THE ROAD TO Net Zero

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Nikhil Joshi and Geethanjali Nataraj consider CBAMs impact on global trade

Tax for climate finance should start with shipping, Pascal Saint-Amans argues

SUSTAINABLE DEVELOPMENT

Foreword

Welcome to the Autumn edition of The Road to Net Zero, a *World Commerce Review* supplement. This publication has been prepared in response to readership demand for an overview of the steps being taken in the transition to a cleaner and greener sustainable world.

All aspects of climate action are examined, with the most respected authors providing the reader with the most comprehensive information available. Our brief is to provide all the data necessary for the readership to make their own informed decisions. All editorials are independent, and content is unaffected by advertising or other commercial considerations. Authors are not endorsing any commercial or other content within the publication. ■

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Introduction

Carbon Border Adjustment Mechanism (CBAM) is among the potential policy measures to address the critical issue of carbon leakage across the world. A CBAM functions by imposing a levy on imported goods based on their carbon content, which is determined by evaluating the greenhouse gas emissions associated with the production process.

The goal is to harmonize the carbon costs between domestic and imported goods, thereby preventing carbon leakage. This approach ensures that imported goods face a comparable carbon cost to domestic goods, thereby reducing the competitive disadvantage faced by domestic industries operating under more stringent climate regulations.

The European Parliament on April 18, 2023, approved legislation to implement the CBAM as part of the EU's Green Deal, which aims to reduce greenhouse gas emissions by 55 per cent by 2030.

Accordingly, commencing on October 1, 2023, enterprises that export steel and aluminium to the EU are obligated to establish robust monitoring systems that quantify the carbon intensity inherent in their production processes.

Additionally, they must furnish comprehensive reports detailing this measured carbon intensity. Although several other industries, such as cement, fertilizer, and electricity, are also encompassed by this regulation, their relevance to India's exports to the EU is negligible.

Subsequently, starting from January 1, 2026, exporting companies operating within the EU jurisdiction will be mandated to provide CBAM certificates. These certificates serve as a mechanism to bridge the discrepancy between the carbon pricing paid in the country of production and the prevailing price of carbon allowances within the EU Emissions Trading Scheme.

However, there is criticism, particularly from developing countries like India that the CBAM is a trade-restrictive policy and India has also taken this matter to the WTO.

The UK is also considering moving along the same lines as the EU and the Government initiated a comprehensive consultation encompassing various interconnected policies, including CBAM, mandatory product standards (MPS) relating to embodied emissions, additional measures aimed at stimulating the demand for low-carbon products, and emissions reporting. The consultation period lasted 12 weeks and concluded in June 2023.

To maintain competitiveness globally and mitigate the impact of the measures to address carbon leakage, it is important for India to prepare a comprehensive response including possible retaliatory measures

The UK is mulling to cover all sectors and products eventually under the proposed measures. It is also looking at emission measurement, CBAM price measurement, and the timing and manner of introduction of these measures.

One proposed option is to initially introduce the UK CBAM for a select number of sectors and then gradually expand its coverage in a phased approach.

As set out in the consultation, the UK Government intends to proceed to introduce embodied emissions reporting in 2025. This would be followed by a phased implementation of the CBAM in 2026 in conjunction with reforms to the UK ETS allocation of free allowances.

For the UK, any MPS would only be introduced following successful pilots in the late-2020s. The steel industry of the UK has also supported the move towards a CBAM, as it fears that if the UK is not aligned to the EU standards, non-EU steel, made commercially unviable in the EU due to the CBAM, will flood the UK markets at lower costs and adversely impact the domestic steel industry.

Other countries are also considering the EU CBAM as starting point for their efforts to adopt a direct Carbon price, such as Ukraine, Uruguay, and Taiwan, China.

Possible impacts

The steel industry is considered a sector that is difficult to decarbonize and currently accounts for around eight per cent of global emissions. According to the International Energy Agency (IEA), carbon emissions from this sector have risen in the past decade, primarily due to the growing demand and the energy required for steel production.

The introduction of potential policy measures to address carbon leakage is expected to present a substantial challenge to India's metals sector as India is still coal-dependent for 55% of its power needs.

The policy measures to address carbon leakage that will be applied in the EU and will potentially be applied in the UK from the mid-2020s onwards; including a CBAM; MPS; and other demand-side measures to grow the market for low-carbon industrial products could have an adverse economic impact on India's exports of energy-intensive products like steel, aluminium, cement, and fertilizers.

Indian manufacturers have expressed apprehensions regarding the imposition of a tax that could potentially lead to a significant tariff ranging from 20% to 35% on India's exports of steel, aluminium, and cement.

Presently, these exports incur a duty of less than 3%. This tax measure could have a considerable impact, as approximately 27% of India's total exports of steel, iron, and aluminium products, amounting to $8.2 billion, are destined for the European Union and India's exports of articles of iron or steel to the United Kingdom amounted to US$359.1 million in 2022 (COMTRADE).

India's overall export of CBAM commodities, which include iron and steel ($5,083.7 million), aluminium ($2,679.7 million), fertilisers ($0.64 million), and cement ($0.04 million), collectively constitute approximately 8 per cent of India's total exports to the EU during the fiscal year 2022-23.

Over the preceding five-year period, the export of CBAM goods from India to the European Union has demonstrated a surge of 84 per cent, rising from $4.2 billion in the fiscal year 2018-19 to $7.8 billion in the fiscal year 2022-23.

The process of primary aluminium production is known for its high energy consumption, and in India, the utilization of coal-based power plants results in elevated greenhouse gas (GHG) intensity compared to their European counterparts.

During the initial phase of the CBAM, Indian exports to the EU are anticipated to remain steady, as domestic manufacturers adhere to stringent GHG reporting standards that fulfil the requirements until the end of 2025.

Nevertheless, once tariffs are enforced from 2026 onwards, Indian primary aluminium producers will be compelled to procure ETS certificates for emissions that surpass the allocated free allowance, subsequently leading to increased costs.

At present, there exists a disparity in emission intensity between Europe and India, which equates to potential additional costs of around $1,500 per tonne. The resulting cost differential is expected to render Indian exports economically unfeasible in the European market, particularly when compared to competitors, who boast significantly lower emissions, as it would be very difficult for domestic manufacturers to achieve a 25% reduction in emissions intensity by 2030.

Another significant challenge for India is the absence of a domestic emissions trading system. This absence may make it difficult for Indian firms to show that their products are produced using low-carbon technology, leading to higher charges resulting in higher prices, reduced competitiveness, and decreased demand.

Several companies have already set targets to reduce emission intensity to levels more comparable to the current global average by the end of this decade.

However, the adjustment process would require substantial investments and may pose challenges in terms of technological upgrades and operational changes. The impact of these potential policy measures to address carbon leakage will not be limited to steel and downstream steel products alone.

Upstream sectors, including iron ore, will also be affected. However, the emission intensity of iron ore is relatively low, suggesting that its inclusion under the potential policy measures to address carbon leakage should have minimal impact on trade flows.

The UK Government had sought inputs on how to address the trade concerns that are likely to arise with the introduction of the CBAM, such as the treatment of developing country exports, including those from India.

The concerns are that exempting high-carbon intensity products from developing countries could undermine net zero objectives but not doing so could undermine development objectives. Another concern is that post-imposition of the new regime, India is likely to become vulnerable to the dumping of steel items by various countries.

In the context of India's journey towards climate transition, domestic companies have embraced renewable energy sources, either in the form of captive generation or through purchasing from external sources for two primary reasons: firstly, the superiority of renewable energy in terms of cost-effectiveness and reliability compared to traditional grid-based power; and secondly, the increasing pressure from Environment, Social, and Governance (ESG) investors who advocate for decarbonization measures.

The emergence of the CBAM in Europe, and potentially in other advanced economies such as the UK, presents a third influential factor that encourages a greater emphasis on renewable energy adoption by Indian firms.

In response to this, companies in India may identify specific production locations that offer more favourable conditions for procuring unrestricted and affordable renewable electricity. Such favourable conditions may arise due to either the leniency of distribution companies in their renewable energy policies or the physical accessibility to the Inter-State Transmission System.

This growing preference among exporters to procure renewable energy, therefore, has the potential to stimulate increased investments in renewable energy infrastructure within India.

Conclusion and way forward

To maintain competitiveness globally and mitigate the impact of the measures to address carbon leakage, it is important for India to prepare a comprehensive response including possible retaliatory measures as well as explore carve-outs for certain sectors/goods and MSMEs with the EU, and possibly the UK if it implements an CBAM.

These could include exemptions, or longer timeframes as well as technical assistance and financial support for compliance. India should also continue to oppose the discriminatory provisions of the CBAM.

If left unopposed, there exists a potential peril wherein the EU could progressively broaden the scope of its designated product range in the forthcoming years, a direction that their official stance appears to indicate.

Beyond the potential trade distortions, a concern surrounding the CBAM mechanism pertains to funding the transition towards the adoption of less carbon-intensive production methods, particularly within the realms of least developed and emerging economies.

Considering the EU's leadership role in ambitious global climate targets, it is an opportune moment to remind the EU of its prior commitment to contribute $100 billion annually to facilitate developing economies in financing their climate-focused initiatives.

Indian companies can adopt various strategies to minimize the impact of the potential policy measures. One approach is to invest in renewable energy sources and energy-efficient technologies to decrease carbon emissions, consequently reducing the tax burden under the CBAM.

Another strategy involves optimizing supply chain processes to lower the carbon footprint of their products. Additionally, India is laying the groundwork for establishing a carbon market. The Ministry of Power released a draft of the Carbon Credits Trading Scheme (CCTS) on March 27, 2023, which outlines the institutional framework and operational mechanisms that will govern the future carbon credit market in India.

The Indian government is seized of the matter and has termed CBAM 'unjustifiable discrimination' on developing nations and that it is being 'selectively applied' to sectors that are in foreign trade in turn impacting their competitiveness.

While considering retaliatory measures against similar measures by the EU, India had pitched for mutual recognition of its carbon certificates as well as recognition of India's proposed Carbon Credit Trading System. India is also looking at promoting carbon auditors.

Moreover, India has sought special treatment for its MSMEs as almost half of such companies will be affected by CBAM. The Indian steel industry, among the CBAM-impacted sectors, is taking initiatives to switch to being renewable energy-powered and to green manufacturing processes.

The EU, which deems CBAM as not protectionist but a measure to fight climate change, has shown a willingness to collaborate with India to reduce the 'administrative burden' on businesses for CBAM compliance.

India must therefore implement a carbon pricing mechanism and advance the development of low-carbon technologies. These measures will assist Indian businesses in complying with potential policy measures to address carbon leakage and reduce the carbon intensity of their products.

Furthermore, India should re-evaluate its export strategy and explore alternative markets where its products can remain competitive if the potential policy measures to address carbon leakage are implemented. ■

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The views are personal and cannot be attributed to the organization to which the authors belong.

The EU must stop carbon leakage at the border to become climate neutral

The EU is committed to achieve climate neutrality by 2050. Justus Böning, Virginia di Nino and Till Folger argue that to meet this aim carbon leakage at the border must be stopped

The Emissions Trading System has been the cornerstone of the EU's efforts to achieve climate neutrality by 2050. However, as currently implemented, it does not charge a price for the carbon embedded on import goods. This column shows that while the scheme has been successful in curbing the EU's carbon emissions, this has come at the cost of increased imports of carbon-intensive goods. It also highlights how the extent to which firms can outsource their carbon emission depends on ownership structure, with foreign-owned firms better placed to reorganise production to avoid the scheme.

The EU is determined to achieve climate neutrality by 2050. The environmental benefits of this resolution will be global, but will the burden be equally shared worldwide? What is the risk for the EU to incentivise relocation or imports of high carbon footprint production from emissions havens?

Carbon leakage[1] is a risk of environmental policies adopted without international coordination (Ishikawa and Cheng 2021). While scholars tend to agree that leakage has remained limited after the introduction of the EU Emissions Trading System (ETS) (Dechezleprétre *et al* 2022, aus dem Moore *et al* 2019), they tend to argue in favour of exempting exports from carbon pricing (Weder di Mauro *et al* 2021).

However, their conclusions assume market conditions that the 'Fit for 55' package, with the aim of reducing net greenhouse gas (GHG) emissions in the EU by at least 55% by 2030, could rapidly change. In line with the reduction in emission allowances in recent years, the price of emissions, which represents the cost companies must pay for polluting in the EU and thus determines the incentive to relocate to unregulated regions, has increased considerably.

Against this backdrop, to preserve competitiveness of firms in the region and prevent carbon leakages, a carbon border adjustment mechanism (CBAM) on imports will charge foreign companies the same price paid by local businesses for their emissions when supplying the EU.

By charging the same price irrespective of the geographical location of emissions and producers, the CBAM aims at placing companies on an equal footing in the EU market, offsetting eventual competitiveness losses.

To preserve competitiveness of firms in the [EU] and prevent carbon leakages, a carbon border adjustment mechanism (CBAM) on imports will charge foreign companies the same price paid by local businesses for their emissions when supplying the EU

In this column, we contribute to the debate about the efficacy of EU green policies and their fallout on EU firms' competitiveness in three distinct ways. First, we provide new evidence on the ETS efficacy in curbing EU carbon emissions; at the same time, we highlight that the success came with costs. Carbon leakage occurred in regulated industries, and they appear less negligible than previously identified.

Second, we present the result of a novel study about the anti-competitive effects on EU industries associated to the ETS implementation. We shed light on the fact that uniformly applied policies can still produce differential effects on firms' output depending on their company's ownership structure.

Finally, because the choice to introduce a CBAM is connected to incentives for companies to dodge costly regulation, our analysis sheds light on the conditions under which it could deliver the EU's climate neutrality goal (Böning *et al* 2023).

The ETS has delivered on its mandate, but prompted carbon leakage in regulated industries

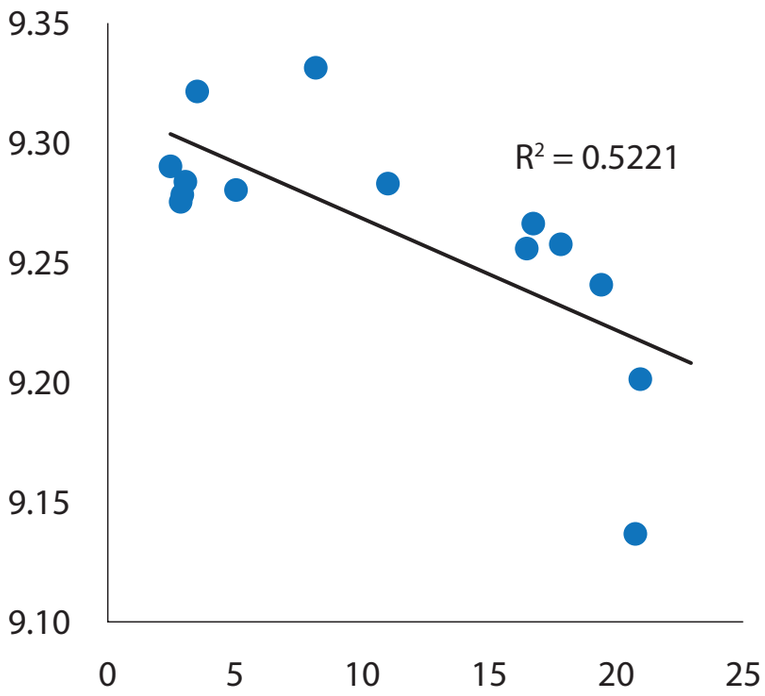
A provisional deal on a revised ETS has already been reached and the discussion about introducing a CBAM on imports are at an advanced stage[2]. A prerequisite for the new deal to work is proving that the existing ETS scheme has indeed reduced regional and global emissions. We determine the effectiveness of the ETS in two ways.

Firstly, by looking at yearly emissions we can see that these are negatively correlated with ETS stringency, which is proxied by the share of traded in total allowances in the previous year[3]. The linear negative association explains more than half of the variance in the average log of yearly emissions (see Chart 1).

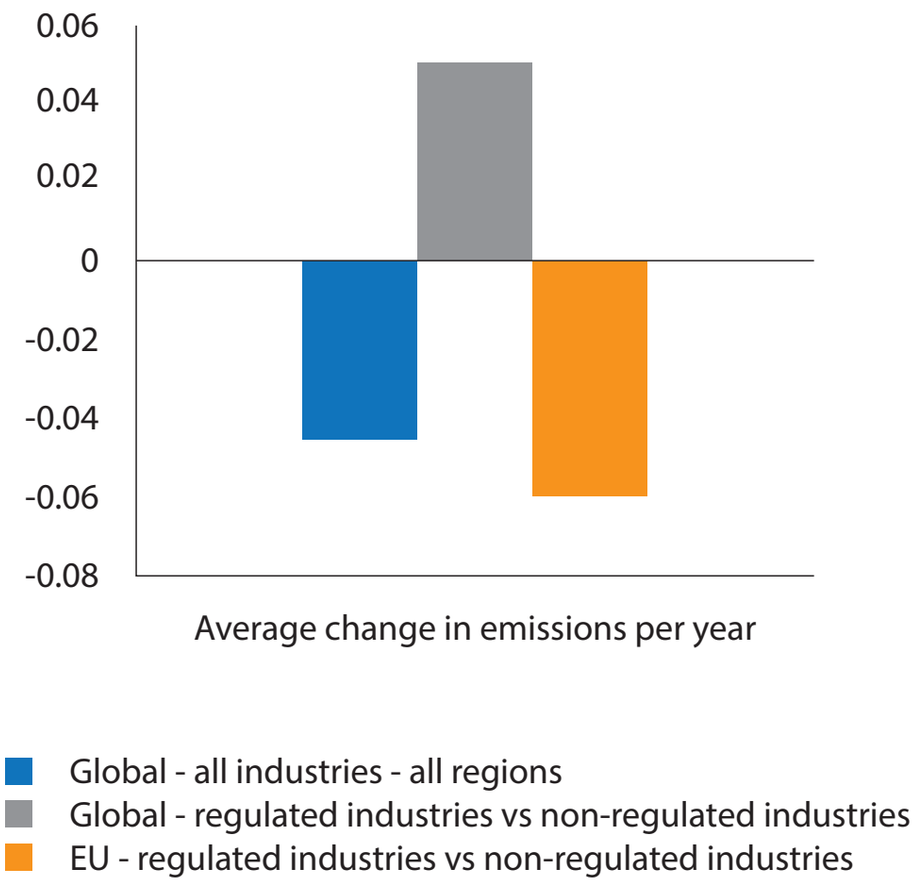
These are estimated to have declined by about 2 percentage points more for each unitary increase in the ETS stringency[4]. The economic mechanism can be summarised by some firms investing in cleaner technology and selling unneeded emissions allowances.

Figure 1. ETS efficacy and associated carbon leakages

a) Carbon emissions (vertical axis) against ETS stringency (horizontal axis)



b) 3D measures of the ETS benefits and costs - efficacy vs carbon leakages



Notes: The sectoral emissions plotted in the left hand side chart were regressed against sectoral trends, country, time and sector characteristics then averaged across sectors. The scatter bin-plot show that the emissions, unexplained by these determinants, correlate negatively with the ETS stringency. ETS stringency is proxied with the lagged value for the shares of traded allowances over total allowances. The 3D measure of ETS benefits and costs are derived from a diff-in-diff-in-diff estimate of yearly log emissions between 2005 and 2018, on its lagged value, country, sector, time fixed effects price of emissions, sectoral trend and country deterministic trends. The blue bars is the reduction in global emissions after the ETS came into force in 2005. The grey bar shows the change in emissions in ETS industries but global level. They are offsetting the global reduction. Last, the yellow bar depicts the average change in emissions of ETS industries in the EU relative to the average change in emissions of the same industries but global level (grey bar). Overall, EU efforts to reduce emissions were countered by the increase in global emissions of ETS industries.
Sources: Tonnes of CO_2 equivalent greenhouse gas emissions are from the European Environment Agency (EEA), which also provides the number of allowances and the amount of surrendered emissions by sector and country since 2005.

Meanwhile, other firms may cut back on production, thereby reducing emissions and allowing them to sell the saved emissions permits. To corroborate this hypothesis, we also find that pricier emissions and more stringent caps accelerated the EU greening process after 2013.

Thereby, we conclude that the pricing mechanism was effective as emissions declined faster the higher the stringency and the higher the price of each emission permit, in line with other analyses in the literature (Känzig 2023).

However, these achievements came with costs that are uncovered when the study is extended to unregulated industries and regions. A distinct analysis estimates the ETS's efficacy through a '3D' (difference-in-difference-in-difference) approach which leverages on the triple dimensional (time-sector-region heterogeneity) to identify the scheme's effects, while controlling for emissions autoregressive processes, sectoral trend and time, industry and country fixed effects. This second analysis confirms that the ETS resulted in cuts in the EU's GHG emissions of approximately 2–2.5 percentage points per year.

Nevertheless, unlike earlier studies which found limited empirical evidence of carbon leakages, our analysis finds that heavy emissions activities increased outside the EU, as emissions in regulated industries within the EU declined.

Against a backdrop of declining emissions since 2005 (Figure 1b, blue bar), the global yearly emissions by regulated industries rose over the same period (grey bar). Thus, the additional reduction in regulated industries within the EU (yellow bar) were offset by a simultaneous rise in emissions of those same industries elsewhere. This runs counter to the EU's efforts to also help reduce emissions globally.

The ETS's anti-competitive effects: a guide for the equal footing of the CBAM

In order to see whether the ETS equally incentivised all companies to relocate or import emission intensive inputs, we utilised information on sectoral output values and input-output linkages. We also distinguished companies by location (within and outside the EU) and ownership structure (domestic and foreign affiliates of multinational enterprises) which we match with industry's emissions and ETS prices[5].

We then regress the value of production by sector-country and ownership type on (1) emissions intensity by sector-country-ownership type, (2) exposure to emission intensive inputs distinguishing them by sourcing region (EU and outside the EU), and (3) the cost of the exposure to EU ETS regulation[6].

The aim is to verify whether a uniform regulation can trigger differentiated effects depending on the companies' ownership and the exposure of production to high-carbon footprint inputs, which are either sourced from within the EU and, hence, covered by the ETS or from outside the EU.

We find the EU production in regulated sectors to generally be more sensitive to emissions intensity than non-EU production, irrespective of the company ownership structure. We also find that purchasing high-emission inputs from within the EU translates into a competitive disadvantage for companies located within the EU.

For these companies, shifting the sourcing of inputs from within to outside the EU raises total production but to a different extent for domestic and foreign owned companies.

Specifically, the production of domestically owned companies in regulated industries from within the EU correlates negatively with the share of high-carbon footprint inputs sourced from within the EU and correlates positively with

the share of the same inputs when they are sourced from outside the EU. Production of foreign-owned companies behaves similarly in terms of correlations across sourcing regions.

However, the impact of a reshuffling across sources of emission intensive inputs from within to outside the EU grows larger as the price for allowances rises (Figure 2). Because ETS prices have risen in recent years and are anticipated to continue growing as the FIT-for-55 package comes into force, the incentive to change sources for foreign owned companies is ever growing.

Against this background, foreign-owned companies seem better placed to dodge the regulation and reshuffle their inputs sources in favour of those located outside the EU unless these are also held accountable for their emissions when supplying the EU customers.

