Utrecht University

Climate risk assessment and climate investment gap:

the role of investors' expectations and policy credibility for the EU transition

Prof. Irene Monasterolo,
Utrecht University School of Economics and SUERF

Climate finance in an uncertain world,
Milan, 18 January 2024

Utrecht University

Outline

- Assessing climate-financial risk in an uncertain world
- Climate stress test: some lessons
- The interplay of investors' expectations and policy credibility: why it matters for the low-carbon transition and for financial supervision
- From climate risk assessment to climate investing
- A European climate bond to fill the EU green investment gap

Utrecht University

Assessing climate-financial risk in an uncertain world

What do they have in common?

K. Georgieva, IMF .Photo: Bloomberg

C. Lagarde, ECB. Photo: REUTERS/Heiko Becker

- Central banks and supervisors worry about the impact of climate risks on financial stability
- + 140 central banks and supervisors joined the Network for Greening the Financial System (NGFS) tthat recommended investors to conduct **climate risk assessment and climate stress test** using climate scenarios.

Why? A delayed transition brings economic losses

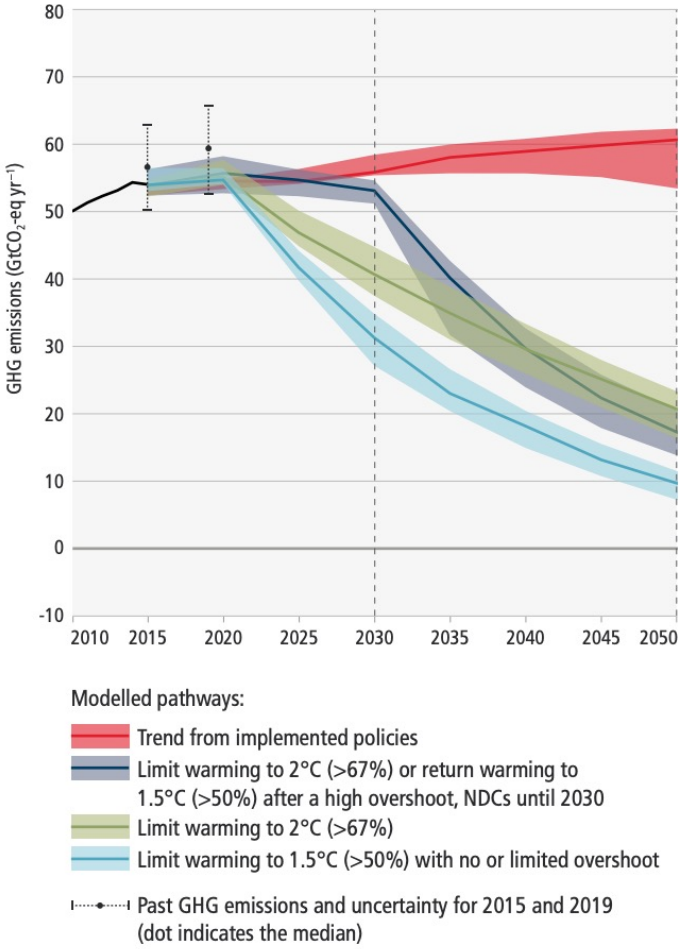


Fig: global GHG emissions projections by policy action until 2100. Source: IPCC (2022)

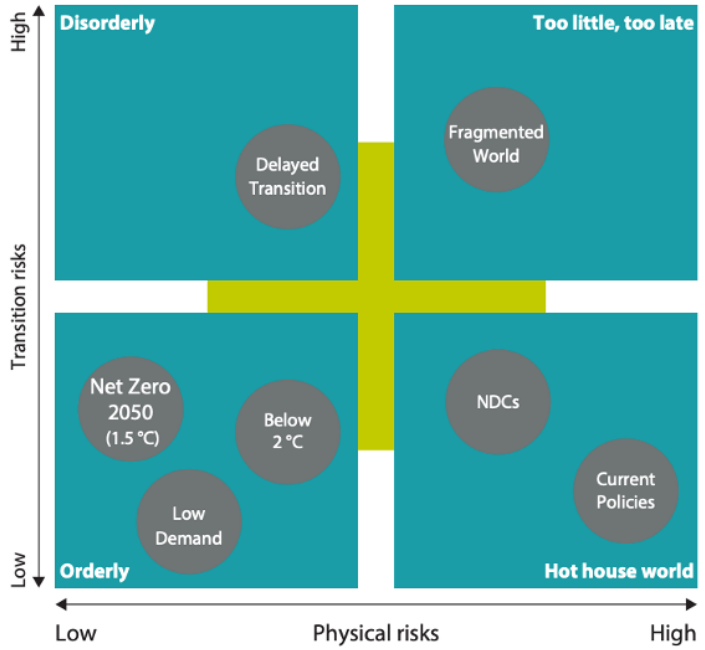


Fig: NGFS climate scenarios framework. Source: NGFS 2023.

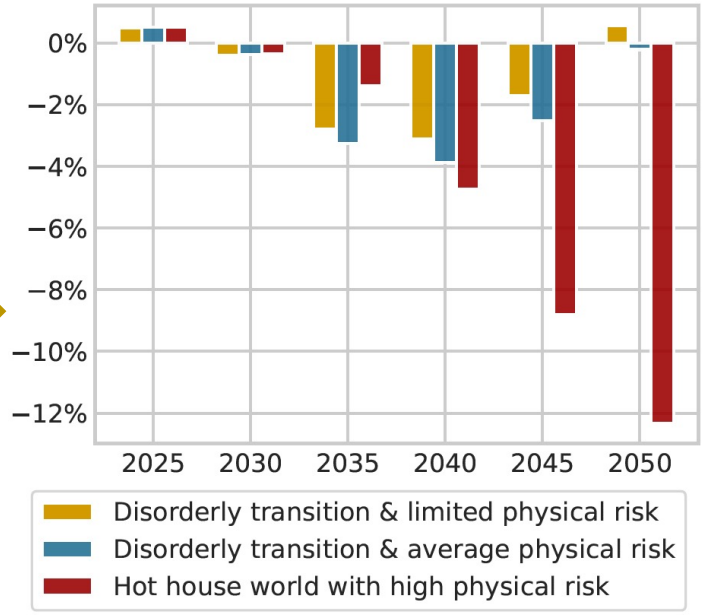


Fig: Real GDP euro area, comparison with orderly transition scenario. Source: Gourdel et al. 2022.

