

Economy, environmental sustainability and energy transition

October 2020

Main messages (I)



The **increases in temperature** and the **GHG concentration** of the last two centuries cannot be explained without considering **human activity**.



Without a rapid and **substantial reduction** in **GHG emissions**, the Earth's average temperature **will exceed thresholds** that trigger **severe environmental effects** and increase economic costs, including potentially **catastrophic risks**.



The emission of GHG into the atmosphere creates a **negative economic externality**, which requires global, coordinated and **public policies for its correction**.

Main messages (II)



The fact that rising temperatures provoke effects with **unclear magnitudes** adds **uncertainty** to the mix. However, the catastrophic and irreversible **risks** that emerge on the most representative scenarios, clearly state that the **rational response is avoiding temperature spikes through urgent and decisive policies.**



Among the necessary measures, **the economic analysis gives priority to a uniform global carbon tax** over more developed emission markets or green subsidies, which are also needed. The **distributional impacts of these policies** have also to be considered.



In the long run, **innovation will be crucial.** Currently, environmental policies are favored by low interest rates and post-pandemic policies.

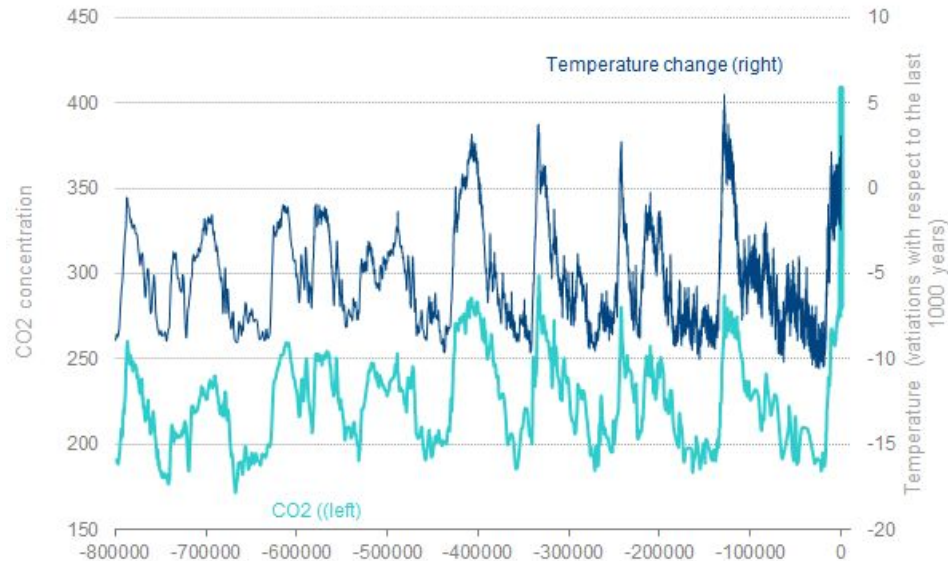
01

Global warming, greenhouse gas emissions and human activity

There is a close relationship between the average temperature on Earth and the atmospheric accumulation of greenhouse gases

TEMPERATURE AND CO₂ EMISSIONS

(Ppm and °C. LAST 800.000 YEARS)



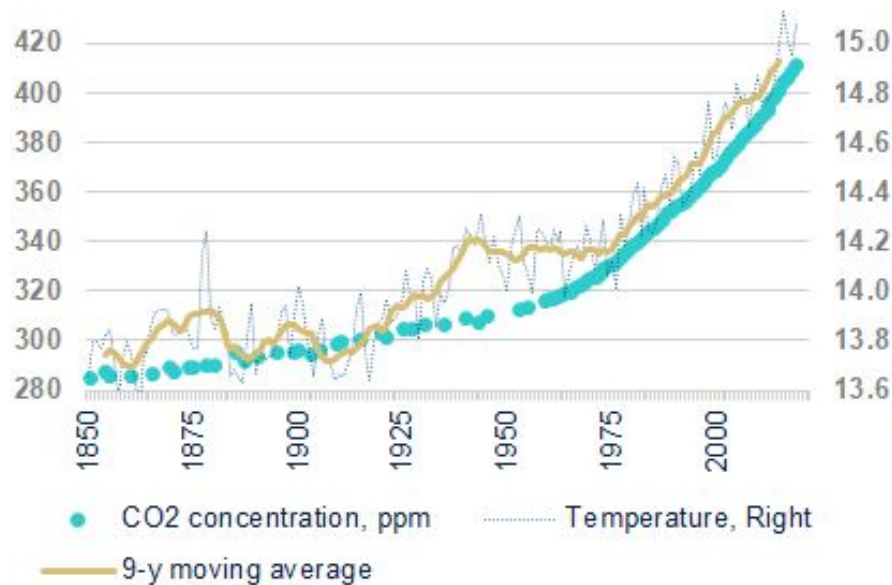
Source: BBVA Research.
Based on Jouzel et al (2007), Lüthi et al (2008) and NOAA.