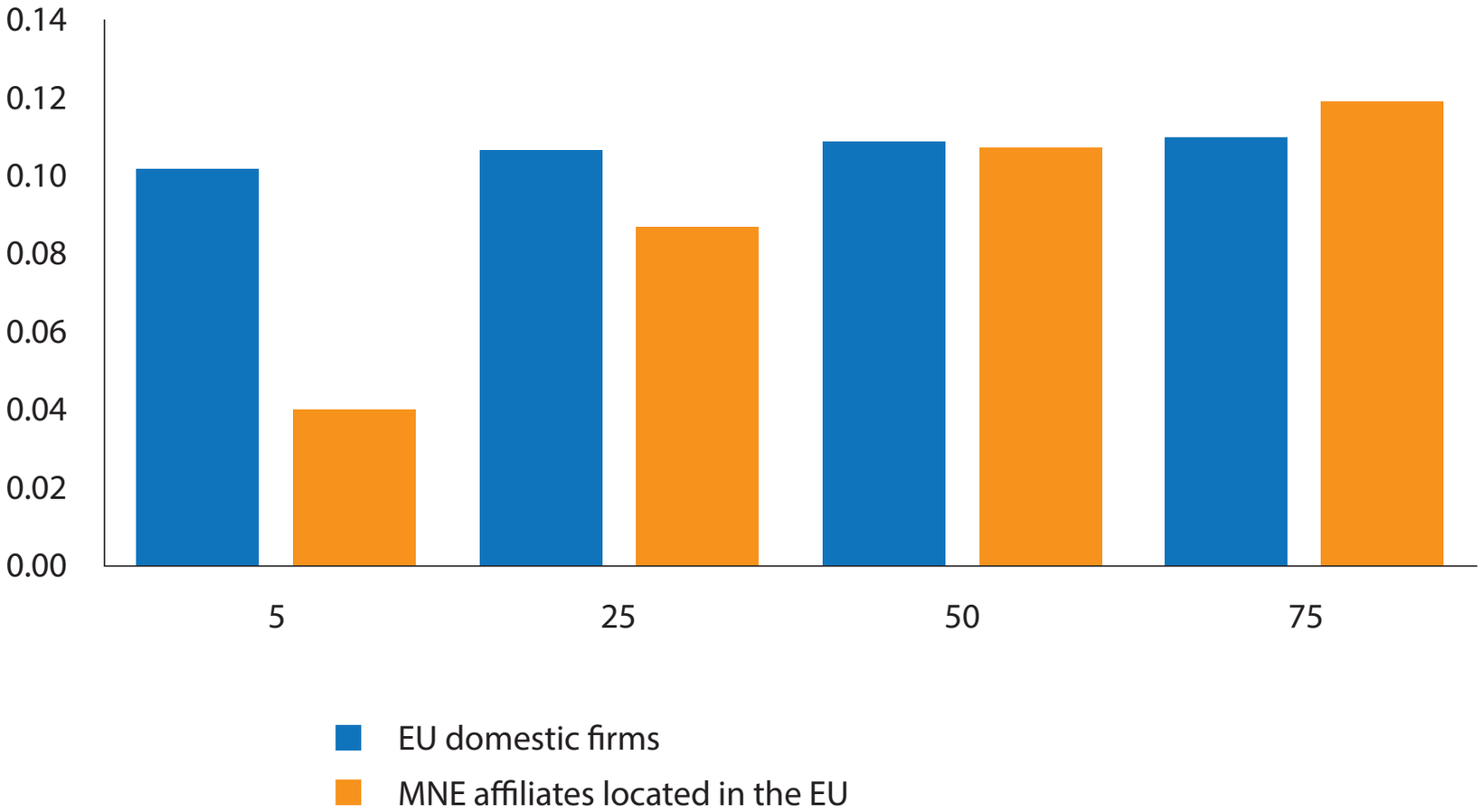
The analysis does not reach the same conclusions when investigating production of companies located in the EU but operating in unregulated sectors; reshuffling across input sources in this case did not lead to any sizeable increase in total production, at least not for the time under consideration.

Conclusion

Overall, our study confirms that the ETS is effective in curbing EU emissions, but at the cost of burdening companies in the EU, especially domestic ones, and triggering carbon leakages.

Different sensitivity of EU production to sourcing of emissions-intensive inputs depending on the company's ownership, suggests that some business models may have more leeway in reorganising production processes and sourcing high-carbon footprint inputs from outside the EU.

Figure 2. Sourcing high-carbon footprint inputs: The effect on production of a 1 percentage point shift from the regulated EU to unregulated regions (in percentage points)



Notes: The chart depicts the effect of a hypothetical shift by one percentage point across sourcing regions of high carbon footprint inputs from within to outside the EU based on estimates from regression analysis. The log value of sectoral production is regressed on country-sector-ownership fixed effects, emission intensity (emissions per euro worth of production), log value of inputs and the four shares of high carbon footprint inputs sourced from Domestic and MNE companies. The coefficient on these four regressors return the sensitivity of sectoral production to emission intensive inputs depending on regions they are originated, eg. from within and outside the EU. The specification also includes the interaction of these shares with the price paid on allowances in t-1, to capture the non-linearity of exposure to ETS regulation depending on the cost/price for allowances. The equation specification encompasses also deterministic country and industry trend and time unobserved heterogeneity, besides proper country-sector-ownership type fixed effects. Matching the AMNE and WIOD databases eventually yields 34 sectors and 44 countries (including RoW) spanning 2000-2016. Regulated (ETS) industries are Coke and refined petroleum products (C19), Basic metals (C24), Other non-metallic mineral products (C23), Electricity, gas, water, waste and remediation (DTE), and Transport and storage (H).
Sources: OECD-AMNE, authors estimations

Because the new EU environmental legislation aims at preventing similar behaviour through the CBAM, there is a need for a careful design of this mechanism, in terms of equivalent tariff charged on emissions embedded in imports and of CBAM industry's coverage. Our analysis advises in favour of extending the application of a CBAM on all regulated productions. ■

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Endnotes

1. According to the European Commission website, "[c]arbon leakage refers to the situation that may occur if, for reasons of costs related to climate policies, businesses were to transfer production to other countries with laxer emission constraints. This could lead to an increase in their total emissions. The risk of carbon leakage may be higher in certain energy-intensive industries" (https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/free-allocation/carbon-leakage_en)

2. Both these tools are devised to strike the best possible trade-off between carbon emissions reduction and the preservation of production competitiveness in the region by minimising the occurrence of carbon leakages also taking into consideration administrative, technical and political aspects related to their enforcement. The remodelled ETS envisages stricter trading rules, extends the industry coverage, in particular to transport and buildings, and cuts more decidedly on emission allowances. More importantly it gradually phases out the free carbon allowances, granted to emission-intensive and trade-exposed (EITE) industries to prevent carbon leakages. The EITE industries are those with an increase in direct and indirect production costs induced by the ETS, as a proportion of the gross value added, by at least 5%; and that operate in sectors with trade intensity with non-EU countries (imports and exports) above 10%. In this context, a CBAM on imports of certain EITE products (cement, iron, steel, aluminium, fertilisers, and electricity) is phased in as of 2026 to guard EU production from the competition of foreign companies operating in unregulated regions. Importers will buy certificates proportional to the emissions embedded in imports at the ETS market price. For further details, see https://www.consilium.europa.eu/en/press/press-releases/2022/03/15/carbon-border-adjustment-mechanism-cbam-council-agrees-its-negotiating-mandate/ https://www.consilium.europa.eu/en/press/press-releases/2022/12/18/fit-for-55-council-and-parliament-reach-provisional-deal-on-eu-emissions-trading-system-and-the-social-climate-fund/. Stepping up Europe's 2030 climate ambition - Investing in a climate-neutral future for the benefit of our people," Communication.

3. For a given technology and industry's production, the ratio of traded over total surrendered allowances rises in those sectors where granted allowances become scantier, mimicking the degree of sectoral stringency of the emissions'

regulation. However, the contemporaneous values of these sectoral ratios could be plagued by endogeneity since they co-move with relative industry's production, thus pushing up also the traded ones. Thereby in our study, the ETS stringency is defined by the share of traded allowances over total surrendered allowances per regulated sector at t-1. Intuitively if in a given period companies were forced to purchase a higher share of total emissions, their production cost will increase proportionally to the spending on allowances, incentivizing them to cut down on emissions the year after. This is what our empirical estimates confirm.

4. The sectoral emissions are regressed against sectoral trends, country, time, sector characteristics, the ETS stringency (e.g. share of traded in total allowances) and the cost associated to the traded emissions.

5. Data on gross output by country and sector, the share of emission-intensive inputs and imports on total were obtained from the OECD AMNE database that distinguishes companies according to domestic and foreign ownership (see Cadestin et al. 2018). The period covered spans 2005-2016

6. The exposure is defined by the share of high carbon footprint inputs on total inputs. The cost is the same share multiplied by the price of emission allowances per period. In the attempt to eliminate any bias which could affect the results coming from other unobservable factors affecting production which are unrelated to the ETS, the analysis controls for 3D fixed effects (sector-country-ownership), include time fixed effects and sectoral and country deterministic trends.

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Rebooting the EUs Net Zero Industry Act

Simone Tagliapietra, Reinhilde Veugelers and Jeromin Zettelmeyer argue that the EU should reboot the proposal and refocus its objectives, improve its governance and add financial incentives to ensure implementation

Executive summary

In March 2023, the European Commission published a legislative proposal for an EU response to the US Inflation Reduction Act: the Net Zero Industry Act (NZIA). It is an unconvincing policy proposal, both for what is in it and for what is not in it.

The proposal has five problematic aspects. First, it takes a top-down approach, in which specific technologies are selected for preferential treatment. Preferable would be a technology-neutral approach open to all current and future technologies that help tackle the net zero challenge.

Second, its blanket 40 percent self-sufficiency benchmark for EU domestic cleantech manufacturing by 2030 sends a protectionist signal, is poorly defined and does not reflect the differences in EU capacity in the cleantech sector.

Third, it relies on the acceleration of permitting procedures as the main policy instrument, although this is not the main obstacle to cleantech investment in the EU.

Fourth, it proposes more strategic use of public procurement. While this is an objective to be supported, the specific proposals are likely to be ineffective because of the way they are designed. Fifth and not least, the NZIA would lack a governance structure that would ensure effective implementation.

In addition, the NZIA does not tackle three critical issues. It does not address investment obstacles related to failures of the single market. It does not tackle the coordination problem at the core of developing an EU green industrial policy.

Finally, it does not develop an EU-level funding strategy, but rather relies on state aid, with the related risk of fragmentation.

The European Parliament and EU countries in the Council of the EU should reboot the proposal and refocus its objectives, sharpening its limited instruments, improving its governance, and adding financial incentives to ensure implementation.

In parallel, the EU should develop a broader green industrial policy strategy that leverages the single market in a credible manner, building a solid new governance framework and a new EU-level funding approach.

The EU needs to preserve the power of its competition policy toolbox to avoid incumbency, protectionist and rent-seeking traps

1 Introduction

Europe's industrial policy, with its green and digital twin focus, has long emphasised resilience and 'open strategic autonomy' as a policy objective. The declared aim of the European Commission's March 2020 New Industrial Strategy for Europe was to manage the green and digital transitions while avoiding external dependencies, particularly on China (European Commission, 2020).

Its policy goals included securing the supply of clean technologies and critical raw materials, stepping up investment in green research, innovation, deployment and up-to-date infrastructure, creating lead markets in clean technologies and making more strategic use of single-market regulations, public-procurement rules and competition policy.

One day after the publication of the strategy, the World Health Organisation declared the COVID-19 outbreak a pandemic. That shock, with all its consequences for the emergency procurement of personal protective equipment and vaccines, challenged the strategy and led to a substantial revision in May 2021.

The updated strategy emphasised strengthening the resilience of the single market in key areas including health, green and digital policy. This would be done by diversifying international partnerships, developing Europe's strategic industrial capacities and monitoring strategic dependencies (European Commission, 2021).

Additional concerns about strategic autonomy have now made Europe's quest for a green industrial policy even more pressing. The war in Ukraine has further highlighted Europe's geostrategic vulnerabilities, including fears about the possibility of China weaponising cleantech and critical raw materials exports in a similar way to what was done by Russia with gas supplies.

The United States's 2022 Inflation Reduction Act (IRA) has been another wake-up call for Europe to scale-up its cleantech efforts and establish itself as a competitive, autonomous player in what are considered to be major growth sectors. The International Energy Agency estimates that the global market for key manufactured clean technologies will triple in size by 2030 (IEA, 2023).

Facing these strategic autonomy and economic competitiveness pressures, the European Commission is again seeking to revise its industrial policy proposals. This is a difficult task for at least three reasons.

First, EU countries differ in terms of industrial structure, geography, preferences for certain technologies and fiscal space. These differences influence how they think about achieving resilience and open strategic autonomy. They also imply that EU-level proposals can be divisive (and they usually are).

Second, even setting aside these differences, the question of how resilience and strategic autonomy should be defined and achieved is difficult to answer. What are the most effective and efficient policy instruments to achieve resilience? To what extent are there trade-offs with other critical policy objectives, including economic efficiency, growth and rapid decarbonisation? How far should the EU move away from a horizontal approach shaping framework conditions, such as strong competition policy and open trade, towards a vertical approach that favours specific industries and projects?

Third, the EU has limited industrial policy powers. While the European Commission leads on competition and trade policy, it has much weaker instruments to influence public investment, innovation and skills. For instance, its Horizon Europe budget for research and innovation (R&I) only covers about 7 percent of public R&I spending on cleantech by EU countries (European Commission, 2022).

Spurred by the shock of the Russian invasion, geopolitical tensions and the challenge presented by the US IRA, the European Commission in March 2023 published two important legislative proposals: for a Net Zero Industry Act (NZIA) (European Commission, 2023b) and a Critical Raw Materials Act[1]. This policy brief focuses on the NZIA[2].

We describe and review the key elements of the proposal. We also point out obstacles to cleantech reform that the NZIA does not address, in part because these obstacles relate to single market and EU governance failures that require a broader solution.

Accordingly, our policy recommendations include both a proposal to revamp the NZIA and a vision for an EU green industrial policy beyond the NZIA.

2 Key elements of the NZIA

The proposed NZIA is an industrial policy to promote cleantech manufacturing, organised in four steps. First, it lists net zero technologies considered to be 'strategic'. These include solar photovoltaic and solar thermal, onshore wind and offshore renewables, batteries and storage, heat pumps and geothermal energy, electrolysers and fuel cells, sustainable biogas and biomethane, carbon capture and storage (CCS) and grid technologies.

Second, it would set an overall benchmark target for EU domestic manufacturing in these technologies to meet at least 40 percent of the EU's annual deployment needs by 2030. The NZIA also proposes a target for an annual injection capacity in CO_2 storage of 50 megatonnes (Mt) CO_2 by 2030, to spur the development of CCS.

Third, it outlines a governance system based on the identification of Net Zero Strategic Projects (NZSPs) by member states, with a minimal check by the European Commission. NZSPs must contribute to CO_2 reductions, competitiveness and security of supply, and should involve technologies close to commercialisation[3].

This approach represents a break with what has been done so far: support focused on earlier stages of technology development, including research, early-stage development and prototyping.

Fourth, the NZIA outlines a set of policy instruments, mostly at national level, to support the selected NZIA projects:

1. Acceleration of permitting and related administrative procedures, within time limits pre-set by the EU, including by identifying a one-stop-shop national authority in charge of these projects.

2. Coordination of private funding. The Commission estimates that meeting the headline 40 percent target by 2030 will require €92 billion in investment, with the bulk (around 80 percent) coming from the private sector, to be facilitated by a 'Net Zero Europe Platform fostering contacts and making use of existing industry alliances'.

3. Limited public subsidies, mainly at national level (see below). Support for NZSPs is to be prioritised in national and EU budgets. However, the NZIA proposal does not allocate new EU-level funding, and neither is such funding being allocated in parallel[4].

4. Public procurement procedures and auctions, which are to include 'sustainability and resilience criteria, which can be given a weight of up to 15-30 percent. At the same time, bids that propose the use of equipment for which a non-EU country of origin provides at least 65 percent of EU supply are to be disadvantaged.

The NZIA proposal also mentions other areas, including regulatory sandboxes and the skills agenda, but without implementation details. Although the Commission acknowledges skills shortages as a major barrier (an estimated shortfall of 180,000 skilled workers in hydrogen and 66,000 in solar PV in 2030, for example), the NZIA does not

develop a strategy to tackle this problem, limiting itself to coordinating initiatives, such as Net Zero Industry Academies, through the Net Zero Europe Platform.

Since EU countries are assigned the role of main provider of public funds for NZSPs, it is important to read the NZIA in parallel with the Temporary Crisis and Transition Framework (TCTF), modified by the European Commission in early March 2023 in response to the IRA (European Commission, 2023c).

The TCTF outlines conditions under which the Commission will approve 'aid accelerated investments in sectors strategic for the transition towards a net zero economy', defined as batteries, solar panels, wind turbines, heat pumps, electrolysers and carbon capture usage and storage, as well as the production and recycling of priority components and critical raw materials[5]. Specifically, EU countries are allowed to:

1. Provide more support to cleantech production located in disadvantaged regions, capped at a certain percentage of the investment costs and nominal amounts, depending on the location of the investment and the size of the beneficiary;

2. Grant higher percentages of the investment costs if the aid is provided via tax advantages, loans or guarantees. This implies that state aid is not limited to funding capital expenditures but that operating expenditures (OPEX) can also be covered, up to the identified funding gap. This approach is novel for Europe as it has been only rarely adopted previously, most notably in the case of cohesion regions;

3. Provide matching aid, that is, the amount of support the beneficiary could receive for an equivalent investment in the alternative location, or the amount needed to incentivise the company to locate the investment in the EU. This part is perhaps the clearest revision of the state-aid guidelines as a reaction to the IRA.

This matching-aid option requires individual notification and must respect several safeguards: (i) investments must be in assisted areas, as defined in the applicable regional aid map; or (ii) crossborder investments involving projects located in at least three countries, with a significant part of the overall investment taking place in at least two assisted areas, one of which is an 'a' area (outermost regions or regions where the GDP per capita is below or equal to 75 percent of the EU average).

Furthermore, the beneficiary should use state-of-the-art production technology from an environmental emissions perspective. Finally, the aid cannot trigger relocation of investment between EU members.

3 Problems with the current proposal

Taking the scope of the NZIA as given, five issues are problematic.

3.1 Technological scope is overly selective

First, the NZIA adopts a top-down approach in which policymakers seek to promote a pre-defined set of technologies, and within these, specific projects considered 'strategic' for the transition to net zero. This can lead to two problems: policymakers may end up backing the wrong technology, and this backing may generate unnecessary and damaging costs.

While the list of NZIA technologies contains most of the major technologies currently in use or close to commercialisation, it excludes others. For example, while the proposal recognises that 'advanced technologies to produce energy from nuclear processes with minimal waste from the fuel cycle, small modular reactors, and related best-in-class fuels' are net zero technologies, it does not include them in the list of strategic net zero technologies, thus preventing them from becoming NZSPs.

The same is true for technologies for improving energy efficiency, early-stage technologies such as near-zero materials or direct air capture, and – obviously – technologies not yet on the public radar.

Because of the high path-dependencies in green technologies and the high degree of uncertainty intrinsic to technological innovation, industrial policy that seeks to promote a pre-defined set of green technologies can lead to inferior outcomes. It would have been better to adopt a technology-neutral approach, open to any project and technology that can contribute to lower emissions and greater competitiveness and resilience.

An additional concern applies even when the selected technology is in fact the right one. The proposed NZIA asks EU countries to promote projects based solely on their propensity to advance or commercialise that technology. However, many such projects may not need public support. In rare cases, such support could be costless (for example, if it consists of waiving a bureaucratic requirement that has no merit in the first place).

Mostly, however, support involves a cost, whether in the form of public money, lighter environmental checks or a distortion of competition (tilting the playing field against projects and companies that are not selected). As a result, NZIA promotion may, in some cases, do more harm than good.

In sum, the procedure for determining NZSPs seems unlikely to properly balance the risk of government failure against the market failures it is trying to address. In the presence of technological path-dependency, it may even exacerbate market failures.

3.2 The 40 percent benchmark is problematic

Second, the NZIA adopts a 40 percent self-sufficiency benchmark for domestic manufacturing as the only relevant indicator of 'strategic autonomy'. This is problematic for several reasons.

1. It disregards the costs of promoting self-sufficiency in particular technologies, compared to the use of cheaper imports. As a result, it is unclear whether meeting such a target would accelerate or slow EU decarbonisation and whether it would in fact advance resilience, which is more closely related to the concentration of imports than their overall volumes (Welslau and Zachmann, 2023). No impact assessment, whether on cost, emissions reductions or resilience objectives, was performed to justify the 40 percent domestic manufacturing target.

2. Even if an import substitution target is viewed as necessary for achieving strategic autonomy, it is unclear why this benchmark should apply across all NZIA technologies, which differ in many ways: in terms of their current domestic manufacturing capacity (see Sgaravatti *et al* 2023), the costs of expanding domestic manufacturing in the EU compared to alternatives, and the lead times for expanding production.

3. The extent to which the target applies to component parts of the identified net zero technologies is also unclear. Several of these components are very important and represent a major bottleneck for domestic manufacturing in Europe.

3.3 The focus on fast-track permitting is misplaced

Third, a major focus of the proposal is the fast-tracking of permitting procedures for NZIA technologies. While improving permitting procedures is always a good idea (not only for strategic projects), its relevance as a determinant of investment in this context is not clear.

Permitting times represent a significant drag on the deployment of renewable energy, CCS projects and mining projects, but not normally for the manufacturing industry. In the EU, the principal obstacles to manufacturing production and investment tend to be skills and access to funding (see EIB, 2022).

Thus, it is unlikely that fast-tracking of permitting and administrative procedures will provide a significant boost to cleantech investment in Europe.

3.4 Strategic use of public procurement is irrelevant in practice

Fourth, while the NZIA emphasises more strategic use of public procurement, its actual proposals risk being irrelevant in practice. The 'sustainability and resilience' award criteria introduced by the NZIA can be ignored if applying them results in a 'disproportionate cost' for an EU country, defined as a cost gap between the domestic technology and foreign technology of more than 10 percent.

Considering that European domestic manufacturing of certain clean technologies – most notably those in which Europe is lagging, like solar panels – remains considerably more expensive than in Asia, such cost gaps may be common and the NZIA criteria are unlikely to be much applied.

3.5 Governance is light

Fifth, the governance of the NZIA looks light. EU-level oversight of national decisions is envisaged to be minimal, although projects support by member states will generally receive preferential treatment (whether financial or non-financial).

European Commission monitoring is supposed to focus on whether manufacturing capacity in the EU grows in line with the 40 percent self-sufficiency target. There is no mechanism to check the selection of NZIA projects by EU countries with respect to their effectiveness in meeting climate or resilience targets, their proportionality and their impact on the level playing field.

The proposal mentions the Net Zero Europe Platform as a governance tool, but its purpose seems to be the coordination of public instruments and links to private investment sources, not to ensure that the right projects are selected and that the NZIA meets its ultimate objectives at an acceptable cost.

In terms of monitoring progress and evaluating impact, the proposal mentions that an evaluation will be done by the European Commission after three years and then regularly thereafter. But it is unclear how this process will be organised and implemented, running the risk that it will be little more than a nominal exercise. And it remains unclear what will happen if the EU is not on track on certain technologies.

It is also worth mentioning that, as in the case of other recent legislative proposals, such as the March 2023 Electricity Market Design reform proposal[6], the NZIA proposal did not pass through the usual ex-ante exercise done by the European Commission services to assess the likely impact of the proposal compared to alternatives. It was only followed-up by a working document discussing NZIA investment needs and funding options (European Commission, 2023a).

4 What is missing from the NZIA

The NZIA's premise is that cleantech in the EU can and should be promoted by improving the business environment specifically for cleantech. However, cleantech investors face many of the same barriers that constrain other categories of private investment in Europe, including lack of access to finance, high energy costs, policy fragmentation and scarcity of critical skills.

Addressing these barriers may be more useful, even from the narrow perspective of promoting cleantech, than giving preferential treatment to cleantech projects.

Reducing these obstacles would require much more comprehensive reforms than proposed in the NZIA. These include a more integrated European electricity market that would help to lower energy costs structurally, an EU-wide strategy to develop and improve (green) tech skills, and the creation of a banking and capital markets union to overcome Europe's highly bank-dominated and fragmented financial system and mobilise private capital for cleantech (Kleimann *et al* 2023).

Furthermore, those reforms would promote not only cleantech investment, but would foster growth and competitiveness in the EU more broadly.

The proposed NZIA is also too narrow in that it does not tackle the central problem plaguing EU green industrial policymaking: lack of coordination. Europe has a multitude of green industrial policy initiatives at EU level, adding to the multitude of policy initiatives at national and regional levels (Tagliapietra and Veugelers, 2021).

These initiatives are generally not coordinated and may even conflict. Uncoordinated industrial policies fail to capitalise on EU economies and synergies scale and could undermine the level playing field across Europe.

While the NZIA proposes a Net Zero Europe Platform to coordinate the preferential treatment of projects selected, this does little to address the fragmented state of cleantech industrial policymaking in the EU and risks worsening this fragmentation further.

In recent years, the EU has tried to foster an industrial policy aimed at creating European ecosystems for the manufacturing of batteries and electrolysers, via European Alliances and related Important Projects of Common European Interest (IPCEIs).

Although the IPCEIs are financed by EU countries, they require crossborder EU cooperation and their formation and selection are coordinated by the European Commission and assessed for compatibility with state aid guidelines.

While it is too early to assess their effectiveness, they are designed to capitalise on EU scale and protect the single market. By focusing almost exclusively on the promotion of individual projects at national level, the NZIA takes a step in the wrong direction.

Finally, and related to the need for a consistent EU-wide industrial policy, the proposed NZIA lacks a solid EU-level funding instrument. A Strategic Technologies for Europe Platform (STEP) proposed by the EU on 20 June 2023, does not provide new fresh EU resources but rather repackages existing ones.