…and risks for financial stability

- **2017: framework for climate stress-test** that embedded climate scenarios in a stress test of individual portfolios and the financial system.

Investors have large, heterogeneous exposure to transition risk via Climate Policy Relevant Sectors

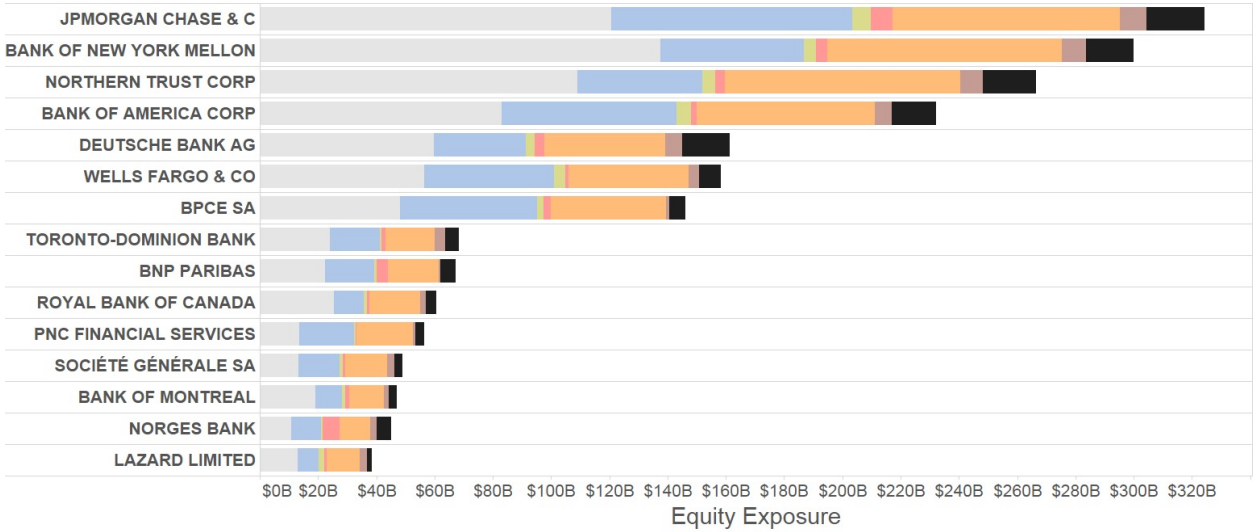


Fig. Exposure (USD billion) of equity portfolio of largest banks to Climate Policy Relevant Sectors (CPRS) including fossil (black), utilities (grey), energy-intensive (orange), housing (pink), transport (green). Battiston et al. 2017.

Losses from a high-carbon investment strategy

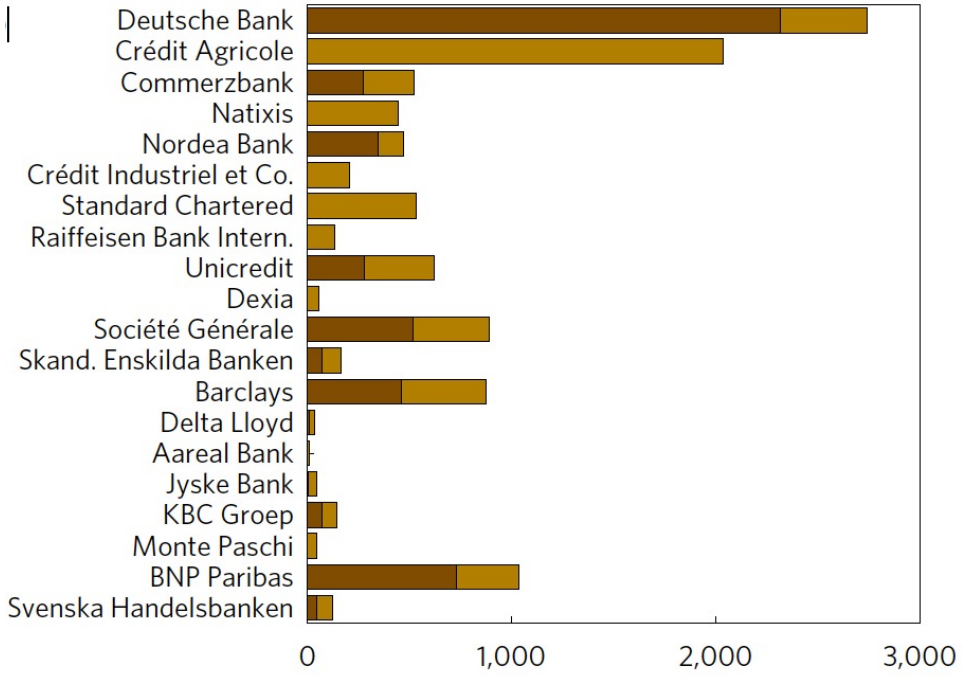


Fig. Climate Value at Risk on holdings of 20 most affected EU banks under current investment strategy. Dark/light : first/first+second round losses. Battiston et al. 2017.