- The **accumulation** of greenhouse gases (**GHG**), such as CO₂, makes the atmosphere to **retain more energy** compared to the outer space, which raises temperatures.
- At the same time, the **rise in temperatures favors the accumulation of CO₂** (loop).
- The **concentration of CO₂** in the atmosphere exceeds 400 parts per million (ppm), the **highest concentration in the last 800,000 years**.

There is a close relationship between the average temperature on Earth and the atmospheric accumulation of greenhouse gases

TEMPERATURE AND CO₂ EMISSIONS

(Ppm and °C. 1850-2019)



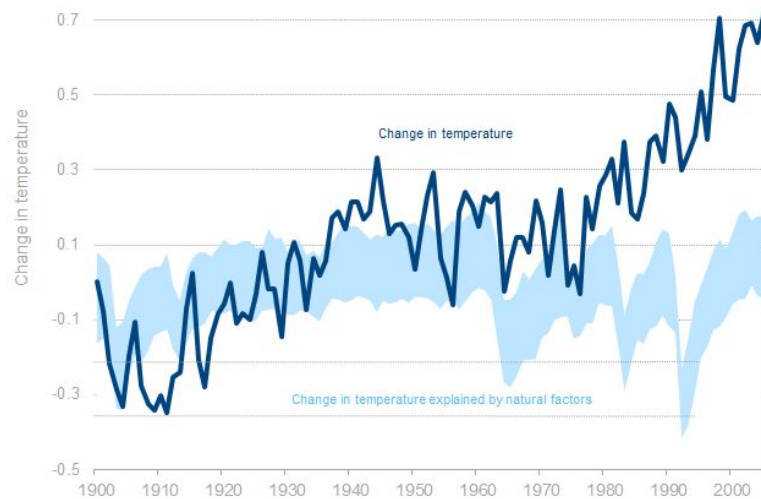
Source: BBVA Research based on data.world.

- The accumulation of greenhouse gases (GHG), such as CO₂, makes the atmosphere to retain more energy compared to the outer space, which raises temperatures.
- At the same time, the rise in temperatures favors the accumulation of CO₂ (loop).
- The concentration of CO₂ in the atmosphere exceeds currently 400 parts per million (ppm), the highest concentration in the last 800,000 years.
- Since 1950, both the concentration of GHG in the atmosphere and the temperature increases have boosted.

Temperature and GHG concentration increases cannot be explained away from human activity, with relevant impact of uncertain magnitude

CHANGE IN TEMPERATURE

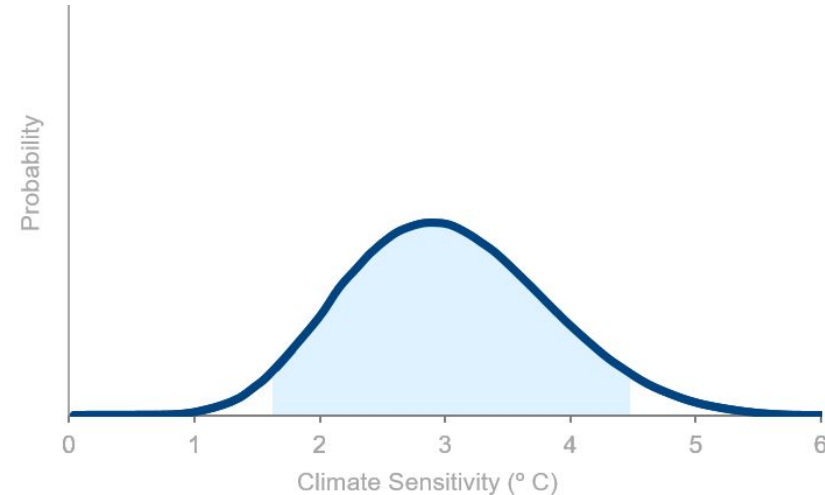
DEVIATIONS FROM THE AVERAGE, 1850-1900 (°C)



Source: BBVA Research based on Huber and Knutti (2012).

CLIMATE SENSITIVITY TO CO₂

(AREA: 90% PROBABILITY INTERVAL)



Source: Andrés y Doménech (2020) based on Knutti, Rugenstein and Hegerl (2017).

The climate system is complex, with tipping points that accelerate interactions, increase catastrophic events,...

RAISING THE ALARM

Evidence that tipping points are under way has mounted in the past decade. Domino effects have also been proposed.



