



# Climate Change and Debt Sustainability

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# Key Facts

# Key Facts (1)

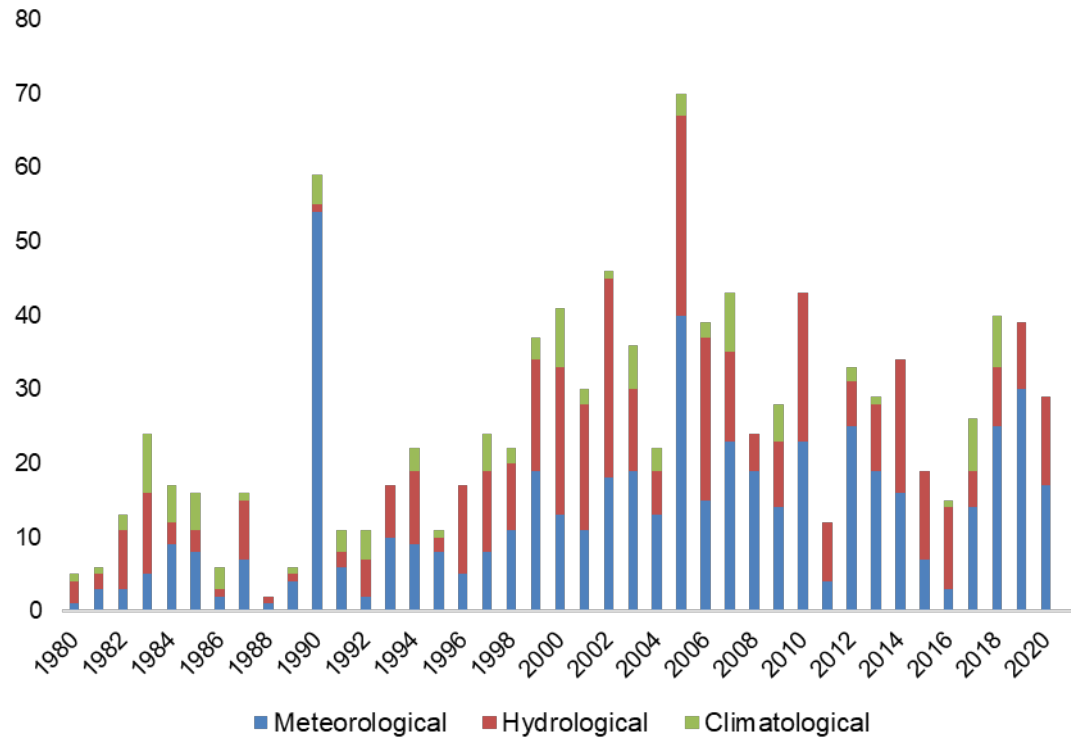
- Climate change is a **complex** global phenomenon and represents a very serious threat
- Climate change affects entire **ecosystems** and exerts negative impacts on our society, particularly on the most vulnerable
- Climate change impacts are felt in many different aspects of **people's lives**, including our **economy**
- Climate risk assessments are challenging, as they are surrounded by **large uncertainty**
- The **long-term horizon**: catastrophic impacts of climate change will be felt beyond the traditional horizons of policymakers and market participants, action is needed now

## Key Facts (2)

- Human activities, **principally through emissions of GHG**, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850–1900 in 2011–2020
- This has **physical consequences**: gradual transformation of the environment (e.g. melting ice sheets; sea level rise); more intense and frequent extreme weather events (heatwaves, droughts, wildfires)
- The risk of **non-linearities** and **tipping points** may increase the likelihood for catastrophic and irreversible outcomes to occur
- There is a **rapidly closing window** of opportunity to secure a liveable and sustainable future for all (IPCC, 2023)

