THE ECONOMICS OF CLIMATE RISK FOR SOVEREIGNS: INSIGHTS FOR SUSTAINABLE FINANCE

European Stability Mechanism

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OUR AGENDA

Climate Change and Risks

What are the main risks from climate change, and why do they matter for sovereigns?

Macroeconomic & Fiscal Impacts

How does climate change affect growth, inflation, fiscal balances, and debt sustainability?

Policy & Sustainable Finance

What are the key policy trade-offs between short-term costs and long-term resilience?
How can sustainable finance tools help mobilise private capital?

I. CLIMATE CHANGE & CLIMATE RISKS

Understanding why climate change is critical and creates physical and transition risks — with rising impacts and costs for economies and societies.

CLIMATE CHANGE: A DEFINING CHALLENGE OF OUR GENERATION

"We are the first generation to feel the effect of climate change and the last generation who can do something about it."

Barack Obama, Former US President, 2014

"By polluting the oceans, not mitigating CO2 emissions, and destroying our biodiversity, we are killing our planet. Let us face it, there is no planet B."

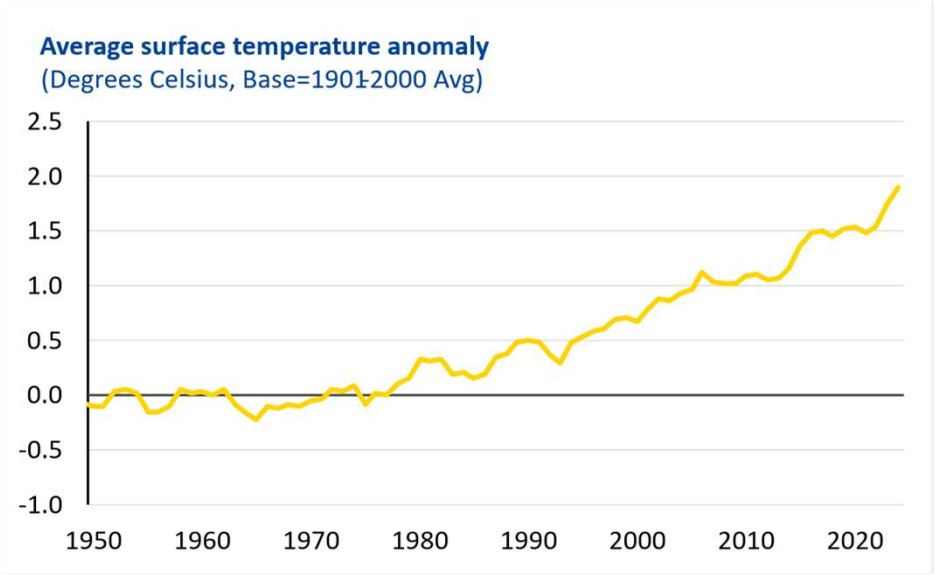
Emmanuel Macron, President of France, 2018

CLIMATE CHANGE AS A GLOBAL PHENOMENON

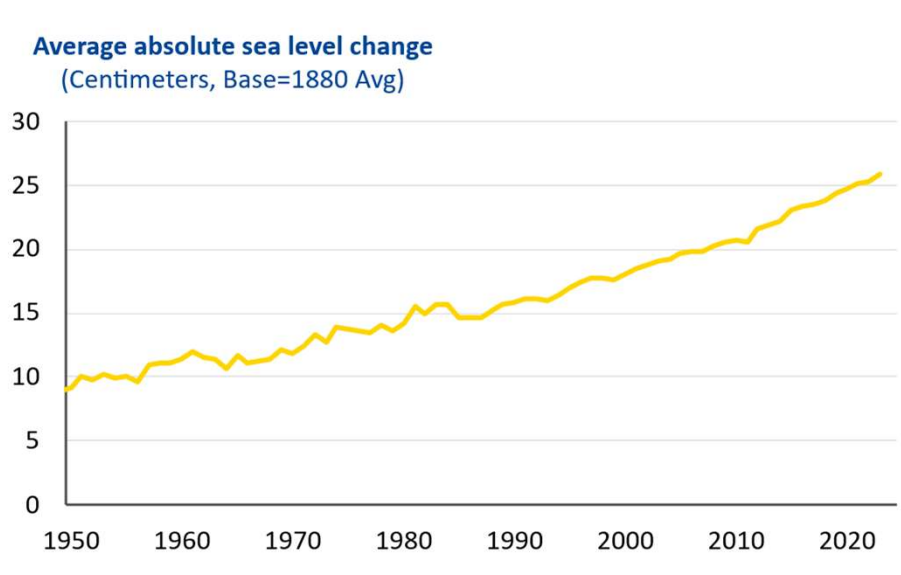
Global average temperature has risen ≈ 1.2°C since pre-industrial levels

Melting ice & **Sea levels** rising (≈ 20 cm since 1900; accelerating)

Frequency & severity of extreme events has increased (extreme precipitation, droughts, record-breaking heatwaves & wildfires)



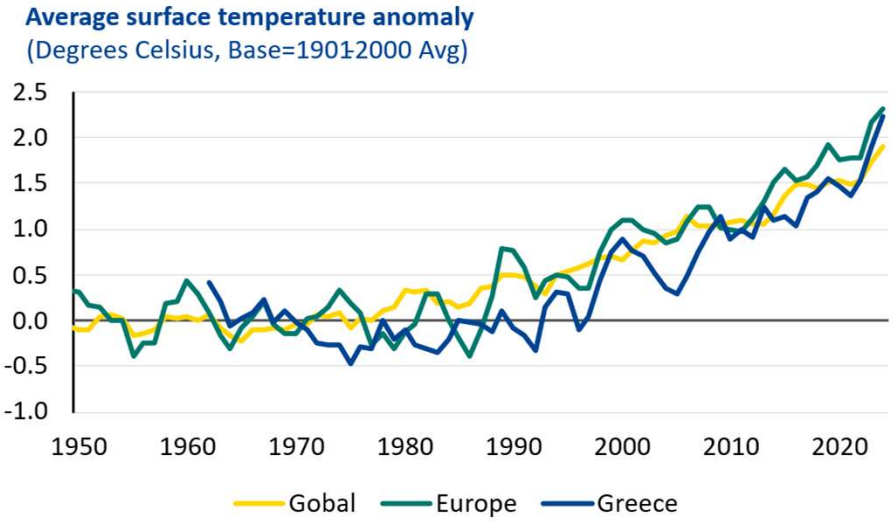
Source: National Oceanic & Atmospheric Administration (NOAA)



Source: National Oceanic & Atmospheric Administration (NOAA)