A. Amazon rainforest
Frequent droughts

D. Boreal forest
Fires and pests changing

H. Permafrost
Thawing

B. Arctic sea ice
Reduction in area

F. Coral reefs
Large-scale die-offs

I. West Antarctic ice sheet
Ice loss accelerating

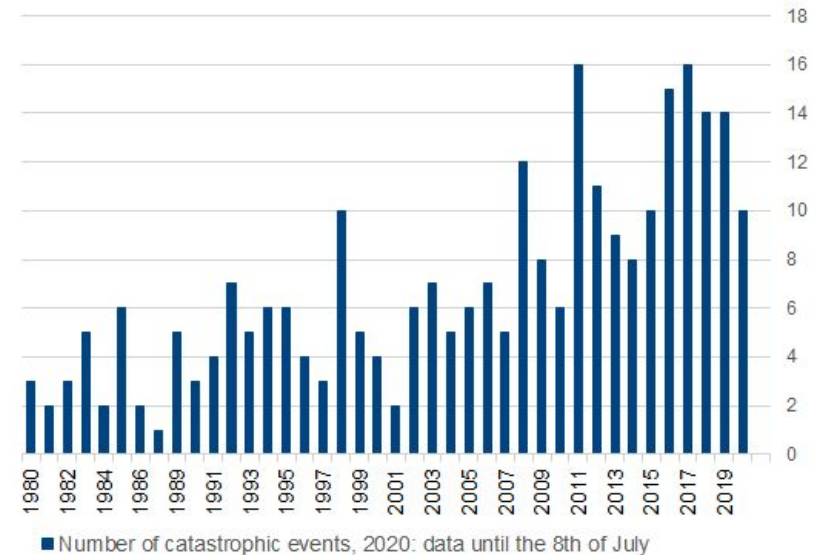
C. Atlantic circulation
In slowdown since 1950s

G. Greenland ice sheet
Ice loss accelerating

J. Wilkes Basin, East Antarctica
Ice loss accelerating

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USA. NUMBER OF CATASTROPHIC CLIMATE EVENTS (*)

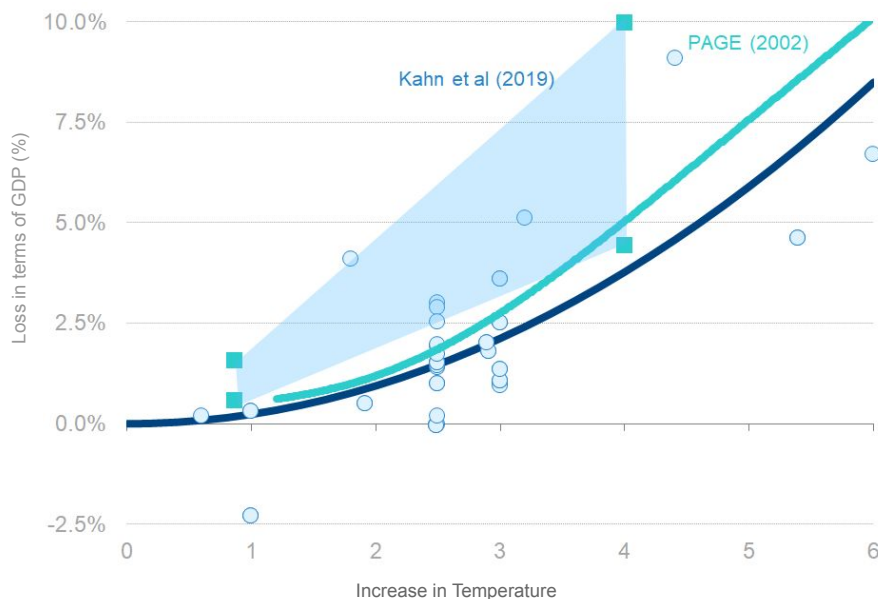


Source: BBVA Research based on NOAA.

(*) Billion-Dollar Weather and Climate Disasters (CPI-adjusted).

... and increase economic costs in a non-linear way with respect to temperature

THE ECONOMIC COST OF TEMPERATURE INCREASES (AS A PERCENTAGE OF GDP)



- The estimation of the **economic costs** of increased temperatures is subject to **modeling uncertainty** ...
- ... but at the same time, **other sources** of uncertainty have to be considered: estimation of **climate sensitivity** or the **turning points** that trigger accelerated effects on the climate system.

The economy is affected by different risks (not only physical ones) and the effects spread through different transmission channels

CLIMATE RISKS AND THE DIFFERENT TRANSMISSION CHANNELS TO THE ECONOMY AND THE FINANCIAL SYSTEM

Physical risks:

- **Chronic:** changes in temperature, sea level, air quality.
- **Catastrophic:** hurricanes, droughts, ...).



Transition risks:

- Changes in regulations (emission standards, carbon prices,...).
- Changes in demand preferences.
- Technology changes.



Macroeconomic channels

(not exhaustive):

- Drop in productivity.
- Capital depreciation.
- Relative price change.



Microeconomic channels

(not exhaustive):

- Households: health, housing value, disposable income (carbon tax).
- Companies: balance sheet deterioration, change in demand preferences.



Financial risks:

- Credit risk.
- Market risk.
- Liquidity risk.
- Operational risk.

