19 June 2023

Climate risk across the big five EU economies
Higher climate change costs under a delayed transition

Stress testing economies for their exposure to climate-change scenarios is vital for discovering hidden climate risks in investors' portfolios, hence the value of stressing countries for their climate vulnerabilities.

Our Macroeconomic Climate Stress Test (MCST) explores two important climate-related risks.

First, we look at physical risks associated with temperature (chronic risk) and river flooding and droughts (acute risk). Secondly, we examine transition risks across the entire economic value chain, in other words accounting for the so-called scope-1, scope-2 and scope-3 greenhouse gas emissions.

The MCST projects climate risks in the three climate scenarios developed by the Network for Greening the Financial System (NGFS), namely orderly (early and gradual), disorderly (delayed), and hot-house (inaction) scenarios.

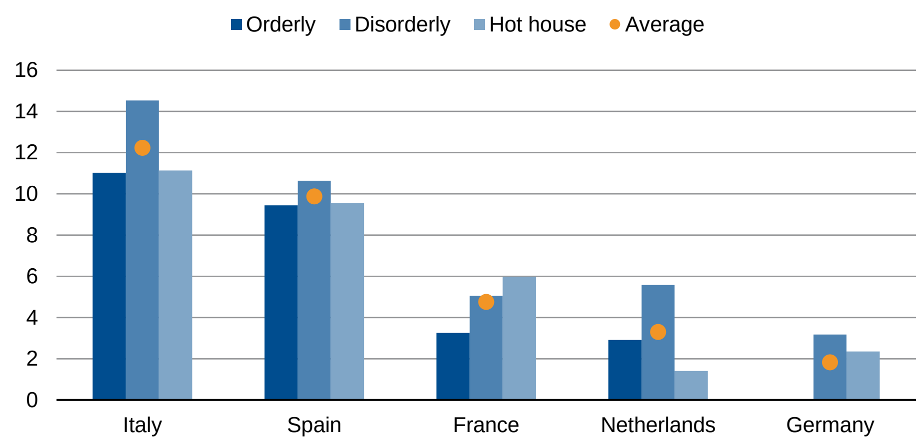
Stress testing Europe's big economies finds Italy vulnerable, Germany less risky

Applying the MCST to Europe's five largest economies – Germany, France, Italy, Spain, and the Netherlands – we find that Italy is the large EU economy most at risk in an adverse climate-change scenario in the decades ahead. Climate change under a delayed transition could cost a hypothetical EUR 17.5trn between 2020 and 2050, representing 14.5% of GDP.

In contrast, we find that Germany is the least climate-risk exposed country, where in a scenario of delayed transition could cost EUR 7.1trn, representing 3.2% of cumulative GDP between 2020 and 2050 (**Figure 1**).

Our results show a dispersion of climate risks across the largest EU economies. Transition risks are the most important in these countries, so a delayed transition (disorderly scenario) could lead to the highest revenue losses compared with the orderly or hot-house scenarios. Except for the Netherlands – partly because of its low exposure to physical risk given significant existing investment in flood-prevention – the orderly transition would lead to the lowest climate costs among the largest EU economies.

Figure 1. Climate change-related impact measured in loss-to-GDP (%), cumulative 2020-2050



Notes: values on the y-axis represent for the period 2020-2050 the cumulative discounted losses driven by climate change relative to cumulative GDP without climate change (baseline scenario). We use a discount rate of 3% based on the spot rate of all bonds according to the ECB.

Source: Scope ESG Analysis

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However, with an achieved transition to net-zero by 2050 (orderly and disorderly), EU economies will not face additional transition risk in the second half of the century and could limit the physical risk impact to +2°C (or +1.5°C) compared with the hot-house scenario, where physical risk is expected to be five times higher by the end of the century according to NGFS projections. A costly transition in the first half of the century would allow the EU big five countries to avoid possibly catastrophic and irreversible economic damage of the hot-house scenario in the second half of the century, projections for which are beyond the scope of our MCST model.

Climate risks until 2050

EU "big five" climate change cost up to EUR 41 trn by 2050

Scope's MCST projects for the five largest EU-economies cumulated costs associated with climate change of EUR 41trn under the disorderly scenario (6.3% of cumulated GDP).

However, climate costs are disproportionally distributed across countries, where under the disorderly transition Italy is the most exposed to climate risk with EUR17.5trn costs by 2050 compared with EUR 7.1trn costs for Germany.