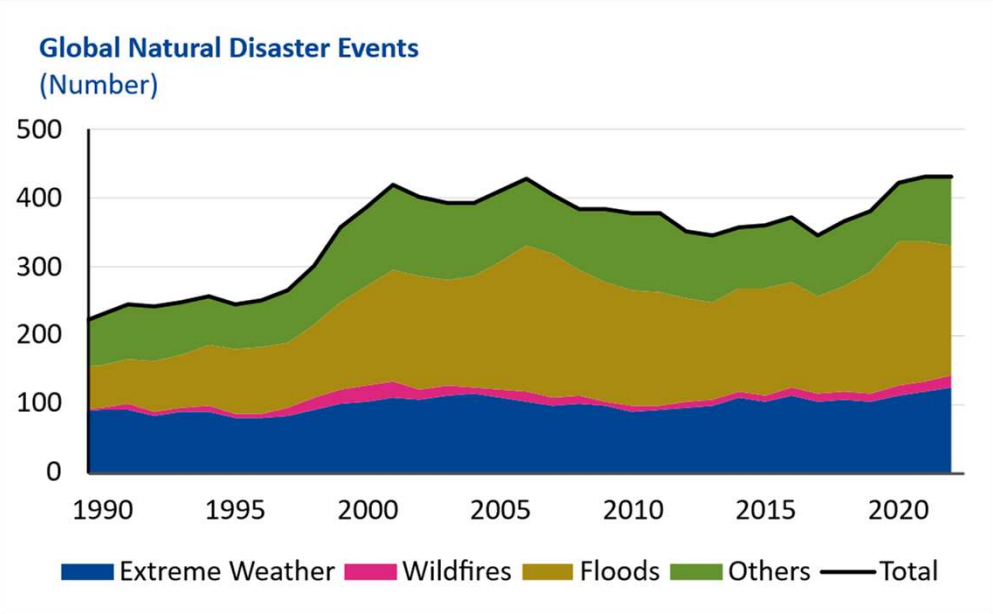
CLIMATE CHANGE: EVIDENCE FROM EUROPE

- Warming faster than global average (esp. Mediterranean, Arctic regions)
- More frequent storms, floods & wildfires
  - The **2025 EU wildfire season** was the worst on record—over 1 million hectares burned, emitting ≈37 million tonnes of CO_2 (roughly annual emissions of Portugal or Sweden), with climate change cited as a key driver. (The Guardian)
  - In the Mediterranean (Turkey, Greece, Cyprus), wildfires were found to be **22% more intense** due to climate change, driven by soaring temperatures, prolonged aridity, and strong winds. (AP News)
- Uneven impacts → North-South divide in exposure & resilience.

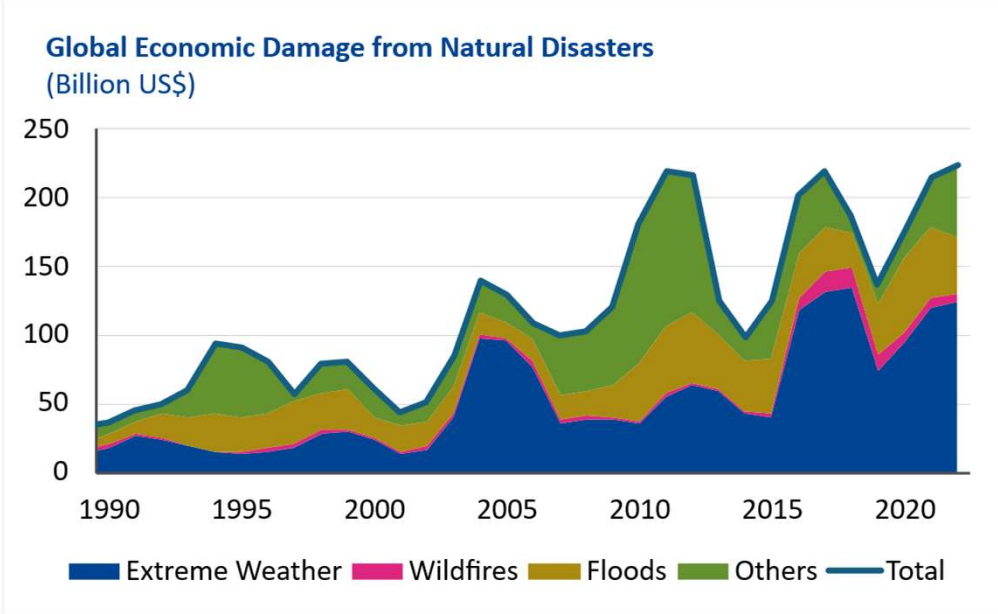


Source: National Oceanic & Atmospheric Administration (NOAA) & UN

WHAT HAS CLIMATE CHANGE ALREADY COST?



Source: Our World in Data/Haver



Source: Our World in Data/Haver

CLIMATE CHANGE: EMERGING RISKS

Climate Change: The Evidence Is Here

Climate risks emerge

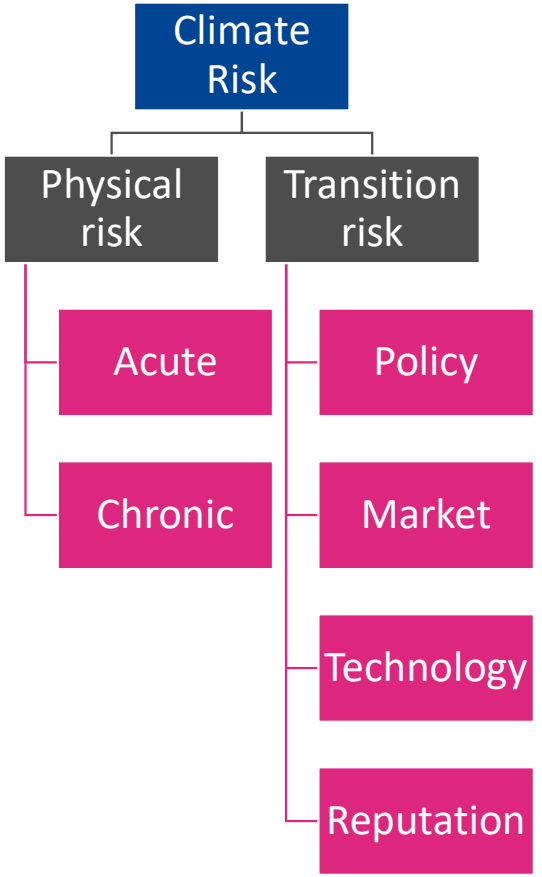
What Are Climate Risks?

WHAT ARE CLIMATE RISKS?

Definition: Climate risk refers to the potential negative impacts of climate change on economies, societies, and financial systems. It encompasses both direct damages from environmental changes and indirect effects from policy, market, and technological shifts

Physical Risks: Direct risks from climate-related weather and environmental changes that cause damage to infrastructure, ecosystems, and human health

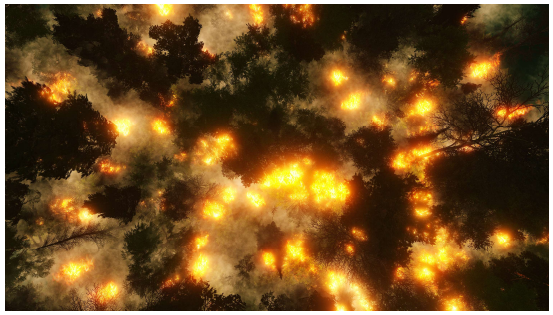
Transition Risks: Indirect risks arising from the adjustment toward a low-carbon economy. These emerge from changes in policy, regulation, markets, technology, and reputation that can affect asset values, business models, and public finances