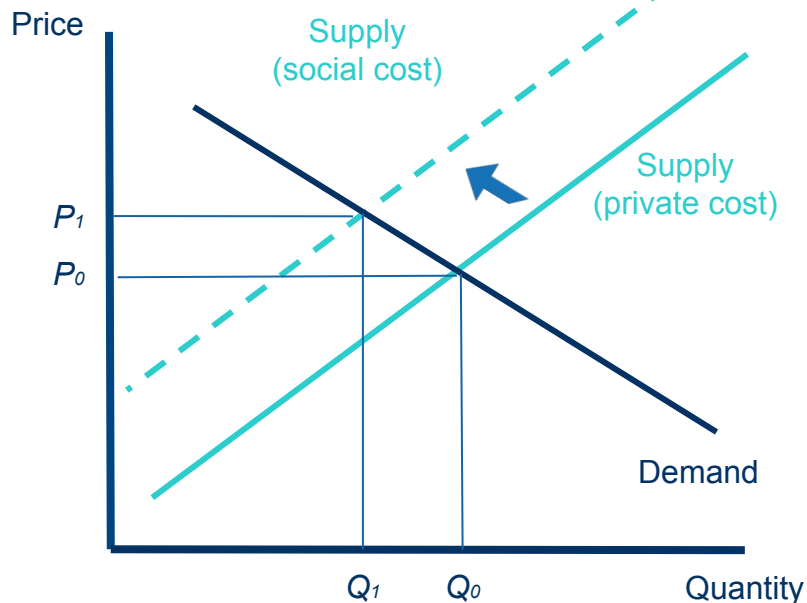


02

Acting against climate change: rationale, objectives and instruments

Rationale for intervention: emissions are a negative externality

NEGATIVE EXTERNALITY: EMISSIONS (DIAGRAM)

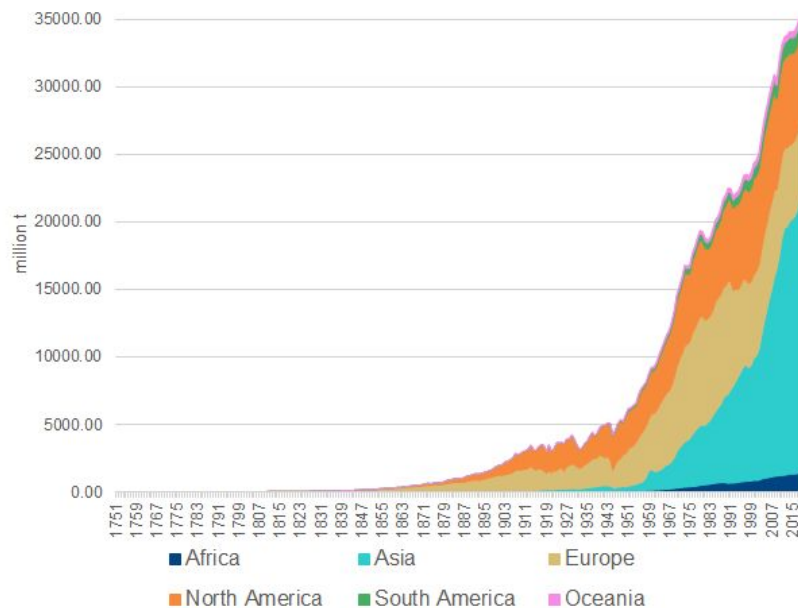


- Market prices do not include the cost of emissions: we produce more than the socially optimal level of emissions.
- Costs internalisation: taxes (Pigou), property rights (Coase).

Rationale for intervention: emissions are a negative externality with a global scope

GLOBAL CO₂ EMISSIONS

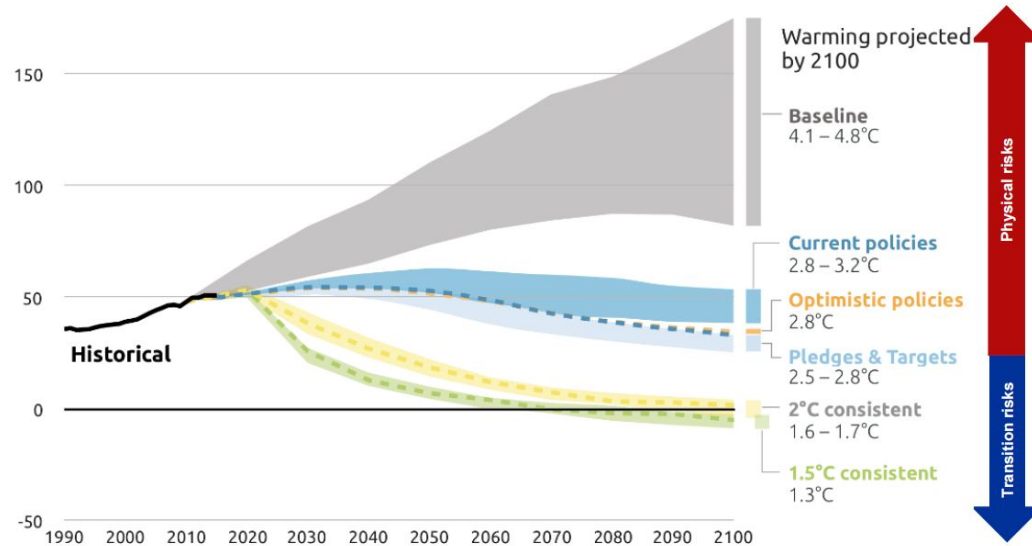
(1750-2019. HISTORICAL EMISSIONS BY REGION)



- Local GHG emissions impact temperature on a global scale.
- Emissions (by main geographic areas) have undergone significant trend changes.