This initiative also has a much broader scope than NZIA, covering all sorts of 'strategic technologies', including clean, digital and biotechnologies[7].

Public financial support for cleantech would thus need to come mainly from EU countries' regular budgets, which risks jeopardising the single market's level playing field. This risk might materialise quickly if countries with more fiscal space decide to create their own green industrial policy packages.

For instance, if Germany goes ahead with a large subsidy scheme to lower electricity costs in energy-intensive industries in general, and cleantech manufacturers in particular[8], it will likely trigger a backlash from other member states, as seen after Germany's adoption of the €200 billion 'economic defence shield' to counter rising energy prices (Tagliapietra *et al* 2022). The same goes for France's plan to adopt a 'green industry bill', including generous tax credits for national cleantech manufacturers[9].

There is a case for public subsidies, for early stage, high-risk clean technology in particular, but also for the early deployment of more mature technologies. Delivering these subsidies at EU level would avoid fragmenting the single market and better exploit the scale of the EU by harnessing EU-wide synergies, internalising knowledge spillovers and improving cost and risk sharing.

The NZIA could have been an opportunity to streamline and unify EU funding tools that could be used for cleantech manufacturing, to create a new EU funding instrument if needed and to better coordinate with and between national funding tools.

5 Recommendations for NZIA 2.0 and a broader EU green industrial policy strategy

As proposed, the NZIA is unlikely to achieve its aims, while likely generating unintended costs. It also falls well short of a comprehensive green industrial policy for Europe. To promote cleantech manufacturing, two steps should be taken.

First, in the legislative process, the NZIA should be rebooted, to make sure that at least some specific areas of intervention are dealt with efficiently and that the risk of unintended consequences is minimised.

Second, the EU needs to move beyond the scope of the NZIA and start working on the development of a broader EU green industrial policy strategy.

5.1 Rebooting the NZIA

5.1.1 Refocus the objectives

- Drop the 40 percent domestic manufacturing target and replace it with key performance indicators (KPIs) that capture the trend and resilience effects of cleantech investment.

The success of the NZIA should be measured on the basis of whether it can mobilise the massive private investments required to meet Europe's cleantech needs, and whether these make Europe more competitive and more resilient. Such KPIs should replace the ad-hoc 40 percent domestic manufacturing target.

- Adopt a technology-neutral approach instead of cherry-picking specific technologies, in order to include all technologies that today and in the future could contribute to reaching Europe's climate, competitiveness and resilience goals.

5.1.2 Sharpen the instruments

- Make sure the NZIA delivers on its key goal of streamlining permitting. While permitting is not necessarily the most important barrier to the development of cleantech manufacturing in Europe, it is – and will realistically remain – a useful NZIA instrument.

  At this point, it is important to ensure that the NZIA delivers on this item. This will not necessarily be easy, considering member states' competence in this area, but it will require stronger governance than what is currently envisaged.

- Be bolder on strategic public procurement. NZIA takes a first step towards more strategic utilisation of public procurement. This is good news, as public procurement has so far been a neglected instrument in the European Green Deal toolbox (Sapir *et al* 2022).

  However, the 10 percent cost-gap safeguard included in the proposal (allowing the procuring authority to choose the cheaper bid, even if it has a lower sustainability score, if the cost gap exceeds 10 percent) will likely make this step irrelevant.

One way of making it more effective while limiting the cost for procuring authorities might could involve: (i) linking the cost-gap safeguard threshold to the sustainability and resilience score of a bid, up to some maximum (for example, for projects that do very well on sustainability and resilience it could be as high as 30 percent); (ii) partly subsidise, using EU funds, the difference between the costs of the winning bid (taking account of the resilience and sustainability score) and the lowest-cost bid (see discussion of financial incentives below).

5.1.3 To ensure implementation, strengthen governance and offer financial incentives

To make sure these instruments are used effectively, the NZIA 2.0 requires both strong governance and the right financial incentives.

- Strong governance is needed to address the key challenge in developing an EU green industrial policy: coordination. Alignment of different stakeholders, policy competences and instruments must be steered to achieve the stated objectives.

The NZIA proposal does not tackle this central point, referring only to the establishment of a Net Zero Europe Platform, which seems to be conceived as a forum to share best practices rather than a real steering and coordination body.

NZIA 2.0 needs to ensure that the European Commission plays a meaningful coordination role, starting with closer coordination between the main relevant Commission directorates for the NZIA: internal market, competition, energy, growth and trade.

Strong governance is also required to monitor and evaluate which NZIA policy interventions work and which do not, measured against the KPI of growing private cleantech investment. This will help learn fast and adapt policymaking fast, if needed.

- As the EU has limited tools to foster national action and steer coordination, it must be able to offer some incentives. Limited EU resources should be used to part-pay for projects that involve pan-European collaboration.

  When it comes to strategic procurement, EU funds (including the EU Innovation Fund, REPowerEU or Cohesion Funds) could be used to part-fund national public procurement of innovative clean technologies, to encourage the roll-out of clean technologies at EU scale without creating excessive costs for the government entities undertaking the procurement.

5.2 Developing a broader EU green industrial policy strategy

To develop a full-fledged green industrial policy, the EU needs to leverage its greatest asset: the single market. Only a well-functioning, globally linked EU market will be able to achieve a similar scale to the domestic markets of the United States and China.

Fragmented national measures will not lead to private investments in cleantech ecosystems at the scale that Europe needs to become a globally competitive, resilient, cleantech powerhouse. To achieve this, the EU needs to foster and deepen its single market for goods, services, components, energy, capital, people and ideas.

Without such 'horizontal' policies, targeted 'vertical' policies (including NZIA instruments such as permitting, public procurement and skills) will not deliver results at the needed scale.

Take the example of skills. This is a major bottleneck for the development of cleantech manufacturing in Europe, more than permitting. While the EU has limited competence in this field, providing the right incentives to member states could catalyse national action.

At the same time, single market reforms require a new push, including capital markets union, electricity market design and alignment of EU cleantech regulations. To be a forceful lever for private cleantech manufacturing investment, the single market must be open and competitive.

The EU needs to preserve the power of its competition policy toolbox to avoid incumbency, protectionist and rent-seeking traps. EU trade policy should not fall into a reciprocal protectionist trap: it needs to remain open to allow the EU to import intermediate goods and natural resources that it cannot competitively produce itself, and to help keep export markets open.

Most of these horizontal framework conditions have been essential for EU competitiveness in the past and are now more important than ever.

To promote a broad and strong green industrial policy, the EU needs to take a step further on governance. The EU should reinforce governance by creating a competent and empowered body, which is sufficiently politically independent – or detached from political pressures – yet accountable for its achievements with a set of clear, realistic milestones and targets.

The US experience can be inspiring in this regard. After the approval of the Inflation Reduction Act, President Biden appointed John Podesta as Senior Advisor to the President for Clean Energy Innovation and Implementation and Chair of the President's National Climate Task Force, with a mandate to oversee the implementation of the IRA's clean energy and climate provisions.

A similar move by the European Commission might make sense, to ensure top-level coordination and political steering of the overall process – which is vital for the longer-term socio-economic and political sustainability of the

European Green Deal and its aim of being Europe's new growth strategy. An EU counterpart to Podesta might also pave the way for better EU-US coordination of cleantech industrial policy, to avoid spiralling subsidy wars.

A broad and solid EU green industrial policy also requires a new EU-level funding strategy. To accompany the implementation of a broader green industrial policy, the EU will need a new funding strategy.

Otherwise, public incentives to spur private investment in cleantech would come from national state aid, which would create risks of single-market fragmentation and fan political tensions between EU countries.

A new EU strategy in the field should:

1. focus on supporting the development and scaling-up of pan-European public-private ecosystems;

2. support the whole innovation cycle of cleantech in an integrated manner, from disruptive innovation to deployment at scale;

3. prioritise areas in which market, network and transition failures are most likely and government selection failures least likely, ensuring additionality and leveraging of other (member state) public and private funding;

4. fit within a portfolio of funding instruments, which is well balanced between top-down and bottom-up solicited projects.

To achieve these goals, the EU could consider the creation of an EU version of the US Advanced Research Projects Agency, with an emphasis on Energy and Climate ('ARPA-EC'), aimed at fostering high-risk, early-stage development projects for new cleantech manufacturing technologies[10].

An EU ARPA-EC could also issue competitive tenders for new technological alternatives to critical components, products or services when there are supply concerns in existing green technologies, thus addressing the EU's demand for resilience and autonomy by calling on the EU's science and innovation capacity.

ARPA-EC should connect to complementary funding schemes, both at national and at EU level, including the European Resarch Council (ERC) and European Innovation Council (EIC). The ERC and EIC should maintain their focus on supporting bottom-up ideas, thus balancing the top-down cleantech NZIA programmes.

It is important to stress that an ARPA-style approach requires more than just importing a label. To ensure the unique character of an ARPA-EC as risk-taking public funder for energy and climate, sufficient funding will be required, to allow it to take a portfolio approach and make multiple high-risk bets.

Equally important is to design it properly for success, most notably, by giving autonomy and organisational flexibility, especially flexibility to recruit and accommodate the venture-capital entrepreneur type of policy programmers and officers.

Calls must have clear quantifiable goals and trackable metrics, so that policy officers can be given high levels of autonomy, together with clear mandates and accountability.

The EU could also fund the creation of support schemes designed to top-up national and other EU funding in projects that demonstrate pan-European collaboration or coordination, contributing to the creation of cleantech ecosystems at EU scale.

A particular line of action to address the critical lack of skills for green investments, would be the funding of programmes to stimulate the intra- and extra- EU mobility of cleantech skills[11]. These could be targeted specifically at fostering intra-EU mobility between upstream and downstream parts of European cleantech ecosystems.

6 Conclusion

The US Inflation Reduction Act has revived Europe's deep-seated fears of de-industrialisation and of missing out on the growth opportunities of cleantech manufacturing. Such a reaction should not be surprising: turning brown jobs into green jobs represents an essential condition for Europe to maintain and strengthen its socio-economic model – and welfare state – while meeting its decarbonisation goals.

This is the fundamental reason why the EU has adopted the European Green Deal as its growth strategy. At the same time, the EU's recent experience with overreliance on Russian gas has made the security of clean-energy supply, and more generally resilience to trade disruptions, a central policy objective.

The NZIA as proposed by the European Commission is a partial and poorly designed green industrial policy that is unlikely to deliver meaningful results in relation to the triple objective of EU decarbonisation, competitiveness and resilience.

The European Parliament and EU members in the Council of the EU must reboot the NZIA and make sure it both delivers on its limited scope of action and minimises the risk of unintended consequences.

In parallel, the EU needs to advance a much broader and stronger green industrial policy strategy, resting on three pillars: horizontal single-market reforms, an upgraded steering and co-ordination body at the EU level, and a strong,

central advanced research funding agency in the mould of ARPA. Delivering on this strategy should be a priority goal of the new EU institutional cycle from 2024. ■

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Endnotes

1. See European Commission press release of 16 March 2023, https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1661.

2. For an assessment of the Critical Raw Materials Act see Le Mouel and Poitiers (2023).

3. TRL (technology readiness level) classifies technologies by their stage of development. NZIA targets TRL 8 indicating technologies that have been tested and 'flight qualified' and are ready for implementation into an existing technology.

4. An EU-level 'Sovereignty Fund', which might include clean-tech support, mentioned in speeches by Commission President Ursula von der Leyen in spring 2023, has not materialised. Instead, on 20 June, the Commission proposed a repackaging of existing EU funds under a so-called Strategic Technologies for Europe Platform (STEP), introducing a "sovereignty seal" as an "EU quality label for sovereignty projects" and a "sovereignty portal" for accessing funding opportunities under STEP. See European Commission press release of 20 June 2023, https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_3347.

5. See https://competition-policy.ec.europa.eu/system/files/2023-03/overview_of_TCTF_section_2.8_schemes.pdf.

6. See European Commission press release of 14 March 2023, https://ec.europa.eu/commission/presscorner/detail/en/IP_23_1591.

7. See European Commission press release of 20 June 2023, https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_3347.

8. As proposed by Germany's economy minister. See Federal Ministry of Economic Affairs and Climate Action press release of 5 May 2023, https://www.bmwk.de/Redaktion/DE/Pressemitteilungen/2023/05/20230505-habeck-legt-arbeitspapier-zum-industriestrompreis-vor.html.

9. See Élysée press release of 11 May 2023, https://www.elysee.fr/emmanuel-macron/2023/05/11/accelerer-notre-reindustrialisation-le-president-presente-sa-strategie.

10. The Advanced Research Projects Agency–Energy (ARPA-E) programme, established shortly before the 2007-08

financial crisis, has around $350 million in annual funding and aims, like its Defense Advanced Research Projects Agency sister, to nurture new strategic energy technologies to achieve rapid deployment of radical technologies with high market potential.

11. For example, through dedicated NZIA Erasmus and Marie Curie fellowships, or mobility top-ups to Horizon Europe or other funded projects.

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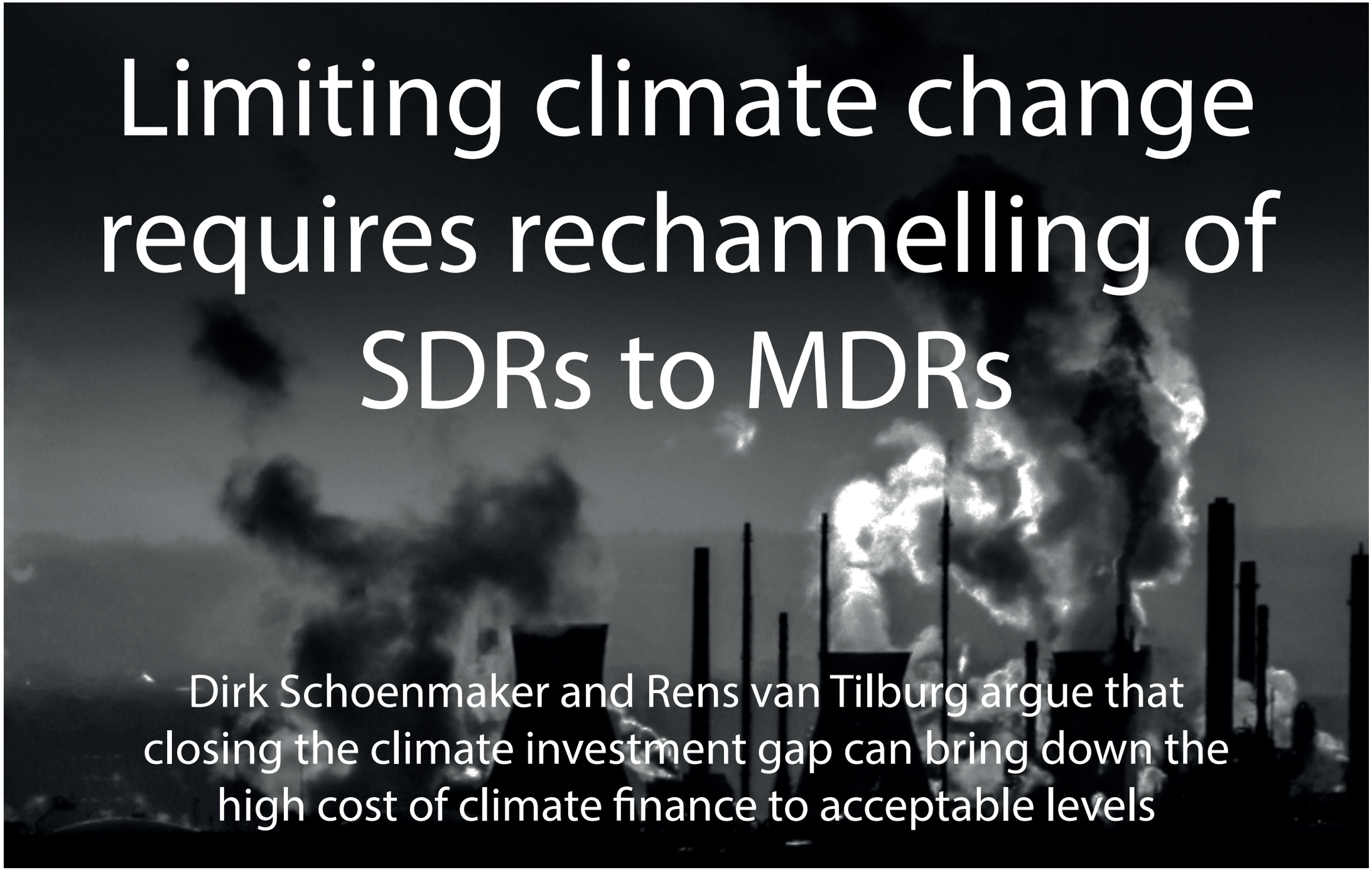
Limiting climate change requires rechannelling of SDRs to MDRs



Dirk Schoenmaker and Rens van Tilburg argue that closing the climate investment gap can bring down the high cost of climate finance to acceptable levels

Investments are needed around the globe to mitigate climate change, but it is in developing countries, where population growth and economic growth prospects are greatest, that climate mitigation investments need to grow the most.

This column argues that closing the climate investment gap in these countries requires rechannelling of Special Drawing Rights to Multilateral Development Banks, which can bring down the currently often prohibitively high cost of climate finance to acceptable levels.

A stable climate is one of the foundations of our welfare and wellbeing. In order to limit climate change, investments in climate mitigation are needed globally. It is in developing countries, where population growth and economic growth prospects are greatest, that climate mitigation investments need to grow the most (IPCC 2022).

Currently, however, liquidity constrained low-income countries are often not able to invest in renewable energies, despite the fact that the life cycle costs of renewable energy production is in most places already lower than that of fossil fuel options.

However, renewable energies do come with higher initial investment costs due to the relatively high capital expenditures. Investments that are often prohibitively expensive for low-income countries (Schoenmaker and Volz 2022, van Tilburg *et al* 2022). The cost of capital for a solar PV project in advanced economies and China is around 4%, whilst for emerging and developing economies this figure is around 12% (IEA 2022).

In absolute terms, developing countries now need to invest annually $1 trillion more in climate mitigation (Bhattacharya *et al* 2022). On top of this come costs of climate adaptation of $300 billion (UNEP 2021) and up to $580 billion for loss and damage by 2030 (Markandya and Gonzalez-Eguino 2018). Against these numbers, the 2009

promise of high-income countries to bring $100 billion to the table – a promise that still has not been fulfilled – pales.

At COP27 a roadmap was presented for how to get the needed extra climate mitigation investments by 2025. According to this roadmap, most is expected from two sources of finance: domestic resource mobilisation and private finance, with an increase of $417 billion (from $236 billion) and $326 billion (from $69 billion), respectively (Songwe *et al* 2022).

Rechannelling SDRs to MDBs has the potential to increase the available capital for climate investments where it is needed most: in developing countries

With many developing countries struggling with their debt situation and private finance flows to many low-income countries on a downward trajectory, other sources of public finance are needed (Murawski *et al* 2023).

Special Drawing Rights delivering the billions needed

One rare source of finance for developing countries that has increased since 2021 is the IMF's Special Drawing Rights (SDRs). At the height of the pandemic, the IMF created $650 billion worth of SDRs. Developing countries were able to trade these for the much-needed dollars and euros to invest in their health and social support systems. The $53 billion of SDRs that went to lower-middle-income countries and $9 billion to low-income countries have quickly been spent.

The G20 committed to reallocate another $100 billion of SDRs to developing countries. Up to around $60 billion of this can be absorbed by two IMF-trusts: the already existing Poverty Reduction and Growth Trust (PRGT) and the newly created Resilience and Sustainability Trust (RST).

While the $60 billion limit for the combined IMF trusts is not set in stone, it is also not easy to expand these by too much – the reasons for this being the capacity to distribute the funds and the real money needed to provide the loans on concessional terms.

Rechannelling through Multilateral Development Banks

Given the limitations of the IMF trusts, proposals have been made to rechannel SDRs through Multilateral Development Banks (MDBs) like the World Bank and its regional counterparts the African and Asian Development Banks.

These MDBs have a much broader apparatus and longer experience with development and climate finance in developing countries. They have thus a large potential to scale up their climate finance. MDBs can bring down the currently often prohibitively high cost of climate finance to acceptable levels.

MDBs have tried and tested methods of leveraging private finance for development. For instance, the International Bank for Reconstruction and Development has leveraged the total paid-in capital by a factor of ten (Humphrey and Prizzon 2020).

By doing so, MDBs can also create safe, investable local currency assets that can attract domestic savings. Domestic savings that currently are exported to a large extent at low returns to financial centres in advanced countries (Schoenmaker and Volz 2022).

Most MDBs are already prescribed holders of SDRs. One option therefore is for MDBs to issue 'SDR-bonds' (Setser and Paduano 2023). As this is structured as a security, it is easy for all the major SDR holders to purchase it.

Most importantly, this would allow the US to make good on its pledge to rechannel $20 billion of SDRs. The SDR bond would strengthen the MDBs' liability structure by providing them with a low-cost, long-term financing source. This should facilitate MDBs in the implementation of capital adequacy reform to reduce their equity-to-loan ratio limits.

An even more effective use of SDRs for MDBs is to use them as hybrid capital which can be leveraged at the rate of four to one, as proposed by the African and the Inter American Development Banks (Plant 2023).

Yet, the largest block of SDR holders – the members of the EU, which hold around $200 billion of the roughly $900 billion of SDRs – are still in doubt as to whether they can rechannel their SDRs to MDBs. The reason for this are previous legal opinions of the ECB that indicate that not all rechannelling of SDRs to MDBs may be compatible with the EU's legal framework, more specifically with the monetary financing prohibition.

However, no legal opinion has been published by the ECB yet on the two specific proposals discussed here. Given that these preserve the reserve asset status of the rechannelled SDRs and are being used for similar purposes as the IMF trusts that have received clearing by the ECB, it should be possible to also allow this use of the SDRs by EU member states.

What's more, the European Investment Bank already has access to Eurosystem reserve assets through its access to the ECB's repo facility and borrowings from Eurosystem national central banks (Paduano 2023).

Conclusion

Rechannelling SDRs to MDBs has the potential to increase the available capital for climate investments where it is needed most: in developing countries. Given that no clear substitutes are in sight, this route deserves priority in being explored and made passable through finding a construction that is compatible with the EU's legal framework. ■

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Tax for climate finance should start with shipping

Pascal Saint-Amans argues that emissions from international shipping are the most realistic target for taxes to pay for climate spending in developing countries

The Bridgetown initiative, a climate finance plan for developing countries launched by Barbados prime minister Mia Mottley in 2022, inspired the Summit for a New Global Financial Pact, held in Paris on 22-23 June. The more than 40 leaders in attendance, including German Chancellor Scholtz, Chinese Premier Li Qiang and Brazilian President Lula, revived discussions on financing the energy transition in the South together with the fight against poverty.

They confirmed the reallocation of $100 billion of International Monetary Fund Special Drawing Rights and agreed on the need for multilateral development bank reform to mobilise more public and private funds. There was also agreement on the need to work further on international tax.

What could sound like a vague commitment on tax might actually deliver a concrete outcome if a few conditions are met. To all economists, carbon taxation is the first-best candidate for an international tax to finance the energy transition. With only 40% of global carbon emissions priced, at an average worldwide price below €5 per tonne, a global carbon tax is long overdue.

However, the political economy of the reform makes it impossible in the current circumstances (France's *gilets jaunes* movement is the poster child of the opposition to carbon pricing). The Paris summit also floated briefly the idea of moving carbon taxation upstream to the point of fossil-fuel production, before rejecting it as a no-go.

One carbon tax might work, however. It was discussed in preparation for the summit but not mentioned explicitly in the outcome statement: a tax on carbon emissions from the shipping industry. Countries should give it a chance for three reasons.

First, global shipping is a crossborder activity that has both benefited from and contributed to globalisation, and is a significant contributor to overall emissions, representing almost 3% of global emissions, while all of Africa contributes 4%.

Second, this industry currently pays no tax on its carbon emissions. The fuel is completely tax free. No excise duties, no carbon tax. Moreover, shipping companies are not subject to regular corporate income tax anywhere in the world at a time when their profits have reached unprecedented levels.

The design should ensure impact even if not all countries implement. The 15% global minimum tax does not require all countries to implement; rather only a critical mass is required for it to have an impact

Third, very little progress has been made on improving the carbon efficiency of shipping fuel and shipping is in fact falling behind its own commitments. The International Maritime Organisation's net zero ambitions are not aligned with the Paris Agreement, and negotiations at the IMO on the path towards carbon neutrality by 2050 are stalled.

If properly orchestrated, global agreement on an international tax can happen, as shown by the deal reached by 137 countries in October 2021 establishing an effective 15% global minimum tax (even though the shipping industry is the only one carved out from this agreement). A tax on carbon emissions from shipping could follow the same path, with a few essential steps.

