The economics of extreme weather events

Nordic and Baltic economies relatively spared so far

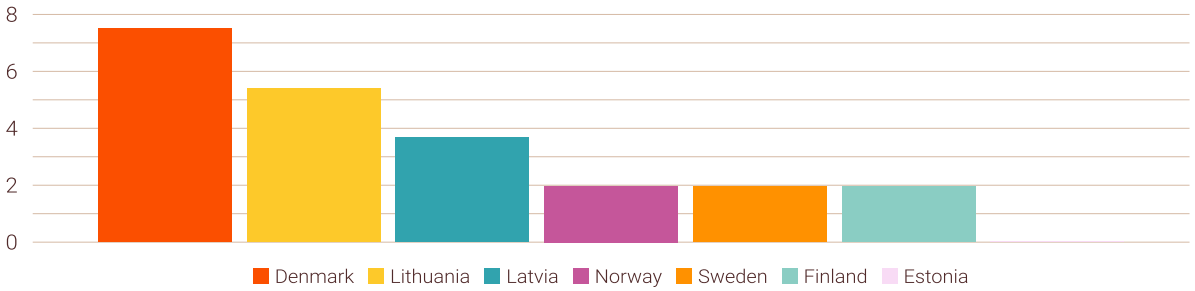
- The impacts of extreme weather vary across geographies, across sectors, and, thereby, across countries. Water and waste, agriculture, transportation, and tourism are among the sectors affected the most.
- Globally, the direct costs of extreme weather events are on the rise and have amounted to around EUR 100 billion every year since 2010.
- Moreover, although indirect costs from extreme weather events, such as reduced economic activity, supply-chain disruptions, and health effects are harder to quantify, studies suggest that they could be an additional multiple of direct costs ranging from 1.5X to over 10X.
- Nevertheless, the Nordic and Baltic economies have been relatively spared so far, incurring quite small losses due to extreme weather events. However, the costs are expected to increase as climate change intensifies, affecting more parts of the globe.
- Large-scale investments will be necessary to enable the global economy and societies to mitigate the risks from extreme weather events. Upward price pressure and capital losses are also likely.

Over the period 1980-2017, economic losses due to extreme weather in the Nordics and Baltics varied between EUR 10.3 billion in Denmark and EUR 0.1 billion in Estonia, which compose only a small part of global GDP.

Yet, taking into account the indirect cost with the 2X multiplier, the cumulative yearly losses over the period 1980-2017 are over 7 % of Denmark's GDP in 2017. A comparison across the Nordic and Baltic countries reveals that extreme weather has eaten a part of the GDP also in Lithuania and Latvia. Meanwhile, the losses in Estonia are hardly visible.

Human-induced climate change is fuelling extreme weather events; hence economic losses are expected to grow further in the future. In addition, companies will have to adapt – not only to assess the risks of physical extreme weather disruption and damage, but also to change their investment decisions over a longer-term horizon.

Cumulative losses over the period 1980 to 2017, including estimate of indirect costs
% of GDP in 2017



Sources: Swedbank Research & Macrobond & European Environment Agency
Note: Indirect cost included with the multiplier 2X
Cost for Estonia is 0.1 % of GDP

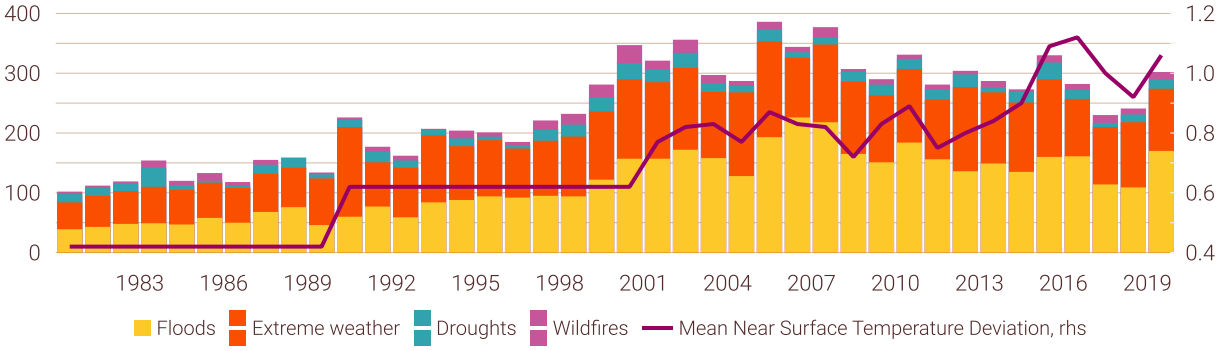
Analysts:
Sonja Liukkonen, Junior Economist Finland, sonja.liukkonen@swedbank.fi
Emma Paulsson, Junior Economist Sweden, emma.paulsson@swedbank.se
Greta Ilekyte, Economist Lithuania, greta.ilekyte@swedbank.lt

