

#### 4.3. EFFECTS OF EXTREME WEATHER EVENTS ON NATIONAL ACCOUNTS AND THE EUROPEAN ECONOMIC FORECASTS

Last summer was the hottest ever recorded globally and in Europe.<sup>(58)</sup> Extreme events like heatwaves, fires, droughts and floods have been raging across the continent, and beyond. There is growing scientific consensus that these events can be largely attributed to human-made climate change<sup>(59)</sup> and that they have been occurring with increasing frequency and scope, with dramatic consequences for the people affected, the environment, and also for the economy.

This box discusses how the economic impact of extreme weather events can be measured and the extent to which it is reflected in national accounts and the European Economic forecasts, which are based on them. To this end, it will be useful to first shortly recapitulate the types of risks climate change entails for national economies. In a second and third step, the economic ramifications of extreme weather events and ways to measure them will be reviewed.

##### Taxonomy of climate change risk

In categorising the types of climate change risks for the economy, this box follows a widely used taxonomy<sup>(60)</sup> that distinguishes two broad categories of such risks:

1. *Physical risk*: this category comprises all possible effects of climate change that directly arise from the change in climatic conditions, as opposed to effects precipitated by a changing regulatory and policy framework. Physical risks of climate change can cause both market and non-market losses, with the latter comprising damages to the physical and mental wellbeing of the affected population or to ecosystems and environmental assets, which are not traded on markets and thus are difficult to measure. Given the scope of the box, the focus will be on market losses. Physical risk for the economy is further divided into the following subcategories:
  - *Gradual physical risk*: this subcategory covers the economic fallout caused by all long-term changes to climatic conditions, such as the challenges faced by the tourist or agricultural sectors brought about by rising average temperatures.
  - *Acute physical risk*: it is about the economic implications of climate change at the tails of the distribution of climate events, i.e. extreme weather events. There are different ways to subdivide acute physical risk. One such classification distinguishes between meteorological, hydrological and climatological events.<sup>(61)</sup>
2. *Transition risk*: to mitigate physical climate change risks, administrations around the world and especially in Europe are implementing policies aimed at transitioning to a CO<sub>2</sub>-neutral economy. This ‘green transition’ entails massive shifts in the economic landscape possibly exerting considerable strain on carbon-intensive sectors.

It should be apparent from the above that gradual physical and transition risks are mostly concerned with long-term changes to the economy, while acute physical risks deal with short- and medium-term shocks. Considering the horizon of the European Economic forecasts, acute physical risks are, consequently, most relevant and shall be the focus of this box.<sup>(62)</sup>

<sup>(58)</sup> See for example [press release](#) by Copernicus from November 8 2023.

<sup>(59)</sup> See for example: Clarke, B., F. Otto, R. Stuart-Smith and L. Harrington. (2022). “Extreme weather impacts of climate change: an attribution perspective.” *Environmental Research: Climate* 1 (1).

<sup>(60)</sup> See for example: Batten, S. (2018). “Climate change and the macro-economy: a critical review.” Bank of England *Staff Working Paper* 706.; Gagliardi, N., P. Arevalo and S. Pamies. (2022). “The Fiscal Impact of Extreme Weather and Climate Events: Evidence for EU Countries.” *European Economy Discussion Paper* 168.

<sup>(61)</sup> An example of meteorological events are storms. Hydrological events include floods or similar, while climatological events encompass heatwaves, cold waves, droughts etc.

<sup>(62)</sup> This is, however, not to say that gradual physical or transition risks are of no consequence to short-term economic forecasting, like the European Economic forecasts. Their materialisation is also set to gradually feed into the representation of the economy allowed by the macroeconomic variables underpinning such forecasts and will, therefore, inform them. Furthermore, transitional policies with a short- or medium-term effect on, say, energy prices will also be reflected in short term economic forecasts.

### Transmission mechanisms of acute physical climate change risk

In general terms, acute physical risks of climate change can have direct and indirect impacts on the economy. All direct destruction of fixed capital, including housing and infrastructure, crops, consumer goods etc. by extreme weather events is considered a direct impact, whereas indirect impacts relate to the economic ramifications of said destruction – both on the supply and demand side.

On the supply-side, the damage caused by an extreme weather event may hamper the production capacity of the affected sectors of the economy. Specific branches of economic activity, such as agriculture, tourism or the production of hydroelectric energy, appear most exposed. On the demand side, reductions in wealth may result in lower consumption and investment. Reduced domestic production may also lead to higher imports. Increased uncertainty surrounding climatic change could cause a drop in demand for residential housing. Ultimately, supply and demand shocks will interact and entail, at least in the short term, disruption to growth and price volatility.