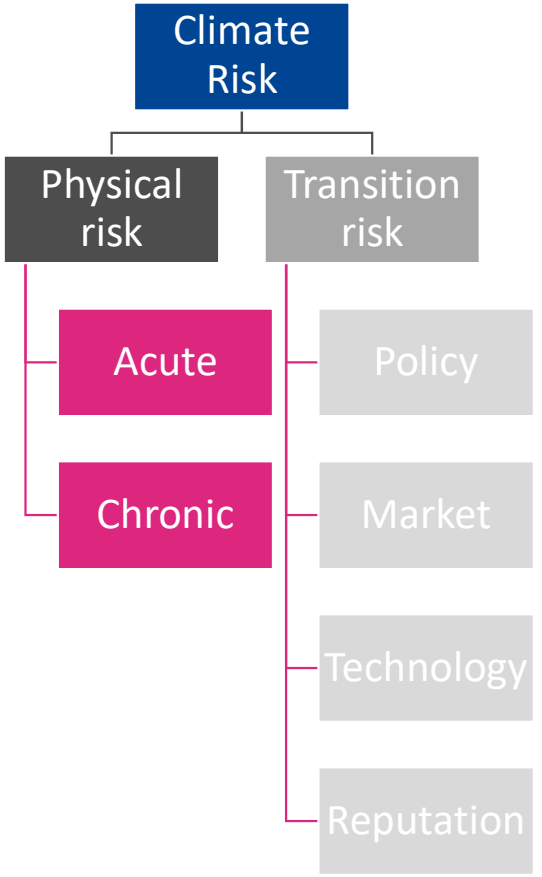
PHYSICAL RISKS

- **Acute:** sudden-onset events such as floods, storms, and wildfires that cause immediate damage to infrastructure, assets, and human lives
- **Chronic:** long-term, slowly emerging risks such as sea-level rise, persistent droughts, and desertification that gradually erode infrastructure, agricultural output, and habitability of certain regions

Acute risk: Wildfire

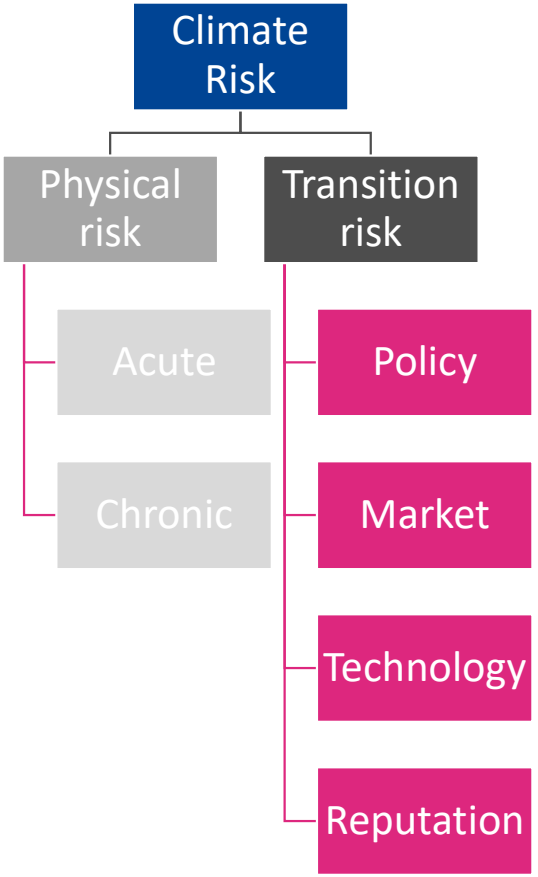


Chronic risk: Desertification



TRANSITION RISKS

- **Policy**: measures such as carbon pricing, emissions trading systems, and environmental regulations that create incentives to reduce emissions. Example: the EU Emissions Trading System (ETS) setting a price on carbon allowances
- **Market**: changes in consumer preferences and investor sentiment that can reduce demand for carbon-intensive products, leading to stranded assets. Example: declining coal demand leaving coal plants and mines unprofitable
- **Technology**: advances such as renewable energy, electric vehicles, or carbon capture that disrupt existing industries and business models. Example: the rise of solar and wind power challenging fossil fuel sectors
- **Reputation**: risks to firms or governments from negative public perception of their climate policies or practices. Example: companies facing boycotts or divestment due to poor environmental performance, or sovereigns paying higher borrowing costs if perceived as climate laggards.



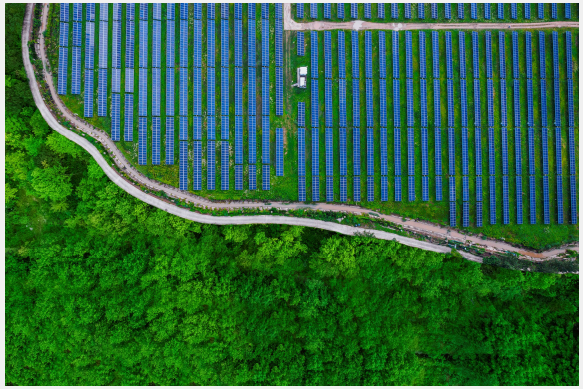
(MAIN) POLICY REACTION TO CLIMATE CHANGE

Adaptation: proactive adjustments to reduce vulnerability to climate impacts and enhance resilience

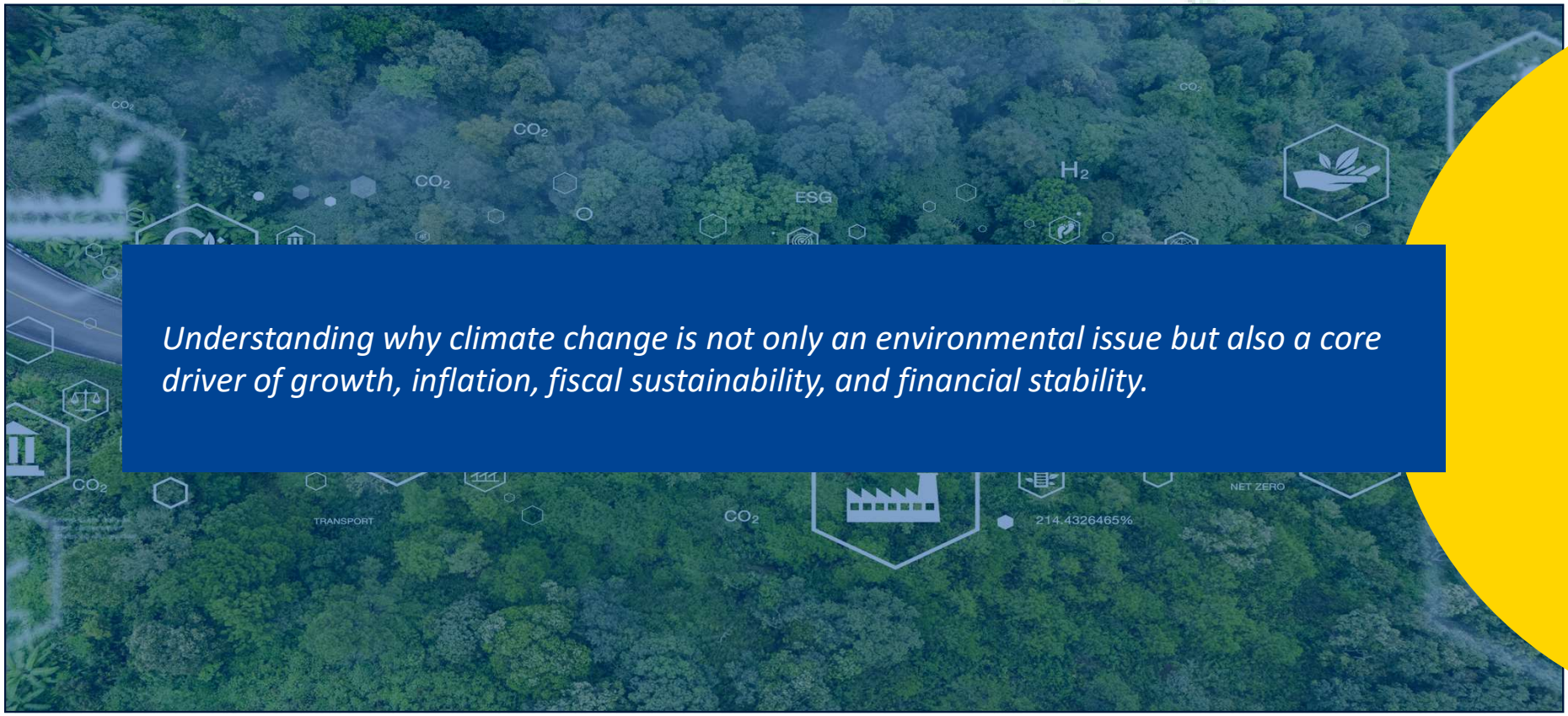
- **Goal:** limit damages and protect communities from unavoidable climate change.
- **Examples:** building sea walls, climate-resilient infrastructure, irrigation systems, early warning systems