Costs of extreme weather events[1] are growing

Globally, the number of extreme weather events, such as extreme temperature, floods, wildfires, or droughts, has increased notably since the 1980s (WMO, 2021; Our World in Data, 2021). Meanwhile, the frequency of some weather events, such as floods or hurricanes, has nearly doubled since the beginning of this century.

A global number of natural disasters and mean near surface temperature deviation

Number of natural disasters (lhs); mean near surface temperature deviation, degrees Celsius (rhs)

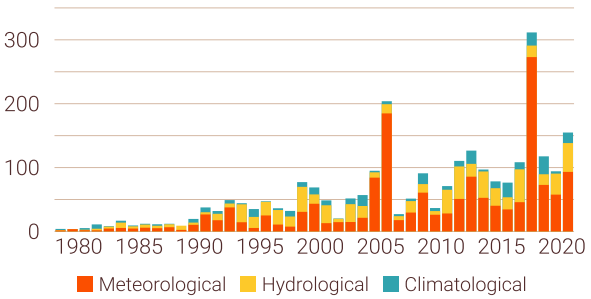


Sources: Swedbank Research & Macrobond

By increasing global surface temperature, climate change is an important component influencing the frequency, scale, and duration of these weather events (IPCC, 2021). Last year, the global mean surface temperature was approximately 1.2°C higher than the pre-industrial baseline. This rise in surface temperature has increased the intensity of rainfall events occurring in Western Europe by 3–19 %, according to a World Weather Attribution Report (WWA, 2021). The likelihood of heavy rainfall (during a short amount of time) compared with the likelihood of a 1.2 °C cooler climate has increased by a factor of between 1.2 and 9 (WWA, 2021). Droughts and extreme weather events, such as hurricanes or storms, have become more frequent as well. Moreover, the most recent decade, between 2011 and 2021, has been the warmest on record. Climate research also indicates that, even if we were to stop all emissions today, we have already emitted enough to expect warming to continue at least until the middle of the century (IPCC, 2021).

World economic costs of extreme weather events by category

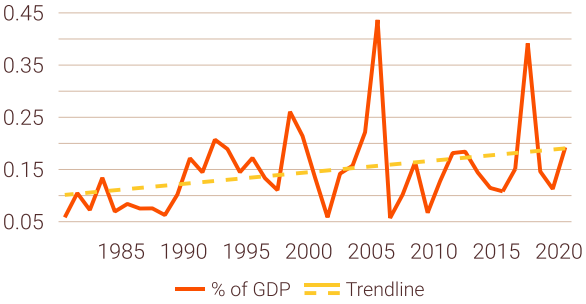
Billion, EUR



Sources: Swedbank Research & Macrobond

World economic costs of extreme weather events

% of world GDP



Sources: Swedbank Research & Macrobond

It is estimated that the direct global costs of extreme weather events are constantly rising; since 2010, they stood at around EUR 100 billion each year. Climate-related indirect costs, such as reduced economic growth, supply-chain disruption, or changed investor sentiment, also cost billions. Climate