At the same time, the physical damage caused by an extreme weather event will likely entail reconstruction and repair efforts, in the form of increased investment into infrastructure and capital goods, as well as increased public consumption and social transfers.<sup>(63)</sup> Specific branches of economic activity, such as construction, would face increased demand. Furthermore, the typically narrow geographical scope of the destruction caused by these events might spur growth in other regions with a similar economic fabric as the affected area.

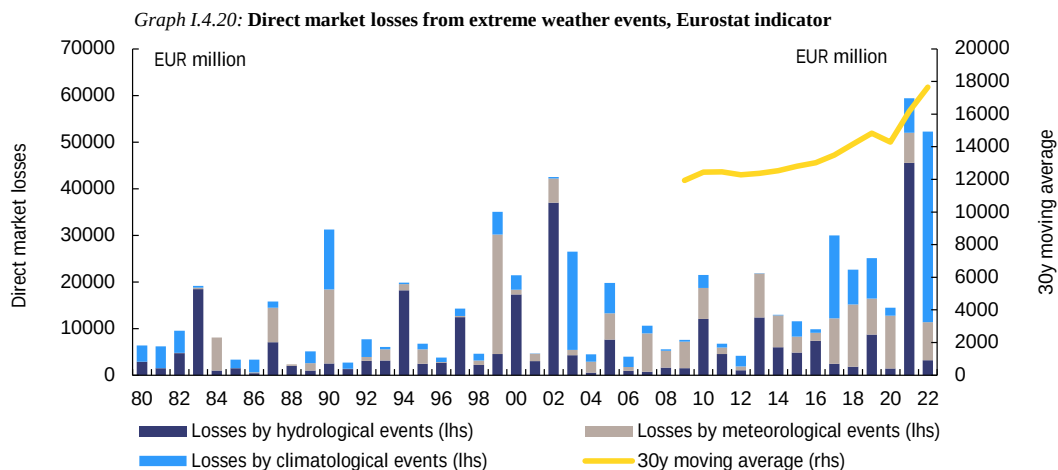
It is difficult to confidently predict the net effect of natural hazards on the growth trajectory of the affected regions or countries. The economy could shift to a lower growth trajectory in case of a significant destruction of resources and productive capital and if reconstruction efforts mobilise resources that could otherwise be utilised for productivity-increasing investments, such as R&D and innovation. However, there could also be a scenario in which possible positive effects outweigh the negative effects – namely, if obsolete capital stock is replaced with more productive assets.<sup>(64)</sup>

### Quantification of both direct and indirect impacts of materialised acute physical climate change risk

Direct impacts of extreme weather events find their way into national accounts in a similar manner as other natural hazards – e.g. earthquakes or volcanic eruptions – or non-natural disasters, such as a war. The destruction of capital will be recorded in the ‘other changes in the volume of assets’ account, resulting in a reduction of the fixed capital stock. These changes are usually not published by Eurostat or national statistics institutes, though the published capital stock figures should reflect them. However, said fixed capital stock data is released with a considerable time lag of typically two years, since parts of the necessary information, such as insurance records, become available with a substantial lag. Additionally, the data does not inform about the causes of the change in capital stock. Direct losses of non-capital goods, like consumer durables, are also not reflected in national accounts. As to the environmental damage from natural hazards entailing non-market losses, like for instance the loss of the recreational value of a natural park due to a

<sup>(63)</sup> The fiscal impact of extreme weather events is an important facet of acute physical climate change risks that deserves in-depth analysis but can only be touched upon here in the interest of brevity. For discussion and further information on that see for example: Zenios, S. (2021). “The risks from climate change to sovereign debt in Europe.” *Bruegel Policy Contribution Issue No. 16/21*; Radu, D. (2021). “Disaster Risk Financing: Main Concepts and Evidence from EU Member States.” *European Economy Discussion Paper 150*.

<sup>(64)</sup> The relevant literature puts forward three opposing hypotheses on the net effect of natural hazards on the growth trajectory: the ‘no recovery’ hypothesis, the ‘recovery to trend’ hypothesis and the ‘creative destruction’ hypothesis, which maintain that in the medium- to long-term after a catastrophe the growth trajectory will be lower, equal or higher, respectively. Empirical research seems to point to the direction of the ‘no recovery’ hypothesis (see for example: Batten, S. (2018). “Climate change and the macro-economy: a critical review.” Bank of England *Staff Working Paper 706*; Gagliardi, N., P. Arevalo and S. Pamies. (2022). “The Fiscal Impact of Extreme Weather and Climate Events: Evidence for EU Countries.” *European Economy Discussion Paper 168*).



Source: European Environment Agency (EEA).

wildfire, there is as of yet no comprehensive data set for the EU.<sup>(65)</sup> The revision to the System of National Accounts (SNA) in 2025 will not change significantly how natural hazards directly impact national accounts.