Mitigation: actions to cut or prevent greenhouse gas emissions and enhance carbon sinks

- **Goal:** slow down or stop global warming in the long term
- **Examples:** renewable energy deployment, carbon capture technologies, energy efficiency measures, reforestation



II. THE MACROECONOMICS OF CLIMATE CHANGE & RISKS



Understanding why climate change is not only an environmental issue but also a core driver of growth, inflation, fiscal sustainability, and financial stability.

CLIMATE CHANGE AFFECTS BOTH DEMAND AND SUPPLY

Aggregate demand

spending by households, businesses, and government.

- **Household consumption:** Higher food/energy prices reduce real disposable income.
- **Investment:** Transition risks and uncertainty affect private investment decisions.
- **Government spending:** Increased fiscal spending (disaster relief, adaptation, and reconstruction) boost demand in the short run.
- **External demand:** Trade partners hit by climate shocks reduce imports/exports.

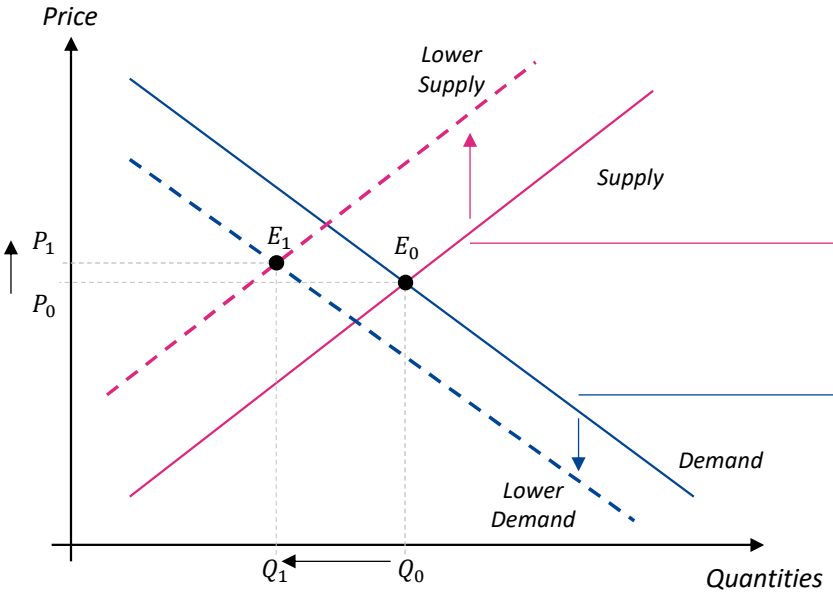
Aggregate supply

productive capacity of the economy *(ability to produce goods and services).*

- **Labor productivity:** Heat stress reduces worker efficiency (construction, agriculture, services).
- **Capital stock:** Extreme events destroy infrastructure and affect housing.
- **Supply disruptions:**
  - **Natural resources:** Droughts and floods reduce agricultural yields; water scarcity limits production.
  - **Energy supply:** Extreme weather disrupts power grids, hydro output, and renewables.

CLIMATE CHANGE CAN LEAD TO STAGFLATION

Climate Change Impacts on Demand and Supply



Source: ESM

Stagflationary pressures:

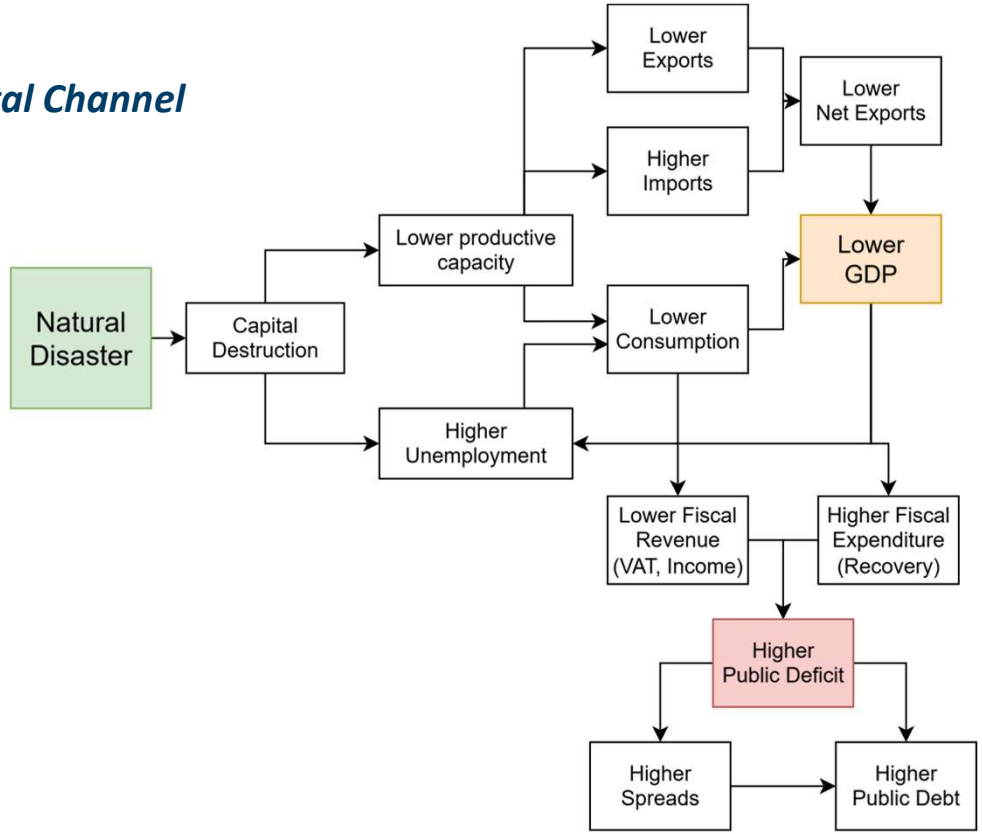
- lower growth (supply constraints): $Q_1 < Q_0$
- higher inflation (food/energy shocks): $P_1 > P_0$