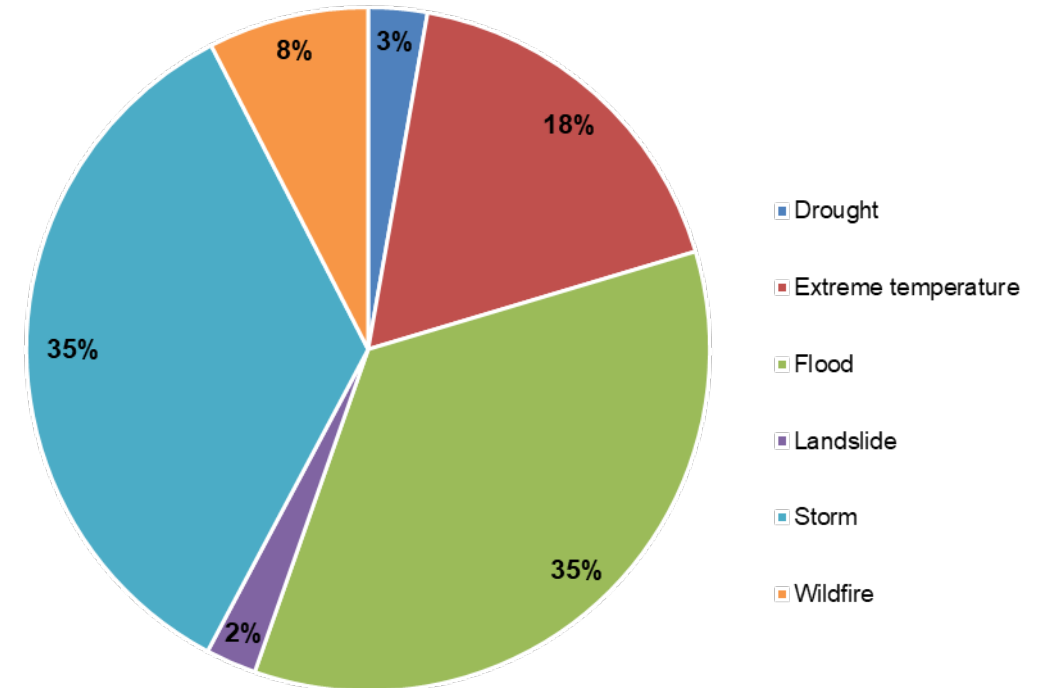
# Extreme weather events in the EU, 1980-2020

Number of weather and climate-related disasters, by disaster subgroup, EU27, 1980-2020



Source: Emergency Events Database (EM-DAT; CRED, UCLouvain)

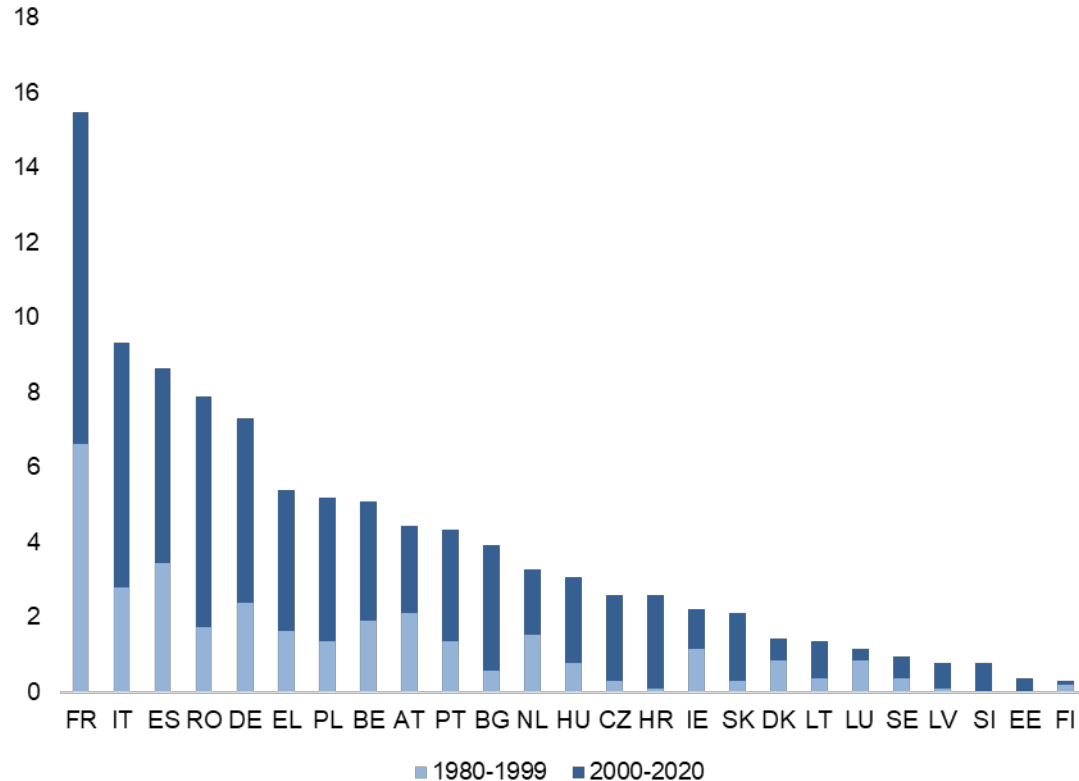
Weather and climate-related events, by disaster type, EU27, 1980-2020, % of total reported events



Source: Emergency Events Database (EM-DAT; CRED, UCLouvain)