The importance to assess climate risks for finance

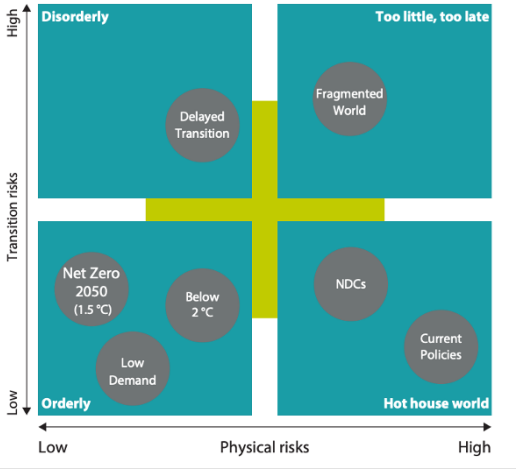
- Some central banks carried out climate stress tests (e.g. ECB 2021, 2023; OeNB 2022, Banque de France 2020, Bank of England 2022, etc).
- **Climate stress tests** quantifies the losses that a financial actor could face on the balance sheet, conditional to the realisation of a set of **climate scenarios**
  - In addition to the actor's direct exposure to climate risks, losses depend also on leverage; indirect exposures through financial network; potential mispricing of collaterals associated to financial contracts
  - Uncertainty captured by the *breadth* of climate scenarios. **Policy credibility is a key driver of uncertainty.**
- Goal: help financial institutions to (i) **assess and manage risks,** (ii) **reallocate capital.**

Stress-test vs climate stress test

- **Both** stress tests and climate stress test:
  - **quantify the 'largest' losses** that the balance sheet of an individual investor (micro-pru.) or the financial system (macro-pru.) could incur if a scenario materialised
  - translate economic losses, conditioned to scenarios, into adjustments in counterparties' **probability of default, financial performance**, **value of contracts**
  - estimate **distribution of losses** and calculate financial risk measures to capture tails
  - can account for the effects of **financial contagion** (network of pairwise exposures)
- **Differences: scenarios**
  - Stress test: economic scenarios (mild vs adverse). Climate stress test: **climate scenarios**

Climate stress-test framework

Climate scenarios

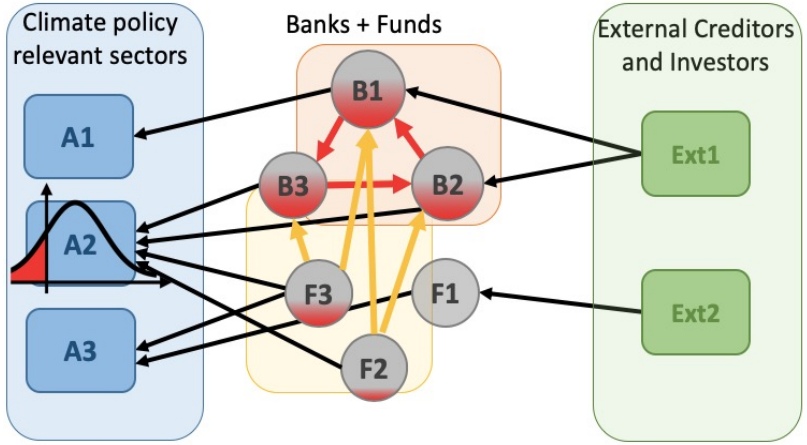


NGFS 2023

- Climate scenarios (physical, transition risk)
- Estimates of sectors' production by energy technology, cash-flow streams of securities
- Valuation adjustment of issuers' default probability, bond spread, credit risk etc.

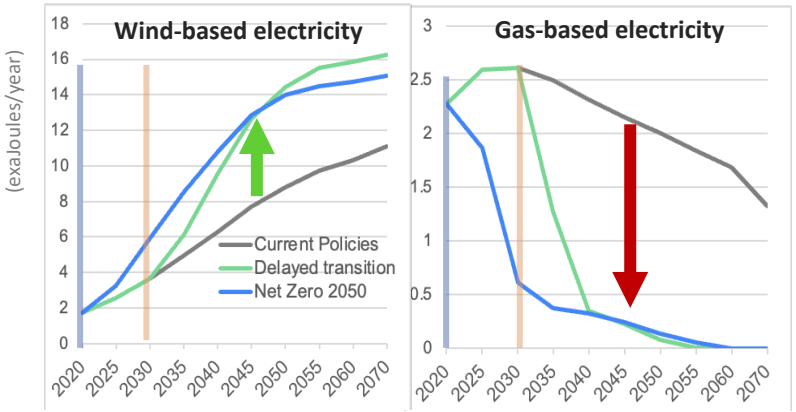
→ Reallocation of capital to less risky assets

Amplifications via financial networks



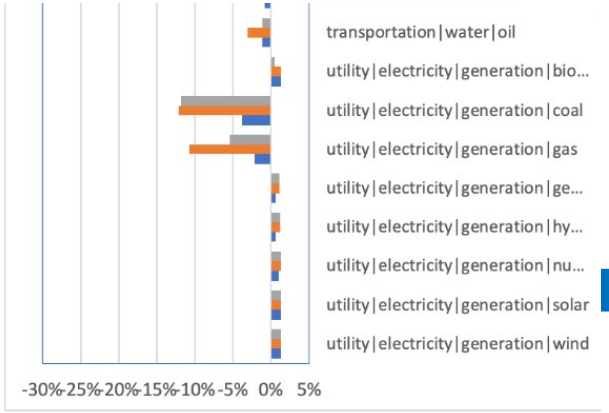
Roncoroni et al. 2021

Output trajectories



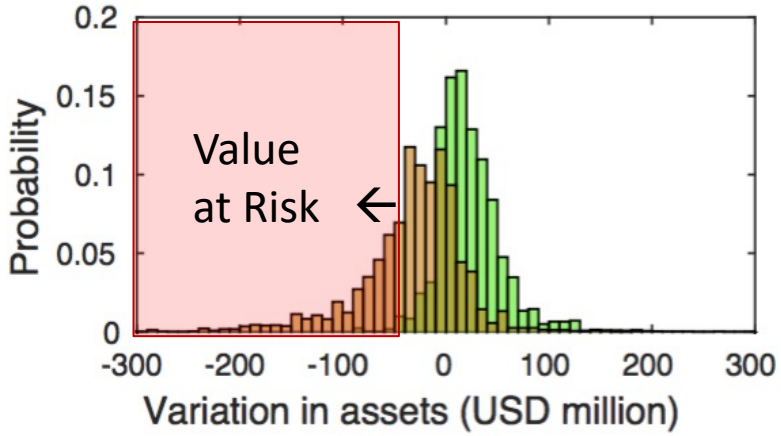
Own elaborations on NGFS database explorer