There should be a top-down approach, in the form of a message from leaders to their delegates at the IMO to empower them to deliver meaningful progress. The Paris statement of outcomes could have been more explicit but it is not too late. The design should ensure impact even if not all countries implement.

The 15% global minimum tax does not require all countries to implement; rather only a critical mass is required for it to have an impact. This pushes the slow movers, so that it is not just the first movers that accrue the revenues.

A first step has already been taken with the European Union including shipping emissions in its emissions trading system (ETS). In 2026, half of the emissions related to shipping to and from Europe will be in scope of the ETS.

The EU should seek allies to build a critical mass of countries, or of subnational governments where the large ports are located. It might be easier to convince the states of New York and California, than negotiating with the US as a whole.

Negotiations at the IMO will soon resume. The EU coalition to build out taxation of shipping emissions should start with small island states, like the Marshall Islands, under threat of disappearance because of rising sea levels. Together, they could open up a new route for international taxation. ■

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A fight for every job: decarbonising Europe's cars

Decarbonising is key to achieving climate neutrality in the EU by 2050. Bela Galgóczi argues that the automotive industry's ability to manage the transformation will have implications for millions of Europeans

The shift to electric cars is gaining momentum, with huge implications for millions of workers. The priority for trade unions is to secure jobs and workers' rights. But what will a just transition mean for Europe's automotive industry amid growing market competition between the EU, the US, and China?

A timeline for the phase-out of petrol-powered cars produced in Europe has now been set. The transition to electric vehicles is part of the European Union's *Fit for 55* package, which aims to reduce the region's net greenhouse gas emissions by at least 55 per cent by 2030 compared to 1990 levels and 100 per cent by 2035 (though with a loophole for synthetic fuels).

Decarbonising road transport – a huge contributor to overall greenhouse gas emissions – is key to achieving climate neutrality in the EU by 2050, a commitment that lies at the heart of the European Green Deal. With deadlines looming, Europe's automobile industries are charting the electrification course rapidly.

This, of course, is good news. The way the transition is taking place, however, is far from ideal. As one of Europe's largest industries – and biggest sources of employment – shifts into gear for major change, new fault lines are emerging. Its ability to grapple with the inevitable conflicts and successfully weather the transformation will have major implications for millions of Europeans.

What's at stake?

The automotive industry is currently facing a range of challenges. Besides undergoing an internal shift to digitalisation, automation, and total value chain reorganisation, it now needs to fast-track a move towards electric vehicles.

This transformation is upsetting the long-standing dominance of industry heavy hitters such as Volkswagen and BMW, and allowing newcomers like Tesla to enter the market in a previously unimaginable way.

To Germany's shock, the Tesla Model Y outsold the Volkswagen Golf in September 2022. Chinese companies like BYD and SAIC Motor are also gaining new ground, making up 6 per cent of EU electric car sales in 2022. This is likely to reach 20 per cent by 2030.

The fact that the automotive industry is not covered by the EU's Just Transition framework is a serious omission that risks deepening an already conflictual and unequally distributed process

It is increasingly clear that past success offers no guarantee of future competitiveness. The EU's potential diminishing dominance in this global industry is set into sharp relief in this new era of deglobalisation, with pandemic-induced supply chain disruptions and the end of the rules-based post-World War II international order – accelerated by Russia's invasion of Ukraine – raising the geopolitical stakes even higher.

In the European Union, the automotive sector is directly responsible for 2.6 million jobs. With 13.8 million direct and indirect jobs as a whole, it accounts for more than 6 per cent of total European employment.

Forecasts on how electrification will affect these jobs depend on their scope and assumptions, but most predict major job losses in the manufacturing segment – between 275,000 and 410,000 by 2040 according to a 2021 study by the European Association of Automotive Suppliers. This may be partly compensated by increasing value added from electronics, autonomous drive systems, and electric charging infrastructure.

According to a study published in 2021 by the Boston Consulting Group, up to three million industry jobs will also be fundamentally transformed in terms of the skills required, place of work, contract type, and working conditions.

These forecasts assume that new car sales will remain stable – but this cannot be taken for granted. Ever fewer new cars are sold each year, and stability in sales revenues is only due to them getting larger and more expensive.

This assumption also reveals how many industry players see automotive electrification: not as part of a wider decarbonisation of transport that includes fewer cars and better mass transit, but simply as the replacement of the combustion engine with an electric one.

Media concern has focused on possible employment loss due to electrification. The greatest risk, however, is missing the train. Slowing down the mobility transition at this stage would undermine European competitiveness and result in greater job losses in the long term. At this point, focusing on aggregate job gains or losses is therefore less important than helping European companies, regions, and workers navigate the transition.

It is also important to understand that, even if overall automotive employment in Europe remains relatively constant, European manufacturers and regions – from the generalist volume producers in France and Italy to Germany's premium manufacturers and the central and eastern European supply chain – will experience the transition in vastly different ways.

While all major regions saw a decrease in the number of new cars sold between 2000 and 2019, Germany only saw a 9 per cent reduction, whereas Italian sales dropped by 51 per cent. In the same period, employment in the sector rose by 3 per cent in Germany but plummeted by 43 per cent in France. The car industry in central and eastern Europe – boosted in past decades by foreign direct investment – is a special case.

It's cheap and flexible workforce offers a competitive advantage, but the industry's future here remains uncertain. The region has the oldest, most polluting, and fastest-growing car fleets in Europe and a population largely unable to afford electric vehicles. More problematically, its unions are weaker and often not internationally affiliated.

These workers and plants have less bargaining power and are particularly vulnerable to decisions made elsewhere. Also a problem is the industry's continuing 'upmarket drift' – the production of heavier, faster, and more expensive battery electric vehicles and plug-in hybrids that, among other issues, need larger batteries – which is putting a strain on critical material use.

The trade union perspective

The primary focus of Europe's automotive trade unions is clearly to secure jobs and workers' rights as the industry navigates the green transition, but individual unions play different roles depending on their scope. Workplace unions within specific plants or companies tend to prioritise the short-term goals of their members.

By contrast, higher-level trade unions with a more national or international outlook and at one level removed from the immediate concerns of workers – such as the European Trade Union Confederation (ETUC) – are more likely to situate the interests of their members within long-term societal goals such as the need for environmental policies and political participation.

In the industrial relations literature, trade union responses to the green transformation can be grouped into three categories: opposition, hedging, and support. In contrast to an uncompromising opposition to climate change mitigation, hedging strategies accept the need for emissions reduction policies but seek to minimise environmental regulation. Support strategies are in favour of climate mitigation and take a proactive stance on decarbonisation.

Over the last decades, trade unions have developed their ability to challenge profit-driven changes imposed by capital. The changes proposed under the green transition are of a different ilk: they are policy driven and serve the public interest.

Instead of questioning or impeding the necessary restructuring, trade unions must become drivers of this change while working to manage its consequences. This is a huge challenge, and one exacerbated by the capital-labour conflict.

Even if unions agree with the long-term objective of the restructuring process, proposed changes such as reducing jobs and lowering conditions can resemble the profit-maximising efforts that unions usually resist on their members' behalf.

On top of that, precarious jobs with less security make up a large and growing share of posts. Such jobs have historically borne the costs and risks associated with change, making it both harder to protect them and to get these workers on board with restructuring.

This asymmetry of power, alongside a growing recognition of the importance of climate and environmental objectives, has led to trade unions becoming the drivers behind the 'just transition' concept. In 2018, global manufacturing union IndustriALL and others called for balanced emissions reductions that take employment and social aspects into account and for a just transition fund for industry.

Industry stakeholders can exert considerable power at policy-making level. Employer associations – the owners' and managers' versions of trade unions – have been playing a controversial role in lobbying for lighter regulation on car emission standards.

The 2015 Dieselgate scandal – which uncovered that manufacturers such as Volkswagen had installed defeat devices allowing cars to cheat pollution controls – shows how the industry has tried to evade regulation after failing to prevent it.

In the run-up to the European Council's 2018 adoption of a 35 per cent reduction in car CO_2 emissions by 2030, both unions and employers' associations supported the German government's push for a lighter 30 per cent target. With the *Fit for 55* package, the cut increased to 55 per cent for cars and 50 per cent for vans by 2030, rising to 100 per cent by 2035.

In 2021, German automotive association VDA opposed the phasing out of the combustion engine, and IndustriALL has also expressed concerns about fast-track electrification.

But things are changing. Germany's largest trade union, metalworkers' union IG Metall, has revised its previously cautious approach and embarked on a fast-track transition. And in 2022, European-level trade unions launched an urgent appeal calling on policymakers to support the automotive sector in implementing a just transition.

The sector as a whole is not currently included in the EU's Just Transition Mechanism – set up to *"ensure that the transition towards a climate-neutral economy happens in a fair way"* – as the latter is limited to carbon-intensive regions, while the prospective Social Climate Fund will primarily aim to balance the regressive effects of the Emissions Trading System (ETS2).

Looking at individual plants

For an insight into the conflicts and negotiations taking place within individual plants and companies, we can turn to Germany's car industry. There, 'works councils' (Betriebsräte) represent the workforce at plant level and are actively co-managing the transition in order to protect employees.

In 2017, the General Works Council of Daimler, which has the right to be advised of future strategies and make proposals, reached an agreement on Project Future, the company's restructuring plan. This agreement protects all Daimler employees in Germany – including those in logistics and branch offices – from operational dismissal until 2029, though without precluding changes to employees' workload and responsibilities.

There has nevertheless been a protracted fight for each individual job and production location, taking place within a web of opposing interests operating at different levels: between capital and labour, management and the works council, and different locations both within and outside of Germany.

For example, in 2020 the Daimler management launched a massive restructuring programme to 'optimise' its global production network. With this came the announcement of 30,000 job losses worldwide, putting the viability of several plants in question. The French Daimler subsidiary that produced the Smart brand was sold, and the manufacturing of the new electric Smart moved to China.

Daimler's attempt to end production of the V6 diesel engine at its oldest plant in Berlin created a major conflict; after a year of negotiations by the works council, it was decided that the site will manufacture electric motors as part of a restructuring plan.

Volkswagen is grappling with similar internal struggles. Within its 2016 *Pact for the Future*, the company announced that although new technologies and products would create 9,000 jobs, 25,000 would be lost. The pact includes a works-council-negotiated job security agreement up to 2025 and secured commitments to keep the production of new e-mobility components in Germany.

The agreement, which applies to 120,000 employees, does not exclude job cuts; however, these would take place through managed retirement plans, such as the one agreed in February 2021 for 5,000 jobs. The pact made the Wolfsburg main plant the headquarters for digitalisation and electro-mobility – 'Volkswagen's Silicon Valley'.

Tensions around this plant grew in 2021 due to its low-capacity utilisation and productivity. When in November 2021 then-CEO Herbert Diess reportedly warned the supervisory board of up to 30,000 job losses in Germany, a full-blown media scandal erupted. He subsequently backed off, mentioning only 'some downsizing' at the main plant.

Referring to the 2016 *Pact for the Future*, the works council rejected any further job cuts, but added that the workforce is ready for change, though *"only with VW culture. And that includes the works council getting involved."* Its

central works council secured the Wolfsburg headquarters' future by pushing the management to accelerate the launch of autonomous electric vehicles there.

Electric car batteries – which make up between 30 and 40 per cent of the value added of an electric car – will be key to future employment in Europe. The number of jobs created will depend on the approach taken by manufacturers, however: from BMW's external procurement to Volkswagen's integrated value chains.

Calls from trade unions for automotive companies to produce their own battery cells in house, thus mitigating job losses, are increasing, and indeed the size and influence of a company's work council has been found to be a key factor in whether a company goes down this route.

Managing conflict through a just transition

While Europe's car industry has historically not been concerned by the need to transition to greener transport, the automotive sector is now absorbed with managing the fast-track transformation to electromobility required by the EU, using a combination of hedging and support strategies.

On their side, the industry's works councils and trade unions have been heavily involved in protecting jobs and workers. Their efforts have met with some success – predominantly in France and Germany. In the latter, the interventions of the country's powerful works councils have allowed workers and plants to come out of restructuring processes relatively well.

French unions, after witnessing significant job losses in the past decades, believe that electrification presents a substantial reshoring opportunity and are calling for policies to incentivise this.

But even in the most positive of scenarios, the process remains conflictual. Just transition policies, while absolutely necessary, are limited in scope as they tend to be available to specific groups of workers only – those with regular employment contracts – and fail to cover the entire value chain, in particular in foreign countries.

Trade unions at foreign subsidiaries, such as in central and eastern Europe, have less leverage as strategic decisions are made at company headquarters. As a defensive strategy, they hope for a longer phase-out for the combustion engine. Broader social justice issues, such as regional inequalities and the lack of affordability of the heavier and more expensive cars now guaranteeing industry jobs, are less the focus of trade union attention.

Trade unions have always been advocates for active government policy on industrial matters and have welcomed European Commission initiatives such as the Green Deal Industrial Plan and the Net-Zero Industry Act. But the lack of social conditions – such as quality jobs and apprenticeships attached to the available funding – has drawn strong criticism from IndustriALL Europe and the ETUC, who are concerned that the relaxation of state aid rules may put downward pressure on working conditions.

The automotive industry's transition to electric vehicles – as required by the EU under the *Fit for 55* package – is a positive step forward and key to wider ecological transition. But at this time of complete reconfiguration, the sector and its unions need more support to navigate the conflicts inherent in such wide-reaching change.

The fact that the automotive industry is not covered by the EU's Just Transition framework is a serious omission that risks deepening an already conflictual and unequally distributed process.

If they want to see a green transition that is fair and generates hope rather than discontent in Europe's workplaces and homes, Greens and all progressive voices must add their weight to the call by trade unions, employers, and NGOs for a just transition framework for one of Europe's biggest sectors and employers. ■

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Is the global transport industry on a highway to climate hell?

Transport has the highest reliance on fossil fuels of any sector. An Atradius Market Monitor examines the challenges in the transition to clean energy

According to the International Energy Agency (IEA), transport has the highest reliance on fossil fuels of any sector. Although its contribution to global emissions dropped sharply when the world hit pause during the pandemic, this has risen rapidly since borders reopened and lockdowns ended.

The greatest increases have been recorded in developing markets: transport-related emissions in developing countries have increased more rapidly than in Europe or North America and this is a trend that is likely to continue in coming decades.

Transitioning to clean energy is not cheap. Cost will be a significant challenge for the sector moving forward. However, as Gido van Graas, Head of ING's Energy Project Advisory Team noted in the *Atradius Clean Energy Transition: A New Way Forward for Global Trade?* Event: *"We see that there are huge investments required to support the energy transition. I believe that the liquidity is there to support that."*

What can our underwriters tell us about clean energy transitions in the transport sector?

Our underwriters note the transport industry cannot be viewed as a homogenous whole. The industry's subsectors face different challenges, with varying outlooks across developing and developing markets. For example, the passenger electric vehicles (EV) sector in developed economies is enjoying growth.

According to the IEA, one in seven passenger cars bought globally in 2022 was an EV, compared to one in 70 in 2017. Decarbonising shipping and aviation is more complex and still requires more research and development.

Challenges: what are the most urgent challenges for the sector in the next three years?

1. Development of infrastructure is insufficient

Every Atradius underwriter we spoke to, representing a geographical spread across the world's developed markets, pointed to insufficient infrastructure as one of the greatest risks to emissions reduction in the transport industry.

In particular, a primary challenge for the transport industry is the need to expand EV charging networks to support growing consumer demand for electrification.

2. High costs are a barrier to adoption

Although our underwriters noted subsidies and tax incentives are available in some markets, this doesn't detract from the fact that energy transition is costly. EVs remain unaffordable for many consumers and the electrification of entire fleets can put too deep a dent in many business balance sheets.

Investment in other alternative energy sources, such a hydrogen, is also costly. The current economic conditions with high inflation and increasing interest rates, also makes for a challenging investment environment.

3. Some sectors are difficult to decarbonise

Aviation remains a heavily carbon-intensive mode of transport. There is a long-term need for further investment in technology and alternative fuels for the sector.

Although the shipping industry can reduce emissions through the use of low-sulphur-compliant bunker oil or cleaner alternative fuels, the cost of these are still higher than heavy bunker fuels. Smaller players are more vulnerable to the increased costs and their survival may depend on their ability to pass on costs to customers.

Opportunities: what are greatest opportunities for the sector in the next three years?

1. Access to financing and government incentives

Several of our underwriters pointed to the availability of financing and subsidies as a clear opportunity for growth, particularly in the US and Europe. Our underwriters in Germany and the Netherlands noted that government stimulation programmes and tax advantages were widely available.

2. Development of alternative fuel sources

New energy such as clean hydrogen and biofuel is becoming an increasingly important element in supporting energy transition in the transport industry and presents great opportunities for growth.

Our underwriting team in Japan explained how this extends to the aviation sector. They said: *"Japan Airlines (TYO: 9201) has already set a goal to become the leading airline in the use of SAF (sustainable aviation fuel) and plans to replace 10% of fuel on board by 2030."*

3. Growth of the EV sector

The EV sector is enjoying growth with global demand presenting opportunities along the entire value chain from chip producers to materials manufacturers and OEMs.

Our underwriters in China said: *"China accounts for about half of global EV sales and will benefit from the global transition towards EVs as well growth in the domestic market which is currently dominated by local brands."*

Where next?

Lowering greenhouse gas emissions in the transport industry is not just about transitioning to clean energy sources. Reshoring industries, bringing them closer to their markets, can help to reduce freight miles.

Digitalisation may also bring about freight transport efficiencies and help to reduce statistics such as reported by the US Bureau of Transportation Statistics that revealed one in four trucks that ran empty in the US in 2019.

Applying the concept of the circular economy could also help decarbonise the transport industry, reducing the volume of tyres that end up in landfill each year for example, although this still has a way to go. ■

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The Road to Net Zero ■ Autumn 2023

Fostering a sustainable digital transformation

Abeliansky *et al* discuss the two side effects of automation – increased inequality and a rise in carbon emissions – and propose a policy response to deal with both problems

Automation and digitalisation are progressing rapidly worldwide, auguring improved productivity and living standards but also the prospect of genuine social harm. This column discusses two side effects of automation – increased inequality and a rise in carbon emissions – and proposes a policy response to deal with both problems simultaneously.

By imposing a higher tax on automation-driven emissions and redistributing the proceeds so as to mitigate increased inequality through education and re-training, such a policy could reduce resistance to new technologies, increase skill levels, and foster the transition to cleaner electricity production.

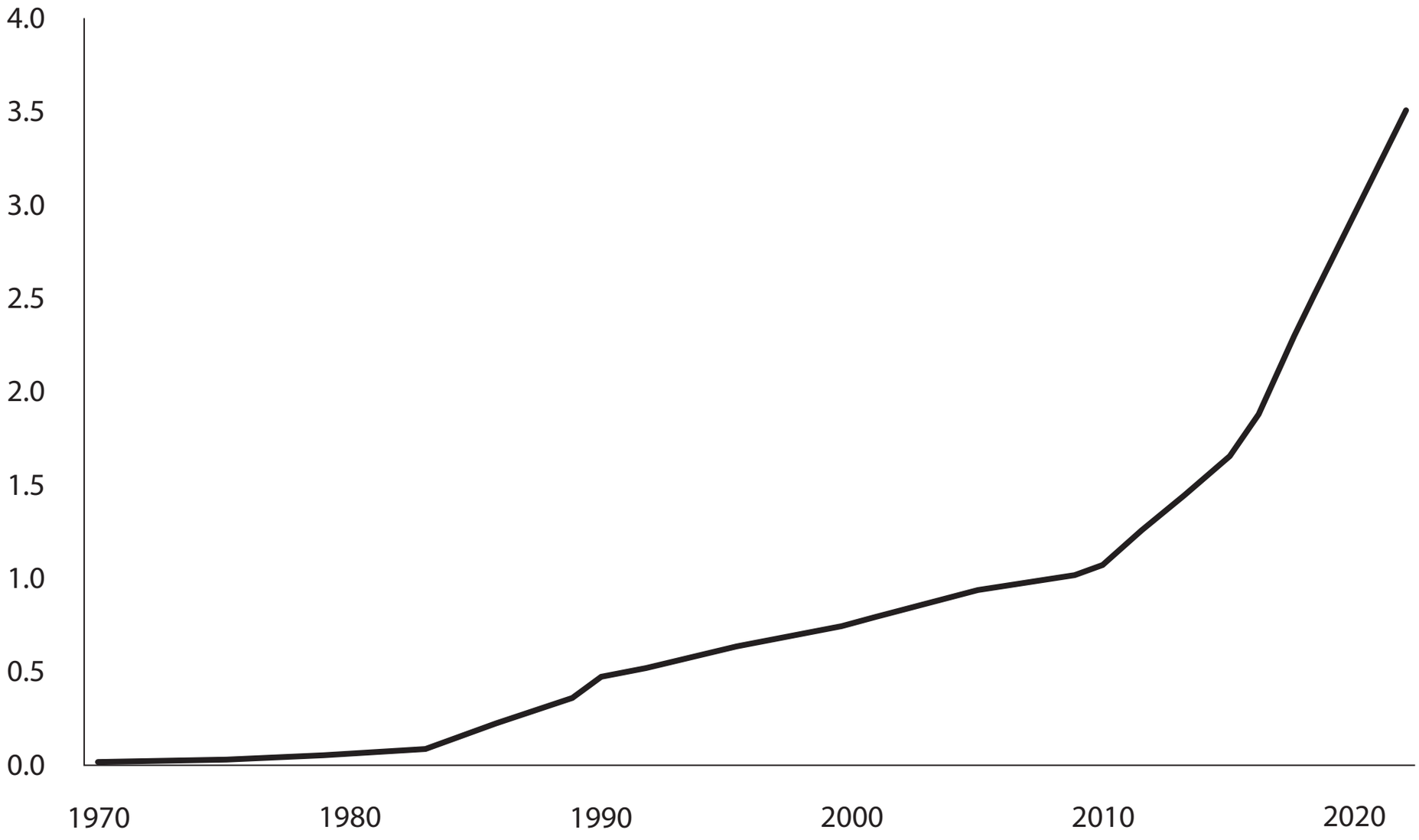
Automation, digitalisation, and artificial intelligence (AI) are progressing rapidly worldwide: robots increasingly substitute for humans in many assembly line tasks; 3D printers are used in the production of customised parts and medical implants; and AI-based models and devices are used to quickly diagnose disease, develop medical remedies, write reports, code, and generate inspiring ideas (*The Economist* 2014, Ford 2015, Brynjolfsson and McAfee 2016, Hu 2023).

Figure 1 illustrates the growth in automation based on one frequently used data source: the International Federation of Robotics (2016, 2017, 2018, 2022). The number of industrial robots[1] worldwide was negligible until the early 1990s, but has since increased steeply, by a factor of eight.

After the global financial crisis of 2007–2009, the growth rate of the number of robots increased markedly to about 10–15% per year (International Federation of Robotics 2022).

Most recently, the number of users of AI-based models has skyrocketed. ChatGPT, for example, surpassed 100 million active monthly users in January 2023, just two months after its launch (Hu 2023).

Figure 1. Worldwide stock of industrial robots (in millions of units)



Notes: International Federation of Robotics (2016, 2017, 2018, 2022) with authors' interpolations for the years lacking data.

While automation, digitalisation, and AI tend to raise productivity and per capita income (Graetz and Michaels 2018), they also raise several concerns. The first apprehension has to do with the potential for automation technologies and AI to replace human labour, and the associated fears of technological unemployment (Arntz *et al* 2017, Frey and Osborne 2017, Abeliansky *et al* 2020).

Policymakers might instead consider an automation tax, which would only be paid by a firm if and when it automated the production of a task and replaced a worker with a robot

A second concern relates to the role of automation and digitalisation in raising inequality levels. Because the corresponding technologies typically complement high-skilled workers but substitute for low-skilled workers, upward pressure is placed on the wages of the former and downward pressure on the wages of the latter, leading to greater wage inequality (Acemoglu and Restrepo 2018, Lankisch *et al* 2019).

Recent research suggests that AI increases the productivity of low-skill workers proportionately more than the productivity of high-skill workers (Brynjolfsson *et al* 2023) in terms of comparable tasks. Nevertheless, AI is used predominantly for tasks that are on average more skill-intensive (see eg. Marr 2023) such as coding and debugging, language translation, and summarising research results.

Humans are, as yet, not perfectly substitutable in these tasks, but are still required for appropriate and effective prompting, and for revising the output produced by AI. This stands in contrast to the use of industrial robots and 3D printers, which are able to perfectly substitute for (predominantly low-skilled) workers.

As a consequence, even if AI reduces the performance gap within given tasks, it could still increase inequality at the aggregate economic level.