Rationale for intervention: urgency

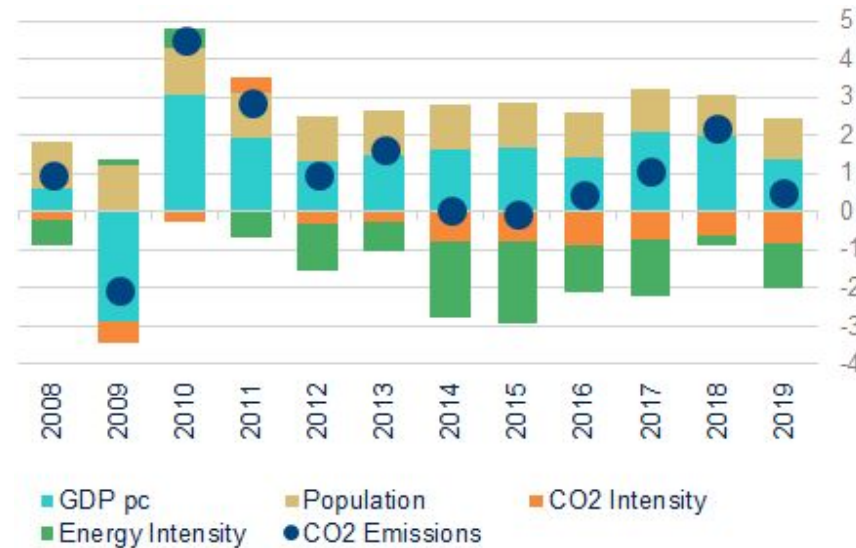
CLIMATE CHANGE SCENARIOS (GLOBAL WARMING AND CO₂ EMISSIONS PROJECTIONS)



- Neither one of the available scenarios suggests that current policies are consistent with the Paris Agreement.
- The Paris Agreement sets out a global framework to avoid dangerous climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C.

The rationale behind the intervention is to decouple the increase in welfare from greenhouse gas emissions

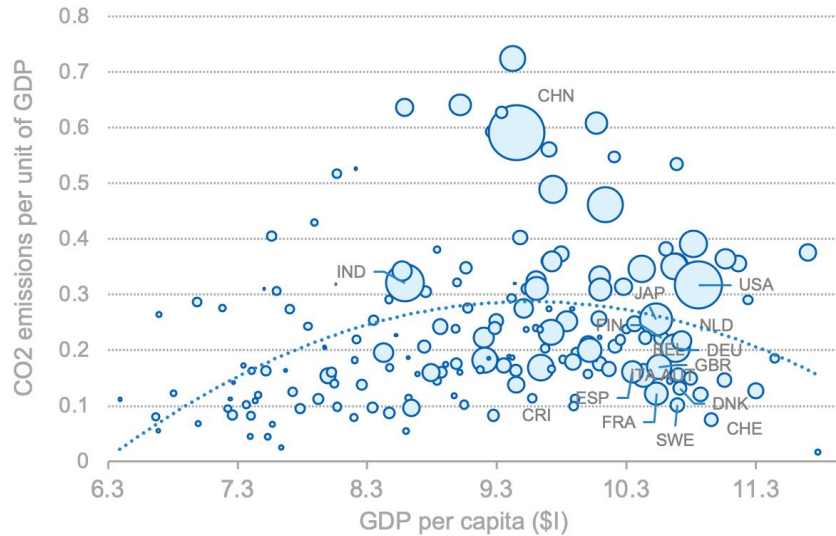
CO2 EMISSIONS AND GROWTH (% AND PP)



- Until today, improvements in **energy efficiency** have not been enough to reduce greenhouse gas emissions.
- So far, emissions **declines** have only been achieved in **periods of recession**.
- Improvements in energy efficiency are crucial.