Financial valuation adjustment



Monasterolo_Bocconi_climate_finance_24

Adjustment of gain/losses distribution



Climate stress-test: lessons for financial authorities

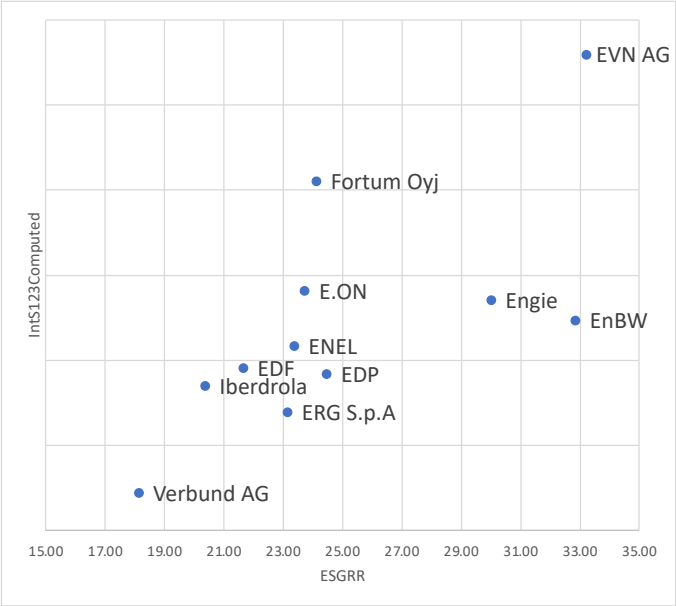
1. **Climate scenarios**: are they capturing the breadth of physical and transition risk, interaction with other shocks (e.g. compound risk, Dunz et al. 2021a, Ranger et al. 2022); the role of finance and expectations (Battiston et al. 2021)?

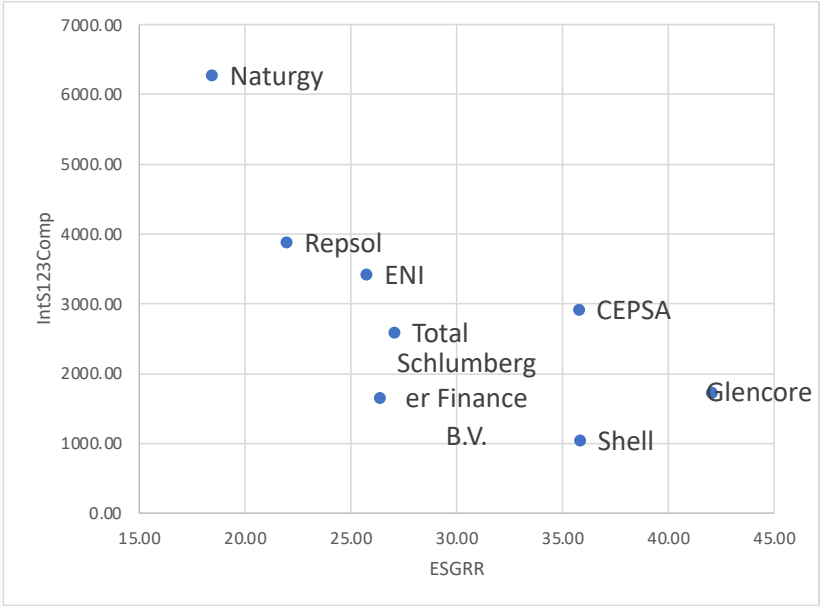
2. **Climate risk disclosure:** are we considering the relevant variables for transition and physical risk (e.g. GHG emissions vs location) and level of disaggregation (asset-level vs aggregate scores, Bressan et al. 2022)?

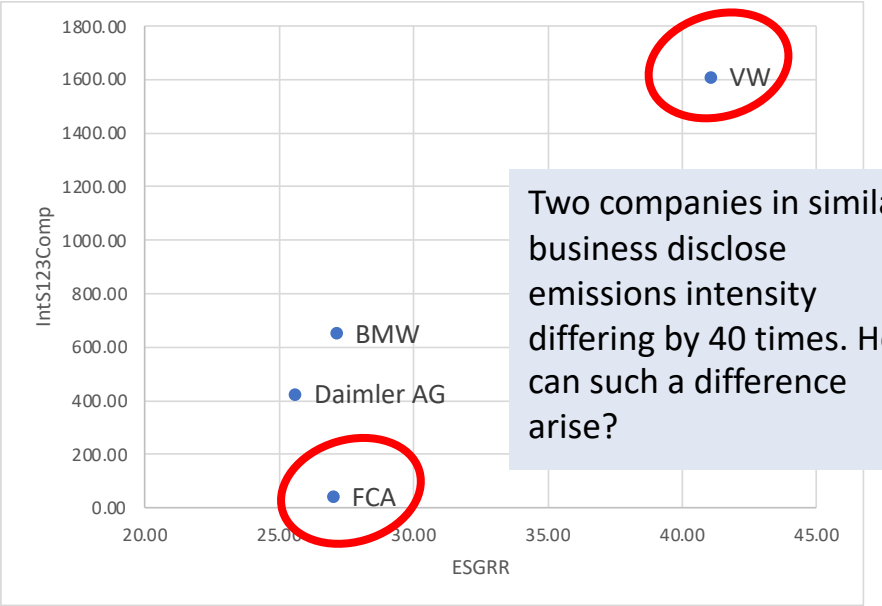
3. **Macroeconomic impacts:** are we missing large GDP losses and co-benefits due to models' assumptions (e.g. rational expectations, representative agents, etc)?

Example: limits of GHG emissions for disclosure

- Greening portfolio of corporate bonds (ECB PEPP) based on GHG emissions and alignment plans:
  - Emission intensity (Scope1+2+3)/Revenues, ESG Risk Rating (ESGRR, Sustainalytics) for bonds
- **Results**: reporting discrepancies exist also intra-sector, challenging investors' evaluation of firms' sustainability, **portfolio rebalancing and prudential regulation:**
  - **Key factor: inconsistency of Scope 3 reporting (see Stellantis vs VW).**







Two companies in similar business disclose emissions intensity differing by 40 times. How can such a difference arise?

Source: Bressan et al. 2022b

Utrecht University

The interplay of investors' expectations and policy credibility in the transition

Troubles with climate policy credibility: examples

In the US, former President Trump withdraws from the Paris Agreement in 2017.

