



**The Coalition  
of Finance Ministers  
for Climate Action**

# **Integrating physical climate risks into public debt sustainability in the EU Member States**

**European Commission**

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**A contribution to the 'Compendium of Practice from a Global Community of Ministries of Finance and Leading Organizations: Economic analysis and modeling tools to assist Ministries of Finance in driving green and resilient transitions'**

**Topic:** Addressing the climate policy questions facing Ministries of Finance: the economic and fiscal impacts of climate change

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**Climate change entails two sources of risks with economic and fiscal consequences.** Physical risks are distinguishable as acute or chronic. Acute physical risks identify extreme weather and climate events, which tend to cause immediate damage and potentially have short- and medium-term consequences. Chronic physical risks may cause permanent damage over the medium and long term, as they reflect more gradual, and often irreversible, transformations of the environment due to global warming. On the other hand, transition risks, related to mitigation policy efforts, may arise from the economic and fiscal consequences of the transition to a low-carbon economy (Batten et al., 2020). In what follows, we focus on the macrofiscal impacts of physical risks from climate change.

**The macroeconomic impacts from physical risks are expected to be heterogeneous across the EU,** mostly through shocks to economic supply and demand. In Europe, the overall exposure has not (so far) been as large as in other parts of the world. In addition, the impacts have varied greatly across individual years, countries, and regions. For instance, between 1980 and 2019, a large share (more than 60%) of the total reported economic losses from weather and climate extremes in Europe was caused by a small number (less than 3%) of unique registered events (European Commission, 2021a). Recent models also show that the economic burden from physical risks is expected to exhibit a clear regional divide (Feyen et al., 2020). Nevertheless, the overall assessed economic impact may suffer from underestimation (Stern, 2013).

**Adverse macroeconomic developments from physical risks could also pose challenges to the sustainability of public finances.** These will likely be affected directly, via increased public spending to replace damaged assets and infrastructures and to support vulnerable households or firms, as well as via the materialization of both explicit (e.g. relief or disaster-specific transfers to local governments, government guarantees for firms and public-private partnerships) and implicit contingent liabilities (e.g. public support to distressed financial institutions). Public finances will also likely be affected indirectly in instances such as reduced tax revenue due to output losses following the disruption of economic activity in climate-sensitive sectors and regions. Vulnerability to climate change might even generate increasing risks of uncertainty, affecting the creditworthiness and international financial accessibility of a given country (Zenios, 2021). The fiscal impact of physical risks is, however, mitigated by countries' ability to adapt, by anticipating the adverse effects of climate change and taking appropriate action to prevent or minimize the damage they can cause.

**Despite its considerable relevance, the analysis of climate-related risks has often been absent from the fiscal sustainability frameworks of international institutions, notably due to the inherent difficulties in conceptualizing and quantifying such aspects.** The impacts are numerous and complex, and they interact in multiple ways. Nevertheless, to ensure sound and sustainable public finances, it is essential to include the likely order of magnitude of such potential impacts, while also accounting for their expected timing, degree of persistence, and uncertainty. At the EU level, notable initiatives on fiscal matters and climate change relate to ongoing work on green budgeting (Battersby et al., 2021; Bova, 2021), disaster-risk financing (Radu, 2021), and disaster risk management (European Commission, 2021b).

**Under its new EU Adaptation Strategy on adaptation to climate change,<sup>1</sup> the European Commission has committed to develop ways to measure the potential impact of climate-related risks on public finances. In particular, it has introduced a stepped approach into its standard Debt Sustainability Analysis (DSA) framework.<sup>2</sup>** In the first step, the aim was to set up the theoretical framework and develop conceptual considerations around the main mechanisms linking climate change to debt sustainability (through both physical and transition risks). The framework has been featured in the form of a conceptual box in the Commission's Debt Sustainability Monitor 2019. On this basis, in the second step, the Commission aimed to provide an empirical assessment of the impact of climate

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<sup>1</sup> See COM/2021/82 final.