Explanation: $E_0 \rightarrow E_1$

- Supply shifts up (lower supply) due to higher costs, lower productivity or less productive capacity
- Demand falls (lower demand) due to less consumption and investments

TRANSMISSION CHANNELS OF CLIMATE SHOCKS

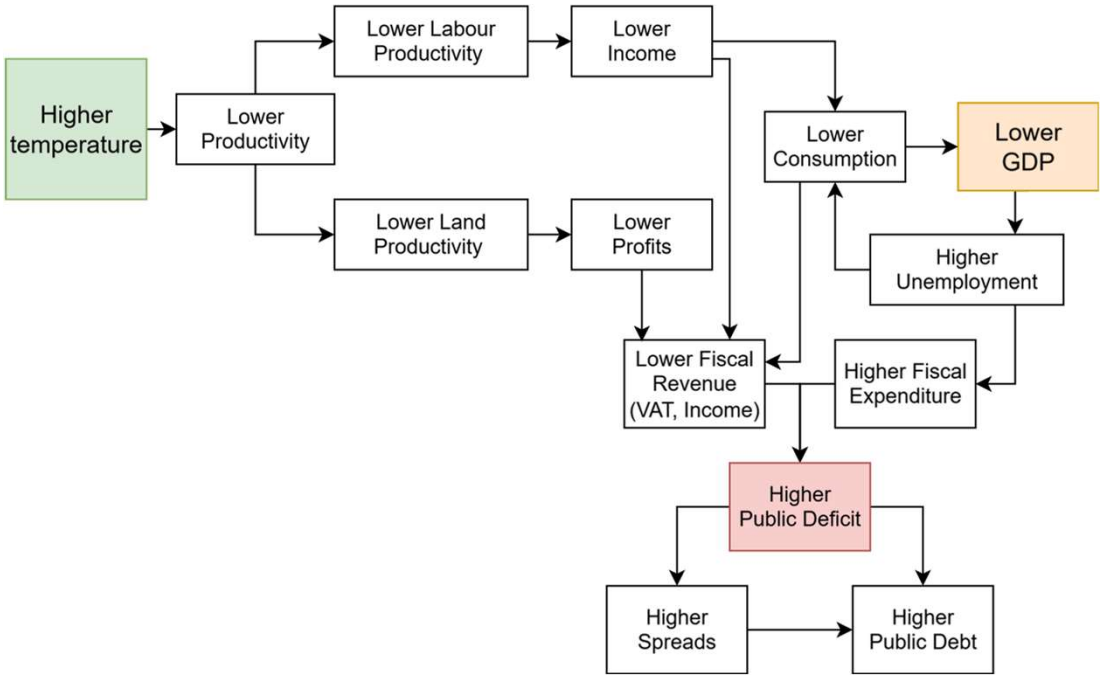
The Capital Channel



Source: ESM

TRANSMISSION CHANNELS OF CLIMATE SHOCKS

The Productivity Channel



Source: ESM

TRANSMISSION CHANNELS OF CLIMATE SHOCKS

1

Physical Risks → Direct Impacts

- **Extreme events** damage capital, reduce labour productivity, and disrupt supply chains.
- **Chronic changes** erode long-term productive capacity.

2

Transition Risks → Adjustment Costs

- **Policy risks:** Carbon pricing, regulation, and phase-out of fossil fuels increase costs for certain sectors.
- **Technological shifts:** Rapid adoption of green technologies can create "stranded assets" in carbon-intensive industries.
- **Market sentiment:** Investor reallocation away from high-carbon activities alters capital flows.

3

Financial & Price Stability

- **Asset re-pricing:** Sudden shifts in valuation of energy, housing, and insurance-linked assets.
- **Inflation pressures:** Food and energy volatility due to both physical disruptions and transition policies.
- **Credit risk:** Rising defaults in climate-exposed industries/regions affect banks' balance sheets.

4

Fiscal & Public Finance

- **Disaster spending:** Higher government expenditures for relief, reconstruction, adaptation.
- **Revenue volatility:** Loss of tax revenues from affected sectors; risks to carbon-dependent states.
- **Debt sustainability:** Increased borrowing to cope with climate shocks.

5

Trade & External Sector

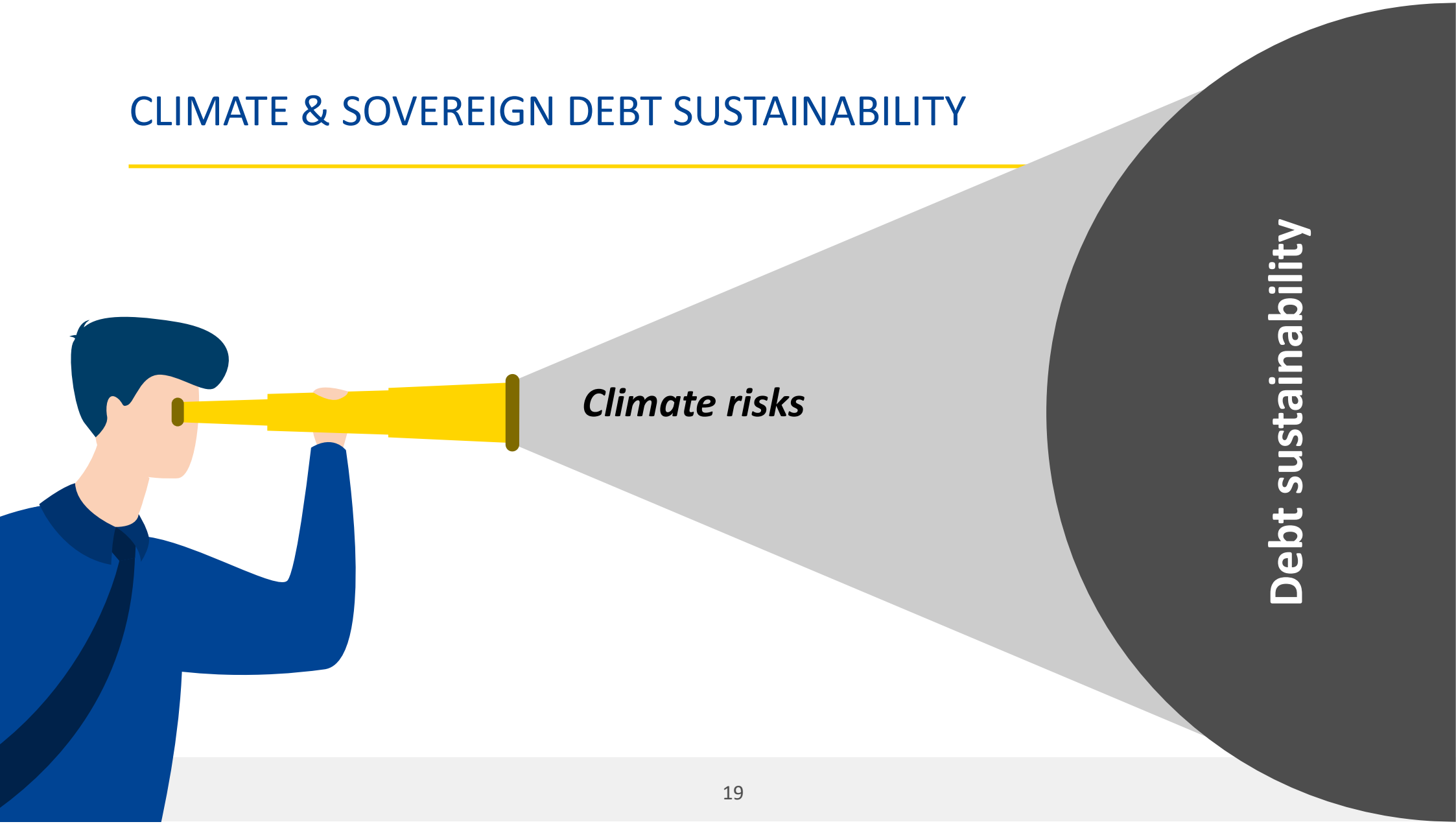
- **Export shocks:** Declining competitiveness of climate-exposed sectors (agriculture, tourism, fossil fuels).
- **Import dependency:** Increased reliance on food/energy imports after domestic disruptions.
- **Cross-border spillovers:** Climate shocks transmitted through global supply chains and commodity markets.