High levels of GDP per capita correspond with lower intensities of emissions, but development is not the only relevant factor

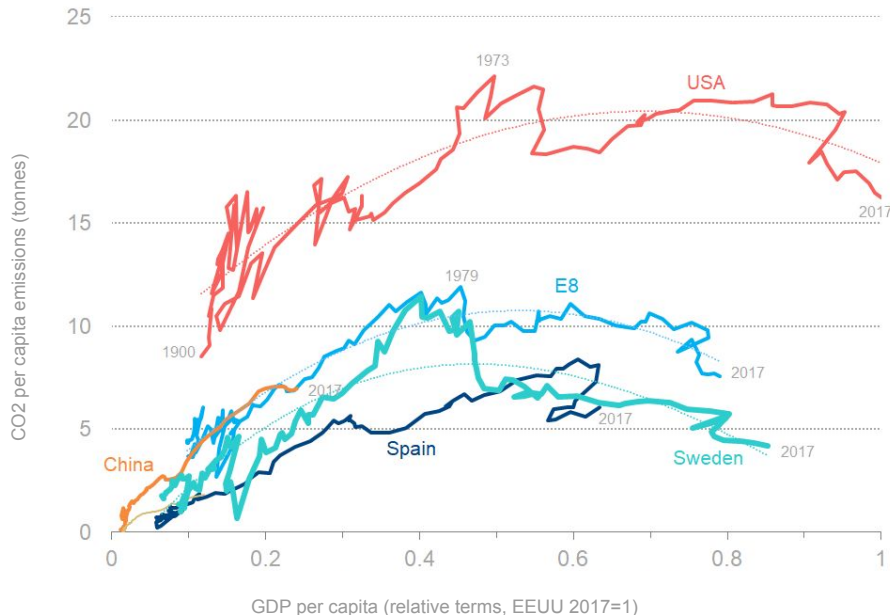
CO2 EMISSIONS AND GDP PER CAPITA (2014, BUBBLE SIZE: TOTAL EMISSIONS)



- The increase in the weight of the **services sector**, less intensive in the use of energy, favors the fall of GHG emissions.
- For the same level of development, **the differences in the intensity of emissions are linked to the energy mix** (endowment of natural resources and energy policy decisions).

High levels of GDP per capita coincide with lower intensities of emissions, but development is not the only relevant factor

CO2 EMISSIONS AND GDP PER CAPITA, 1900-2017



Source: BBVA Research based on [Andrés and Doménech](#) (2020).

- The increase in the weight of the services sector, less intensive in the use of energy, favors the fall of GHG emissions.
- For the same level of development, the differences in the intensity of emissions are related to the energy mix (endowment of natural resources and energy policy decisions).
- For several decades now, the **increase in GDPpc** has been compatible with a **reduction in per capita emissions**, fuelled by new technologies.
- **Regulation** is key to facilitate the adoption of new technologies.

Green investment: how to foster it? Carbon pricing is a key tool, but additional relevant issues have to be tackled

WORLDWIDE LOW CARBON PATENT FILINGS & OIL PRICES

(7-DAY MOVING AVERAGE)



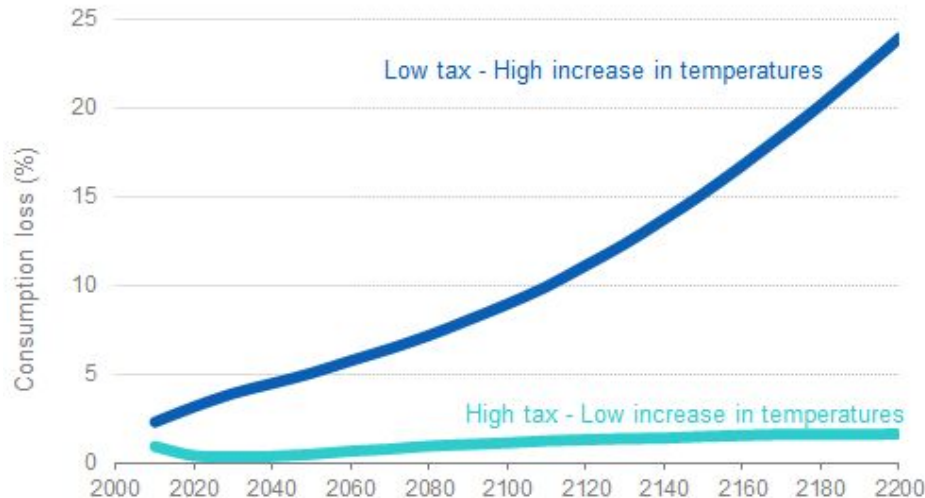
Source: BBVA Research, [OECD \(2020\)](#).

Based on European Patent Office's Global Patent Statistical Database and the World Bank.

- Fossil fuel prices are positively correlated with global patenting activity in low-carbon technologies (OECD, 2020).
- Long-term carbon price signals are needed to achieve sustained investment in low-carbon technologies.
- Relevant issues to be tackled, instruments...:
 - Heightened standards emissions,
 - Higher taxation,
 - Broadening market mechanisms
- ... and, distributional impacts of finally chosen instruments:
 - As regards to taxation, the margin of maneuver is wide, (taxes are low) but distributional impacts are challenging.