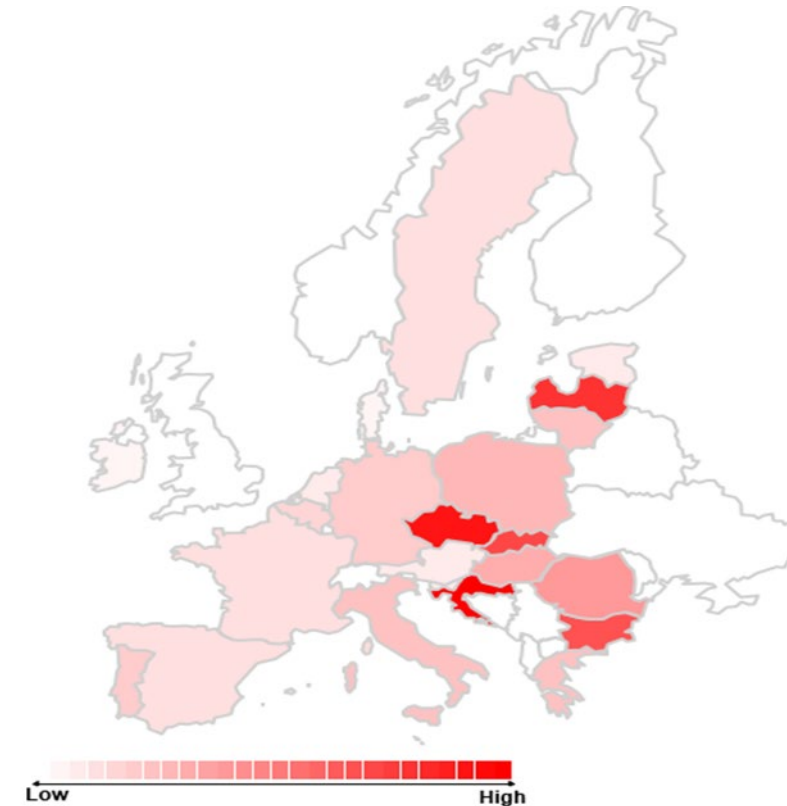
# Extreme weather events in the EU, distributional impacts

Geographical distribution of weather and climate-related events in the EU, per decade, % total reported events



Source: Emergency Events Database (EM-DAT; CRED, UCLouvain)

Increase in weather and climate-related disasters in the EU, by country, 2000-2020



Source: Emergency Events Database (EM-DAT; CRED, UCLouvain)

# Economic and fiscal impacts of climate change

# Economic and fiscal impacts of climate change

- Climate change entails **two sources of risks** with economic and fiscal consequences:
  - 1. Physical risks:**
    - **Chronic:** 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
    - **Acute:** identify extreme weather events, which tend to cause immediate damage and lead to potential short- and medium-term consequences
  - 2. Transition risks:** related to mitigation policy efforts, from the transition to a low-carbon economy
- Physical and transition risks ***are not independent of each other but tend to interact***, as inadequate policy actions to fight climate change can aggravate physical risks and, in turn, intensify transition risk