6

Growth & Distributional Impacts

- **Lower potential growth:** Reduced capital accumulation, productivity, and labour supply.
- **Inequality:** Disproportionate impact on vulnerable households, regions, and developing economies.
- **Systemic risks:** Interactions of climate shocks with migration, health crises, and geopolitical instability.

CLIMATE & SOVEREIGN DEBT SUSTAINABILITY



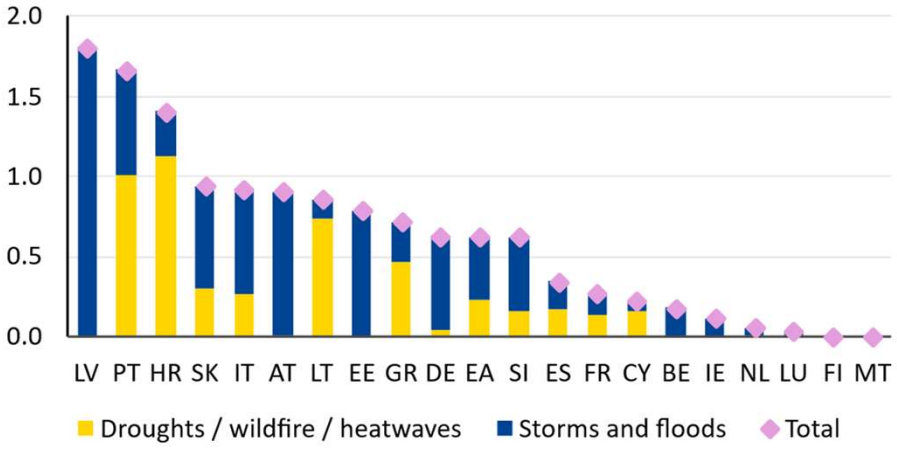
PUBLIC FINANCES UNDER PRESSURE

- Expenditure pressures (additional spending)
  - **Physical acute risks**: emergency response, reconstruction costs, with IMF estimates suggesting disaster-related fiscal costs can average 2–3% of GDP in small states.
  - **Chronic risks**: long-term infrastructure upgrades and healthcare, potentially raising recurrent spending by 1–2% of GDP in highly exposed economies.
  - **Transition risks**: subsidies, compensation schemes, and industrial policy support during decarbonisation.
  - **Scale of investment needs:** EU Commission estimates approximately **2–3% of GDP annually** to 2030.
- Revenue pressures (erosion of the tax base)
  - **Lower tax base** in climate-sensitive sectors → agriculture, tourism, energy-intensive industries.
  - Carbon-intensive sectors decline → lower corporate income and excise tax receipts.
  - **IMF studies** highlight that in some scenarios revenues could fall by up to 0.5–1% of GDP annually in fossil-fuel–dependent economies.

EXPENDITURE VS REVENUE PRESSURES

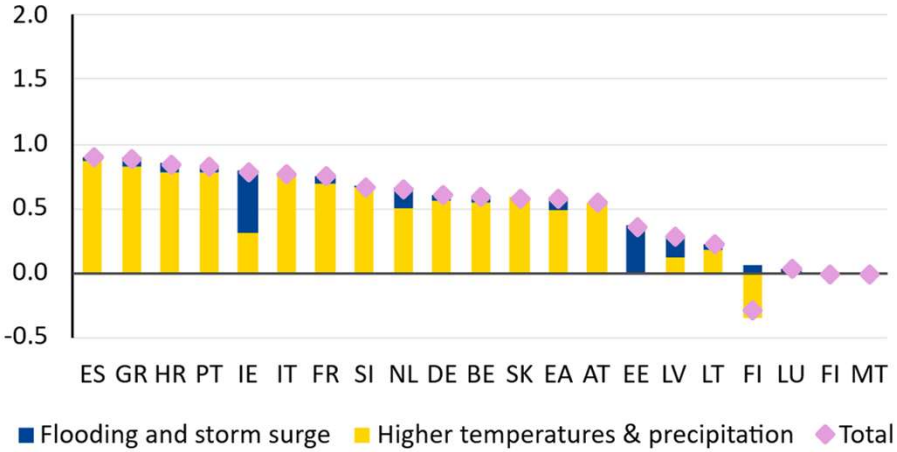
The European Commission highlights that climate-related spending needs could add 1–2% of GDP annually to fiscal deficits if not offset by growth-enhancing reforms:

Short-Term fiscal pressures based on historical losses
(one-year shock, p.p.)



Source: ESM calculations based on Network for Greening the Financial System (NGFS) Long-Term Scenarios

Long-Term potential fiscal presures in the future
(annual average until 2050, p.p.)



Source: ESM calculations based on Network for Greening the Financial System (NGFS) Long-Term Scenarios

CLIMATE CHANGE: IMPLICATIONS FOR SOVEREIGN FINANCING

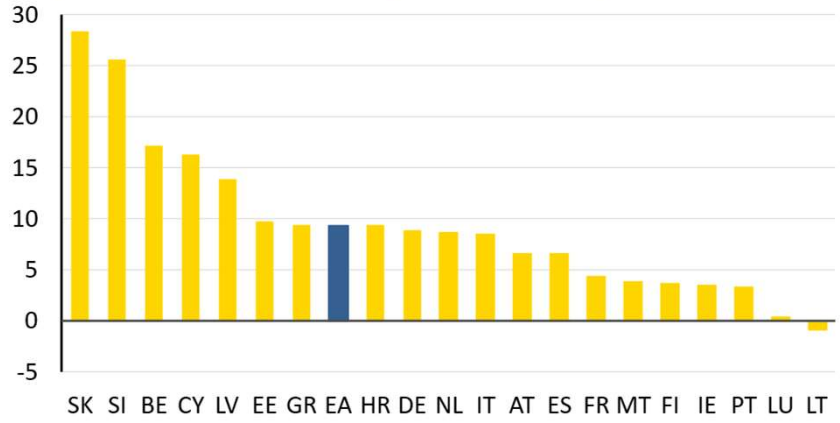
1 Uncertainty affect **investor confidence** and **financing conditions.**

- IMF shows that a one-standard-deviation increase in climate vulnerability can raise sovereign spreads by 30–60 basis points

2 **Sovereign spreads**: Higher for countries with higher exposure as investors demand compensation for heightened risks, both in the short and long term.