FROM POLITICOPRO

Dec 2023

EU's green funds are under the guillotine

A massive investment plan designed to help fight climate change is at risk of being beheaded.

FROM POLITICOPRO

Jan 2024

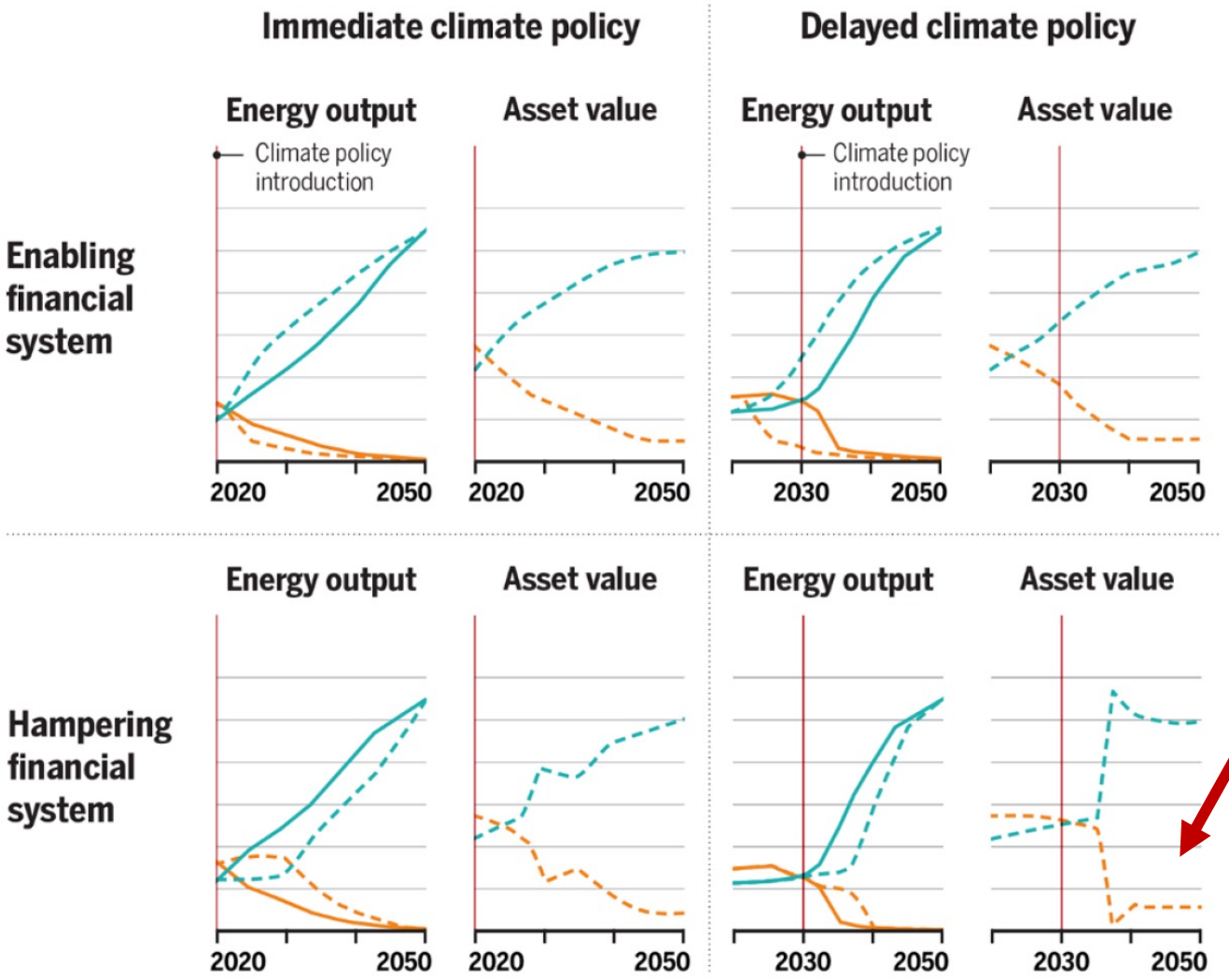
Ursula's empty green Davos promise

Last year, EU chief Ursula von der Leyen promised a deluge of green tech cash. But politics, fiscal austerity and military anxieties have since intervened.

The interplay investors' expectations and policy credibility is key to make or fail the transition

- Investors carry out capital allocation based on **risk assessment**
- **Climate sentiments** matter for the transition: investors' expectations about policy credibility affect their risk assessment and **cost of capital** (Dunz et al. 2021b)
- **Endogeneity of climate risk**:
  - decision makers' perception of climate risks impacts risk materialisation, affecting policy and investment decisions, which in turn affect transition paths and scenarios (Battiston et al. 2021)
  - Current NGFS climate scenarios do not account for finance!
- **What the implications of the enabling or hindering role of finance?**

Expectations affect risk assessment and the transition



When we account for sentiments:

- An orderly transition (e.g. 2degC) can become disorderly if investors do not trust policy (hampering): large and sudden financial valuation adjustments -> price instability
- **Hampering**: could also lead to higher risk than in NGFS disorderly scenario!

Source: Battiston S. et al. (2021).

Utrecht University

The EU investment gap and how to close it: A European climate bond

Monasterolo, I., Pagano, M., Pacelli, A., and Russo, C. (2024). A European Climate Bond. Available at SSRN: https://ssrn.com/abstract=

Gap: investments needs vs budgeted expenses

- EU budget 2021-2027 + NextGenEU: EU Commission long-term budget of €2tn at current prices (30% of EU budget) → **about €330 bn/year**
- Adaptation ranges between €158-518 bn/year (EC 2017) → overall investment needs range between **€550bn/y** and **€912bn/y**
- EU climate investment gap 2023 = **needs** – **budgeted** = € 370 bn/y
  (€700bn/y) **(€330bn/y)**
- **Caution**: based on €912bn/y upper bound of needs, **gap rises to €582bn/y**:
  - Calculation may omit relevant mitigation and adaptation expenses (uncertainty)
  - Gap may be partly covered by national member state (MS) budgets
- But in 2019 EU MS spent €90bn on climate (OECD, 2022): **1/4 of the shortfall!**