While national accounts are not well suited to trace the direct impacts of extreme weather events, the indicator of 'climate-related economic losses', compiled by the European Environment Agency and republished by Eurostat as part of its EU Sustainable Development Goals indicator set, aims at capturing the market losses implied by the materialised acute physical climate change risk, as defined above.<sup>(66)</sup>

The indicator shows that in the EU, extreme weather events caused direct market losses of EUR 650 billion during the period 1980-2022. Of these market losses, less than 20% were insured.<sup>(67)</sup> While the data shows an uneven distribution of the losses over time and across countries – 59% of total direct market losses between 1980 and 2022 can be attributed to only 5% of extreme weather events –, certain trends can be observed. Namely, over the last four decades, the average annual market loss increased continuously from EUR 8 billion in the '80s, to EUR 13 billion in the '90s, EUR 15 billion in the '00s and EUR 17 billion in the past decade. The average annual market loss for the first three years of this decade lies at a staggering EUR 42 billion. Looking at the last 10 years, i.e. 2013-2022, the average annual market loss of EUR 26 billion amounts to 0.16% of the 2022 GDP. Additionally, when calculating the 30-year moving averages, one can see a near 3% annual increase over the last 14 years.<sup>(68)</sup>

The indirect impacts of natural hazards are reflected in national accounts along the lines of the transmission channels delineated above. On the output side, gross value added (GVA) in the affected sectors will likely be dented in the period(s) following the event, but GVA in the sectors involved in reconstruction may increase. On the expenditure side, the indirect impact of extreme weather events could show up in all the demand components of GDP, with the direction of the impact depending on the extent of the indirect negative hit, on the one hand, and on the size and speed of the relief, reconstruction and repair efforts, on the other. Over the typical time horizon of short-term forecasts, extreme weather events could show up as having a positive impact on GDP growth, being dominated by reconstruction investment. This, however, does not imply that the

<sup>(65)</sup> The UN System of Environmental-Economic Accounting includes an Experimental Ecosystem Accounting framework that targets a broader range of interactions between individual environmental assets and human activities – such as carbon-sink properties or recreational values –, which could be used to capture environmental non-market losses.

<sup>(66)</sup> The [indicator](#) is built upon the CATDAT database from Risklayer GmbH.

<sup>(67)</sup> In fact, empirical research suggests that insurance coverage is extremely relevant to the severity of the economic fallout following a disaster, both short- and long-term (see for example: Fache Rousová et al. (2021). European Insurance and Occupational Pensions Authority (EIOPA) *Financial Stability Report*).

<sup>(68)</sup> The 30-year window for the moving average is chosen in accordance with climate normal period defined by the World Meteorological Organisation, to smooth the substantial short-term volatility of climate related data.

economy will stay on the virtual growth path laid out by the ‘creative destruction’ hypothesis, since negative indirect impacts might continue to materialise in later periods.

These effects are currently for the most part too small to affect aggregate figures in the national accounts but may already be visible within regional accounts. However, a catastrophe of sufficient dimensions to influence aggregate figures in the national accounts will be considered in the forecasts for the affected Member States.

An emblematic example of an extreme weather event influencing national accounts and informing Member States’ forecasts are the August 2002 floods in Austria, Czechia and Germany. The impacts of the catastrophe could likely be seen in both national and regional accounts in multiple metrics, such as GDP, construction investment and agricultural production, for the years 2002, 2003 and 2004. The Autumn 2002 Forecast and the Spring 2003 Forecast did consider the effects of the floods on Austrian and German construction investment as well as on government spending (Czechia was not yet part of the EU at the time).

### Conclusion

Natural hazards bear severe costs for the EU economy, both in terms of immediate damage to, e.g. infrastructure, housing and productive capital, and in terms of the resulting disruptions to economic activity.

The system of accounts that underpins the representation of the economy in the European Economic forecasts is not well suited to depict the full economic impact of these events. Estimates of the immediate destruction of capital are reflected in changes in the capital stock, but the data does not disentangle the causes of the change, which may occur for reasons other than climate change. The secondary, indirect impacts of natural hazards do find their way into national accounts, on both the output side – through changes in the gross value added of the affected sectors – and on the expenditure side. All demand components of GDP, both domestic and external, may be impacted, with the direction of the impact depending on the extent of the disruption, on the one hand, and on the size and speed of the relief, reconstruction and repair efforts, on the other. Furthermore, within a country, the balance of the impact of natural hazards as reflected in regional accounts is undetermined, as the disruption in one region may benefit economic activity in other regions. As of yet, the effects of natural hazards are in most cases too small to influence national aggregates. What is more, over the typical time horizon of short-term forecasts, extreme weather events often show up as having a positive impact on GDP growth, being dominated by reconstruction investment (which normally uses public resources and therefore impacts public finances).

Understanding the scope and trends in natural hazards’ impacts is crucial to identify optimal policy choices. To this end, specific methodologies and statistical systems are available and more are being developed. The indicator of ‘climate-related economic losses’, which is presented in this box, is one example.