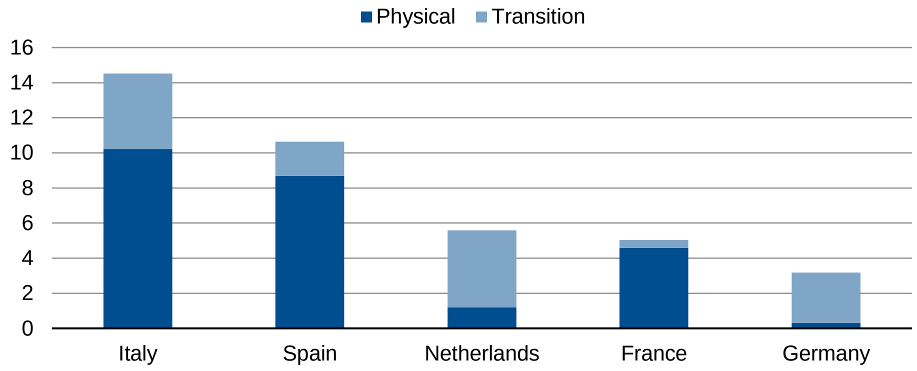
Overall, during 2020-2050, the disorderly and hot-house scenarios show higher economic losses compared with the orderly scenario[1], except for the Netherlands (**Figure 1**).

The highest cost of the disorderly transition is explained by the dominance of transition risk in EU big five countries. **Figure 2** shows the structure of climate risk across the largest EU economies.

The higher cost of the orderly transition compared with a hot-house scenario in the Netherlands is explained by its shallow exposure to physical risk (temperature and river flooding).

First, the moderate temperature increase in the Netherlands results in a positive effect on economic growth. This somewhat counterintuitive result is explained by the non-linear effect of temperature on economic growth leading to a positive impact of rising temperature in cooler EU countries such as Germany and Netherlands[2] (**Figure 3**). Secondly, the strong adaptation of the Netherlands to flooding (coastal and fluvial) leads to a shallow risk driven by future river floods under climate change.

Figure 2. Italy, Spain face heaviest climate costs in disorderly scenario
Climate loss-to-GDP (%) cumulative 2020-50



Notes: values on the y-axis represent for the period 2020-2050 the cumulative discounted losses driven by climate change relative to cumulative GDP without climate change (baseline scenario). We use a discount rate of 3% based on the spot rate of all bonds according to the ECB.

Source: Scope ESG Analysis

[1] In line with results from the NGFS Phase 3 Scenario Explorer (iiasa.ac.at); results of integrated assessment model REMIND-MAgPIE (median)
[2] Global non-linear effect of temperature on economic production | Nature

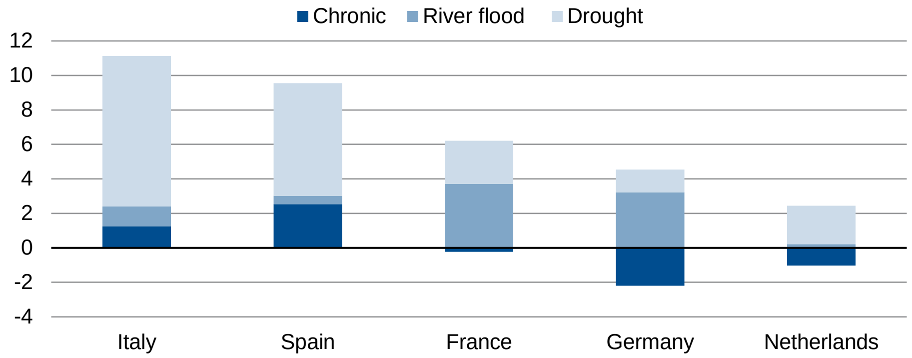
Impact of physical risks

Results:

- Spain and Italy (Mediterranean countries) are exposed to chronic physical risk associated with increase in temperatures.
- France and Germany are exposed to river floods risk with 3.7% and 3.2% of GDP annual losses, respectively, under the hot-house scenario (**Figure 3**).
- Droughts would lead to heavy economic losses in Italy and Spain (8.7% and 6.5% annual GDP losses).

Figure 3. Southern EU economies face heavy physical costs under the hot-house scenario

Physical loss-to-GDP (%) cumulative 2020-50



Notes: values on the y-axis represent for the period 2020-2050 the cumulative discounted losses driven by climate change relative to cumulative GDP without climate change (baseline scenario). We use a discount rate of 3% based on the spot rate of all bonds according to the ECB. Negative (Positive) values refer to benefits (losses).