How to close the investment gap? A European climate bond

- **Our proposal:** issue of EU climate bonds
- Strengthening the current EU carbon pricing framework by:
  - **extending the Emission Trading Scheme (ETS)** to all sectors
  - **EC manages the supply of the allowances** to reach the science-based price target
- The European Stability Mechanism (ESM) issues EU climate bonds:
  - interest and capital serviced by ETS sales revenue, guarantee by unused ESM resources
- The cost of servicing would benefit from:
  - the ESM's rating keeping the bond risk profile low
  - the "green" nature of the bond appealing to ESG institutional investors
  - the "sovereign" nature of the bond → favourable treatment by prudential regulation of banks' and insurance companies' exposures

Timing of the proposal

ECONOMY • EMMANUEL MACRON

Davos 2024: Macron calls for joint European debt to invest in 'future'

The French president described 2024 as a 'key' year ahead of European Parliament polls in all 27 countries later this year.

Le Monde with AFP
Published yesterday at 6:52 pm (Paris)

The Economist

Menu | Weekly edition | The world in brief | Search

By Invitation | Europe's economic challenges

Mario Draghi on the path to fiscal union in the euro zone

It will require new rules and more pooled sovereignty, says the former head of the ECB

Why should climate policies be designed at the EU level?

- National standards would lead to **inefficient climate policy targets:**
  - Each MS has **less incentives** to account for cross-border externalities→ insufficient spending on mitigation
  - less regulated countries attract high carbon activities → **regulatory arbitrage** saps policies' impact (carbon leakage: Benincasa et al. 2022, Leaven and Popov 2022)
  - **low/no fiscal space** in some EU-27 countries may **hinder climate investments**, negatively affecting trade within the whole EU

- **Supra-national design** limits capture of national authorities by national pressure groups: parallel with prudential bank supervision (SSM vs. national central banks)

- Hence, **EU-level cooperation is efficient not only to fund the gap but also to design an efficient EU climate investment program**

Why should climate policies be funded at the EU level?

- The shortfall initially larger as efficiency requires climate investments to be frontloaded: earlier investments achieve more and cost less → **need for public debt issuance**

- But **fiscal capacity** of some EU MS is insufficient (also considering the revised rules of the EU fiscal compact) ⇒ **MS with lower fiscal capacity will underinvest**

- **This outcome is inefficient for the whole EU because of:**
  - climate spillovers: cross-border impact of emissions
  - economic spillovers: insufficient adaptation investments → lower growth in underinvesting country → lower imports from the rest of EU,
  - potential sovereign climate crisis

⇒ efficiency requires joint EU-level funding!

How it works: NextGenEU bond vs EU climate bond

Next Generation EU bond

- fixed issuance → no rollover
- low volume → low liquidity
- backed by MS, off-balance sheet → quasi-sovereign asset → not fully safe asset
- funding various programs → no "greenium"
- placed mainly via syndication → high issuance cost

EU climate bond

- regular issuance → debt rollover
- high volume → high liquidity
- backed by ETS sales revenues, in-balance sheet → sovereign asset → safe asset
- only funding climate policy → "greenium"
- placed via auction → low issuance cost

How many climate bonds could the EU issue?

- **EU climate bond issuance** determined by the fiscal capacity generated by the sales of ETS allowances
- Revenues = carbon price x emissions
- Carbon prices and emissions from NGFS scenarios:
  - Below 2°C (Orderly): gradually increases in the stringency of climate policies, 67% chance of 2°C
  - Current Policies (Hot house world): only currently policies are kept, leading to high physical risks
  - Fragmented World (Too little, too late): delayed and divergent climate policy among countries globally, leading to high physical and transition risks
  - Delayed Transition (Disorderly): ambitious policies needed from 2030 to stay below 2°C end of century leading to high transition risk.

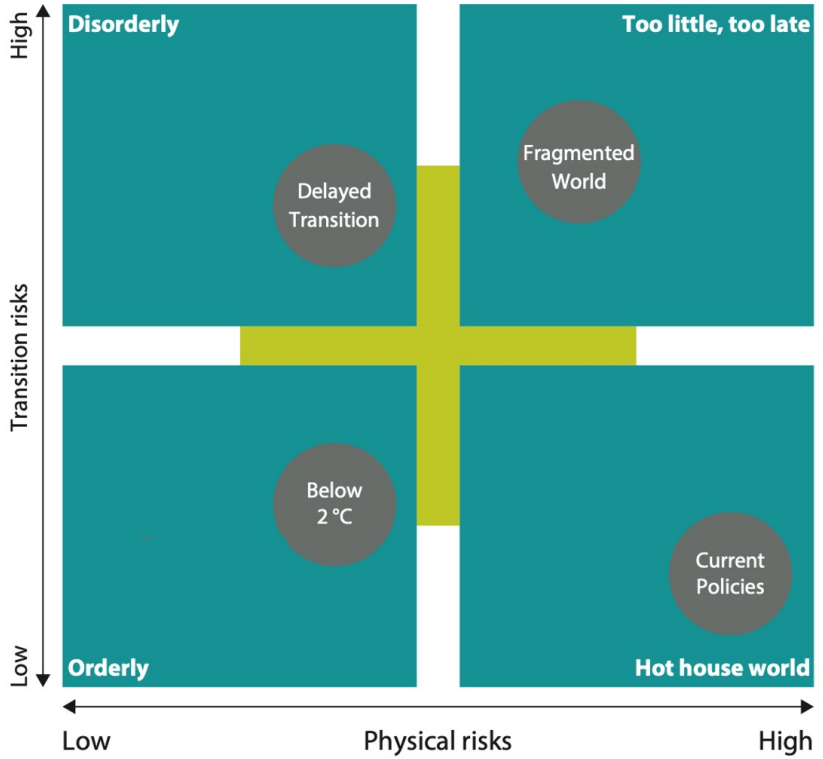


Fig. NGFS scenario framework, 2023

Assessing EU carbon fiscal capacity: five steps

1. NGFS: carbon prices in US$2010/ton Kyoto GHG emissions in Megatons (Mt) CO2eq, every 5 or 10 years, from 2020 to 2100
2. Turn emissions from Megatons to tons (1 Mt = 1mln t)
3. Convert revenues in $2023 using US GDP deflator, interpolated yearly
4. Compute the **present discounted value (PDV)** of constant-dollar revenues for each NGFS scenario (start: 2024) using the US Treasury Inflation-Protected Securities (TIPS) rate from FED as a discount rate:

$$\text{PDV} = \sum_{j=0}^{76} \frac{revenue_{2024+t}}{(1+r_t)^t}$$

where 76: years is the time horizon, r_t is the maturity-*t* real spot rate as of 2024