<sup>2</sup> The European Commission assesses fiscal sustainability risks to public finances based on a multi-dimensional approach and a well-established framework. This framework integrates findings from the debt sustainability analysis (DSA) and fiscal sustainability indicators. The DSA combines deterministic debt projections (baseline and alternative scenarios) with stochastic projections covering a wide range of possible shocks (see the European Commission's Debt Sustainability Monitor 2023 for details).

change on public finances. Given the existing data and the methodological challenges in capturing all climate-related risks, the initial focus has been on examining the role of physical climate risks.<sup>3</sup> More specifically, the Commission developed its first stylized stress tests (via its standard DSA framework) of the potential impact of acute physical risks from climate change on public finances. This assessment was featured as a thematic chapter of the Commission's Fiscal Sustainability Report 2021 (and related Discussion Paper (Gagliardi et al., 2022)).

**The specific focus of the Adaptation Strategy is to capture the potential debt sustainability impacts associated with extreme weather and climate events in the EU.** This is done by providing stylized stress tests for selected EU Member States, designed as one-off shocks to public finances and growth in the medium term. The assumptions are based on an extensive review of the theoretical and empirical literature on the macroeconomics of natural disasters.<sup>4</sup> Climate-related aggravating factors to debt sustainability are captured by relying on a global natural disaster database (EM-DAT; UCLouvain) and available forward-looking estimates of economic losses from different climate events (PESETA IV, Joint Research Centre, European Commission).

**The stress tests rely on a comparative approach.** They aim to illustrate, for a given country, the deviation from the European Commission's 10-year baseline debt-to-GDP projections, should an extreme event occur in the medium term. In addition, to account for potential interactions between progressively higher temperatures and more intense/frequent extreme events in the future, the impact is further calibrated according to different global warming scenarios (1.5°C and 2°C). In each scenario, the specific extreme event is assumed to simultaneously exert i) a direct impact on government accounts (via the primary balance), affecting the debt level, and ii) an indirect impact via GDP (growth and level) effects (also affecting the debt ratio, via denominator effects). The stress tests are only triggered for a set of particularly exposed and vulnerable EU countries, based on specific selection criteria.<sup>5</sup>

**Results from the stress tests highlight that extreme events may pose risks to debt sustainability in several countries, although they remain manageable under standard global warming scenarios.** The simulated extreme event exerts a significant and persistent negative impact on debt projections, and the adverse fiscal impact is found to increase in higher projected warming scenarios (Table 1). The results appear to be heterogeneous across countries and are subject to large uncertainties. In particular, they will likely represent an underestimation of the expected fiscal impact. This may be due to the potential underreporting of economic losses in existing global disaster databases and to the use of lower bound estimates of the expected adverse economic impact from climate events in the EU, as well as to unaccounted risks from nonlinearities and tipping points, potential negative feedback effects across sectors, and/or adverse spillover effects across countries, combined with a medium-term perspective.

**Large-scale, rapid, and immediate mitigation measures have the potential to limit climate change and its related effects.** Findings from Gagliardi et al. (2022) also point to the relevance of implementing adequate adaptation policies, including insurance and climate-resilient debt instruments to provide financial resilience to climate change and dampen the fiscal impact of climate-related events, thus reducing potential debt sustainability risks. Robust and effective disaster risk management frameworks and disaster risk financing strategies contribute to reducing the potential fiscal cost of natural disasters and increase the incentive to take action to reduce vulnerability while providing financial support. In addition, increasing insurance penetration can support post-disaster recovery, reduce vulnerability, and promote resilience (Radu, 2021; European Commission, 2021b).

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<sup>3</sup> This choice has been motivated merely by data and methodological challenges. In fact, physical and transition risks "are not independent of each other but tend to interact" (Batten et al., 2020; p. 3), as inadequate policy actions to fight climate change can aggravate physical risks and, in turn, intensify transition risks (Gagliardi et al., 2022; European Commission, 2021a; NGFS, 2020). Further work on this is ongoing.

<sup>4</sup> For an overview, see Fache Rousová et al. (2021), Hallegatte et al. (2020), Batten et al., (2020), Batten (2018).

<sup>5</sup> For details, see Section 3 in Gagliardi et al. (2022).

Assessing fiscal risks from climate change is a critical and challenging issue. More specifically, practical caveats remain. Modeling limitations and current data availability constitute important challenges. The existing international datasets recording extreme weather and climate events are not (fully) publicly available and/or often provide a partial reporting of impacts. In addition, the reporting of total economic losses does not follow a common standard, which makes it difficult to disaggregate the total losses between the private and public sectors, which has consequences on the estimation of related fiscal impacts. Finally, due to current data and methodological limitations, the existing analyses necessarily tend to build on several simplifying assumptions and may, therefore, only provide a partial perspective of climate-related fiscal (debt) sustainability risks.