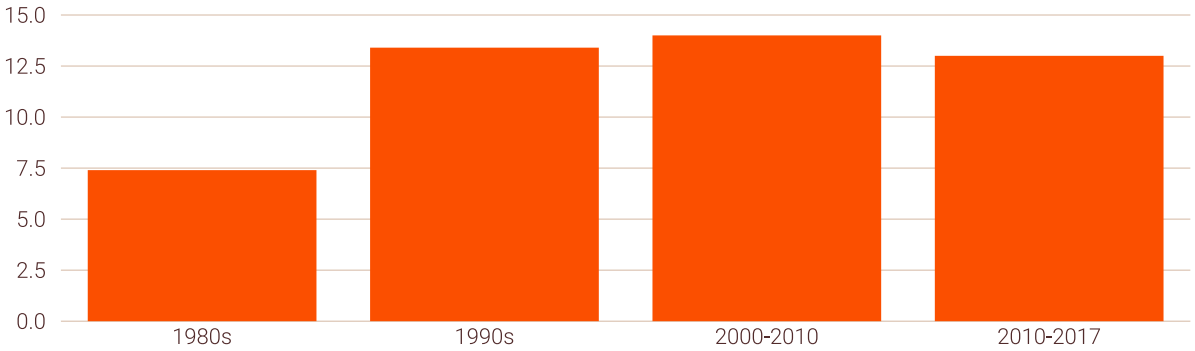
[1] Extreme weather events can be divided into three categories: 1) meteorological (hurricanes, typhoons, windstorms); 2) hydrological (floods); and 3) climatological (heat waves, freezes, droughts, wildfires) (Coburn, 2020).

change could add around EUR 100 billion, or more than 20%, to the global costs of extreme weather events until 2040 (Coburn, 2020).

In Europe, recorded economic losses from weather and climate-related extremes have varied substantially over time and across countries. For the period 1980-2017, the economic losses from extreme weather in the EEA member countries amounted to EUR 557 billion. The average annual economic loss was around EUR 7.4 billion per year in the 1980s, while in the period 2010-2017 it amounted to around EUR 13.0 billion (European Environment Agency, 2020).

The average annual economic loss due to weather & climate-related extreme events in Europe

million EUR



Sources: Swedbank Research & Macrobond & European Environment Agency

Extreme weather events are associated with several types of costs

Extreme weather affects the economies through a number of different channels. While the impact of clear, direct, tangible costs is quite easy to measure, the impact of other costs, such as health, increased inequality, or reallocation costs, is harder to measure monetarily. However, economic studies indicate that indirect costs could be an additional multiple of direct costs ranging from 1.5X to over 10X.

Physical risks could affect the economy either in a chronic way or acutely, i.e., lead to acute impacts (NGFS, 2020). Physical risks are, e.g., higher temperatures, increased or changed precipitation, and a rise of sea levels, which may have impacts on labour, capital, and agricultural productivity. Chronic physical risks require long-term increased investments from companies, households, and governments to build and adapt infrastructure, production measures, and society (NGFS, 2020). Acute impacts of physical climate risks are usually the type of economic impact one thinks of when talking about extreme weather events. Acute impacts on the economy could, e.g., be business disruption and damages to property, infrastructure, and capital (NGFS, 2020). Both acute and chronic physical risks are increasing with global warming.

Costs of extreme weather events:

Direct tangible costs	Indirect tangible costs	Intangible costs	Risk mitigation costs
Costs that occur as a direct result of the physical impact of the extreme event. Examples include direct damage to the infrastructure and property loss (buildings, cars, livestock).	Costs that occur as a result of a direct impact. Examples include business interruption, productivity loss, decrease in tourism, reallocation costs, supply chain disruption, diminished living conditions or changed investor sentiment.	Costs that are felt by the society or companies but are difficult to measure monetarily. Examples include educational, cultural, and health/well-being impacts.	Costs that represent the amount of investment, that was made to avoid a significant damage by natural hazards. Examples include infrastructure adaptation or risk management.

Direct tangible costs of extreme weather events are spread across sectors and location