The third concern has to do with the negative impact of robots, 3D printers, and AI on the labour share of income and its corresponding positive impact on the capital share (Eden and Gaggl 2018, Prettner 2019, Guimarães and Gil 2022a). This is because robots, 3D printers, and AI have properties resembling labour in the production process, and capital in terms of ownership.

Thus, their use transfers income from workers to capital owners and thereby reduces the labour income share. A final concern relates to the high electricity requirement of automation – in particular of AI. Because most countries

still use fossil fuels intensively in electricity production, this implies a potentially negative impact of automation, digitalisation, and (especially) AI on the efforts to mitigate climate change (Creutzig *et al* 2022).

Recent estimates by Patterson *et al* (2021) and Luccioni *et al* (2022) suggest that the training of the large language model GPT-3 required close to 1,300 megawatt-hours of electricity and led to more than 500 tonnes of carbon dioxide equivalent emissions.

These potentially negative aspects have led to calls for the implementation of 'robot taxes' (Dill 2017, Guerreiro *et al* 2022, Gasteiger and Prettner 2022). In this context, however, several drawbacks of such a tax should be considered.

Most immediate is the issue of what defines a robot and should therefore be used to delineate the tax base. The definition of an industrial robot, which replaces human labour alongside an assembly line, may be clear – but it is definitely unclear for algorithms that replace human labour in targeting ads to customers, in writing texts, or in coding.

In addition, because the use of robots, 3D printers, and AI raises productivity, a robot tax that impedes their general adoption would be associated with a loss of per capita income and a reduction in living standards (Prettner and Strulik 2020).

Policymakers might instead consider an automation tax, which would only be paid by a firm if and when it automated the production of a task and replaced a worker with a robot (ie. the automation tax is not paid by firms investing in robots upon entry).

Results suggest that a robot tax may have a much more negative impact on employment and wages than an automation tax (Guimarães and Gil 2022b), yet machines are usually not able to replace workers in all tasks, making the assessment of the replacement of workers by machines blurry in practice.

Moreover, it might be difficult to distinguish an automation-related job separation from other sorts of separations. This murkiness raises questions as to whether potential alternatives to a robot (or an automation) tax exist that could achieve similar outcomes without such drawbacks – or would at least minimise them.

In the following section, we propose a tax-subsidy scheme that may help alleviate automation-driven inequality and automation-driven emissions by linking them through one consistent policy response.

Solving two problems using one tax

One potential way to ensure a sustainable digital transformation is to link the negative economic and environmental consequences of automation and digitalisation by imposing a higher tax on carbon dioxide emissions and using some of the proceeds thereof to fund schemes for those who suffer negative consequences during the transition.

Such schemes could include:

(1) retraining those who lose their jobs because their skills become obsolete;

(2) ensuring more generally that the education system does not leave any children behind with inadequate skills for contemporary labour market success;

(3) providing (possibly temporary) public employment for displaced workers who struggle to find new jobs (eg. Kasy and Lehner 2023, who evaluate such a guaranteed job programme implemented in the Austrian municipality of Gramatneusiedl); and

(4) providing social security benefits in terms of unemployment insurance and health insurance for those who cannot get retrained or re-employed for various reasons (see Prettner and Bloom 2020 for an overview on the effects of different policy responses to automation).

If the proceeds are used to reduce distortionary taxes, the effects of such a policy may resemble the double dividend of environmental taxes (Goulder 1995, Bovenberg 1999).

The difference is that, in this case, the proceeds of the tax would be used to mitigate increases in inequality – thereby reducing resistance to the adoption of new technologies – and to foster the skill level of the population through education and re-training (eg. Peralta and Gil 2021, who show that a direct subsidy to low-skilled workers displaced by automation is roughly neutral in terms of economic growth). Both the tax and the subsidy are expected to be beneficial to long-run economic growth.

To summarise, the crucial advantages of a tax-subsidy scheme that links the negative environmental externalities of automation and digitalisation with the undesired inequality effects are as follows:

- The negative pollution externalities of the increasing use of robots and AI could be internalised.
- Those who suffer due to automation and digitalisation during the transition could be compensated (at least partly) by the proceeds of such a tax, which should help contain a further rise in inequality.

- The problem of defining a robot to designate what is being taxed – and all associated bureaucratic complications in executing robot taxation – do not occur.

- The resistance to new technologies that are beneficial on average and at the aggregate level could be reduced, with corresponding long-run benefits for economic growth and development.

- As a consequence of all the previous items, overall living standards could be raised.

- In addition, and in contrast to a pure robot tax, a higher emissions tax would provide an additional incentive to switch from polluting sources of electricity generation to cleaner technologies, thereby fostering their adoption and innovation.

Overall, a tax-subsidy scheme along the lines proposed here could be an important instrument to ensuring a sustainable digital transformation that keeps both emissions and inequality in check.

Conclusions

Automation and digitalisation improve productivity and living standards, but tend to have negative social side effects by creating 'losers' from the transformation and negative environmental side effects by increasing emissions due to higher electricity demand.

To compensate the losers, robot taxes have been proposed. Even if these taxes could be implemented from a practical perspective, which is highly uncertain, they reduce efficiency and living standards by slowing the adoption of technologies that rely on automation and digitalisation.

To overcome this problem and foster a sustainable digital transformation, we propose a policy response that links its two negative side effects – increasing inequality and higher emissions.

The environmental externalities from the transition to automation and digitalisation could be internalised by a higher tax on emissions, while the proceeds of this tax could be redistributed to compensate the losers from the transition.

Implementing such a scheme would also be helpful for reducing resistance to the new technologies, increasing the skill level of the population, and fostering a transition to cleaner electricity production. All these effects would be in line with the goal of ensuring a sustainable digital transformation.

Thus, it is important to start this discussion and to evaluate the effects of such a proposed tax-subsidy scheme quantitatively. Of particular significance is the question of the appropriate size of such a tax and its fiscal impact. ■

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Endnote

1. The International Organization for Standardization (ISO) defines an industrial robot as an "automatically controlled, reprogrammable, multipurpose manipulator, programmable in three or more axes, which can be either fixed in place or fixed to a mobile platform for use in automation applications in an industrial environment."

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Flight to climatic safety

Weather-related disasters are increasing in frequency and intensity. Fabrizio Ferriani, Andrea Gazzani and Filippo Natoli investigate whether these events can shape international investors' portfolio flows

Natural disasters can shape global financial investment. This column employs a dataset that spans 2009-2019 to study the effect of extreme natural events on global financial flows. The authors find that when disasters strike, investors reduce their net flows to mutual funds exposed to affected countries only if the latter are emerging economies at higher climate risk.

At the same time, they reduce flows into unaffected, high-climate-risk countries in the same region and increase them into climatically safer advanced economies. Natural disasters appear to trigger an updating of beliefs about the global climate threat, with investors searching for climatic safety.

Weather-related natural disasters are increasing in frequency and intensity worldwide because of climate change. Their economic consequences are highly heterogeneous across countries, as some countries are more exposed or more vulnerable than others (Rossi-Hansberg and Cruz 2021, Blanchard and Tirole 2022). This heterogeneity may have profound financial implications at the global scale.

However, while the economic analysis of climate change and natural disasters has often adopted a multi-country perspective (Dell *et al* 2014, Botzen *et al* 2019), evidence of the effects of local climate events beyond country borders is rare at best. Notable exceptions are Gu and Hale (2023) and Hale (2023), who study the implication of natural disasters for foreign direct investment and exchange rates, respectively.

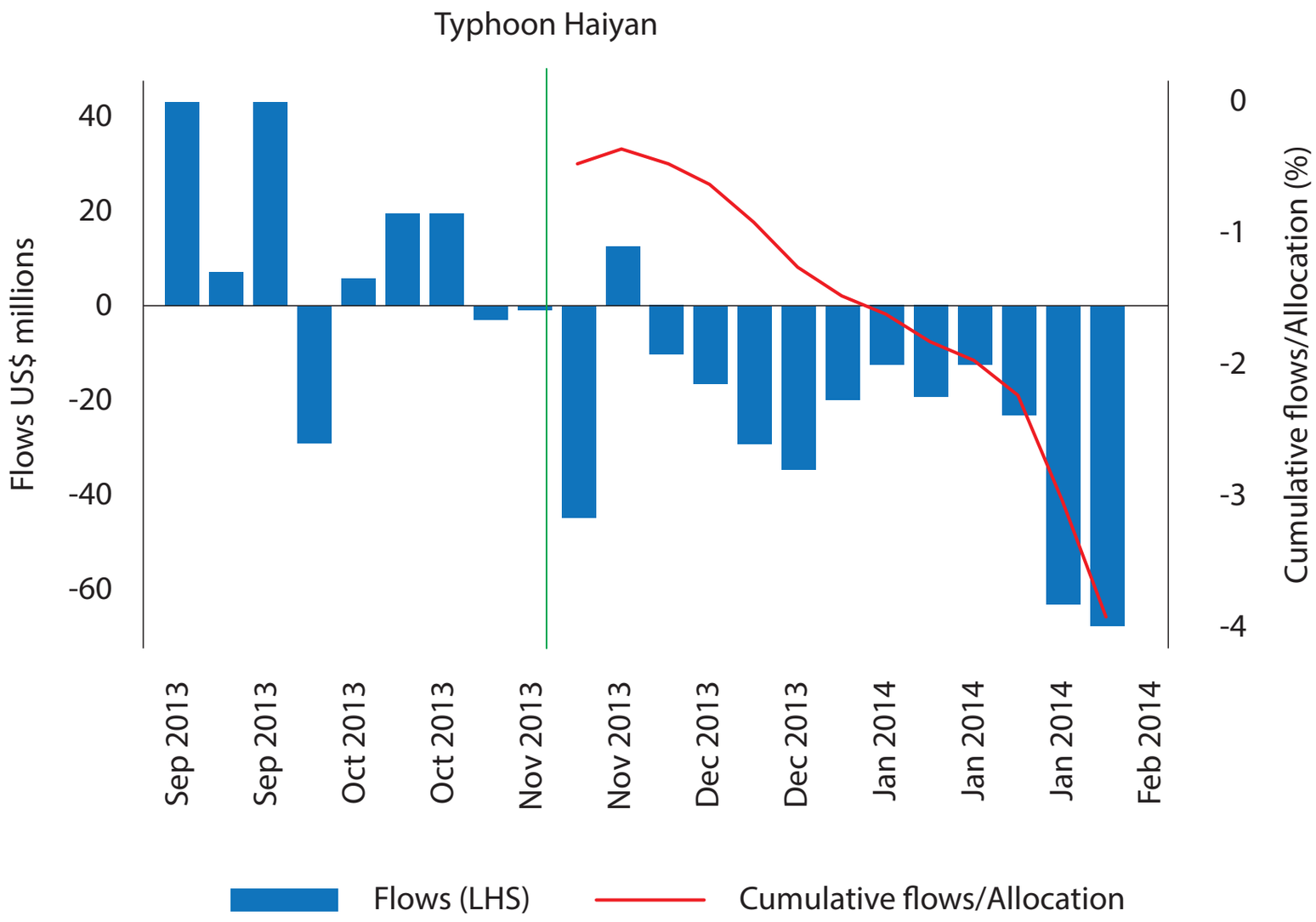
We take up this issue by investigating whether these events can shape international investors' portfolio flows. We construct a multi-country weekly dataset tracking the occurrence of large natural disasters and net inflows to equity mutual funds by destination country[1]. We employ the dataset that spans 2009-2019 to study the effect of extreme natural events on global financial flows[2].

The Typhoon Haiyan case study

A neat illustration of the mechanism we uncover is exemplified by the dynamics of net inflows to mutual funds investing in the Philippines before and after Typhoon Haiyan in 2013 (Figure 1). Whereas, before the disaster, equity flows to the country were fluctuating, after the typhoon a clear and persistent pattern of capital outflows emerged. We generalise this narrative and investigate the drivers underlying this phenomenon through rigorous econometric analysis.

Results suggest that international investors flee countries that are risky from a climatic standpoint and recompose their portfolios towards safer economies that are also more resilient to future natural disasters

Figure 1. Case study: Impact of Haiyan Typhoon on equity portfolio flows to the Philippines



The impact of natural disasters on portfolio flows

In our recent paper (Ferriani *et al* 2023), we use several panel regression models to estimate the effect that natural disasters exert over time on portfolio equity flows[3].

Our estimates point to a significant response of international investors exclusively when disasters hit emerging economies (EMEs), in particular those classified as the most vulnerable to climate change, see Figure 2[4].

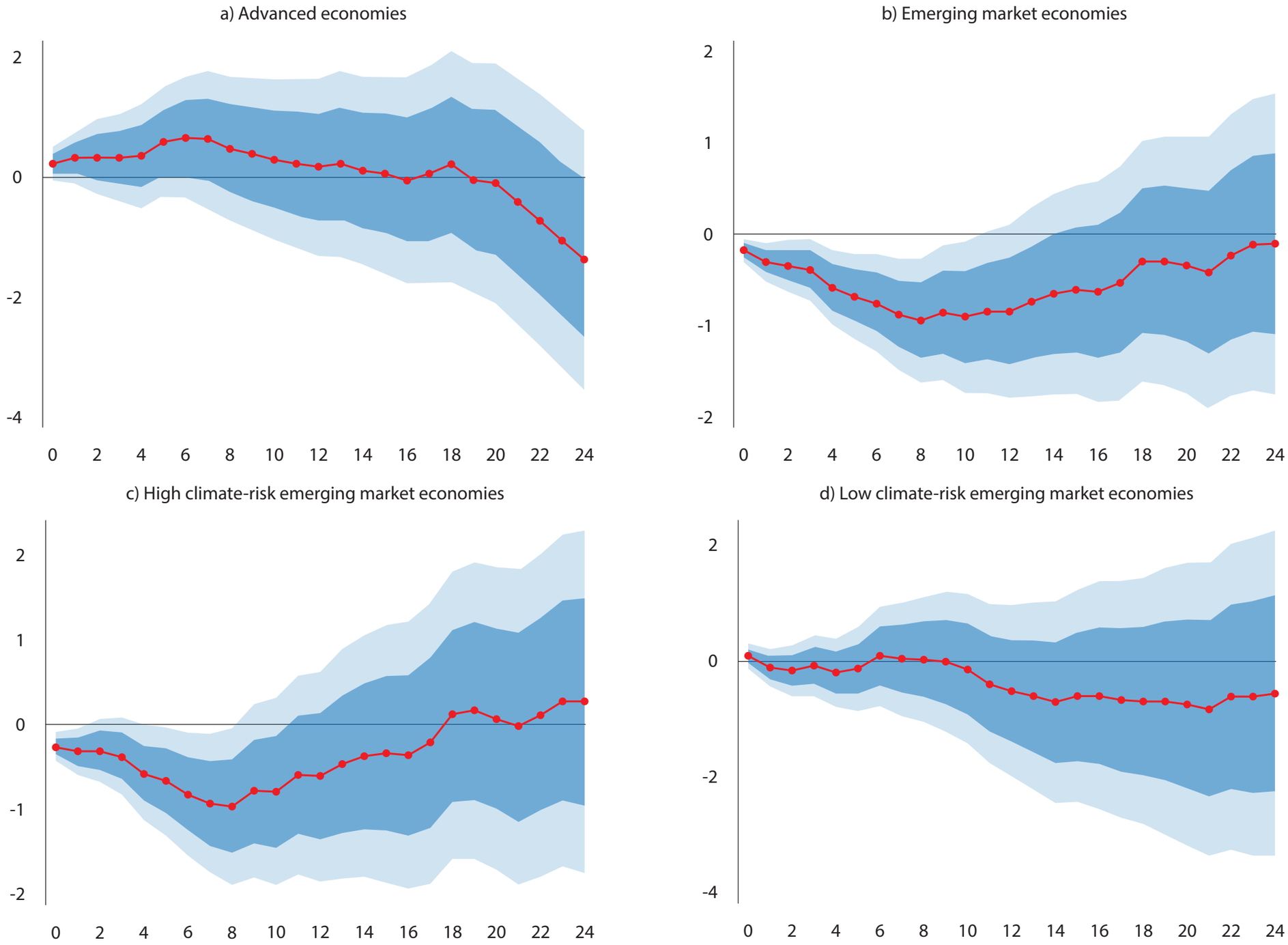
Inflows to these countries drop gradually after the disasters unfold, with inflows remaining persistently subdued for about three months. The cumulated impact of each event at its maximum is, on average, associated with a 0.1 percentage point decrease in net portfolio flows (scaled by asset under management), a sizable effect if compared with average weekly net flows that are equal, in our sample, to 0.16%[5]. Conversely, advanced economies and less climate-vulnerable EMEs do not see a reduction in capital inflows.

Search for climatic safety

What drives the response of investors? Disasters can physically disrupt the productive structure of the economy and investors may pull out of the country due to the fall in expected cash flow. Our analysis suggests, however, that the investors' behaviour is primarily driven by an update of beliefs on the global climatic threat.

This conclusion builds on two additional results. First, we show that investors pull out even from neighbouring countries that have not been directly hit by a disaster but that are arguably subject to the same climatic risks. This result holds even controlling for trade linkages between neighbouring countries, ie. net of any spillover effect coming from the disaster.

Figure 2. Impact of natural disasters on equity portfolio flows



Note: Impact of natural disasters on equity portfolio flows, the horizon is weekly; coefficients represent percentage points, with 68% and 90% confidence bands.

Second, after a disaster occurs in climatic-vulnerable EMEs, advanced economies benefit from increased inflows proportionally to both their exposure to climatic risk and their level of insurance to climatic events (Figure 3)[6].

Among advanced economies, traditional safe haven countries such as Japan, Germany, and Switzerland, which are typically beneficiaries of standard flight-to-safety episodes, do not receive heightened flows in response to natural disasters occurring in high climate-risk EMEs.

Taken together, these results suggest that international investors flee countries that are risky from a climatic standpoint and recompose their portfolios towards safer economies that are also more resilient to future natural disasters.

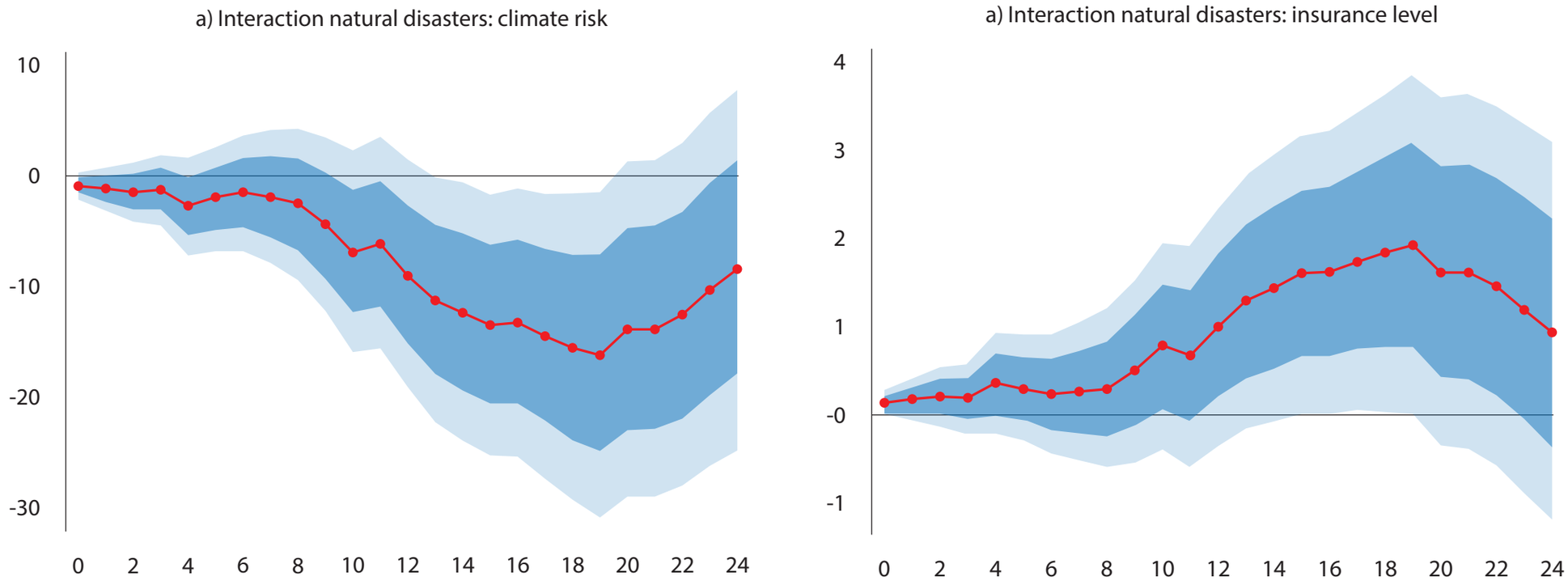
The occurrence of such events appears to raise investors' attention towards the global climatic threat, shaping their beliefs about the portfolio risks attached to the invested countries. According to this interpretation, disasters can shape mutual funds inflows and outflows by triggering a specific flight-to-safety motive for trading, based on the perceived climate risk of the invested assets – a flight to climatic safety.

Importantly, all these results hold after multiple robustness tests where we use alternative measures of portfolio flows, climatic riskiness, insurance level, definitions of climate events, and controls for each countries' fiscal capacity.

Conclusions and policy implications

We uncover a novel and relevant dimension through which climate change affects the global economy that was previously disregarded in the international finance literature.

Figure 3. Spillovers to advanced economies



Note: Spillover from high-risk EMEs to AEs. The left plot displays the IRFs of the interaction term between ND-GAIN vulnerability index and the dummy for natural events occurrence in HCR EMEs; the right plot displays the IRF of the interaction term between non-life insurance coverage and the dummy for natural events occurrence in HCR EMEs. The horizon is weekly; coefficients represent p.p., with 68% and 90% confidence bands

Going ahead, these portfolio movements are likely to become more sizable and volatile as climatic disasters increase in frequency and intensity over time due to climate change, raising uncertainty about financial capital availability at the country level.

These findings are relevant for the policy debate on the design of effective mitigation and adaptation policies at a regional scale. ■

Fabrizio Ferriani, Andrea Gazzani and Filippo Natoli are Senior Economists at the Bank of Italy

Endnotes

1. The data on natural disasters comes from the Emergency Events Database (EM-DAT) of the University of Louvain. Data on portfolio equity is provided by the Emerging Portfolio Fund Research (EPFR) dataset.
2. For ease of exposition, we consider natural disasters and extreme weather events as interchangeable.
3. We estimate the dynamic causal effect using local projections (Jorda 2005).
4. According to the vulnerability component of the University of Notre Dame-Global Adaptation Index (ND-GAIN). We define vulnerable EMEs as those countries above the median.
5. The obtained effect on net flows is roughly equivalent to a 5 basis point US monetary shock, based on the study of the impact of US monetary policy shocks on EME mutual funds provided in Ciminelli et al. (2022).
6. Insurance is measured as the amount of non-life insurance premium to GDP (as %) obtained from the World Bank.

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Carbon trade-offs: how firms respond to emissions controls

Regulatory efforts to control carbon emissions are intensifying around the world. Maria Cecilia Bustamante and Francesca Zucchi examine the effects of carbon pricing mechanisms on businesses

Given that regulatory efforts to control carbon emissions are intensifying around the world, understanding the incentives that carbon pricing creates for firms is paramount. This column presents a framework showing that whilst carbon pricing mechanisms curtail firms' carbon emissions, as it becomes costlier to comply, these mechanisms also tilt polluting firms' investment mix towards short-term abatement and away from green innovation. Subsidies for innovation can partly offset this shift and, overall, can boost firms' green investment.

To limit global warming, several countries around the world have adopted carbon pricing mechanisms (or are considering doing so). As shown in Figure 1, regulators rely on two carbon pricing mechanisms: emissions trading systems and carbon taxes (or a combination of the two).