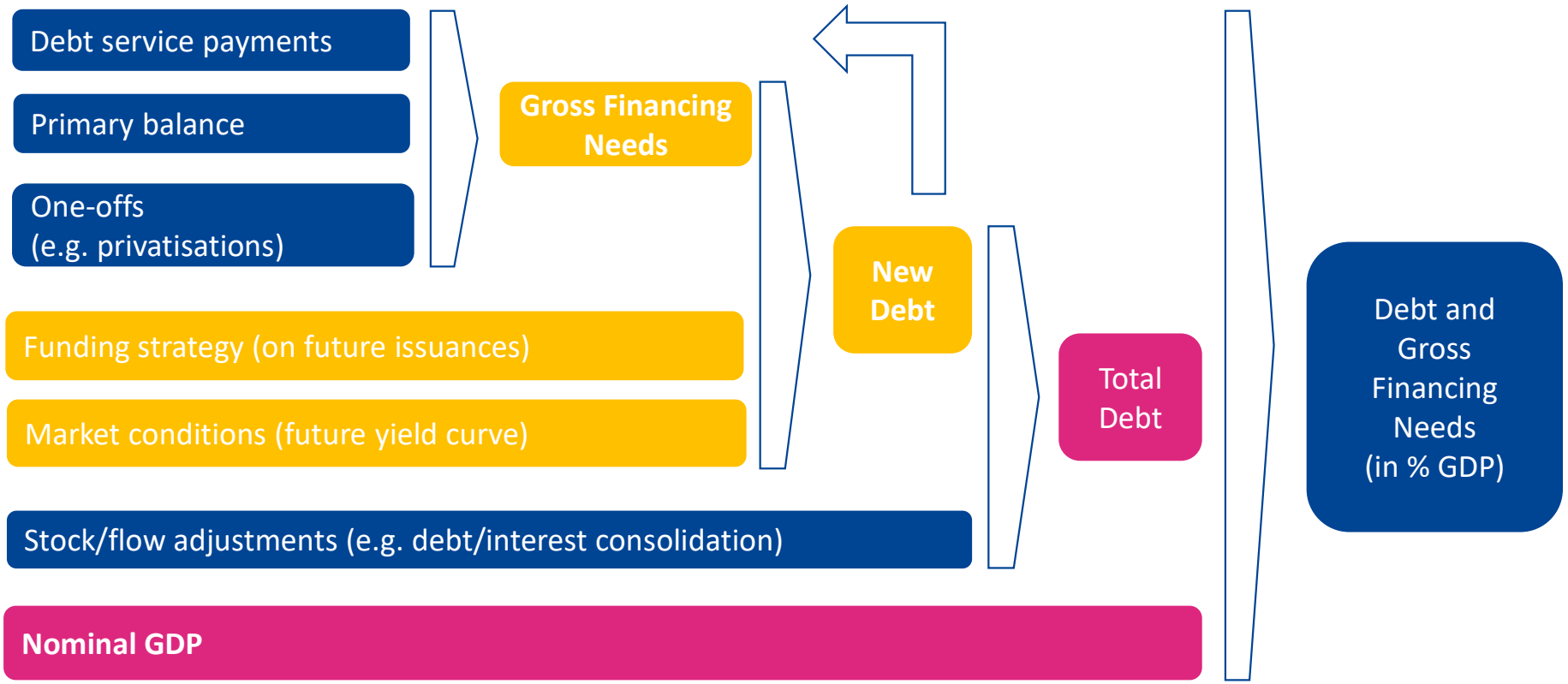
3 **Credit risk:** Long-term risks reflected in credit ratings and debt sustainability

Sovereign yields pressures in 2030
(bps absolute diferencial with respect to the baseline)



Source: ESM calculations based on Network for Greening the Financial System (NGFS) Short Term Scenarios

DEBT ACCUMULATION EQUATION



CLOUDS ON DEBT SUSTAINABILITY FROM CLIMATE CHANGE

High starting debt:

- Debt levels already elevated (many EU sovereigns >90–100% of GDP).

Rising fiscal pressures:

- Disaster relief & recovery costs (wildfires, floods, storms).
- Large upfront investment needs for green transition & resilience.

Lower growth potential:

- Productivity losses from heat stress, supply disruptions.
- Climate impacts on key sectors (agriculture, tourism, energy).

Higher funding costs:

- Greater uncertainty and sovereign risk premia for climate-vulnerable countries.

IMF stress tests suggest that repeated climate disasters can worsen debt-to-GDP ratios by 10–15 percentage points over two decades.

III. POLICY PERSPECTIVE & AVAILABLE TOOLS

Exploring the trade-offs governments face, how national and EU climate policies interact, and the tools available to finance and implement a credible green transition.

NATIONAL CLIMATE POLICIES: BUILDING RESILIENCE & SUSTAINABILITY

1. Invest in resilient infrastructure (coasts, water, wildfire prevention).
2. Scale renewable energy & modernize grids.
3. Reform subsidies & expand carbon pricing.
4. Improve disaster preparedness & insurance coverage.

POLICY TRADE-OFFS IN THE CLIMATE TRANSITION

1

Short-term Costs vs. Long-term Gains

- Mitigation and adaptation investments require **large upfront spending**, while benefits (lower damages, avoided costs, growth from green sectors) materialize later.
- Fiscal space and political cycles make this difficult.

2

Climate Ambition vs. Fiscal Sustainability

- More ambitious targets → higher short-term investment needs.
- Risk of straining debt sustainability if not offset by EU funds, green bonds, or growth multipliers.

3

Adaptation vs. Mitigation Allocation

- Scarce resources force choices: **protect against current climate impacts** vs. **cut emissions for the future**.
- Both are necessary, but sequencing is politically and fiscally challenging.

4

Economic Efficiency vs. Social Equity

- Carbon taxes, subsidy removal, and higher energy prices are **efficient signals** but often **regressive**, hitting low-income households hardest.
- Requires balancing with compensation schemes or redistributive measures.

5

Public Investment vs. Private Mobilization

- Heavy reliance on public budgets risks crowding out other spending.
- Mobilizing private capital requires credible frameworks but may reduce government control.

6

National Priorities vs. Global/EU Commitments

- Governments must align domestic needs (jobs, energy security) with **international obligations** (Paris, EU Fit for 55).
- Tension between short-term sovereignty and long-term cooperation.