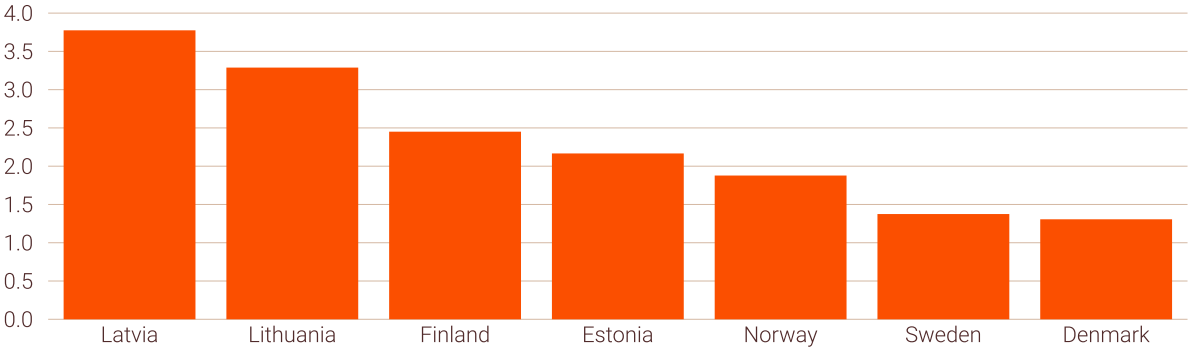
The impacts of extreme weather are different across economic sectors, mostly depending on the sector's activity and specific location (e.g., close to the sea or watercourses). Since extreme weather events have a location-specific nature, the vulnerability to high physical risk is spread quite homogeneously across sectors, according to the ECB's climate stress test. Between 20% and 30% of all firms in different sectors in the euro area are subject to climate risk, which indicates how broadly affected the economy can be (ECB, 2021).

As a result, the exposure to extreme weather events varies across countries. Firms are exceptionally subject to high physical risks in some countries, especially Southern Europe, where wildfires are more common. In Central and Eastern Europe, countries are expected to suffer more from flooding risks, which hit companies near the coastal lines more frequently (ECB, 2021). Investments and adaptations directed to mitigate physical risks associated with extreme whether events will, therefore, have to be adjusted based on the geographic location.

Across countries, the impact on the insurance and finance sector consists of more volatile claims and damages to physical capital, underlying assets, and collateral. In our home markets, the insurance and finance sector can possibly benefit from the increase in extreme weather, as some investments are directed to the northern countries because they are less affected by climate change than other countries (Deloitte, 2020) However, even the Nordic countries have experienced a significant rise in weather-related damage due to floods, which has increased claims. Therefore, the criteria for granting insurance have changed completely, and insurance companies are looking closely at climate risks. This means that, e.g., flood risks can affect insurability in some regions (Weather related damage in the Nordic countries, 2013).

Gross value added, agriculture

% of GDP, 2020



Sources: Swedbank Research & Macrobond

The increase in floods or extensive droughts and storms will also have a negative impact on agriculture in the Nordics and Baltics. The agriculture sector adds from 1.4% of GDP in Denmark to 3.7% in Latvia. The agricultural sector is particularly vulnerable to extreme weather events that might lead to poorer harvests. As crops, livestock, and fisheries are at risk, so is food security (FAO, 2015). The Swedish Food Agency published a report in November 2021, warning that increasing heatwaves and cloudbursts raise the risks for bacteria, parasites, and mould in food, all of which have negative effects on public health. Overall, climate change and a rise in extreme weather events will likely increase prices in food as the supply of crops and livestock decreases or becomes more volatile. This is only one of the examples of how climate change and extreme weather events can put price pressure on raw materials and commodities.

Extreme weather events will also have a direct impact on the electricity sector, since storms and severe weather often damage the electricity grid. The transportation sector also suffers from increasing risks related to extreme weather events. Floods, extreme wind, and wildfires affect transport infrastructure and may cause landslides and damage to vital connections. As transport on roads is shifted to overseas shipping to mitigate emissions, the transportation sector will become more affected by the frequency and intensity of storms.

Waste and water supply sectors are affected by floods and cloudbursts: as the already-existing water infrastructure is not built to handle abnormally intense rain, this leads to the flooding of streets and the bursting of pipes. The functioning of wastewater treatment plants is sometimes affected, and sewage has leaked into bathing places, which affects public health. Extreme weather events have the capacity to turn wastewater systems into sources of chemical and biological contamination of ecosystems; this is sometimes irreversible and may spread to other locations through transboundary rivers (WHO, 2011). With a view to securing a safe water supply and mitigating the risks for interruptions, investments will be needed to adapt the present infrastructure and implement innovations for building new, less climate-sensitive waste and water systems. In 2017, Swedish Water estimated that the need for investments to secure the future water supply demanded a yearly price increase of regional water and waste tax of 4%, on top of inflation, for the coming 20 years (Swedish Water). Substantial and ongoing price increases could lead to upward inflation pressure - "greenflation."