# Physical risks

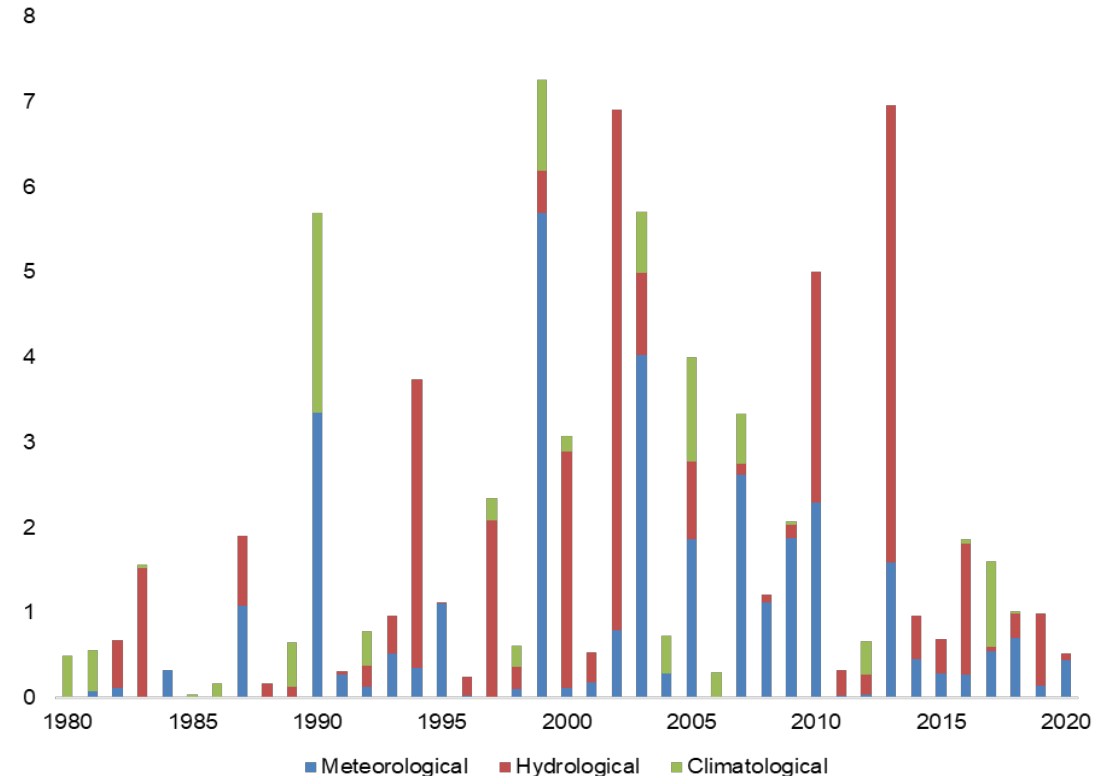
# Economic impacts of *physical risks*

- Unforeseen shocks via the main economic growth drivers:
  - **Supply**: capital stock damage and disruption; food and input shortages; impacts on labour supply
  - **Demand**: consumption and investment patterns; impact on trade flows
- **Most adverse impacts**: people in countries with high exposure to climate disasters and lower capacity to prepare for and cope with such events
- Impacts may **spill over** to less exposed economies via **global market interactions**
- **Timing of the economic impact**:
  - Extreme events tend to cause **immediate** economic damage
  - Damage may last in the **medium term**, depending on country specificities
  - **Inadequate insurance coverage** of disasters amplifies the adverse economic impact

# Economic impacts of *physical risks* in the EU (1)

- **Heterogenous** impacts across the EU
- **Flood** and **storm** events: main driver behind economic losses
- Impacts differ **over time** and **across countries**
- A **large share** (more than 60%) of total reported economic losses caused by a **small number** (less than 3%) of all unique registered events
- Economic losses may be **two-to-three times higher** in the EU, by 2050 (*JRC, 2021*)
- By the end of the century, losses may increase **even further** (*JRC, 2021*)
- Economic impacts may suffer from **underestimation**

Economic losses from extreme weather events in the EU (% of total events), by disaster subgroup, 1980-2021



**Source:** European Commission, based on the EM-DAT database.

# Economic impacts of *physical risks* in the EU (2)

Selected major extreme events and associated economic losses, by country/year

Country	Year	Disaster type	Related economic losses, % GDP	Total economic losses over 1980-2020, % GDP
BE	1990	Storm	0.5	0.8
BG	2005	Flood	1.5	3.3
CZ	1997	Flood	3.0	6.9
DK	1999	Storm	1.5	3.0
DE	2002	Flood	0.6	2.2
EE	2005	Storm	0.9	0.9
IE	1990	Storm	0.2	0.6
EL	1990	Drought	1.0	3.6
ES	1983	Flood	2.3	7.7
FR	1999	Storm	0.8	2.8
HR	2000	Extreme temp.	1.1	2.6
IT	1994	Flood	0.9	3.2
LV	2005	Storm	1.9	1.9
LT	2006	Drought	0.7	0.9
LU	1990	Storm	2.9	3.1
HU	1986	Drought	2.0	4.3
NL	1990	Storm	0.5	1.2
AT	2002	Flood	1.1	2.4
PL	1997	Flood	2.2	4.3
PT	2003	Wildfire	1.0	4.9
RO	2000	Drought	1.3	5.0
SI	2007	Storm	0.8	1.7
SK	2004	Storm	0.9	2.4
FI	1990	Storm	0.0	0.0
SE	2005	Storm	0.7	0.8

Factor increase in economic losses, by mid-century and warming scenario

Regional aggregate	1.5°C scenario	2°C scenario
Mediterranean	x2.0	x2.3
Atlantic	x2.3	x3.4
Continental	x1.7	x2.1
Boreal	x1.6	x2.3
<b>EU</b>	<b>x1.9</b>	<b>x2.5</b>

Source: European Commission, Gagliardi et al. (2022); based on the PESETA IV project.

Source: European Commission, Gagliardi et al. (2022); based on the EM-DAT database.