5. Convert the PDV into using the current exchange rate $1/€0.9167

EU carbon fiscal capacity

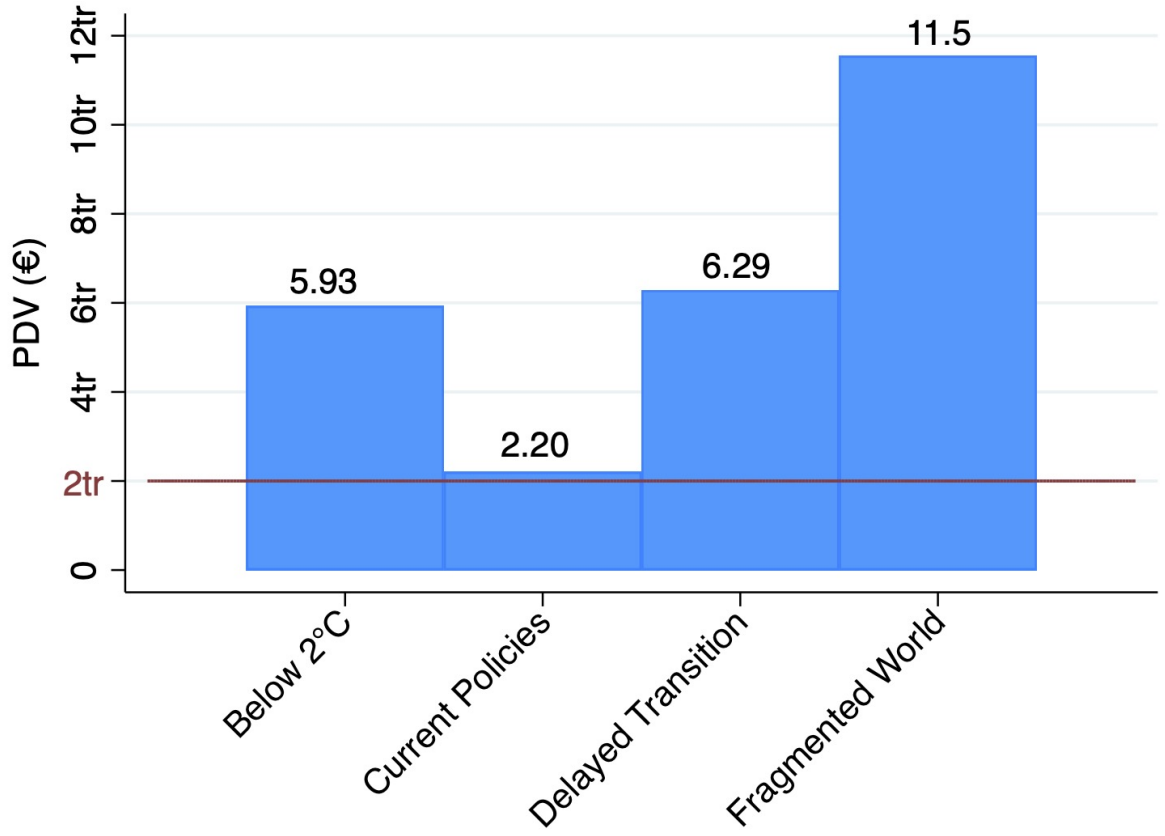


Fig. PDV of Estimated Revenues. PDV in €tn for each NGFS scenario. €2tn (red line) is the EC's long-term budget (6y).

- Issuance capacity varies from a lower bound of €2.20tn in "current policies" to an upper bound of €11.5tn in the "fragmented world"
- **In all cases the issuance capacity of EU climate bonds exceeds the €2tn EC's long-term budget (6y) for climate actions and €2.22tn corresponding 6y climate investment gap!!**

Benefits: safe and green asset supply and financial stability

The EU climate bond is a **cost-efficient** way to fund EU climate policies:

- **liquidity benefits** of EU regular issuance (different maturities)
- filling demand for a **EU safe asset:** issued by a supranational authority with high credit rating and backing of revenue from sales of ETS allowances

- **Benefits for financial stability:**
  - avoid diabolic loop bank - sovereign risk (Brunnermeier et al. 2017)
  - avoid sudden, self-fulfilling capital flights in search of safety from high-risk to low-risk countries at times of crisis.

