task for Europe?" Geneva Papers on Risk and Insurance – Issues and Practice 44, 732–759

Finken, S., and C. Laux, 2009, "Catastrophe bonds and reinsurance: the competitive effect of information-insensitive triggers," Journal of Risk and Insurance 76, 579-605

IBRD, 2017, "Prospectus supplement," World Bank, https://bit.ly/3kUFKAC

IBRD, 2018, "Super-sized catastrophe bond for earthquake risk in Latin America," World Bank, https://bit.ly/2ZN4ym1

IMF, 2020a, "World Economic Outlook," International Monetary Fund, https://bit.ly/3opKTCH

IMF, 2020b, "Fiscal monitor," International Monetary Fund, https://bit.ly/3B1g0Z1

Mutenga, S., and S. K. Staikouras, 2008, "The theory of catastrophe risk financing: a look at the instruments that might transform the insurance industry," Geneva Papers 32, 222-245

ODI, 2020, "Risk-Informed approaches to humanitarian funding," https://bit.ly/3F0Q7e6

OECD, 2016, "National terrorism risk insurance programmes of OECD countries with government participation," Organisation for Economic Co-operation and Development, https://bit.ly/39WRwUW

Official Journal of the European Union, 2016, "Council regulation (E.U.) 2016/369," https://bit.ly/3kWrY0g

PEF, 2018, "Operations manual," Pandemic Emergency Financing Facility, https://bit.ly/3F6Vaty

Skogh, G., 2008, "A European nuclear accident pool," The Geneva Papers 33, 274-287

Tandon, A., C. Murray, J. Lauer, and D. Evans, 1990, "Measuring overall health system performance for 191 countries," GPE Discussion Paper Series no. 30

Teh, T., and C. Woolnough, 2019, "A better trigger. Indices for insurance," Journal of Risk and Insurance 86, 861-885

WEF, 2020, "Global risk report," World Economic Forum

WHO, 2016, "An R&D blueprint for action to prevent epidemics," World Health Organization, https://bit.ly/3uvlE23

World Bank, 2018a, "Disaster risk finance: a primer: core principles and operational framework," https://bit.ly/3ophwkg

World Bank, 2018b, "IBRD catastrophe deferred drawdown option," https://bit.ly/3CYQm7G

## REFERENCES


Barrieu, P., and L. Albertini, 2009, The handbook of insurance-linked securities, Wiley Finance

Brim, B., and C. Wenham, 2019, "Pandemic Emergency Financing Facility: struggling to deliver on its innovative promise," British Medical Journal, https://bit.ly/3me37Ez

Bryce, C., P. Ring, S. Ashby, and J. Wardman, 2020, "Resilience in the face of uncertainty: early lessons from the COVID-19 pandemic," Journal of Risk Research 23:9, 1-8

Clarke, D., and O. Mahul, 2011, "Disaster risk financing and contingent credit," World Bank, https://bit.ly/3in00qW

Clarke, D., O. Mahul, R. Poulter, and T. The, 2017, "Evaluating sovereign disaster risk finance strategies: a framework," Geneva Papers 42, 565–584

Cummins, J. D., and P. Trainar, 2009, "Securitization, insurance, and reinsurance," Journal of Risk and Insurance 76, 463-492

Cummins, J. D., and M. A. Weiss, 2009, "Convergence of insurance and financial markets: hybrid and securitized risk-transfer solutions," Journal of Risk and Insurance 76, 493-545

De Mot, J., and M. Faure, 2019, "Public authority liability and the cost of disasters," Geneva Papers on Risk and Insurance – Issues and Practice 44, 760–783

DG Competition, 2014, "Study on co(re)insurance pools and on ad-hoc co(re)insurance agreements on the subscription market," European Commission, https://bit.ly/3kXoNFG

European Commission, 2020, "Strategy for COVID-19 vaccines," Communication 245, https://bit.ly/2Y4jICC