# Fiscal impacts of *physical risks*

- Public finances may be affected *directly* and *indirectly*

## Some instances:

- **Pressure on public spending:** replace damaged infrastructure, social transfers, subsidies, adaptation policies
  - **Tax revenue losses:** due to disruption of economic activities following extreme events
  - **Explicit and implicit contingent liabilities:** government guarantees, public support to banking and insurance sectors
  - **Sovereign financing costs:** adverse impacts from risks of uncertainty and financial markets' reaction
- Potential impacts on **debt sustainability risks** and sovereign capacity to repay debt over the medium term

# Transition risks

# Economic impacts of *transition risks*

- **Climate mitigation action** is needed to stabilize the climate and limit physical risks
- More than 140 countries around the world have announced or are considering a **net-zero target by mid-century**
- The transition to a decarbonised economy is expected to have several **macroeconomic** implications:
  - Need to revise our **energy sector** (accounting for around 75% of GHG in the EU)
  - Improvements in **energy efficiency, land use, land use changes, and forestry** (LULUCF)
  - **Technological, behavioural, and policy** changes are required
- **Conventional argument:** *trade-off* between the reduction of current emissions, which comes at a direct mitigation cost, and long-term environmental quality
- Climate mitigation will **spur investments** in green technologies and infrastructure, thus boosting aggregate demand, job creation, lower production costs, and economic growth (**green growth**)
- The transition may lead to **asymmetrical impacts** and **adjustment costs** as a result of changes in *demand, capital allocation, and the labour market* (**distributional effects**)

# Fiscal impacts of *transition risks*

- Public finances are also expected to be subject to **several challenges**
- Climate mitigation policies may exert **mixed pressures** on both *public spending* and *revenues*
- Overall impact: will depend on the *timing, design, and implementation* of policies
- **Potential impact on public spending:**
  - Higher public expenditure needed to replace and renovate capital stock
  - Subsidies or transfer to support the transition or compensate the most affected groups
  - (Relatedly) higher public expenditure (including investment) for adaptation policies
- **Potential impact on revenues:**
  - Carbon pricing instruments are likely to generate significant revenues allowing to potentially remove distortionary taxes, thus boosting efficiency and growth (*double dividend*)
  - Need for additional revenue sources, as decarbonisation is successfully phased-in
  - A strategic and timely use of revenues will be key to avoid potential deteriorations of countries' fiscal positions



# Climate change and macro-fiscal frameworks

# Climate change and macro-fiscal frameworks (1)

- Climate-related risks **often absent from fiscal sustainability frameworks of official institutions**, notably due to inherent difficulties in conceptualising and quantifying such aspects
- Modules **tentatively** examining potential climate-related risks to the sustainability of public finances have recently seen a surge (UK OBR; Swiss Federal Department of Finance; IMF/World Bank)
- **Related fiscal initiatives at the EU level**: green budgeting (Battersby et al., 2021; Bova, 2021); disaster-risk financing (Radu, 2021), and disaster risk-management (European Commission, 2021)
- **Climate change risks and DSA**: conceptual framework in the 2019 Debt Sustainability Monitor (European Commission, 2020) – in the context of the **EU's New Adaptation Strategy**

# Climate change and macro-fiscal frameworks (2)

**EU Adaptation Strategy (February 2021)** - Four principal objectives:

- Smarter Adaptation
- Faster Adaptation
- **More systemic adaptation**
- Step up international action on adaptation to climate change

## **More systemic adaptation**

- The Commission will support the further development and implementation of adaptation strategies and plans at all levels of governance with three cross-cutting priorities:
  - **Integrating adaptation into macro-fiscal policy**
  - Nature-based solutions for adaptation
  - Local adaptation action

# Climate change and macro-fiscal frameworks (3)

## Integrating adaptation into macro-fiscal policy

- The Commission will:
  - *Develop ways to measure the potential impact of climate-related risks on public finances, develop tools and models for climate stress testing*, and engage in discussions with Member States on better take into account climate change in national reporting and fiscal frameworks;
  - Explore and discuss with Member States *actions to dampen the fiscal impact of climate-related events and reduce fiscal-sustainability risks*

# Introducing fiscal risks due to climate change in the Commission's DSA framework

- A step-by-step approach:
  1. **Conceptual considerations** presented in the [2019 Debt Sustainability Monitor](#)
  2. **Stress tests** on the fiscal impact of extreme weather events in the EU ([Fiscal Sustainability Report 2021](#); [ECFIN Discussion Paper](#), [EU at COP27](#), [VoxEU column](#))
  3. **Going forward:** (on-going) tentative construction of *climate policy scenarios* (via stylised, 'what if' analyses - building on available data and assumptions – in line with the existing literature)