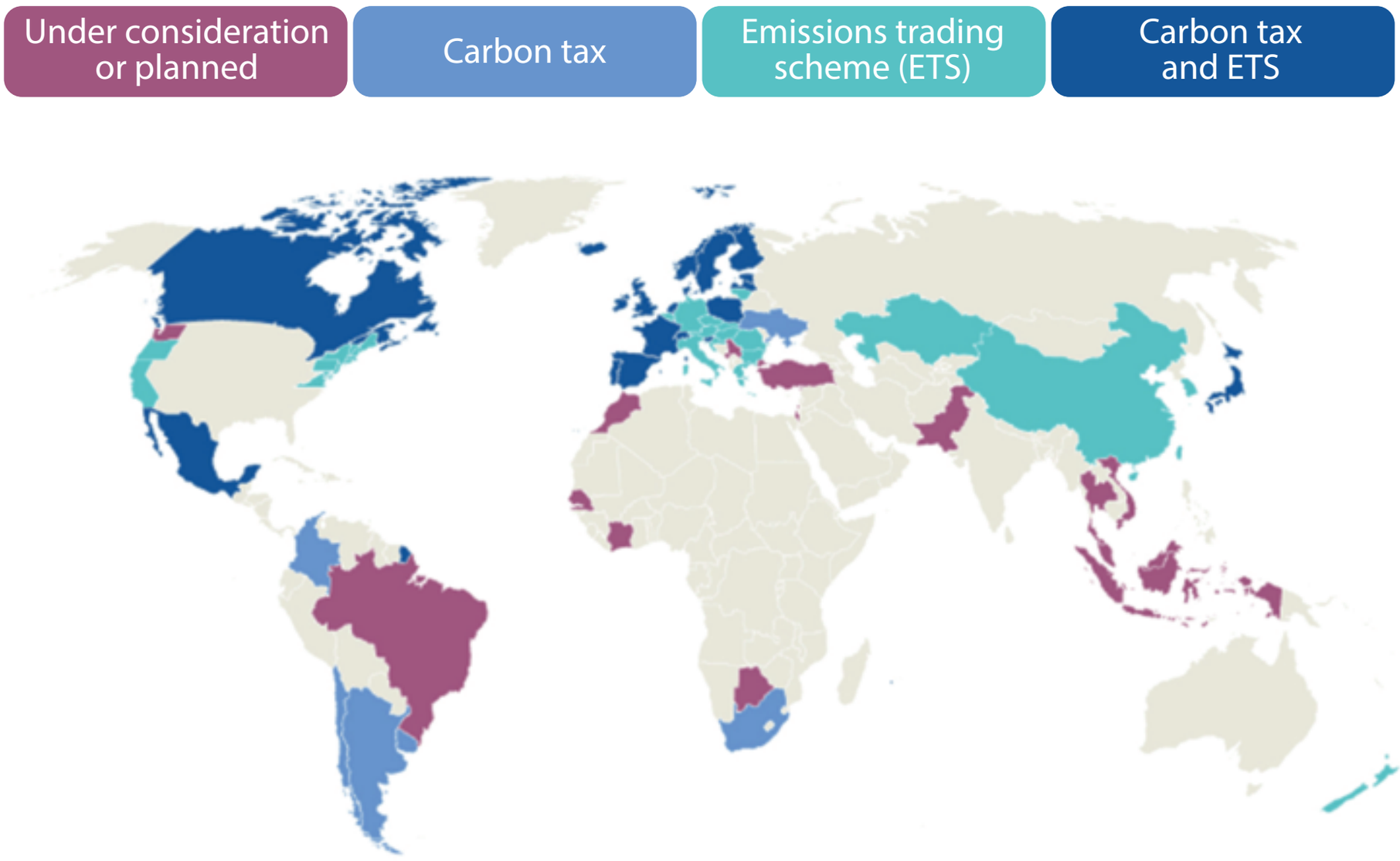
Under emissions trading systems, carbon credits give firms the right to release a set volume of emissions into the atmosphere (generated through their production processes). These credits are also tradeable, which means firms with a shortage of credits can buy them, and firms with an excess of credits can sell them.

In contrast, under carbon tax systems, a central authority sets a predetermined price that emitters pay for a set volume of emissions. A common feature of carbon pricing mechanisms is that they impose additional costs on businesses.

As a result, every tonne of carbon dioxide produced through industrial processes needs to be paid for, either by surrendering carbon credits (which are costly) or by paying a tax on it.

Given that regulatory efforts to control carbon emissions are intensifying around the world, understanding the incentives that carbon pricing creates for firms is paramount. Intuitively, by making pollution costly, carbon pricing mechanisms should provide incentives for firms to reduce their carbon footprint.

Figure 1. Carbon pricing around the world



Notes: The map illustrates the adoption of carbon pricing mechanisms around the world. The boundaries and other information shown do not imply on the part of the IMF any judgement on the legal status of any territory or any endorsement or acceptance of such territories.
Sources: World Bank Group, IMF staff calculations and national sources, July 2022.

However, a key question is how firms attain this goal. The answer is indeed not obvious, as firms can have various options at their disposal to limit their carbon footprint; for instance, they can cut their output or engage in green investment with various horizon and cost profiles.

The control of carbon emissions by regulators poses a new challenge in the corporate world, namely maximising shareholder value by developing an optimal carbon management policy

To answer this question, in a recent paper (Bustamante and Zucchi 2023) we have constructed a theoretical framework to investigate the incentives that carbon pricing creates for firms and how they should therefore best respond.

We study the three most prevalent regulatory frameworks: laissez-faire (or no regulation), emissions trading systems and carbon tax systems. We assume that firms choose the mix of policies that maximises shareholder value.

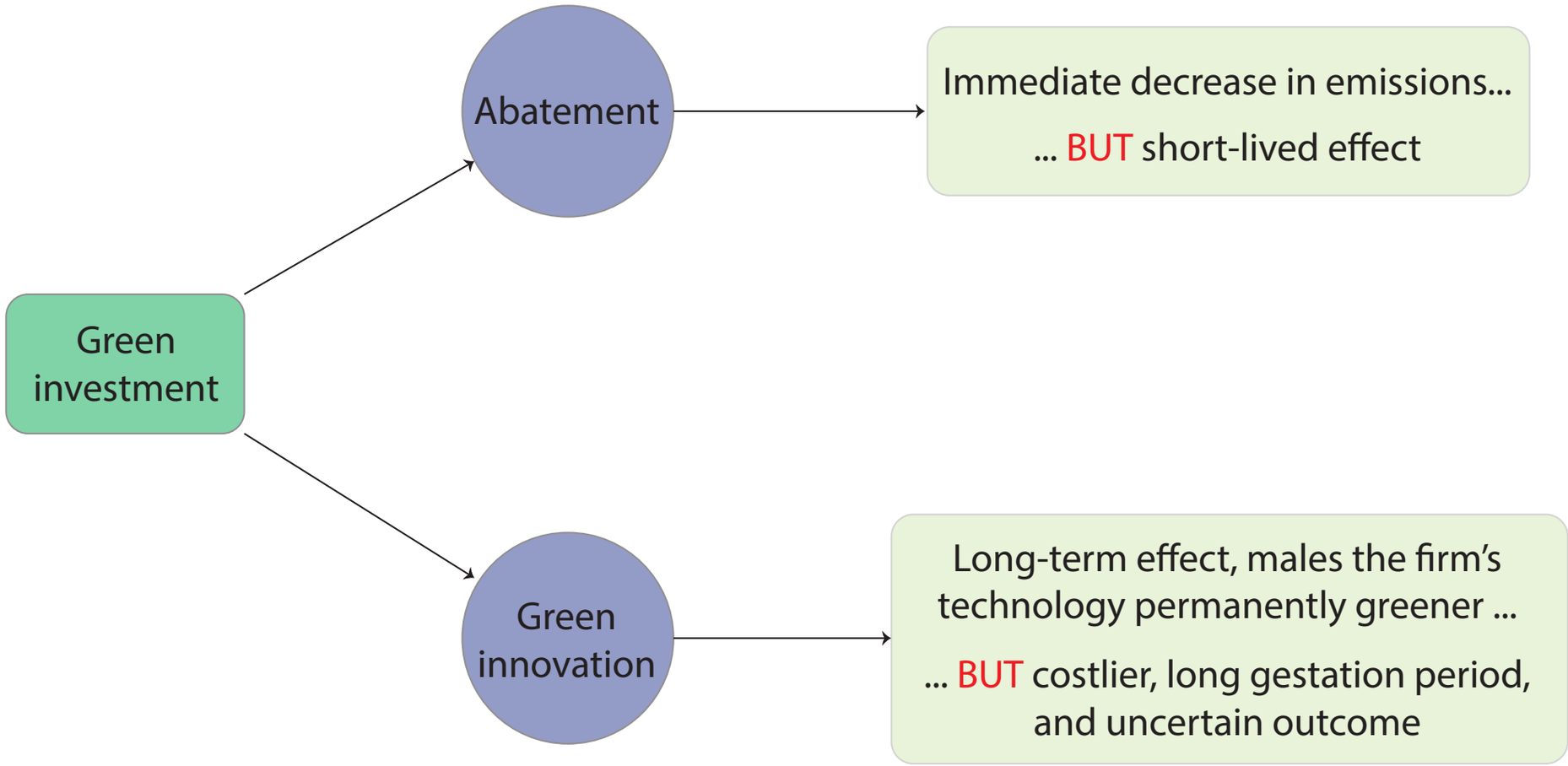
First, they can adjust their scale of production, which directly determines their gross carbon emissions. Second, firms can engage in green investments, which are intended to make industrial processes cleaner. Third, under emissions trading systems, they can optimally manage and trade carbon credits. As a result of this dynamic problem, firms' net emissions depend on the choices they make, and vary over time.

As a novel distinction, our framework acknowledges that green investment projects feature different characteristics. Two green investment projects at opposite extremes of the spectrum can be considered, as illustrated in Figure 2: abatement and green innovation.

At one extreme, abatement projects are aimed at offsetting some of the firms' emissions. That is, firms generate emissions through their production processes and abatement projects have the effect of 'cleaning up' some of these emissions. Planting trees or carbon capture and storage are just some examples. While immediately reducing firms' net emissions, abatement projects do not result in structural technological change.

At the other extreme, green innovation fosters the transition to novel, more sustainable technologies and has a long-lasting effect – it makes a firm's technology permanently less polluting[1]. Pioneering inventions which accelerate the phasing-out of fossil fuels are a key example. While having a long-term impact on sustainability, green innovation is costlier than abatement, has a long gestation period, and has an uncertain outcome[2].

Figure 2. Green investment types



Note: The diagram shows the different types of green investment that a firm can undertake along with the associated benefits and downsides, as described in Bustamante and Zucchi (2023).

How do firms respond to carbon pricing?

A first insight of our analysis is that carbon pricing effectively leads to a reduction in firms' net carbon emissions compared with laissez-faire, which is consistent with the available evidence (See, for instance, Fowlie *et al* 2012, Martin *et al* 2016).

This happens for two reasons. First, firms produce less compared with laissez-faire, as carbon pricing makes them internalise the externalities associated with their industrial processes. Second, firms engage in green investment.

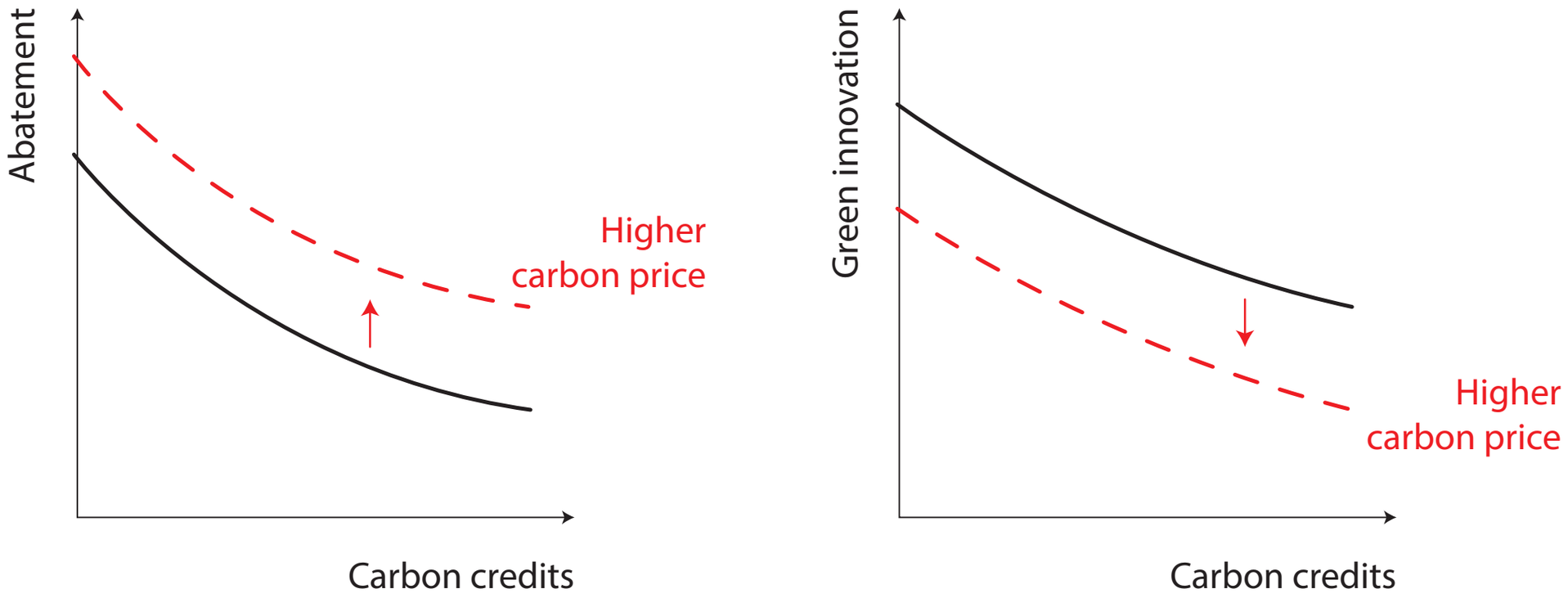
Moreover, our analysis reveals that carbon pricing affects firms' green investment mix. As it becomes costlier to comply, polluting firms tilt their green investment mix towards short-term abatement and away from green innovation, as illustrated in Figure 3.

The reason is that abatement effectively and immediately reduces a firm's expected cost of carbon regulation, whereas green innovation has a delayed and uncertain outcome. That is, by engaging more in abatement, firms decrease their net emissions with immediate effect – thus, they reduce their need to buy credits under emissions trading systems, or they lower their tax liability under carbon tax systems.

Shifting to abatement, however, can slow down the transition to greener technologies. Our analysis shows that this shift can be (at least partly) offset by complementing carbon pricing with subsidies for green innovation. Such subsidies not only spur greater engagement in green investment, but also tilt the mix in favour of green innovation.

In the specific case of emissions trading systems, our model also warns that firms holding larger balances of carbon credits are less committed to curbing their emissions (consistent with the empirical evidence in De Jonghe *et al* 2020).

Figure 3. Carbon pricing and the green investment mix



Notes: The diagram shows how the different types of green investment (abatement and green innovation) respond to an increase in the carbon price, as described in Bustamante and Zucchi (2023). If the carbon price increases – meaning that it becomes costlier to comply – polluting firms increase their investment in abatement and decrease their investment in green innovation. The figures also show that firms' engagement in green investment decreases as their balances of carbon credits increase.

The reason is that firms adopt precautionary policies to minimise their need to buy carbon credits and incur the ensuing costs. This precautionary need is especially strong when firms have low balances of carbon credits. In those instances, firms optimally cut production to reduce their consumption of credits and, additionally, increase their green investment.

Conversely, a large balance of carbon credits reduces this precautionary need. Thus, firms increase production and reduce their engagement in green investment, leading to higher emissions overall. Our model then suggests that limiting the distribution of free carbon credits can make firms more committed to green investment.

Lastly, our model suggests that carbon regulation does not necessarily decrease shareholder value. Despite the long-standing perception of a conflict of interests between businesses and environmental regulators, a growing body of empirical literature documents that the effects of climate regulation vary across firms (eg. Bolton *et al* 2023, Trinks and Hille 2023).

Our paper provides theoretical grounds for this evidence. In fact, the sale of carbon credits as well as subsidies for green firms can effectively increase valuations if firms are sufficiently committed to reducing their carbon footprint.

Conclusion

The control of carbon emissions by regulators poses a new challenge in the corporate world, namely maximising shareholder value by developing an optimal carbon management policy. We show precisely how firms should optimally manage carbon emissions through their scale of production, green investments of various types, and the management of carbon credits.

Our analysis suggests that carbon pricing mechanisms curtail firms' carbon emissions but, as it becomes costlier to comply, these mechanisms also tilt polluting firms' investment mix towards short-term abatement and away from green innovation.

Subsidies for innovation can partly offset this shift and, overall, can boost firms' green investment. Our model also shows that, under emissions trading systems, firms with large balances of carbon credits are less committed to reducing emissions, which provides an argument in support of limiting the allocation of free carbon credits. Overall, we conclude that carbon regulation does not necessarily decrease shareholder value. ■

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Endnotes

1. Green innovation is viewed as necessary to limit global warming to the Paris Agreement's targets, as noted by Aghion et al (2022), among others. A seminal contribution studying endogenous green innovation is Acemoglu et al (2012).

2. De Haas and Popov (2023) document how these characteristics make green innovation hard to finance.

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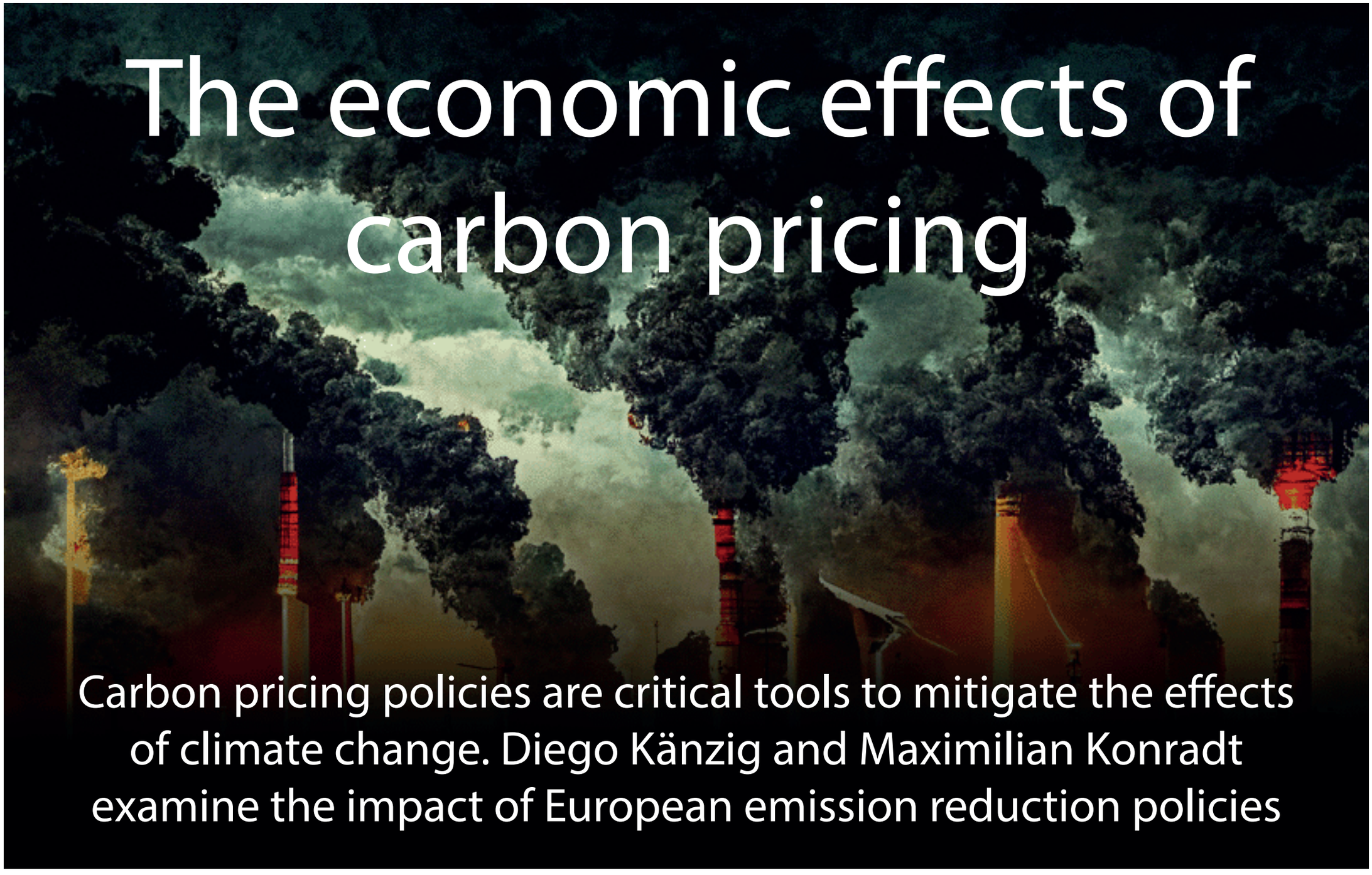
The economic effects of carbon pricing



Carbon pricing policies are critical tools to mitigate the effects of climate change. Diego Känzig and Maximilian Konradt examine the impact of European emission reduction policies

Carbon pricing policies are increasingly used as a tool to mitigate climate change. While there is mounting evidence on the effectiveness of such policies for emission reductions (eg. Martin *et al* 2014, Andersson 2019), less is known about their economic effects. In this column, we provide new empirical evidence on the aggregate and regional impacts of carbon pricing, drawing on our recent research on the European experience (Känzig and Konradt 2023).

There are two main climate policy tools in Europe. The cornerstone to combat climate change is the EU Emissions Trading System (EU ETS). However, many European countries have also enacted national carbon taxes to complement the common carbon market.

We assess the dynamic effects of both policies in a unified empirical framework to be able to attribute any potential differences to policy design.

Specifically, we estimate a panel model of European countries and identify the effects of carbon pricing by controlling for global and local macro-financial conditions in addition to country fixed effects, building on the approach by Metcalf and Stock (forthcoming).

For the carbon market, we also employ the high-frequency strategy proposed in Känzig (2023) and find that the two approaches produce comparable results.

Our findings suggest that while both policies have successfully reduced emissions, the economic costs of the European carbon market are larger than for national carbon taxes, leading to a stronger fall in GDP and a sharper rise in unemployment.

To account for the differential effects, we evaluate the role of (1) fiscal policy and revenue recycling, (2) pass-through and sectoral coverage, (3) spillovers and leakage, and (4) monetary policy. We find that all four played a significant role.

Carbon pricing policies in Europe have been successful at reducing emissions but can come at economic costs that are borne unequally across different regions

Lastly, we study the heterogenous effects of the common carbon market on European countries. Our results imply substantial differences in the economic impacts of a similarly sized carbon shock across European countries, depending on the share of freely allocated emission permits and the degree of market concentration in the power sector.

The effects of Europe's carbon pricing initiatives

The EU ETS is one of the largest carbon markets in the world and accounts for over 40% of the bloc's total emissions. It covers the most carbon-intensive sectors, such as the power sector and heavy-emitting industrial sectors.

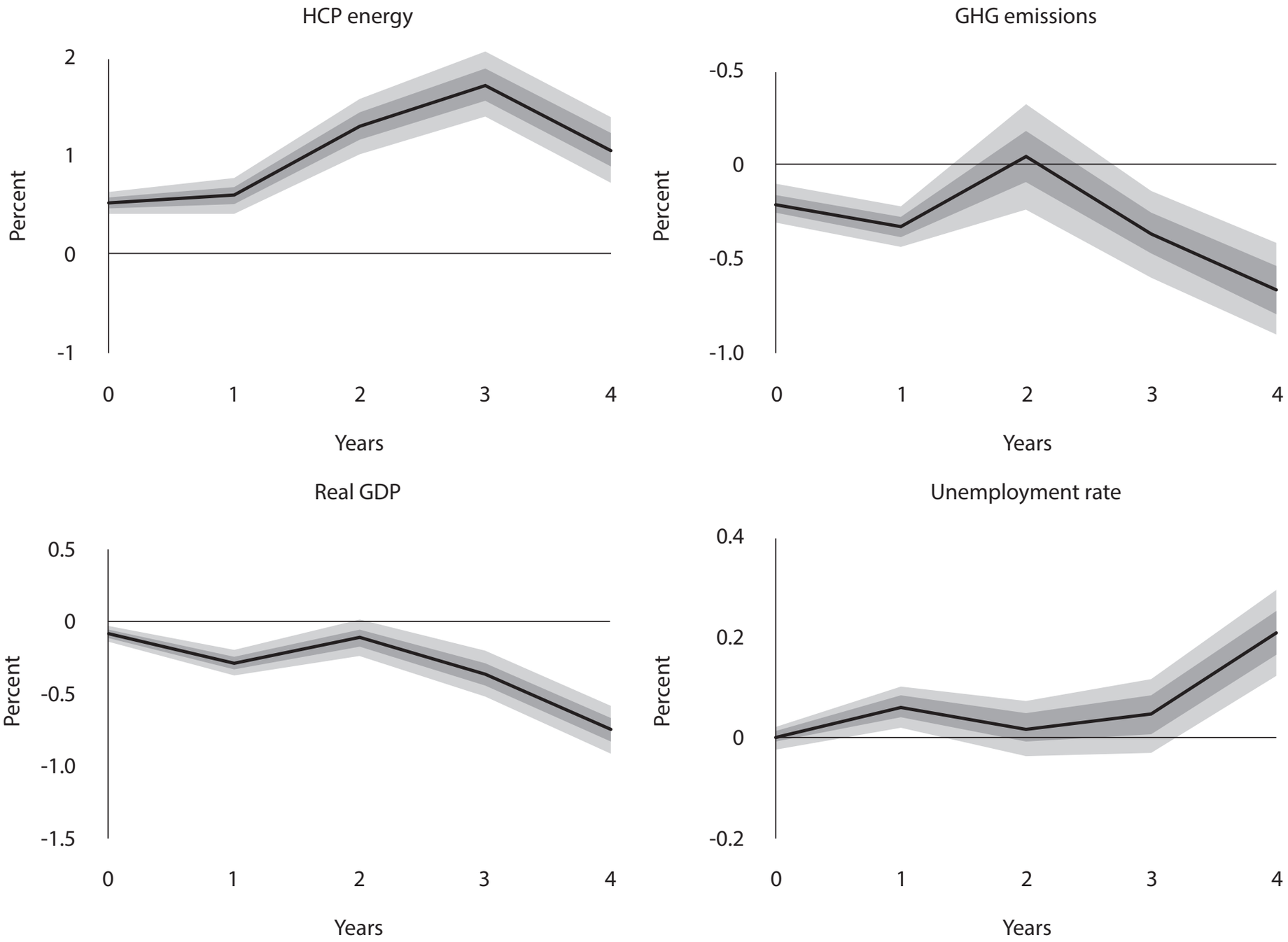
Figure 1 shows the estimated responses to a euro increase in the coverage-weighted carbon price on emissions and the economy. We see that higher carbon prices lead to a significant increase in energy prices and a persistent fall in emissions.