Regarding the manufacturing sector in the Nordic and Baltics, the biggest risks most likely come through indirect and spillover effects. Like pandemics, weather-related disasters in other parts of the world can delay delivery times and cause trouble in value chains for several sectors. In a ballpark analysis, the impact of delayed input components on Swedish exports in 2021 has been estimated. Export losses amount to EUR 6 billion, and GDP has lost about 0.6%. A similar impact on the Nordic and Baltic economies could arise due to extreme weather events in other countries. Another sector indirectly affected by the increase in extreme weather events is tourism. More frequent heat waves in Southern European countries during the summer could lead to tourist flows to Northern European countries. On the other hand, global warming will reduce the length of the winter tourism season.

Likely impacts to different sectors in Nordic and Baltic countries:

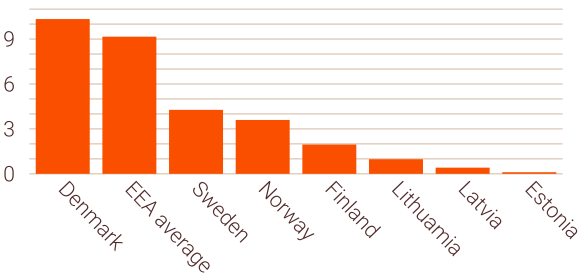
Insurance & Finance	Agriculture	Manufacturing	Tourism
More investments can be directed to Nordic and Baltic countries due to relatively stable climate conditions. At the same time weather related damages can increase claims damages.	For example, increase in floods will have negative impact agriculture. However, the changes in climate can also have some positive effects, for example, increased growing season in Northern countries.	For the manufacturing sector biggest risks come most likely through indirect and spill-over effects. Weather related disasters in other parts of the world can delay delivery times and cause value losses in multiple sectors.	Increase in heat waves in Southern European countries will likely increase tourism in the Nordic and Baltic countries during the summer. However, warm winters can negatively affect snow related tourism especially to Lapland.

Extreme weather hampers economic growth in the Nordic and Baltic countries

The increase in extreme weather events will impact the economies of our home countries, but there will be regional differences between and within countries. So far, the realised total economic losses in the Nordic and Baltics, except for Denmark, have been relatively small in a European comparison. Looking at data on a per capita level, the losses in both Denmark and Norway have been higher than in EEA member states on average. Based on the number of citizens and land area, Denmark has since the 1980s paid the second-highest price after Switzerland (European Environment Agency, 2020).

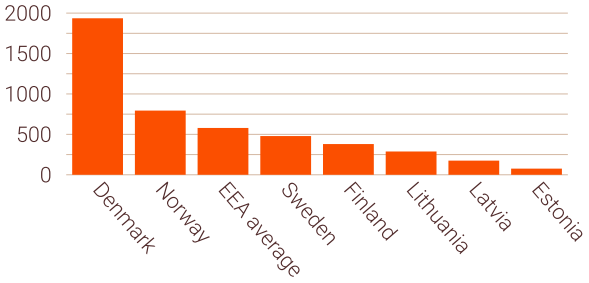
The reason why these extreme weather and climate events have been so expensive in Denmark can be found in the large cities' placement near the waterfront. People have chosen to settle by the water, often in very low-lying areas. This means that there is a risk of major losses in the event of flooding. (State of Green, 2019.)

Losses due to extreme weather related events in the Nordic and Baltics (1980-2017)
Billion euros



Sources:
Swedbank Research & Macrobond & European Environment Agency

Losses due to extreme weather related events in the Nordic and Baltic countries (1980-2017)
Per capita



Sources:
Swedbank Research & Macrobond & European Environment Agency

On average, economic losses in Denmark were EUR 0.28 billion per year from 1980 to 2017. The cumulative losses over the period analysed are nearly 4% of Denmark's GDP in 2017, while the average yearly losses were 0.1% of Denmark's GDP in 2017. However, the actual economic losses have likely been even larger. As mentioned above, economic studies suggest that indirect costs could be an additional multiplier of direct costs ranging from 1.5X to over 10X. Studies suggest that, 2X is a reasonable multiple to be used in estimations (Coburn, 2020). Taking this into account—calculating the indirect cost using the 2X multiplier - the cumulative yearly losses over the period 1980 to 2017 are over 7% of Denmark's GDP in 2017. A comparison across Nordic and Baltic countries reveals that extreme weather has also eaten a relatively large amount of the GDP in Lithuania and Latvia. Meanwhile, losses in Estonia are hardly visible.