**Table 1: Debt-to-GDP projections (selected years), baseline versus 1.5°C and 2°C warming scenarios**

Debt-to-GDP projections					
Spain	2021	2023	2024	2032	2032 change
<i>Baseline</i>	120.6	116.9	120.3	126.1	
<i>1.5°C scenario</i>	120.6	116.9	125.4	130.6	4.5
<i>2°C scenario</i>	120.6	116.9	126.2	131.3	5.2
Romania	2021	2023	2024	2032	
<i>Baseline</i>	49.3	53.2	54.3	76.9	
<i>1.5°C scenario</i>	49.3	53.2	57.4	79.6	2.7
<i>2°C scenario</i>	49.3	53.2	57.9	80.1	3.2
Portugal	2021	2023	2024	2032	
<i>Baseline</i>	128.1	122.7	121.8	126.2	
<i>1.5°C scenario</i>	128.1	122.7	124.5	128.6	2.4
<i>2°C scenario</i>	128.1	122.7	124.9	129.0	2.7
Czechia	2021	2023	2024	2032	
<i>Baseline</i>	42.4	46.3	48.0	67.1	
<i>1.5°C scenario</i>	42.4	46.3	52.6	71.1	4.0
<i>2°C scenario</i>	42.4	46.3	53.5	71.8	4.7
Hungary	2021	2023	2024	2032	
<i>Baseline</i>	79.2	76.4	74.9	68.1	
<i>1.5°C scenario</i>	79.2	76.4	78.8	71.3	3.1
<i>2°C scenario</i>	79.2	76.4	79.5	71.9	3.7
Poland	2021	2023	2024	2032	
<i>Baseline</i>	54.7	49.5	48.2	48.3	
<i>1.5°C scenario</i>	54.7	49.5	51.8	51.1	2.8
<i>2°C scenario</i>	54.7	49.5	52.5	51.7	3.4
Greece	2021	2023	2024	2032	
<i>Baseline</i>	202.9	192.1	185.9	154.7	
<i>1.5°C scenario</i>	202.9	192.1	188.8	157.3	2.6
<i>2°C scenario</i>	202.9	192.1	189.2	157.5	2.8
Italy	2021	2023	2024	2032	
<i>Baseline</i>	154.4	151.0	150.6	161.6	
<i>1.5°C scenario</i>	154.4	151.0	153.0	163.9	2.2
<i>2°C scenario</i>	154.4	151.0	153.3	164.1	2.5
Austria	2021	2023	2024	2032	
<i>Baseline</i>	82.9	77.6	76.9	76.3	
<i>1.5°C scenario</i>	82.9	77.6	78.9	77.9	1.6
<i>2°C scenario</i>	82.9	77.6	79.2	78.1	1.9
France	2021	2023	2024	2032	
<i>Baseline</i>	114.6	112.9	114.2	122.3	
<i>1.5°C scenario</i>	114.6	112.9	116.0	123.8	1.5
<i>2°C scenario</i>	114.6	112.9	116.5	124.2	1.9
Belgium	2021	2023	2024	2032	
<i>Baseline</i>	112.7	114.6	116.5	133.6	
<i>1.5°C scenario</i>	112.7	114.6	117.5	134.4	0.8
<i>2°C scenario</i>	112.7	114.6	117.6	134.5	0.9
Germany	2021	2023	2024	2032	
<i>Baseline</i>	71.4	68.1	67.0	61.6	
<i>1.5°C scenario</i>	71.4	68.1	68.3	62.6	1.0
<i>2°C scenario</i>	71.4	68.1	68.4	62.8	1.1
The Netherlands	2021	2023	2024	2032	
<i>Baseline</i>	57.5	56.1	56.0	62.8	
<i>1.5°C scenario</i>	57.5	56.1	56.8	63.5	0.7
<i>2°C scenario</i>	57.5	56.1	57.1	63.7	0.9

Note: The 2032 change measures the difference, as percentage points in 2032, between debt-to-GDP in the 1.5°C and 2°C scenarios, respectively, compared with the European Commission's 10-year baseline debt-to-GDP projections.

Source: Gagliardi et al. (2022)

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