However, this does not come without a cost. Output falls persistently and consumer prices increase, along with a rise in the unemployment rate. These results are broadly consistent with the findings in Känzig (2023), even though the responses are estimated to be somewhat more persistent.

In addition to the EU-wide carbon market, many European countries enacted national carbon taxes to further reduce emissions. These taxes cover sectors and industries that are not part of the emissions trading scheme, such as the transportation and buildings sectors as well as smaller, less energy-intensive industries. Since taxes vary in scope and ambition, we focus on a more homogenous sample of Western and Northern European countries.

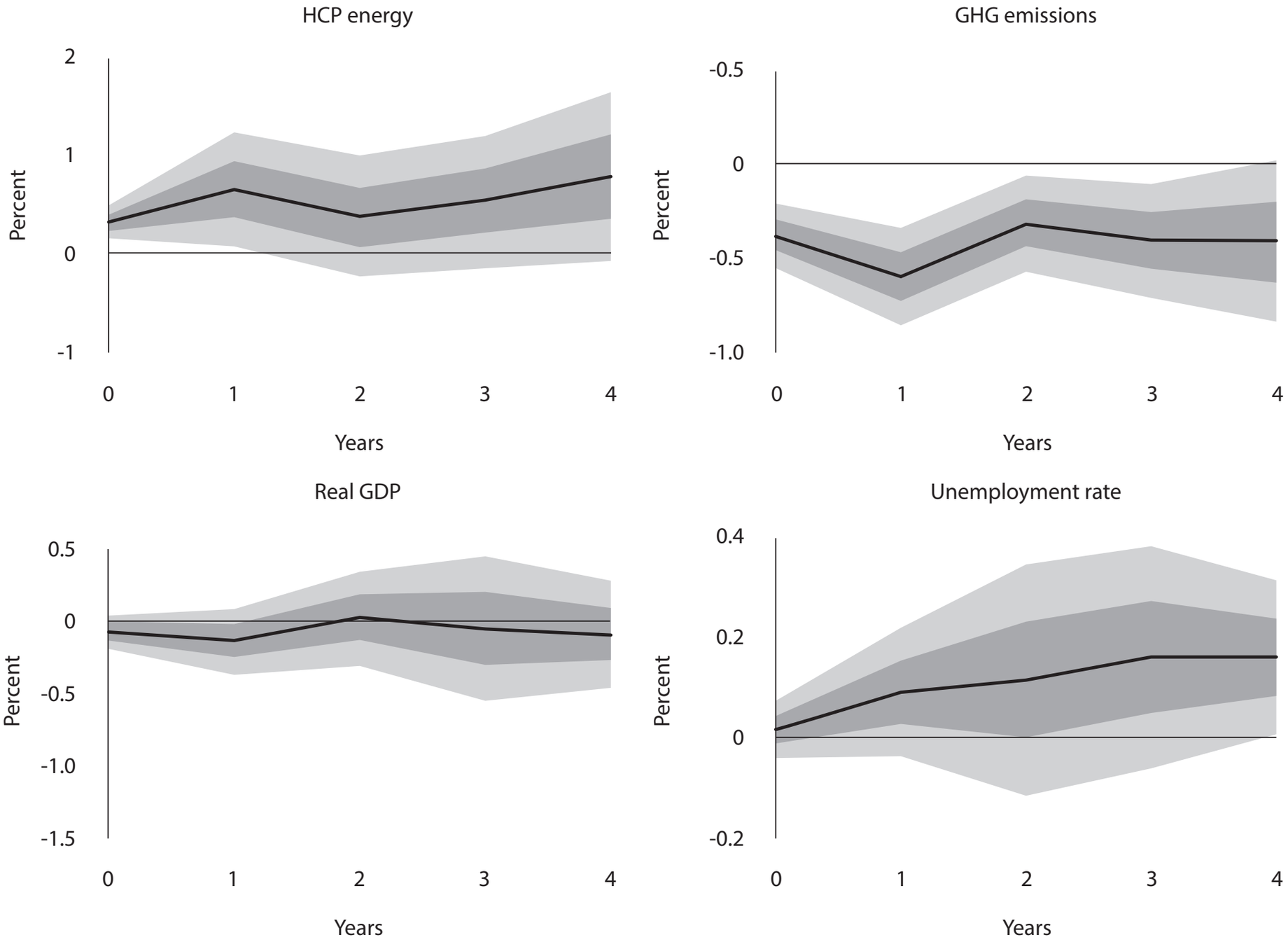
How do the empirical effects compare between the two types of policies? Figure 2 shows a similar fall in emissions following a euro increase in the coverage-weighted carbon tax. The increase in energy prices is more muted, however, and there is little pass-through to overall consumer prices.

Figure 1. The effects of an increase in EU ETS carbon prices



Notes: Impulse responses to an innovation in the ETS carbon price, normalized to increase real coverage-weighted carbon prices by one euro. The solid line is the point estimate and the dark- and light-shaded areas are 68 and 95 per cent confidence bands.

Figure 2. The effects of an increase in European carbon taxes



Notes: Impulse responses to an innovation in European carbon taxes, normalized to increase real coverage-weighted carbon taxes by one euro. The solid line is the point estimate and the dark- and light-shaded areas are 68 and 95 per cent confidence bands.

Further, we find only modest impacts on GDP, industrial production, or unemployment, corroborating the findings of Metcalf and Stock (forthcoming) and Konradt and Weder di Mauro (2021, forthcoming).

What explains the different effects?

What can explain the differential economic effects of carbon prices and carbon taxes? We shed light on four factors, which all play a role. First, unlike the EU ETS, national carbon taxes are frequently implemented alongside broader fiscal reforms that potentially cushion some of the burdens for firms and households.

To show this, Figure 3 separately estimates impulse responses for countries that indicated an intention to recycle carbon tax revenues. We see that the adverse economic effects are more pronounced in countries that do not recycle tax revenues, displaying a stronger fall in output and an increase in unemployment.

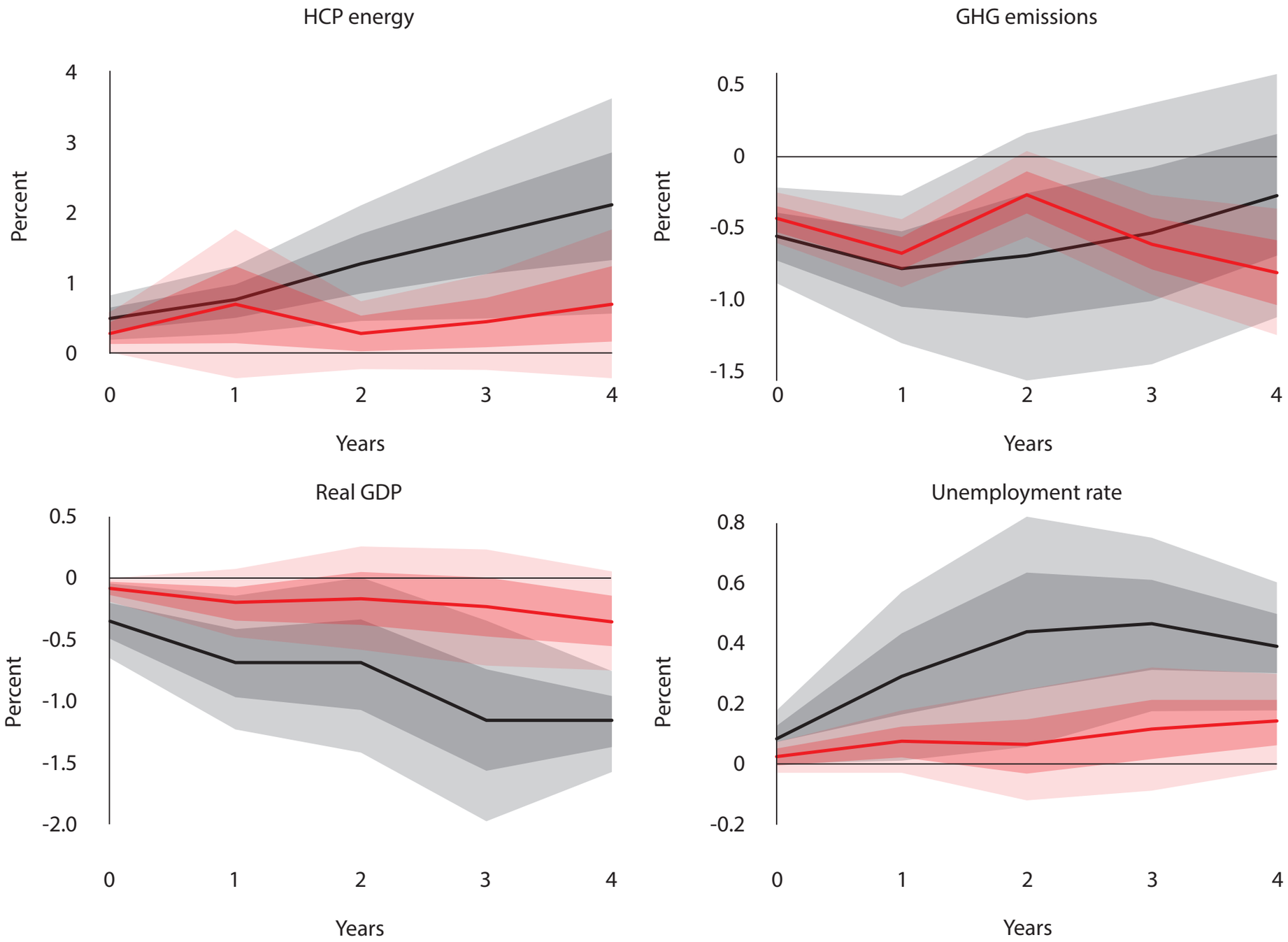
However, these differential impacts cannot be uniquely attributed to revenue recycling as non-revenue recycling countries also display a somewhat stronger response to energy prices.

Interestingly, the emission responses turn out to be comparable, suggesting that redistributing tax revenues can lower economic costs without compromising emission reductions.

Second, an important distinction between the two carbon pricing initiatives relates to the type of sectors that are covered. Since energy-intensive firms likely pass through a larger fraction of emission costs (Fabra and Reguant 2014), prices could be more affected by the EU ETS, which covers the heaviest emitters.

Indeed, we document a significant response of energy, consumer, and producer prices after an increase in EU ETS prices while the price responses after an equivalent increase in carbon taxes are small and insignificant.

Figure 3. The role of revenue recycling



Notes: Impulse responses to a carbon tax innovation in revenue (red line) and non-revenue recycling (black line) countries. The dark- and light-shaded areas are 68 and 95 per cent confidence bands.

Third, the broader scope of the ETS implies that countries experience simultaneous price changes, limiting the role of potential cushioning effects with unaffected trade partners or carbon leakage to third countries, compared to national carbon taxes. Consistent with this view, we estimate that only ETS prices significantly reduce overall EU emissions.

Lastly, monetary policy could also play a role in accounting for the differential impacts. Carbon policy-induced changes in consumer prices could trigger a policy reaction by the ECB, further reinforcing recessionary effects.

Conversely, one would not expect a monetary response to national carbon taxes, especially given the limited price pressure associated with these policies. Our estimates support this view: while interest rates rise significantly after an increase in ETS prices, the response to a carbon tax increase is estimated around zero and insignificant.

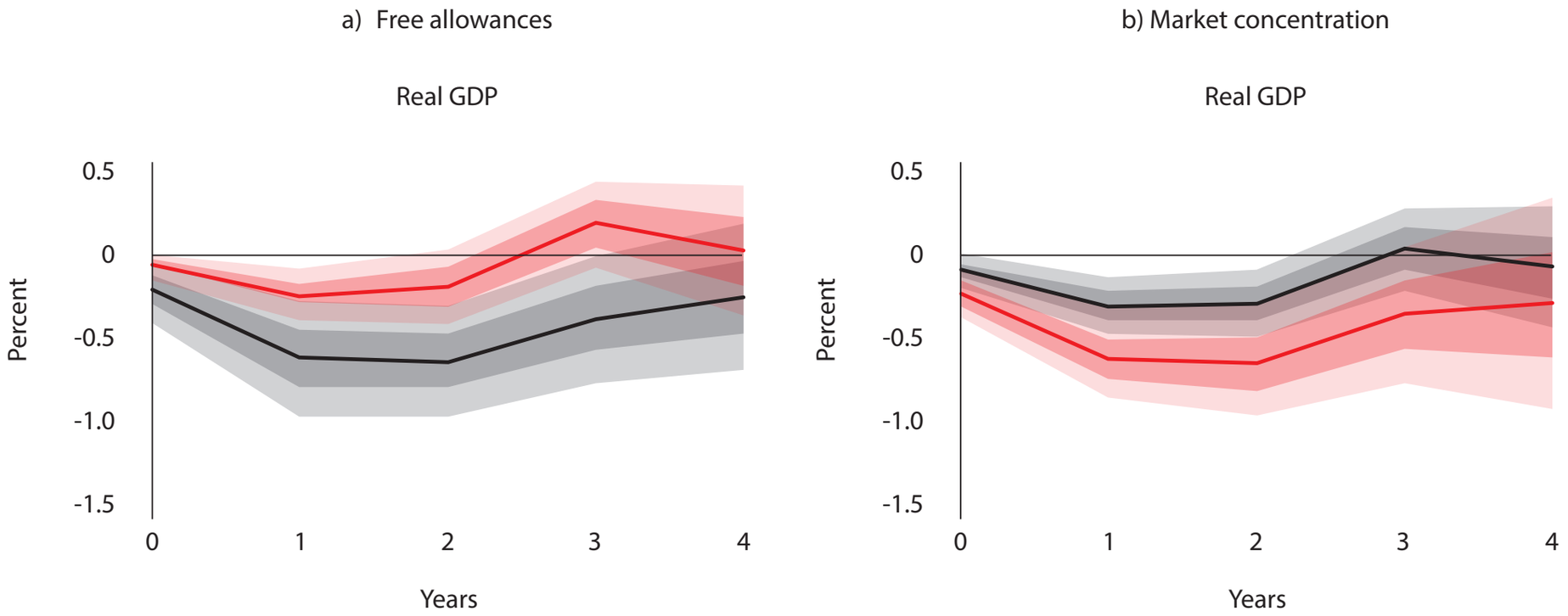
Regional heterogeneity

Although all European countries are faced with common carbon price changes in the ETS, the transmission likely depends on country characteristics.

We focus on the share of freely allocated emission certificates (relative to total emissions) and the degree of market concentration in the power sector as possible transmission channels. The former affects the costs that local firms incur to offset emissions while the latter likely influences the strength of pass-through to energy prices.

Figure 4 illustrates the effects on output based on the carbon price shocks identified in Känzig (2023), normalized to increase the HICP energy component by one per cent on impact.

Figure 4. Regional effects of the EU ETS



Notes: Impulse responses to a carbon price shock at the mean in grey and with one standard deviation higher share of free allowances to total emissions (panel A) and higher concentration in the power sector (panel B) in red. The black/red line is the point estimate and the dark- and light-shaded areas are 68 and 95 per cent confidence bands.

We see that a greater share of free allowances substantially dampens the output response (Panel A). Similarly, Panel B shows that higher concentration in energy markets is associated with a stronger negative effect on economic activity, as the energy price response turns out to be more pronounced.

Interestingly, the fact that free allowances were disproportionally allocated to the poorest member countries implies that they are largely insulated from the economic costs associated with carbon pricing. Instead, our findings suggest that countries in the second quartile of the per capita income distribution are most affected by the carbon market.

Concluding remarks

Carbon pricing policies in Europe have been successful at reducing emissions but can come at economic costs that are borne unequally across different regions.

Our results from contrasting the EU ETS with national carbon taxes suggest that the recycling of carbon revenues is a key policy tool that can mitigate the potential adverse economic effects of carbon pricing.

However, any complementary fiscal policies should also take the sectoral composition and strength of pass-through into account. ■

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Climate risk stress tests underestimate financial sector losses

Henk Jan Reinders, Dirk Schoenmaker and Mathijs Van Dijk review current climate risk stress test methods and identify new approaches

Central bank concerns about climate change are on the rise, and a plethora of new methods have been developed to assess the impact of climate-related shocks on the financial sector. This column reviews current climate risk stress test methods and identifies six types of climate shocks and four types of modelling approaches.

Given the complexity of the link between climate shocks and financial sector outcomes, the authors argue that current methods have several key limitations that may lead to significant underestimation of potential financial sector losses.

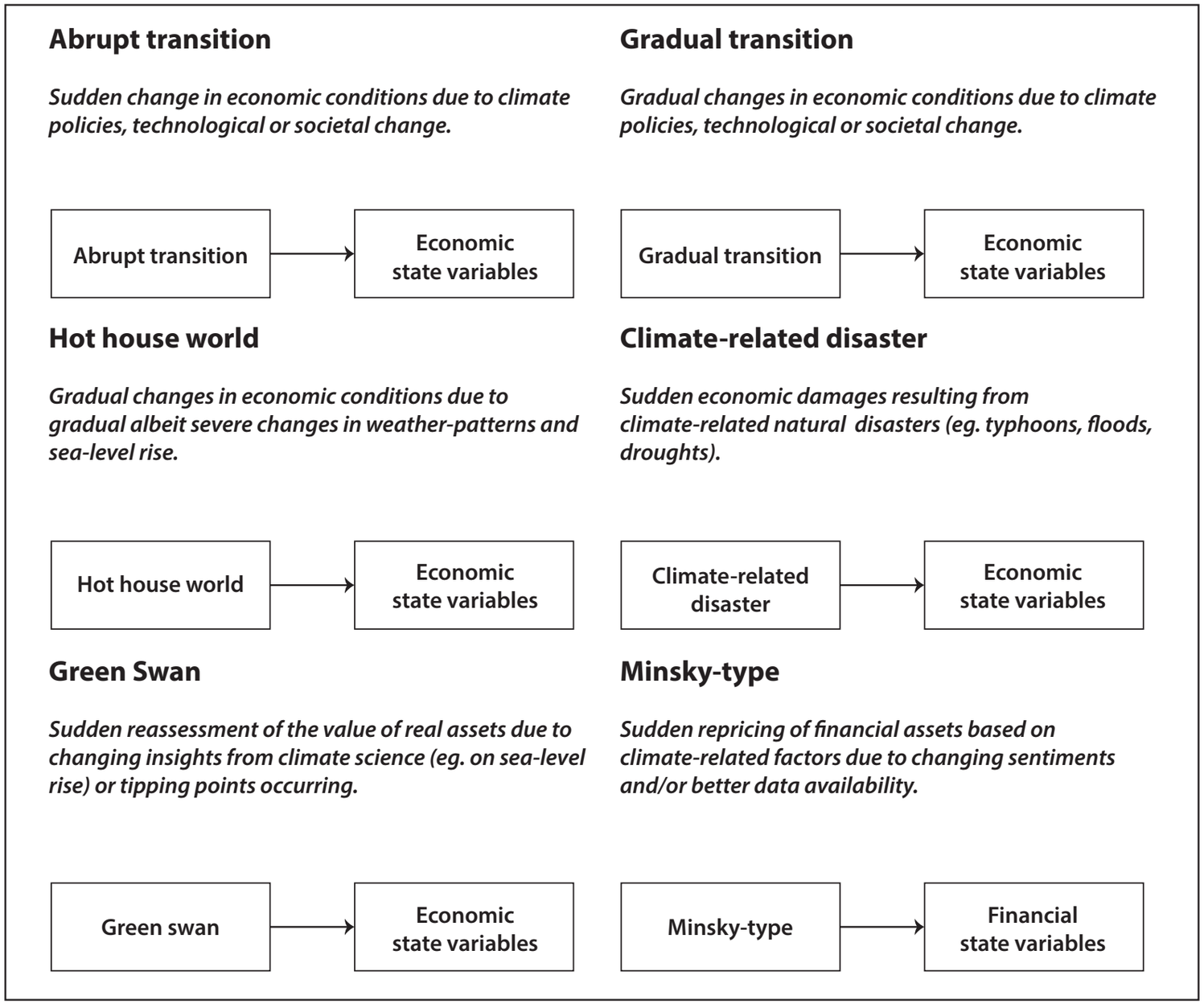
Climate change can potentially cause highly adverse shocks to the financial sector. Central banks and other policy institutions increasingly rely on a host of newly developed climate risk stress-testing (CRST) methods to assess these potential effects.

While traditional financial risk assessment methods typically assume that the future will be similar to the past, climate change is likely to lead to unprecedented and often detrimental changes in a broad set of regions and economic sectors over a long period of time. This implies a need for forward-looking risk assessments, based on those future outcomes that are potentially most detrimental.

We identify six types of climate-related shocks that are relevant for climate risk assessments: abrupt transition, gradual transition, hot house world, climate-related disaster, 'green swan' events, and Minsky-type shocks. Figure 1 provides an overview.

Several of these shocks have been investigated in some detail in current CRST applications. These include orderly transitions, disorderly transitions, and gradual changes in economic conditions due to changes in weather patterns and sea-level rise. The latter is also referred to as a 'hot house world' scenario (NGFS 2022).

Figure 1. Classification of climate shocks



Disorderly transitions have primarily been investigated by looking at the sudden introduction of climate policies (eg. Battiston *et al* 2017) or policy uncertainty (Berg *et al* 2023). Furthermore, an emerging strand of literature investigates the occurrence of one or more climate-related natural disasters on financial institutions (Hallegatte *et al* 2022).

This type of shock is highly relevant from a financial stability perspective, as disasters may cause high losses for banks and manifest themselves in very short time horizons (Klomp 2014).

We believe it is important that the next generation of CRST exercises assess the potentially most damaging scenarios and include feedback loops that can amplify shocks between climate, economic, and financial systems

Other shocks have received much less attention. This is specifically the case for scenarios in which financial sector agents suddenly change their perception of current and future risks, which would be rapidly reflected in today's market prices of financial instruments.

In the climate context, this could chiefly be for two reasons. First, a shock could emanate directly from our changing perception of the state of the global climate system. This could include the unexpected occurrence of climate tipping points or changing insights from climate science – for example, when research would find that sea-level rise occurs more quickly than previously thought.

Bolton *et al* (2020) label these tipping points and changing insights as a 'green swan' event. Second, a shock could emanate from the financial sector if it fails to continuously incorporate the latest climate science and financial sector agents suddenly do so at some point in time – for example, due to increased awareness, a large natural disaster event, or strongly improved climate risk data. We label the latter as a Minsky-type shock.

CRST modelling approaches

To assess the impact of climate shocks on the financial system, different modelling approaches are emerging. CRST must convert initial parameters (climate shocks) into key financial sector variables such as solvency and liquidity ratios.

The typical way that CRST methods do this is by employing macroeconomic models and translating shocks to key variables, such as GDP, into expected losses for the financial system. Additional modelling steps are often required to model the effect of severe climate shocks on the economy and financial system, as they do not have precedents in the past.

Furthermore, climate-related shocks often have specific sectoral and regional impacts, increasing the need for disaggregated (micro-based) modelling approaches. Our review of CRST methods (Reinders *et al* 2023) finds that, besides traditional macro-financial modelling, three new approaches are emerging:

1. The micro-financial approach focuses on firm or asset-level variables and uses valuation models and regression or structural models to estimate financial risk measures and losses.