## Additional DG ECFIN's work on climate change and public finances link:

- [Disaster Risk Financing: Main Concepts and Evidence from EU Member States](#)
- [Disaster Risk Financing: Limiting the Fiscal Cost of Climate-Related Disasters](#)

# The fiscal impact of climate change

First evidence for the EU

# Fiscal impacts of acute physical risks in the EU (1)

## The fiscal impact of extreme weather events in the EU (Gagliardi et al., 2022):

- **Limited** evidence for advanced economies
- **Stylised stress tests**, medium-term perspective, in line with the European Commission's Debt Sustainability Analysis (DSA) horizon
- The aim is to capture risks associated with ***one-off shocks from extreme weather events***, in the form of *aggravating factors* to public debt sustainability
- Rely on past exposure but also *future* exposure and vulnerability to extreme events
- **Novel comparative approach**: in a given country, the deviation from the Commission's 10-year baseline debt-to-GDP projections, *should a past extreme event re-occur in the medium term, calibrating its impact under different global warming pathways (1.5°C and 2°C)* to account for potential increases in frequency/intensity of extreme events

# Fiscal impacts of acute physical risks in the EU (2)

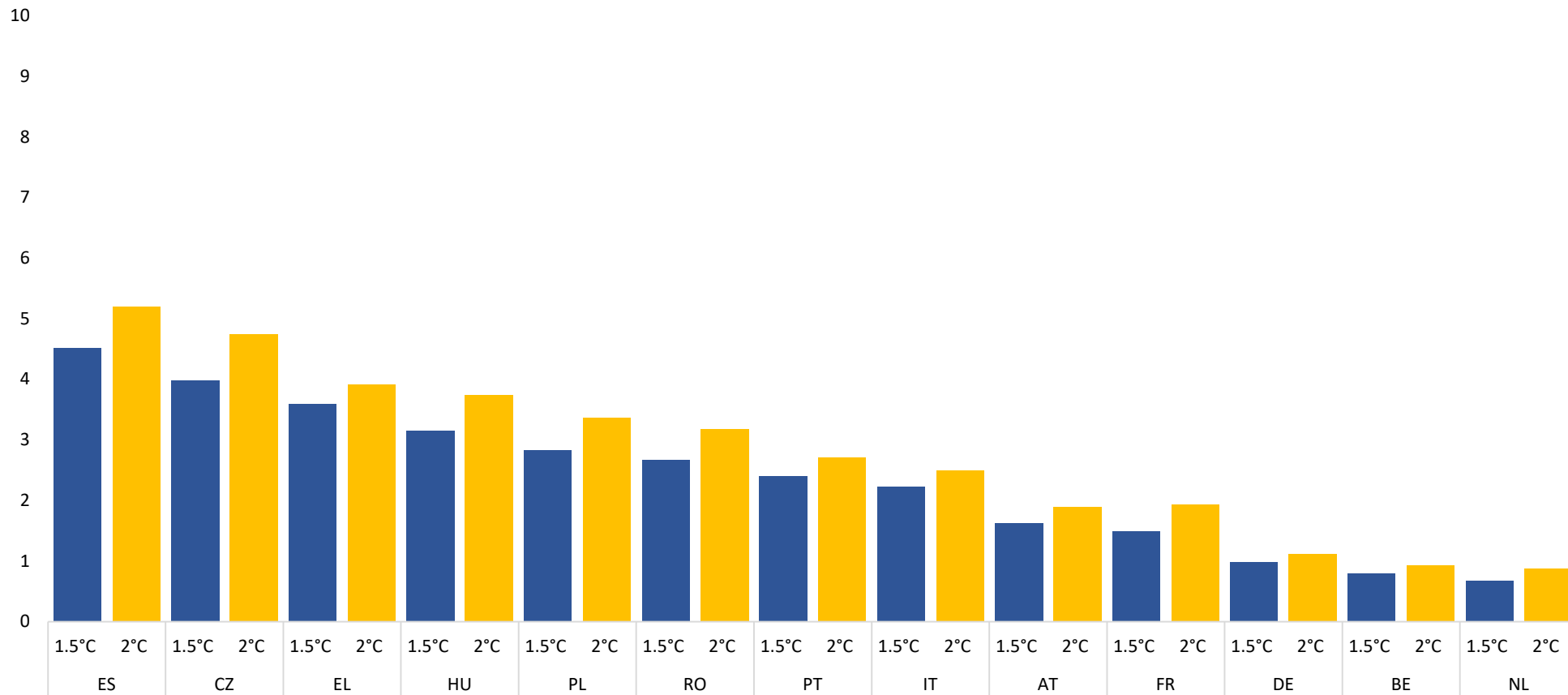
## In practice:

- Rely on a **global natural disaster database** and **future expected losses** from different extreme events; two global warming scenarios (1.5°C and 2°C)
- We assume a **direct** impact on government accounts (i.e. via the primary balance) and an **indirect** impact via GDP (growth and level) effects
- *Main findings*: **non-negligible** impact of extreme events **on public debt and debt sustainability risks in some countries**; manageable impacts under standard **Paris Agreement scenarios**
- Impacts represent a **lower bound**: uncertainty around the frequency and intensity of future extreme events, non-linearities and tipping points, cross-country spillovers



# Fiscal impacts of acute physical risks in the EU (3)

Debt-to-GDP difference (pps.), 1.5°C and 2°C scenarios compared to the baseline, in 2032



Source: Fiscal Sustainability Report 2021; Gagliardi et al., (2022)

# Discussion and conclusion

- **Summing up:**
  - Measuring fiscal risks from climate change is a **critical** and **challenging** issue
  - **Main challenges:** modelling limitations; current data availability; reporting of economic losses; disaggregation of public vs. private sector impacts; current vs. expected vulnerability to climate change
  - In the EU, fiscal impact from extreme weather events is found to be **non-negligible but manageable** under standard global warming pathways
  - Extreme weather events may pose challenges to countries' **fiscal sustainability**
  - Large-scale, rapid, and immediate **mitigation** and **adaptation** measures have the potential to limit climate change and its related effects
  - **Climate transition** is likely to pose further challenges to public finances
  - **Further analyses** on the topic are needed

# Thank you



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# Background slides

# Investment needs in energy system (incl. transport) – *Fit For 55* (1)

Table 7 - Investment in REF and core policy scenarios (2021-2030 annual averages, billion € 2015); Source PRIMES

Investments (bn € 2015)		REF	REG	MIX	MIX-CP	MIX-H2 variant
	Average 2011-2020	Average 2021-2030				
Investments in power grid	12.8	35.1	43.9	43.8	43.9	46.1
Investments in power plants	32.1	41.8	54.1	54.7	55.1	63.7
Investments in boilers	2.3	2.6	3.9	3.8	3.7	3.8
Investments in new fuels production and distribution	0.0	0.0	0.7	0.7	0.6	7.3
<u>Overall supply side investments</u>	<u>47.1</u>	<u>79.6</u>	<u>102.7</u>	<u>103.0</u>	<u>103.3</u>	<u>120.9</u>
Industrial sector investments	10.2	17.0	23.7	24.7	24.1	24.4

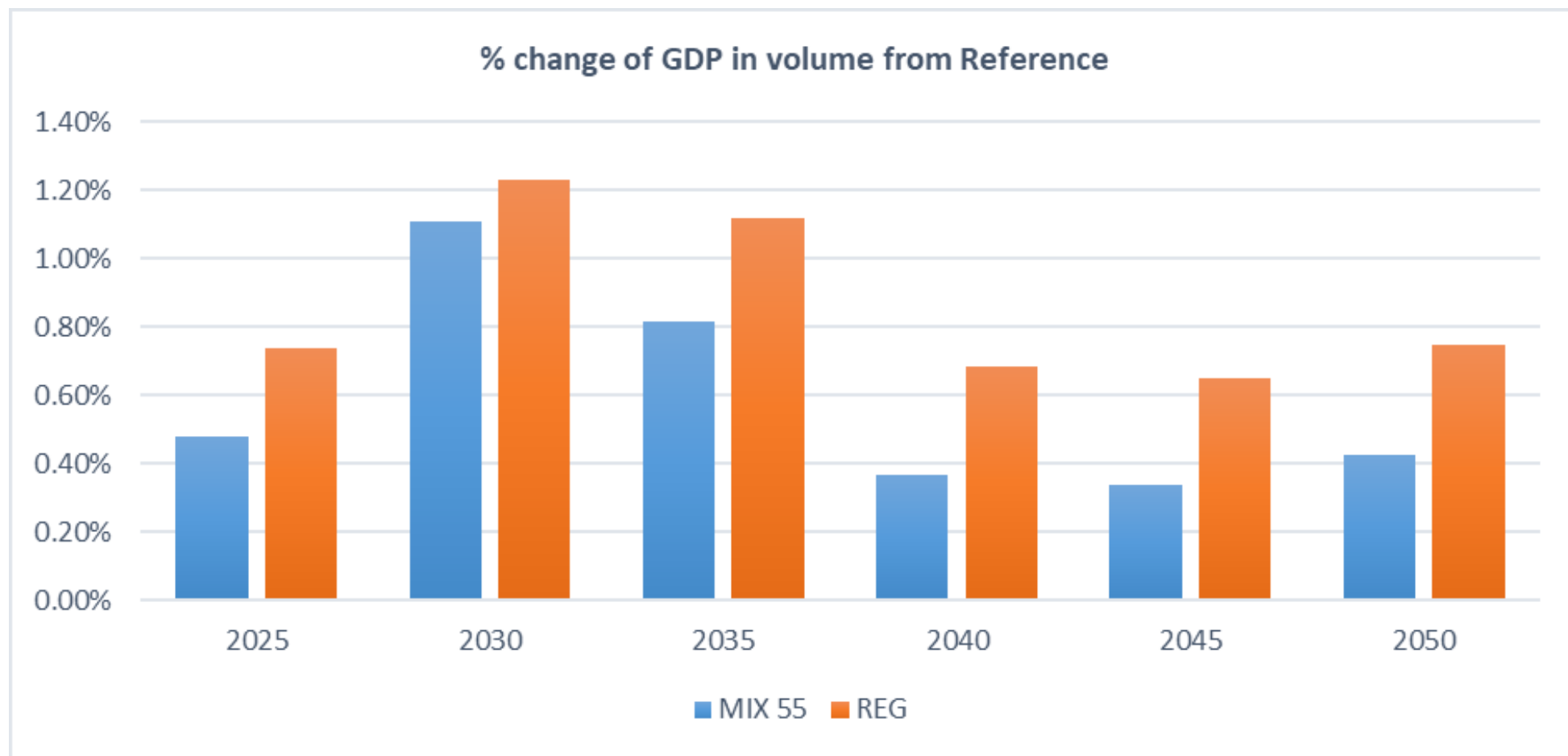
Source: European Commission, SWD(2021) 621 final