Source: Scope ESG Analysis

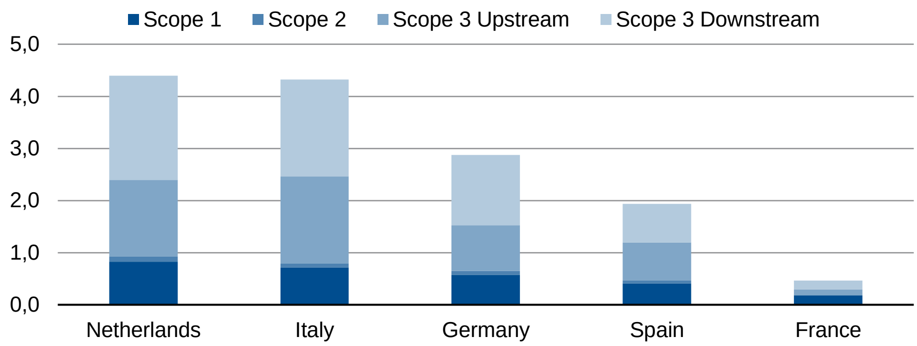
Impact of transition risks

What explains the variation of transition risks across EU economies?

- Assumed carbon intensity pathways differ widely across EU countries following the NGFS scenarios (based on available energy mix, industrial structure, emission sources).
- Indirect value-chain related emissions dominate the expected losses from transition risks, i.e., emissions associated with intermediate and final products.

Figure 4. Netherlands, Italy most exposed to transition risk in disorderly scenario

Transition loss-to-GDP (%) cumulative 2020-50



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Source: Scope ESG Analysis

FAQs

Why does the chronic temperature increase have a positive economic impact in Germany, Netherlands, and France?

Climate scientists have shown that temperature has a non-linear impact on economic growth: In cold regions, increasing temperature positively contributes to output growth until optimal conditions are reached at an annual average temperature of around 11°C[3]. With temperature higher than the optimal, economic output levels decline and thus, economies in the global south are most affected by temperature-related output losses already today. Based on climate projections, the temperature increase in Netherlands, Germany, and France under all transition scenarios remains under the optimal temperature, which result in a positive effect on economic growth.

Why is river floods risk insignificant in Netherlands?

Compared with all countries, our model shows that Netherlands is relatively non-exposed to river floods risk. The strongly integrated adaptation strategy of Netherlands to flooding (coastal and fluvial) leads to a shallow risk driven by future river floods under climate change.

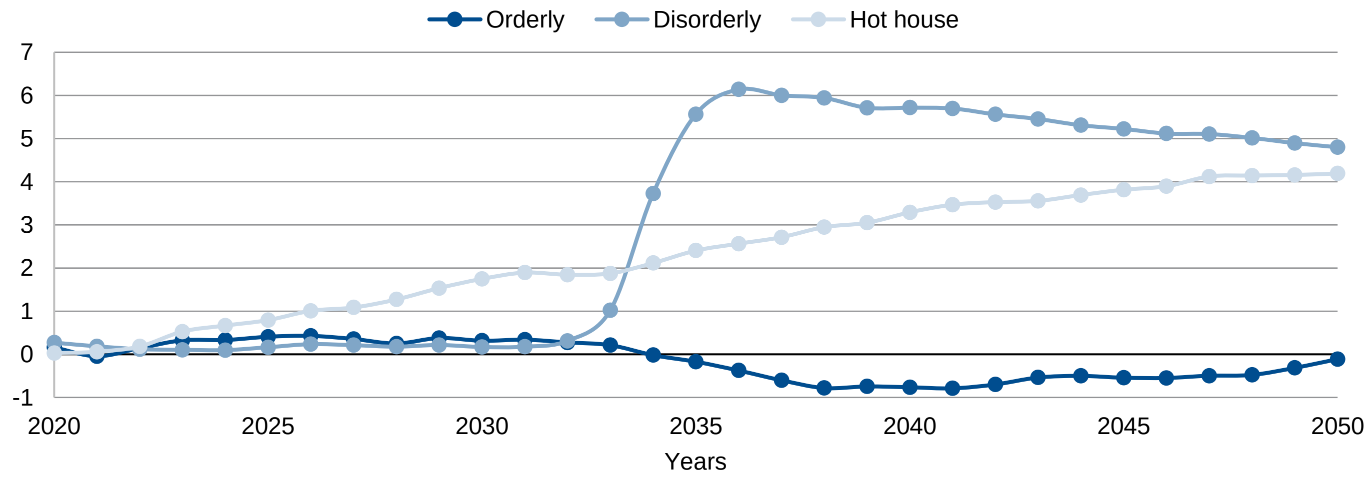
How can transition be beneficial for EU economies?