(INSTITUTIONAL) POLICY LANDSCAPE (EU)

- **European Commission (EC):** designs fiscal framework, integrates climate targets into EU governance, monitors compliance
  - European Green Deal: overarching strategy for climate neutrality by 2050.
  - Fit-for-55 package: measures to cut EU (greenhouse gas) GHG emissions by at least 55% by 2030.
  - EU Emissions Trading System (ETS): cornerstone carbon pricing mechanism.
  - EU Climate Law: legally binding targets (–55% by 2030, net-zero by 2050).
  - EU Taxonomy: classification system for sustainable activities.
- **Funding Mechanisms**: Recovery and Resilience Facility (RRF), Cohesion Funds, Just Transition Fund, InvestEU, EIB green lending.
- **European Investment Bank (EIB):** major public lender for climate and energy projects, has pledged to align all financing with Paris Agreement.
- **European Central Bank (ECB):** incorporates climate risks into financial stability monitoring, and monetary policy operations.
- **European Stability Mechanism (ESM):** provides financial assistance to euro area countries, potential role in supporting climate-related shocks.

TRADE-OFFS IN EU CLIMATE POLICIES

1

Ambition vs. Feasibility

- Raising targets (–55% by 2030, net-zero by 2050) vs. political and technical capacity of member states to deliver.

2

Efficiency vs. Equity Across Member States

- EU-wide carbon pricing ensures cost efficiency, but impacts differ (e.g., coal-dependent vs. renewable-rich economies).
- Solidarity mechanisms (Just Transition Fund, cohesion policy) vs. risk of fragmentation.

3

Fiscal Space vs. Investment Needs

- EU-level funds (RRF, cohesion) mobilize resources, but scale is smaller than overall green investment gap.
- Balancing fiscal discipline (Stability and Growth Pact rules) with climate investment imperatives.

4

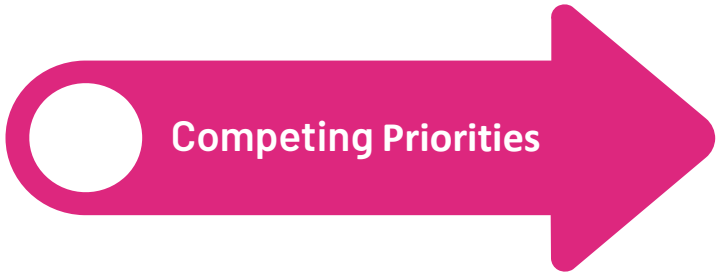
EU Integration vs. National Sovereignty

- Centralised instruments (ETS, taxonomy, common borrowing) vs. member states' autonomy in energy mix and fiscal choices.

BUT …
PUBLIC MONEY IS NOT ENOUGH FOR THE GREEN TRANSITION

Scale of the Challenge

- EU green investment needs: **≈€600 billion/year** (EU Commission estimates).
- Public budgets and EU funds cover only a **fraction** of this gap.
- High post-COVID debt limits fiscal space for additional borrowing.



Why Public Money Falls Short

- Competing pressures: healthcare, defence, social spending, debt service.
- RRF & EU funds are **temporary** and insufficient to meet long-term needs.

THE IMPORTANCE OF PRIVATE CAPITAL IN THE GREEN TRANSITION

Private capital ensures:

- **scale**
- **speed**
- **innovation**
- **market discipline**

Investors hold **trillions in assets** → key to bridging the financing gap.

Sustainable finance

WHAT IS SUSTAINABLE FINANCE?

Integrating **environmental, social, and governance (ESG) factors into investment decisions:**

- **Environmental:** climate change, natural resource use, biodiversity
- **Social:** labour standards, community impacts, diversity and inclusion
- **Governance:** corporate governance, transparency, shareholder rights

Foster **long-term sustainable growth** by aligning investment with global climate goals

Builds **resilience** in financial systems by considering climate-related risks and opportunities

Relies on **fiscal policies** to create incentives, support green investment, and manage risks (e.g., carbon taxes, subsidies, green bonds)

SUSTAINABLE FINANCE

Sustainability

1. Environmental
- Renewable energy sources
- Carbon footprint reduction
- Waste management and recycling

2. Social responsibility
- Fair labour practices
- Community engagement
- Diversity and inclusion

3. Governance
- Corporate transparency
- Ethical business practices
- Stakeholder engagement

Finance

1. Financial Markets
- Stock market
- Bond markets
- Derivatives markets

2. Investment strategies
- Portfolio management
- Risk assessment
- Asset allocation

3. Banking services
- Loans and credit
- Mortgages
- Banking operations

WHAT STEPS HAVE BEEN TAKEN?

EU Momentum on Sustainable Finance & Climate Policy:

- 1997 – **Kyoto Protocol**: binding emission reduction targets for advanced economies
- 2009 – **EU-2020 Climate & Energy Package**: 20-20-20 targets on emissions, renewables, energy efficiency
- 2015 – **Paris Agreement**: global treaty to limit warming well below 2°C
- 2017 – Network for Greening the Financial System (**NGFS**): coalition of central banks/supervisors promoting climate risk management
- 2019 – **European Green Deal**: roadmap for climate neutrality by 2050
- 2021 – **EU Climate Law**: legally binding EU-wide climate neutrality target
- 2021 – **Fit-for-55 Package**: 55% emissions reduction by 2030
- 2022 – **REPowerEU**: reduce energy dependence, accelerate renewables

LOOKING AHEAD…
HOW TO ATTRACT PRIVATE CAPITAL FOR THE GREEN TRANSITION

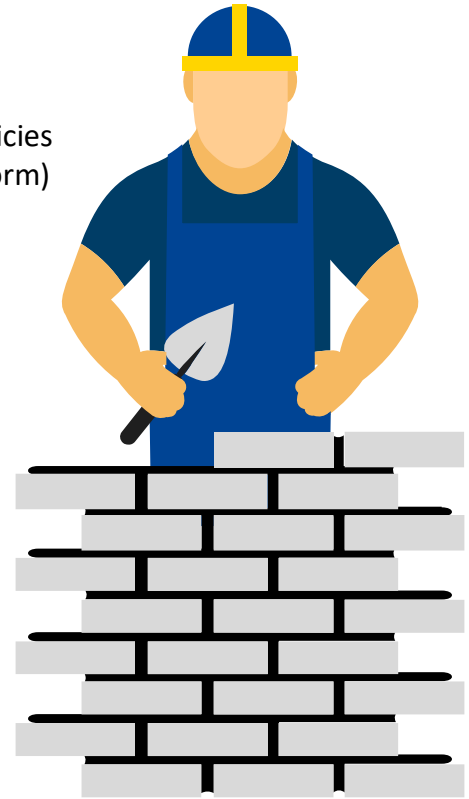
National level

Build a Stable Framework
- Transparent legal environment
- Predictable long-term climate policies (laws, carbon pricing, subsidy reform)

Create bankable project pipelines
- Streamline permitting, standardise contracts.

Targeted de-risking
- Guarantees, Public-Private Partnerships (PPPs), tax incentives

Just Transition measures
- Social support



EU level

Harmonise Sustainable finance standards
- EU Taxonomy
- EU Green Bond Standard for investor confidence

Oversight & credibility
- European Semester
- Monitoring of National plans

Cross-border de-risking
- EIB, InvestEU, EU guarantees to crowd in institutional investors

Provide scale & solidarity
- RRF, Cohesion Funds, Just Transition Fund

Deepen financial integration
- Completion of Savings and Investment Union to channel EU savings into green projects

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European Stability Mechanism

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