# Investment needs in energy system (incl. transport) – *Fit For 55* (2)

Residential sector investments	87.8	125.5	193.8	180.1	157.6	179.7
Tertiary sector investments	40.2	74.6	97.0	94.2	94.5	94.4
Transport sector investments	474.3	647.4	650.6	649.3	648.2	654.1
<u>Overall demand side investments</u>	<u>612.4</u>	<u>864.5</u>	<u>965.1</u>	<u>948.2</u>	<u>924.3</u>	<u>952.6</u>
<b><u>Overall energy system investments</u></b>	<b><u>659.5</u></b>	<b><u>944.0</u></b>	<b><u>1067.7</u></b>	<b><u>1051.3</u></b>	<b><u>1027.6</u></b>	<b><u>1073.5</u></b>
<b><u>as % of GDP</u></b>	<b><u>5.4%</u></b>	<b><u>6.8%</u></b>	<b><u>7.7%</u></b>	<b><u>7.6%</u></b>	<b><u>7.4%</u></b>	<b><u>7.7%</u></b>
<i>additional to 2011-2020 annual average</i>		284.5	408.2	391.7	368.0	413.9
<b><u>Overall energy system investments excl transport</u></b>	<b><u>185.2</u></b>	<b><u>296.7</u></b>	<b><u>417.1</u></b>	<b><u>402.0</u></b>	<b><u>379.4</u></b>	<b><u>419.3</u></b>
<b><u>as % of GDP</u></b>	<b><u>1.5%</u></b>	<b><u>2.1%</u></b>	<b><u>3.0%</u></b>	<b><u>2.9%</u></b>	<b><u>2.7%</u></b>	<b><u>3.0%</u></b>

Source: European Commission, SWD(2021) 621 final

# Macroeconomic impact of increased climate target - *Fit For 55*



Source: European Commission, SWD(2021) 621 final

# COMPARING TWO LONG-RUN TRENDS

	Climate change	Demographic change
Time horizon:	Very long: coming generations	Long: next two generations
Trend is driven by ...	... anthropogenic climate change (GHG emissions – climate – temperature – ecological/economic consequences)	... low fertility combined with increasing longevity, medical progress, migration
Uncertainty relates to ...	...biophysical mechanisms, large confidence intervals	... demographic parameters, smaller confidence intervals
Long-run uncertainty on economic and fiscal consequences ...	... very large (wrt e.g. to growth effects, fiscal costs)	... more limited: We know the crucial parameters of the pension system
Do consequences depend on global policies as well:	yes, climate is a global public good	no, only weak global links (migration, global capital market)
<b>Overall uncertainty long-run fiscal forecasts</b>	<b>Very high (close to “speculation”)</b>	<b>More limited</b>