With an achieved transition to net-zero by 2050 (orderly and disorderly), EU economies face no further transition risk during the second half of the century, and they limit the physical risk impact to +2°C (or +1.5°C) compared with the hot-house scenario, where physical risk is expected to be much higher by the end of the century according to scientific projections (the Intergovernmental Panel on Climate Change report). The costly transition in the first half of the century (orderly or disorderly) will thus avoid the catastrophic and irreversible economic damages of the hot-house scenario during the second half of the century.

How is the climate cost in Germany distributed from 2020 to 2050?

To make this report easier to read, we discussed the ratio of cumulative loss to cumulative GDP in the period 2020-2050 in all figures (**1 to 4**). However, the annual losses are not uniformly distributed across the whole period and will be higher in some years than others. For instance, **Figure 5** shows how the dynamics of climate risk in Germany (as an example) are strongly heterogeneous between the NGFS scenarios across the whole period. The highest cost associated with the disorderly scenario is driven by the sudden and delayed action to mitigate GHG emissions leading to a high transition risk between 2030 – 2035. Yet, from 2035, losses under the disorderly scenario start decreasing strongly (6% in 2035 compared with less than 5% in 2050). For the same period, the inaction (hot-house) scenario continues driving economic losses. Therefore, despite the transition cost, mitigating GHG emissions will prevent the economy's unsustainable losses during the second half of the century. The same dynamics holds when looking at the average GDP loss from climate change across the big five EU economies (**Figure 6**).

Figure 5. Yearly GDP loss from climate change in Germany



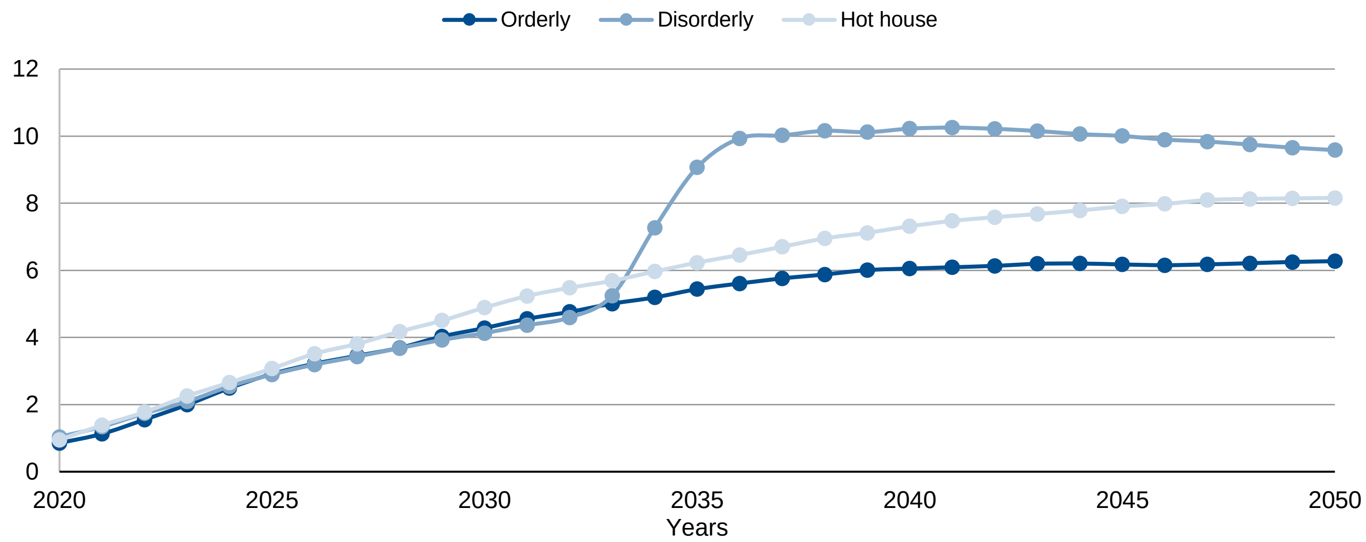
Notes: Values on the y-axis represent for the yearly discounted losses driven by climate change relative to yearly GDP without climate change (baseline scenario). We use a discount rate of 3% based on the spot rate of all bonds according to the ECB.

Source: Scope ESG Analysis

[3] Global non-linear effect of temperature on economic production | Nature

Figure 6. Yearly GDP loss from climate change

Average across the big five EU economies



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Source: Scope ESG Analysis

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