Macroeconomic benefits

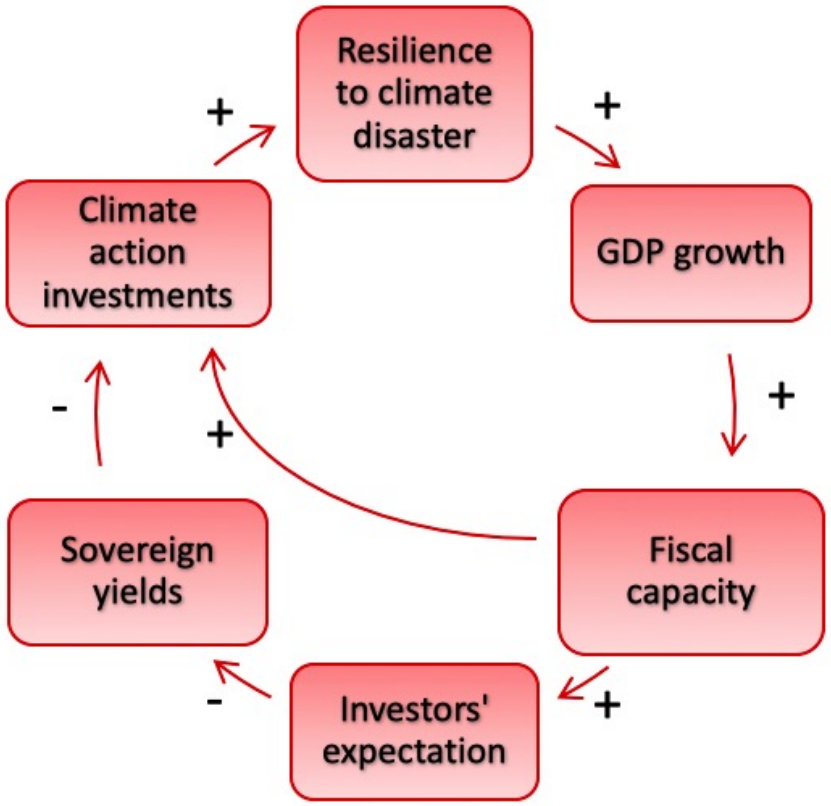


Fig. The real and financial climate feedback loops. The arrows indicate the causal relationships, while the signs indicate the direction of the corresponding effects, either reinforcing (+), or balancing (-).

- By sustaining fiscal capacity, **climate policies contribute to improve investors' expectations** about a country's climate risk, lowering its perceived **solvency risk**.
- This, in turn, would translate into **lower yields** on debt and lower cost to finance climate investments, **reinforcing the positive effect of greater fiscal capacity**
- **Multiple equilibria:** the economy may be trapped in an inefficient equilibrium of low climate investment and resilience, low growth and high sovereign solvency risk.

Benefits: greening of investors' portfolios and monetary policy at the ECB

- **Greeness**: use of revenues from the sale of EU climate bonds **conditional** on their use to fund climate projects in the EU:
  - implementation monitored via KPI
  - EU MS that fail to deliver on KPIs will face a penalty (reduced allocation of subsequent funding)
  - thus, bonds likely to command a "greenium" relative to comparably safe sovereign assets, such as US treasuries.

- EU climate bonds as EU safe and green asset that could be used by the ECB (i) **as a collateral** to perform monetary policy operations, (ii) **as tool** for asset purchase program:
  - **Market neutrality** (overcome concerns about preferential treatment of certain sovereign issuers or sectors)
  - **Secondary mandate**: support the general EU policy (including carbon neutrality) without jeopardizing its price stability objectives

Conclusions

1. **Doing climate stress-test is important – the way we do it as well:**
   - Climate risk assessment is key for reallocating capital and foster the transition
2. **Scenarios should include the interplay** of investors' expectations and policy credibility because they shape transition paths and financial risk
3. A **EU climate bond** could narrow the EU green investment gap by supporting green fiscal policy in coordination with financial policy:
   - Answers to the need for a **safe and green EU asset**
   - Financial backbone of EU response to **competition** from US and China to attract green investments
   - Reduces the **risk of sovereign debt crises** induced by natural disasters.

References (cont)

- Battiston S., Mandel A, Monasterolo I., Schuetze F. & G. Visentin (2017). A Climate stress-test of the EU financial system. *Nature Climate Change*, 7, 283–288.
- Battiston S. Monasterolo, I., Riahi, K., and van Rujiven, B. (2021). Accounting for finance is key for climate mitigation pathways. *Science*, *372*(6545), 918-920.
- Battiston, S., Mandel, A., Monasterolo, I. and Roncoroni, A. (2023). Climate credit risk and corporate valuation. Working paper, available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4124002.
- Benincasa, E., Kabas, G., & Ongena, S. (2022). "There is No Planet B. *There are Countries B to Z": Domestic Climate Policy and Cross-Border Lending (March 23, 2022). Swiss Finance Institute Research Paper*, (22-28).
- Bressan, G., Duranovic, A., Monasterolo, I., Battiston, S. (2022a). Asset-level climate physical risk assessment matters for adaptation finance. Working paper, available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=406227
- Bressan, G., Monasterolo, I, Battiston, S. (2022b). Sustainable investing and climate transition risk: a portfolio rebalancing approach. *Journal of Portfolio Management*, special issue "Novel risks" edt. by F. Fabozzi.
- Brunnermeier, M. K, Langfield, S., Pagano, M., Reis, R., Van Nieuwerburgh, S. and Vayanos, D. (2017). ESBies: Safety in the Tranches. *Economic Policy* 32.90, pp. 175–219.
- Dunz, N., Mazzocchetti, A., Monasterolo, I., Essenfelder, A., Raberto, M. (2021a). Compounding COVID-19 and climate risks: the interplay of banks' lending and government's policy in the shock recovery. *Journal of Banking and Finance, 106303*
- Dunz, N., Naqvi, A., & Monasterolo, I. (2021b). Climate sentiments, transition risk, and financial stability in a stock-flow consistent model. *Journal of Financial Stability*, *54*, 100872

References

- Gourdel, R., Monasterolo, I, Dunz, N., Mazzocchetti, A. and Parisi, L. (2022). The double materiality of climate physical and transition risks in the euro-area*. ECB working paper series,* n. 2665, May 2022. Forthcoming on the *Journal of Financial Stability*.
- Laeven, L. A., and Popov A. A. (2022). Carbon Taxes and the Geography of Fossil Lending. ECB Working Paper Series 2022/2762.
- Monasterolo, I., Pagano, M., Pacelli, A., and Russo, C. (2024). A European Climate Bond. Available at SSRN: https://ssrn.com/abstract=
- Network for Greening the Financial System (NGFS) (2023). NGFS Climate Scenarios for central banks and supervisors - Phase IV. Available at: https://www.ngfs.net/en/ngfs-climate-scenarios-phase-iv-november-2023
- Ranger, N., Mahul, O., Monasterolo, I. (2022). Assessing Financial Risks from Physical Climate Shock: A Framework for Scenario Generation. *The World Bank*, Equitable Growth, Finance & Institutions Insight. Washington, DC: World Bank. https://openknowledge.worldbank.org/handle/10986/37041
- Roncoroni, A., Battiston, S., Escobar-Farfán, L. O., & Martinez-Jaramillo, S. (2021). Climate risk and financial stability in the network of banks and investment funds. *Journal of Financial Stability*, *54*, 100870.