In terms of climate change is better to overshoot than to undershoot

LOSS OF CONSUMPTION WITH A HIGH (LOW) TAX AND A LOW (HIGH) CLIMATE EFFECT

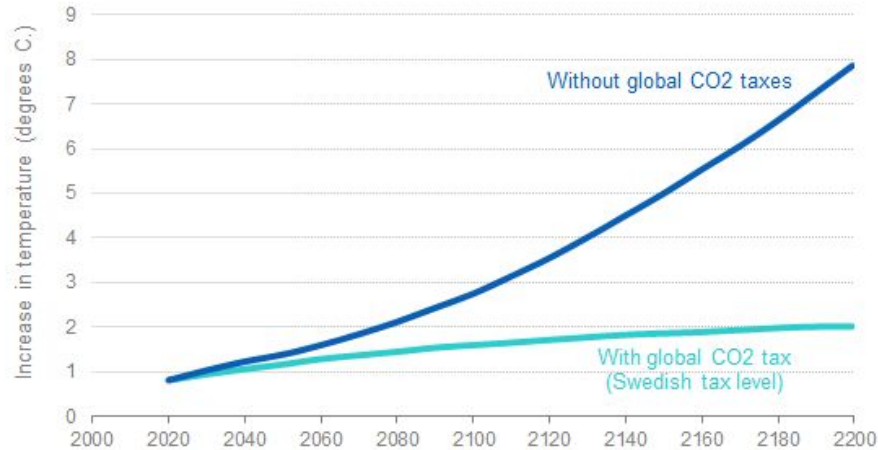


- An **insufficient** regulatory **intervention** lead us to **lose** almost a **quarter of consumption**.
- On the other hand, **excessive intervention** would have a **smaller effect**.
- **Insurance value (Pindyck, 2020)**: Note that state intervention makes up for the non-existence of an insurance market for global risks.

From a comprehensive cost-benefit perspective, the optimal decision is to focus on a uniform global carbon tax

EFFECTS OF CLIMATE CHANGE

(VARIATIONS IN ACCORDANCE WITH THE APPLIED CARBON TAX)



Hassler et al (2020):

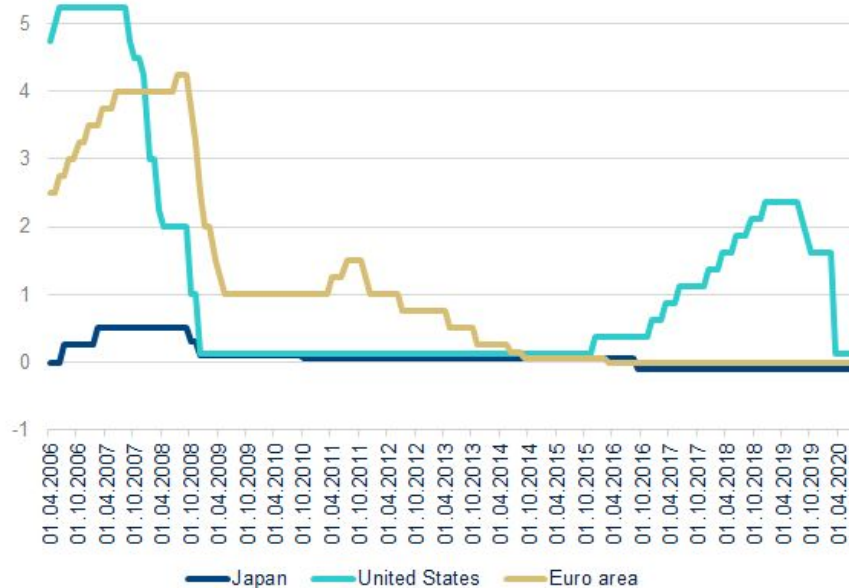
- A uniform and global carbon tax is the best option (difficult to calibrate).
- At least to date, green technology subsidies are a more uncertain alternative.

Nordhaus (2007):

- The focus on prices (carbon tax) should be higher than the focus on quantities (emissions market).

The financial context is favorable: very low interest rates

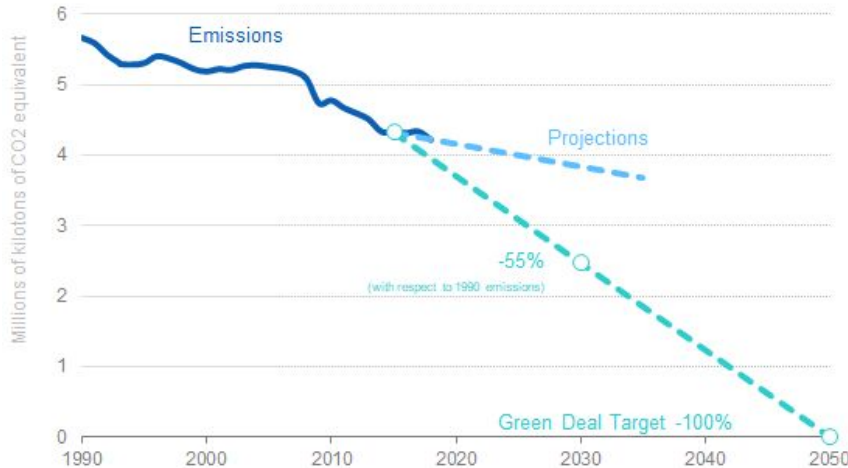
INTEREST RATES OF THE CENTRAL BANKS, 2006-2020



- We must approach **decarbonisation** through a **cost-benefit approach** (discount rate).
- The secular trend of the last decades shows that **real interest rates are moving downwards**.
- This decline is consistent with factors such as the demographic transition or the slowdown in productivity.