European Council, 2020, "Conclusions meeting of the European Council July 17-21," https://bit.ly/3FansDq

European Parliament, 2013, "Decision 1082/2013/E.U.," https://bit.ly/3F8YAvJ

Faure, M. G., and K. De Smedt, 2019, "Compensation for victims of disasters: a task for Europe?" Geneva Papers on Risk and Insurance – Issues and Practice 44, 732–759

Finken, S., and C. Laux, 2009, "Catastrophe bonds and reinsurance: the competitive effect of information-insensitive triggers," Journal of Risk and Insurance 76, 579-605

IBRD, 2017, "Prospectus supplement," World Bank, https://bit.ly/3kUFKAC

IBRD, 2018, "Super-sized catastrophe bond for earthquake risk in Latin America," World Bank, https://bit.ly/2ZN4ym1

IMF, 2020a, "World Economic Outlook," International Monetary Fund, https://bit.ly/3opKTCH

IMF, 2020b, "Fiscal monitor," International Monetary Fund, https://bit.ly/3B1g0Z1

Mutenga, S., and S. K. Staikouras, 2008, "The theory of catastrophe risk financing: a look at the instruments that might transform the insurance industry," Geneva Papers 32, 222-245

ODI, 2020, "Risk-Informed approaches to humanitarian funding," https://bit.ly/3F0Q7e6

OECD, 2016, "National terrorism risk insurance programmes of OECD countries with government participation," Organisation for Economic Co-operation and Development, https://bit.ly/39WRwUW

Official Journal of the European Union, 2016, "Council regulation (E.U.) 2016/369," https://bit.ly/3kWrY0g

PEF, 2018, "Operations manual," Pandemic Emergency Financing Facility, https://bit.ly/3F6Vaty

Skogh, G., 2008, "A European nuclear accident pool," The Geneva Papers 33, 274-287

Tandon, A., C. Murray, J. Lauer, and D. Evans, 1990, "Measuring overall health system performance for 191 countries," GPE Discussion Paper Series no. 30

Teh, T., and C. Woolnough, 2019, "A better trigger. Indices for insurance," Journal of Risk and Insurance 86, 861-885

WEF, 2020, "Global risk report," World Economic Forum

WHO, 2016, "An R&D blueprint for action to prevent epidemics," World Health Organization, https://bit.ly/3uvlE23

World Bank, 2018a, "Disaster risk finance: a primer: core principles and operational framework," https://bit.ly/3ophwkg

World Bank, 2018b, "IBRD catastrophe deferred drawdown option," https://bit.ly/3CYQm7G

## ABOUT CAPCO

Capco, a Wipro company, is a global technology and management consultancy specializing in driving digital transformation in the financial services industry. With a growing client portfolio comprising of over 100 global organizations, Capco operates at the intersection of business and technology by combining innovative thinking with unrivalled industry knowledge to deliver end-to-end data-driven solutions and fast-track digital initiatives for banking and payments, capital markets, wealth and asset management, insurance, and the energy sector. Capco's cutting-edge ingenuity is brought to life through its Innovation Labs and award-winning Be Yourself At Work culture and diverse talent.

To learn more, visit www.capco.com or follow us on Twitter, Facebook, YouTube, LinkedIn Instagram, and Xing.

## WORLDWIDE OFFICES

**APAC**
Bangalore
Bangkok
Gurgaon
Hong Kong
Kuala Lumpur
Mumbai
Pune
Singapore

**EUROPE**
Berlin
Bratislava
Brussels
Dusseldorf
Edinburgh
Frankfurt
Geneva
London
Munich
Paris
Vienna
Warsaw
Zurich

**NORTH AMERICA**
Charlotte
Chicago
Dallas
Hartford
Houston
New York
Orlando
Toronto
Tysons Corner
Washington, DC

**SOUTH AMERICA**
São Paulo



**WWW.CAPCO.COM**

CAPCO
a wipro company