It is estimated that the direct global costs of extreme weather events are constantly rising. Therefore, the negative impact of extreme weather on economic growth could be even larger in the future. Some of the effects of sudden extreme weather events can be mitigated by active adaptation, which also entails cost. However, if risk mitigation is effective, the economic impact of these phenomena is likely to be reasonably small. The network for Greening the Financial System estimates that around 4% of global GDP will be lost in an "orderly transition" to climate change by the end of the century (NGFS, 2020). If, however, adaptation measures fail, the NGFS estimates that the impact from physical risk could increase to 25% of GDP by 2100; the ECB expects that the losses could be even bigger, as not all sources of physical risk are included in the NGFS scenario (ECB, 2021).

In addition, companies will need not only to adapt, but also to change their investment decisions over a longer-term horizon. For example, by following climate trends and projections, they will have to choose colder regions or those with a lower probability of extreme weather events for their investments. In order to avoid unexpected disruptions by more frequent climate-related events, producers might also choose to shorten their supply chains and move production closer to home. But changes take time and reversing earlier trends of offshored production and importation of basic goods will not happen overnight. In Sweden, e.g., the agriculture sector is self-sufficient enough to provide 50% of the food supply, whereas the rest is imported (The Federation of Swedish Farmers, 2021). In early 1990, national food production constituted 75% of the food supply, indicating that an upscale would be possible. However, agriculture continues to compete with other interests for the use of land, and politicians as well as companies will have to consider climate change and extreme weather events when evaluating risks and opportunities. Finland is very self-sufficient, providing about 80% of its food (The Federation of Swedish Farmers, 2021.

Sweden has suffered costs of at least SEK 750 million in extreme weather in 2021

Sweden faces challenges in adapting to the climate risk that has been evident in recent weather-related events, like the flooding in Gävle this summer. Flooding is mostly caused by the dispersion of a large supply of water to lakes and watercourses from intense cloudbursts, snowmelt, or storms, and by raised sea levels (Foi, 2017). This matter because, within 5 km of the coastline, 36% of the Swedish population lives; within 10 km, 49% of the population lives. This means that housing and other property are at risk, and consumer close businesses that are affected (like food stores and businesses that lay near to where people live). The economic consequences of extreme weather events are worsening, since the value of the total assets and the size of the population living near coasts and watercourses have increased (Foi, 2017).

Data on the costs associated with extreme weather events most commonly come from the insurance industry. Therefore, the cost data have a downward bias, since not all resources are fully covered by insurance. According to EEA data, Sweden suffered economic losses of about EUR 4.2 billion between 1980 and 2017, of which 29% was insured. In the table below, some costs from extreme weather events in Sweden are displayed.

Weather-related event	Costs million SEK	Source
Gävle flooding (2021)	Local water company: estimated 250 Insurance costs: 500	SvT Swedish Insurance, 2021
Skåne heavy rain (2014)	Insurance costs: 350	SMHI
Extensive wildfires (2018)	Insurance costs: 500*	Swedish Insurance, 2018
Wildfire in Västmanland (2014)	Insurance costs: 900	Swedish Insurance, 2014

* A small number in the context since much of the forest was not insured. Also, wildfires are usually directly caused by human activity, whereas climate change under certain circumstances is indirectly caused by aggravating the dry and warm conditions in forest and land.

Swedish municipalities that want to invest in measures to mitigate climate risk and extreme weather events can apply to The Swedish Civil Contingencies Agency (MSB) for specific grants. The total budget of the grant was reduced to SEK 25 million in 2021 which is one-tenth of what the municipalities usually apply for (SR, 2021). An increase of the grant would be welcomed by the municipalities, but it will most likely not be near the total amount needed for investments. Private companies and households will have to integrate climate-based risk thinking into their planning for investments in order to secure their assets from these increasing risks in the best way.

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Swedbank LC&I, Swedbank AB (publ), SE-105 34 Stockholm.

Visiting address: Malmskillnadsgatan 23, 111 57 Stockholm.