2. The non-structural approach treats the economic effects of a shock as a black box and directly models the relationship between climate shock and financial outcomes, often using empirical methods.

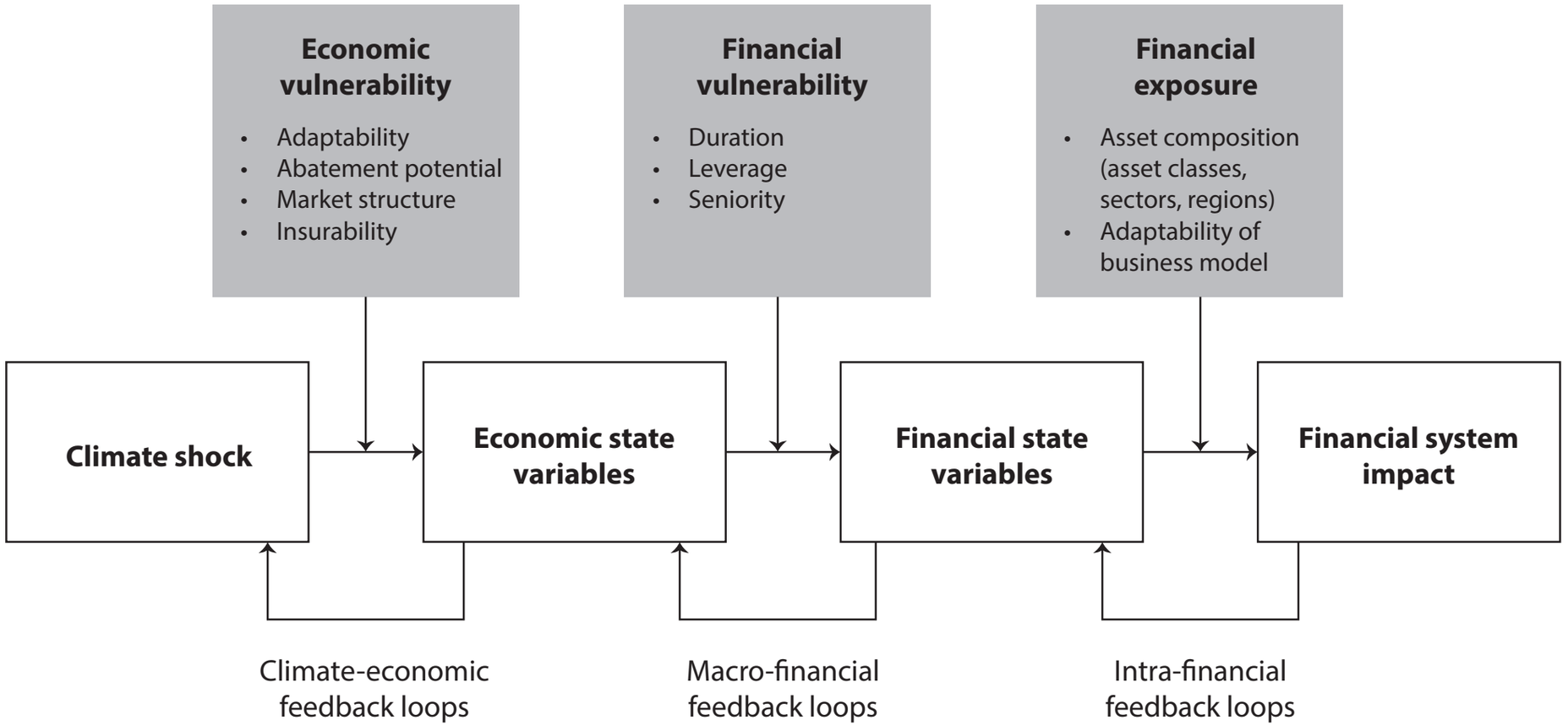
3. The disaster risk approach links disaster risk models to financial sector outcomes, estimating the impact on variables such as economic damage and total factor productivity, which can be further linked to insurance liabilities or non-insurance financial variables.

Next to several relevant moderating effects, there are important feedback loops within the financial system (intra-financial), from the financial system to the economy (macro-financial) and from the economy to climate risk (climate-economic). These feedback loops are endogenous and may amplify the initial shock, as happened during the Global Financial Crisis of 2008-2009 (see Figure 2).

Policy recommendations

Given the complexity of the link between climate shocks and financial sector outcomes, we conclude that all CRST exercises to date have substantial drawbacks. CRST is a developing field with, so far, a wide variety of approaches to model the relation between climate shocks and financial sector outcomes. Common limitations include limited

Figure 2. Moderating variables and feedback loops in the climate-financial relation



scopes (such as including only subsets of channels and asset classes) and incomplete modelling (such as excluding feedback effects).

Furthermore, our review points to an overreliance on macro models with low sectoral and spatial granularity and neglect of certain climate shock types. We conclude that these limitations may well lead to a significant underestimation of potential system-wide financial losses.

We offer suggestions for improving CRST approaches, summarized in Table 1. In particular, we believe it is important that the next generation of CRST exercises assess the potentially most damaging scenarios (such as 'green swan' events or rapid repricing of financial assets) and include feedback loops that can amplify shocks between climate, economic, and financial systems. ■

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Table 1. Avenues for future research

Climate shock
• Improve understanding of tail risks related to a changing climate (eg. tipping points) • Assess plausible but severe 'Green Swan' and Minsky-type scenarios on the economy and financial sector
Vulnerability modelling
• Develop integrated modelling approaches that capture a comprehensive set of feedback loops within the financial sector, and from the financial sector to the economy and climate • Develop microeconomic approaches to climate stress testing (to assess impacts on specific economic sectors and regions) • Develop disaster risk stress tests for financial institutions other than insurers (building on existing disaster risk models)

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The Listing Act: no more than a minor boost to EU equity markets

Streamlining of the company listing process is welcome, but more fundamental reform is needed to revive the EU's flagging equity markets, Alexander Lehmann discusses

There is a growing sense of unease around the trends in European primary equity markets. The number of listed companies has been declining and continues to decline, and initial public offerings by European firms are now regularly done in the United States.

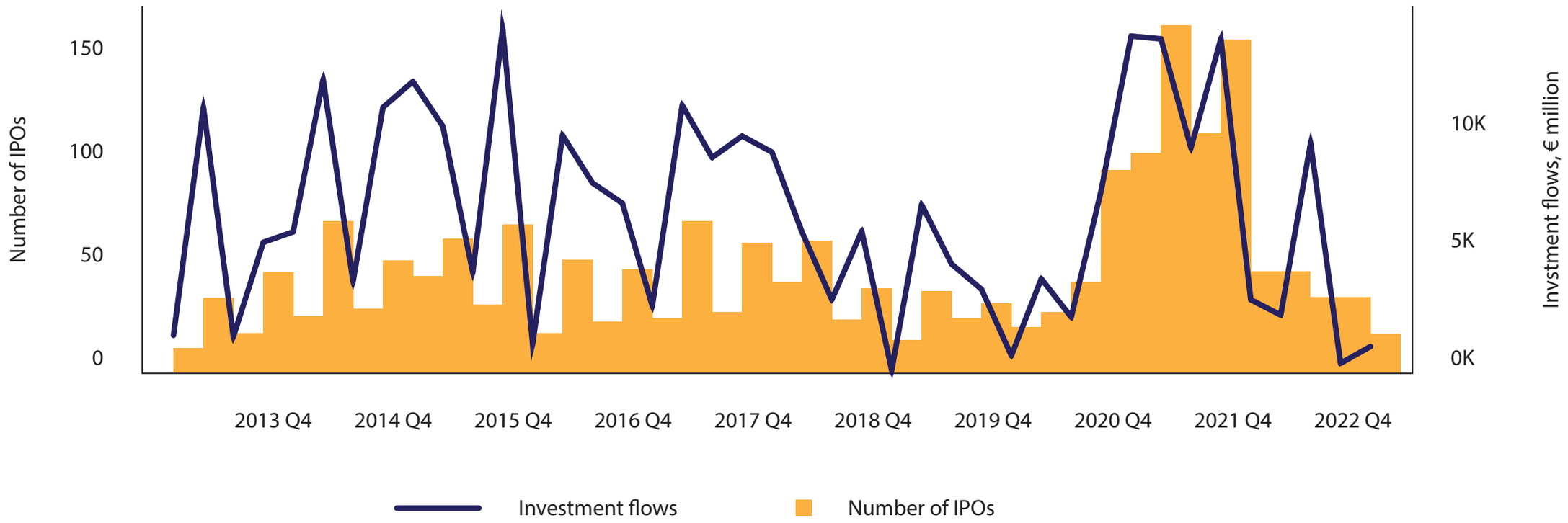
This is the opposite of what European Union regulators want. They emphasise regularly that public equity should play a bigger role in funding innovative companies, and would allow a variety of retail and institutional investors to share in the risks and growth of the corporate sector.

Capital raised on European equity markets in 2022 was the lowest since 1995, at only €89 billion (Suarez, 2023). First-time public offerings (IPOs) are a diminishing subset of this total and within the EU amounted to only €16 billion (more than half of which was accounted for by one large transaction in Germany). Equity issuance on so-called junior markets, where small and medium-sized enterprises (SMEs) benefit from a lower regulatory burden, fell by roughly two-thirds, while the volume of new listings is now minuscule.

The rebound in primary listing activity in 2021 following the COVID-19 pandemic appears to have been transient. Volumes of capital raised and the number of transactions in IPOs seem to have reverted to the more lacklustre levels of previous years. Meanwhile, equity markets in the US and Asia have grown, both relative to the size of the respective economies and compared to global markets overall.

Private equity investors, which do little to foster the benefits of market liquidity and suffer from other shortcomings (Lehmann, 2020a), continue to step into the fold. Notwithstanding the disappointing issuance volumes in EU public equity markets, private equity investments registered their second-highest level ever, at €130 billion[1], while fundraising broke a new record.

Figure 1. IPO volumes and number of firms newly listed on European exchanges



Source: *Federation of European Exchanges*.

Reducing barriers to 'going public'

Eight years on from the publication of the EU's capital markets union plan, and despite the undoubted progress with several legislative projects, the role of EU equity markets seems in fact to have diminished.

The Commission's proposal seeks to design rules that are consistent across the various national markets, and which will make listing more attractive, in particular to smaller companies

This ongoing eclipse of public equity, and of the listed company itself, has several important ramifications for the European economy, and is now the focus of new regulation in both the EU and the United Kingdom.

The European Commission in December 2022 proposed a reform of the regime that governs the listing of companies, including a 'Listings Act'[2]. This is inching forward in the legislative process and has been promoted as a step to revive activity in EU primary equity markets.

In essence, the proposed measures seek to make life as a listed company more attractive for owners, while reducing red tape and other administrative burden involved in the listing process itself and easing disclosure and other obligations on listed companies, in particular for SMEs. Concretely:

- The Commission proposed a new directive that would allow so-called multiple-voting right shares in smaller companies. This is particularly useful where existing owners seek to preserve privileged rights while gaining access to equity capital in the public markets.

- Smaller firms would benefit from revisions to the EU's main capital markets law (MiFID II), as requirements on brokers to charge for investment research would be eased for smaller firms. These so-called 'unbundling' provisions were designed to stem conflicts of interest in brokerage firms, which did not distinguish between the costs of trading and research.

- The listing process itself is to become less costly with a reduction in disclosures required in a prospectus at the time of an IPO. Smaller firms would be encouraged to list and the information that needs to be disclosed in subsequent rounds of capital raising (secondary listings) would also be streamlined.

- Once firms are listed, the requirements on disclosing possible insider information held by owners and managers would also be streamlined. This would simplify the regime in the EU Market Abuse regulation of 2014.

The Commission's initiative proceeds in parallel with a similar reform of the listing regime in the UK, which has also seen a decline in listings. Unlike in the EU, competitiveness is a secondary objective in the mandate of UK financial regulators.

A proposal issued by the Bank of England in early May essentially envisaged easing post-issuance requirements on listed companies, lowering listing requirements and integrating two market segments (standard and premium), thereby relaxing corporate governance requirements somewhat[3]. UK rules on dual-class shares could also become more liberal for a limited period following an initial listing.

Trade-offs

In making the listing process more efficient, the Commission's proposals would compromise on some of the concepts that have underpinned capital markets rulemaking since the financial crisis. A report for the Commission suggested that excessive requirements for disclosure and investor protection explained the relative absence of SME IPOs and called for a much greater differentiation of listing rules by issuer size (Fernandez *et al* 2021).

Given the scarcity of listings, most of the compromises in the proposed Listing Act seem justified by the objective of attracting companies into the public market and boosting market liquidity, in particular where such changes benefit SME listings.

For instance, the amendments to the prospectus rules, which govern what information is published at the time of a firm's listing, should not materially reduce information obtained by investors (documents need to observe a 300-page limit). Companies that are already admitted to trading are to be given a more straightforward path to raise additional capital in secondary issues.

This should come at minimal risks to investors because such companies are likely to have been covered by industry research already. The changes embodied in the proposed Listing Act, therefore, suggest a sensible emphasis on 'proportionality' in pre- and post-listing requirements. This should facilitate market liquidity and market access for smaller issuers.

Containing insider dealing and protecting investor rights have been key objectives in capital market regulation. Experience suggests that EU rules on insider dealing in the 2014 Market Abuse Regulation have been particularly problematic for smaller companies, where management and ownership functions are more often intertwined, and where it may be more difficult to identify what amounts to insider information and who holds it.

For these companies, streamlined requirements for disclosure and identification of insiders seem justified, also because national supervisors will be given extra powers to spot market manipulation.

More problematic, however, may be the proposal for greater leeway for issuers in defining multiple types of shareholder rights, when they list on the dedicated SME equity markets for the first time. This of course comes at some cost to investor rights and the principle of 'one shareholder one vote'.

National authorities will have greater discretion in applying this clause, likely reflecting local corporate governance traditions. This could be particularly helpful in under-developed capital markets, such as in central and southeastern Europe where the depth of SME equity markets is extremely limited (see Lehmann, 2020b).

In these markets, a listing may become more attractive for owners that seek to retain privileged control rights within a public company, though the definition of such rights and shareholder tiers will come at the cost of further fragmenting the single market.

The CMU agenda that lies ahead

Overall, the Commission's proposal seeks to design rules that are consistent across the various national markets, and which will make listing more attractive, in particular to smaller companies. It also seeks to reflect the underdevelopment of markets in several EU states and their different corporate governance traditions.

In this effort it perhaps heeds calls for a market development that is more bottom-up or led by national prerogatives, and which aims at a 'polycentric' CMU. Safeguarding such long-standing concepts in regulation such as transparency, investor protection and market integrity has worked for now, but may be more difficult if such variety is accommodated more broadly.

Yet, the proposed Listing Act implements largely technical changes, which by themselves will do little to instil new dynamism in EU equity markets. A listing regime that is less onerous for smaller companies will be supportive of market liquidity, but much more is needed to foster secondary market liquidity and cross-border holdings, the two central objectives of the CMU agenda.

There remain other major structural barriers to market liquidity, including:

- Inadequate funding of promising start-ups and other growth companies, which constrains firms in the pre-IPO phase and incentivises listing elsewhere;

- Lack of sufficient institutional capital in public markets, specifically from pension and insurance funds;

- Tax and corporate governance rules, which remain largely national prerogatives and continue to fragment markets and undermine liquidity, including because of long delays in recouping withholding tax on cross-border holdings;

- An often inefficient and fragmented post-trade clearing and settlement infrastructure.

Moreover, the discretion and role of national market supervisors has if anything been elevated, and little has been done to streamline procedures within the European Securities and Markets Authority (ESMA) or expand its resources.

The CMU strategy flags only some of these barriers. The next European Commission in 2024 will need to revisit this. EU countries will need to back any revised strategy more fully, recognising the central role the CMU could play in addressing Europe's various financing shortfalls, and boosting its growth and sustainability plans. ■

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Endnotes

1. See https://www.investeurope.eu/research/activity-data/

2. See European Commission press release of 7 December 2022, https://ec.europa.eu/commission/presscorner/detail/en/ip_22_7348

3. See UK Financial Conduct Authority press release of 3 May 2023, https://www.fca.org.uk/news/press-releases/fca-proposes-simplify-rules-help-encourage-companies-list-uk

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If we want to achieve the SDGs, we need to rethink leadership

The SDGs challenge conventional approaches to leadership. Willem Fourie rethinks the heroic bias in leadership

There is an increasing awareness in business schools and beyond that we need to take the 17 Sustainable Development Goals (SDGs) seriously. But how to truly integrate these goals into what we teach and research remains up for discussion.

As somebody who is involved in both the worlds of SDGs and leadership scholarship, I am beginning to understand how the SDGs can help us change the way we teach leadership. Simply put, the SDGs require us to rethink the heroic bias in how we teach and research leadership.

Most people in business schools are well aware of the heroic bias in leadership studies: the often untested assumption that good leaders are exceptional and charismatic individuals with a higher level of agency than other people.

This heroic bias is, of course, not surprising. The earliest reflective work on leadership, such as the books by Thomas Carlyle and the controversial Francis Galton, explicitly depicted leaders as being qualitatively different from their followers.

The heroic bias, or at least an emphasis on individual leaders who have the exceptional capability to inspire followers by selling a great vision, continues to permeate many of our approaches to leadership. Even transformational leadership theory, probably the most-researched contemporary leadership theory, paints leaders in individualistic and heroic terms.

The SDGs, and the 2030 Agenda for Sustainable Development in which they are embedded, challenge such conventional approaches to leadership in at least the following ways:

- The agenda explicitly foregrounds the notion of partnership – between citizens and their governments, between the state and non-state actors, between developing and developed countries and even between current and future generations. Heroic leaders are known to struggle to form mutually accountable and equal partnerships.

Simply put, the SDGs require us to rethink the heroic bias in how we teach and research leadership

- The complexity that underlies the SDGs as a system of goals makes it impossible for one leader to make authoritative judgements. No one individual has the knowledge required to understand the complexity of synergies and trade-offs inherent to the SDGs.

- The level of ambition of the SDGs not only makes collaboration across sectoral and disciplinary boundaries essential but also requires potentially game-changing innovation. This type of innovation is premised on decidedly non-heroic leadership behaviours, such as distributing influence among team members and transitory and task-specific forms of leadership.

- More practically, the lack of global progress on the SDGs requires leaders to admit to their own mistakes and to try to do better. This type of honesty and vulnerability does not characterise heroic leaders.

What needs to change? In my recent book on why leaders fail, I identify a couple of lessons that can be fruitfully applied to how we think about the leadership needed to achieve the SDGs. My overarching argument is that the complexity and urgency of contemporary challenges require post-heroic leaders.

Post-heroic leaders accept their fallibility. Leaders who accept their fallibility do not sell unrealistic and unachievable visions to their followers. Rather, they acknowledge the scope of the challenge and activate their followers' agency. This realism is urgently needed when we talk about the SDGs. No country is on track to achieve these goals, and we need a serious step change if we want to have a shot at achieving them.

Post-heroic leaders embrace their boundedness. At the most fundamental level they are bounded by the culture of their organisation and the expectations of their followers. They are also bounded by their particular skillset and personality.

Such leaders realise the importance of forging productive partnerships even with competing groups and organisations in their environment. In many respects the notion of boundedness is the motivation for the focus on partnership embedded in the SDGs.

The latest research on post-heroic leadership shows that post-heroic leaders benefit from making space for dissent. One of the major weaknesses of how the SDGs are approached in business schools and beyond is that they seem to be beyond criticism.

If we are serious about the SDGs, we need to have honest conversations about their limitations and the trade-offs of specific targets. Only then will we be able to reflect on how to mitigate such trade-offs.

Post-heroic leaders, and certainly the type of leaders we need to achieve the SDGs, practicse courage. Courage is not, as one might think, a heroic leadership trait. When reflecting on Aristotle's foundational definition of courage, this virtue is 'bracketed' by the extremes of excessive confidence and excessive fear or lack of confidence.

Heroic leaders tend to exhibit excessive confidence, which makes them more prone than others to surround themselves by acolytes and engage in risky behaviour. Practising courage, however, means that a leader has the ability to gauge what is called for in a particular situation, and is willing to take on the potential risk of failure.

Other post-heroic traits, capabilities and behaviours can be highlighted, as I also discuss in my book. The overarching point is that the SDGs offer us an opportunity to question and update many of the popular assumptions of what constitutes 'good' leadership.

In a complex world characterised by rising tensions and ever-more serious challenges, overly simplistic approaches to leadership – such as the notion that we merely need exceptional and charismatic individuals – are not good enough. ■

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The manufacturing jobs boom that isn't

Niclas Poitiers argues that the US Inflation Reduction Act shows that massive subsidies are not leading to massive manufacturing job creation

August 2023 marked the first anniversary of the United States Inflation Reduction Act (IRA). Together with the CHIPS and Science Act, it is the flagship of President Joe Biden's industrial policy push. Proponents say it is a tool to fight climate change, create 'good' manufacturing jobs (thus reducing inequality and political polarisation) and keep China in check. But the size of the subsidies involved has generated anxiety among trading partners about investment and jobs moving to the US.

A year on, some results are encouraging. Major new investments in clean-energy production and clean-tech manufacturing have been announced, many in states dominated by the often climate-sceptic Republican party. However, the number of new jobs announced so far must disappoint those in America and Europe who were hoping to rejuvenate the middle class through industrial policies.

The Biden Administration says the IRA has created 170,000 jobs, while analysis by the *Financial Times* found 100,000 new jobs in CHIPS and IRA-related project announcements. These numbers should be treated with caution. Some announced projects might have been pursued even without government support, while others might have been smaller but would still have created some jobs.

Some new jobs might represent retrained workers that do not add 'net' employment in the manufacturing sector. And most of these jobs do not exist yet but are expected to arrive in the coming years as projects are developed.

Even if the 170,000 jobs cited by the Biden Administration are taken at face value, this is not even close to creating anything like the transformation of US manufacturing that was advertised. The IRA new jobs are dwarfed by the business cycle: in the last year, the US economy has added on average 312,000 jobs a month. The latest numbers from July 2023 were among the weakest, but still showed a gain of 187,000 non-farm jobs.

A year's worth of IRA job announcements, most of which will take years to realise, thus does not even account for a month's worth of net employment gains in the last year. The 170,000 IRA jobs account for only 0.1% of the total US labour force of 167 million – far from transformational.

This is also true when looking at manufacturing more narrowly. Many if not most of the new jobs will be in green-energy deployment, construction and related services. But even assuming generously that all 170,000 jobs will be net new industrial jobs, the relatively small US manufacturing work force would grow by only 1.3%.

Policymakers must become more realistic about what they want to achieve with manufacturing subsidies

More projects will be announced but the speed of new announcements is already slowing. The White House has cited some modelling that claims the IRA will generate 1.5 million new jobs economy-wide by 2030, but even this foresees a net gain of only 150,000 manufacturing jobs, which is unimpressive given the timeframe.

That the clean-tech and semiconductor subsidies do not deliver manufacturing jobs at scale should not be a surprise. Chip and battery production are especially capital-intensive but require relatively few, highly-specialised workers.

Furthermore, the lousy return in terms of employment is not unique to the US. An Intel factory in Germany is set to receive €10 billion in subsidies for only 3,000 manufacturing jobs. A VW battery factory in Canada will get about €9 billion in subsidies for an expected 3,000 jobs. In both cases, the subsidy per new manufacturing job is about €3 million.

There are good reasons beyond job creation to want to attract investment in clean-tech and semiconductor manufacturing. China's dominance of solar and battery supply chains is a clear worry, and the geopolitical importance of semiconductors warrants public investment in the sector.

Furthermore, in a political environment in which carbon pricing is perceived as infeasible, subsidies might be the only viable option to fight climate change. Subsidies could also help prepare the ground for more effective policies by creating a favourable political economy, sowing 'green' economic interests in important constituencies.

However, policymakers set themselves up for failure when they claim these industrial subsidies will create a manufacturing job boom. Nor is it serious to claim that not offering generous handouts would lead to disastrous deindustrialisation and job losses.

This doesn't mean the IRA has failed, nor that green policies cannot create green jobs. The IRA was the largest climate package in US history and has already attracted major manufacturing investment. Beyond manufacturing subsidies, it includes significant incentives to decarbonise the electricity grid and road transport. These will help put the US on a path towards a greener economy.

It does show, however, that policymakers must become more realistic about what they want to achieve with manufacturing subsidies. The IRA is a product of an environment in which climate policy is controversial and subsidies might have been the only viable option.

But elsewhere, more efficient instruments to fight climate change while ensuring social fairness are available. Governments that contemplate mimicking US policies should be aware of their opportunity costs. ■

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