The social context is favourable: turning the threat of COVID-19 into an opportunity

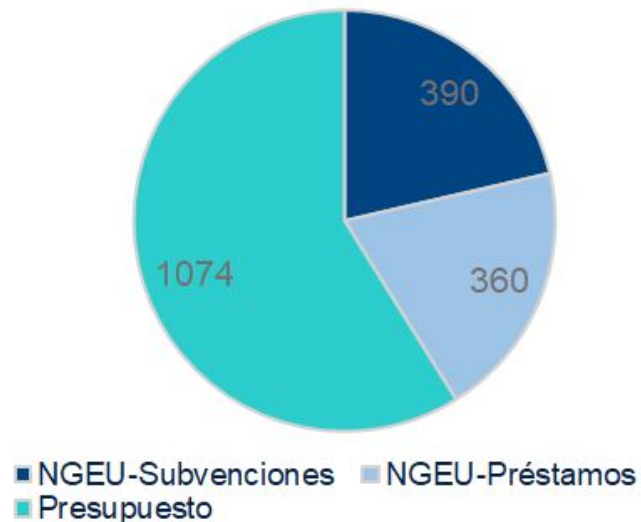
EU. EMISSION REDUCTION TARGETS



- **Parallelism** with a potential climate catastrophe (awareness).
- State **aid** and reconstruction funds should be **conditioned** to the environmental impact of the projects.
- **European Green Deal** (at least one trillion euros will be invested before 2027-2030).
- Businesses should base their **reconstruction** on more **environmentally friendly bases, with greater resilience to global crises**: redefining products and services, more emphasis on ESG, reinforcing global value chains ([GreenBiz, 2020](#)).

Case study: NGEU and the climate transition in Spain

TOTAL EU SPENDING 2021-2027 (BILLION - SHORT SCALE - EUROS)



- The distribution of NGEU funds is based on population, unemployment and GDP per capita, as well as the impact of the 2020-21 crisis.
- 37% of the funds from the Recovery and Resilience Mechanism (90% of the NGEU) must be aimed at facilitating climate transition, being the projects consistent with European objectives and national climate plans.
- The Spanish Climate Change Law Project establishes the objective of climate neutrality in 2050, with further details in the National Integrated Energy and Climate Plan (PNIEC 2021-30).
- Investments in the NGEU will respect PNIEC objectives and the lines of action established by the National Plan for Adaptation to Climate Change.

Strategies to achieve environmental sustainability goals

01

Society involvement

- Collectively promote sustainable economic development.
- Assume the cost of the transition in the short term in order to avoid higher costs in the long term.

03

Sustainable innovation

- New low-emission technologies.
- Adapt to changes already taking place and reduce costs.
- New infrastructures.

02

Change management

- Minimize the potential direct and indirect negative impacts.
- Govern the economic activity to achieve the objectives of the Paris summit, 2015.
- National and international strategic plans.

04

Financing sustainability

- Mobilize the necessary capital to ensure energy transition, innovation and new infrastructure.
- Sustainable finance regulation

03

Conclusions

Main messages (I)



The **increases in temperature** and the **GHG concentration** of the last two centuries cannot be explained without considering **human productive activity**.



Without a rapid and **substantial reduction** in **GHG emissions**, the Earth's average temperature **will exceed thresholds** that trigger **severe environmental effects** and increase economic costs, including potentially **catastrophic risks**.



The emission of GHG into the atmosphere creates a **negative economic externality**, which requires global, coordinated and **public policies for its correction**.

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Among the necessary measures, **the economic analysis gives priority to a uniform global carbon tax** over more developed emission markets or green subsidies. Note that the **distributional impacts of the policies** have to be also considered.



In the long run, **innovation will be crucial**. Currently, environmental policies are favored by low interest rates and post-pandemic policies.

“

I hope that you, our grandchildren, will look back in the years ahead with appreciation. I hope that you can say that we, in this generation, had the resolve to overcome the obstacles and take the steps necessary to preserve our unique and beautiful planet.

”

William D. Nordhaus' speech at the Nobel Banquet, 10 December 2018

04

Annex

Case study: Next Generation EU

EU HAS SET A 2050 CLIMATE NEUTRAL OBJECTIVE

40% GHG reduction target is **insufficient**.



Policy framework is **inconsistent** with climate neutrality **1.5 °C**.

Increase GHG target.



Adapt policy framework.

1. Increase the climate target.

1. Determine the role of the ERS and ETS.

2. Determine its scope.

2. Review and revision of the energy policies RES and EE.

3. Explore the contribution of transport policies.

4. Determine LULUCF role.

5. Explore contribution of non-co2 mitigation.

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