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Global Ripple Effects

Knock-on Effects of EU, US, and China Climate Policies on Developing Countries' Trade

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Abstract

The three major players in the global economy, the United States, the European Union, and China, have been designing climate mitigation policies that will help reduce their carbon emissions but will also likely reshape developing countries' trade, prices, and access to technology. This paper examines developing countries' exposure to such changes. Overall, the policies are expected to curtail demand for fossil fuels, energy-intensive manufacturing, and agricultural exports linked to environmental degradation. They are also expected to open export opportunities in critical minerals, electric vehicles and their components, and renewable energy technologies and components. The exposure of affected export sectors and the overall economy to these changes will vary across countries based on the orientation of their export sectors to the markets in the European Union, the United States, and Chinese as well as the weight of affected exports in their economies. The climate policies will also likely reduce oil prices and raise critical mineral prices, help reduce the cost of green technologies, and increase green foreign investment. The paper draws recommendations for developing countries, the European Union, the United States, and China, as well as the international community, on how best to help developing countries lessen the potential negative competitiveness effects of these climate policies and make the most of the opportunities for a faster green transition and economic development.

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Global Ripple Effects: Knock-on Effects of EU, US, and China Climate Policies on Developing Countries' Trade

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1. Introduction

Different approaches to climate mitigation policy are emerging among three major players in the global economy, collectively responsible for nearly half of GHG emissions.[2] The EU led with a policy mix centered around emissions pricing, with the EU Emissions Trading System (ETS) and its complementary Carbon Border Adjustment Mechanism (CBAM) as its cornerstone for reducing net GHG emissions. By contrast, the US Inflation Reduction Act (IRA) seeks to achieve ambitious greenhouse gas (GHG) reductions by subsidizing clean production and technology adoption with a secondary goal of diversifying the critical minerals supply chains away from China.[3] Meanwhile, China has launched an ETS based on intensity benchmarks that aims to incentivize efficiency improvements.

These different policy approaches are anticipated to have varying consequences on trade affecting producers and consumers in developing countries, a topic not yet covered by the literature. Existing literature focuses on how climate mitigation policies from the EU, US, and China affect their own economies. For example, Bistline (2023) estimates macroeconomic impacts of the US IRA on the US economy, Woollacott (2023) assesses its domestic environmental impacts, and Bown (2023) outlines the impacts for domestic EV manufacturers and their supply chains; Weitzel (2023) quantifies the macroeconomic impacts of the EU climate policy on the EU economy; EU (2021) assesses socioeconomic implications of EU CO2 emission standards for passenger cars; and Yan (2023) assesses the impacts of China's climate policies on its economy. The literature also covers the impacts that climate regulations could have on selected advanced economies and globally. For instance, Kleimann et al. (2023), Attinassi et al. (2023), and Bernoth (2023) analyze the impacts of the US IRA on Europe, while Gründler (2023) discusses global effects. However, the potential effects of these policies on developing countries have been largely overlooked.

This paper examines key mitigation policies implemented by the EU, US, and China, seeking to address following questions:

- What are the differences in the policy approaches of the EU, US, and China?
- What are the economic channels through which the selected EU, US, and China policies impact developing countries?[4]
- Which sectors and countries are most exposed to these impacts?
- How should developing countries respond?
- What measures can advanced economies take to reduce negative spillovers for developing countries?

The paper focuses on three main channels through which these climate policies can affect developing countries: shifts in supply and demand in trade sectors, price changes, and access to technology. Using descriptive statistics and existing research, the paper identifies the sectors and countries most exposed to the policies. The paper does not cover adaptation policies or the impact of developing countries' own policies to meet their Nationally Determined Contributions (NDCs), which are discussed in Brenton et al. (forthcoming).

[2] World Bank's World Development Indicators.

[3] Under the broad 'subsidy' category, we include tax credits for companies and consumers, grants to support programs, and the provision of technical assistance.

[4] In this paper, the term "developing countries" will specifically refer to non-China developing nations.

This analysis aims to broaden our understanding of potential impacts of mitigation policies of key economic players on developing countries' trade flows. The insights gained can serve as a basis for future Computable General Equilibrium (CGE) modeling, which can quantify the effects of these policies on developing economies.

The paper is structured as follows: Section 2 introduces EU, US, and China climate policies, identifies the main differences in their climate approaches and provides the pros and cons of using carbon pricing, green subsidies, and regulations. Section 3 focuses on the channels of impact of these policies and identifies the sectors and economies that are most exposed to the policies and hence likely to be most impacted. Section 4 concludes and provides policy recommendations for developing countries to make the most of the opportunities and help mitigate harmful impacts.

2. Climate change mitigation policies in the EU, US, and China and their impacts on trade

This section outlines key climate legislation in the EU, US, and China, highlighting the differences in their approaches and detailing major policy elements that are expected to impact developing nations.

2.1 EU, US, and China climate policies: Carbon pricing, green subsidies, and regulations

The EU's climate policy revolves around the Fit for 55 package, recently complemented by the Critical Raw Materials Act for the Future of EU Supply Chains, and the Corporate Sustainability Due Diligence Directive (CS3D) proposal in March 2024. These policies are further supported by member state-level measures, which are not covered in this paper. The Fit for 55 package aims to revise and update EU climate, energy, and transport legislation to achieve a 55 percent reduction in GHG emissions by 2030, compared to 1990 levels. Its measures target high CO2 emission intensity sectors and environmentally impactful sectors, aiming to reduce environmental degradation both within the EU and abroad, while promoting diversification of suppliers for critical inputs in the green transition.

In the US, federal climate policy is shaped by the IRA, designed to address energy security and climate change mitigation. The IRA directs new federal spending and tax breaks toward reducing carbon emissions. It earmarks approximately US$370 billion for the next ten years for green energy production and to diversify its supply chains, currently heavily reliant on China, spanning from clean energy manufacturing to critical minerals and EV batteries.

China's climate policy focuses on low-carbon infrastructure through public programs, mineral sourcing via the Belt and Road Initiative (BRI), and emission reduction through its Emission Trading Scheme (ETS), launched in 2021. China is the largest investor in renewable energy, having spent nearly US$760 billion between 2010 and 2019, ahead of the EU ($698 billion) and the US ($356 billion) (UNEP 2019). The country has also heavily invested in low-carbon public infrastructure, such as high-speed rail, urban public transport networks, electric public transport vehicles and EV infrastructure.

The main difference between the EU, US, and China climate policies is that they rely on carbon pricing, green subsidies, and regulations with different intensity. The EU relies more on carbon pricing than on subsidies[5] in its Fit for 55 Package and applies domestic content targets in its Critical Raw Materials Act. Climate policies at the member state level rely on green subsidies to a similar extent as the US (except in the renewable energy sector where EU subsidies are far larger), but they do not include domestic content

[5] While green subsidies are not extensively used at the EU level, their use at the country level is sizeable.

requirements (Kleimann et al. 2023). The US primarily uses subsidies under the IRA, incorporating some domestic content requirements, though some US states also use carbon pricing. China relies more on regulatory measures and public support than on market-based instruments (WBG 2022). Market-based instruments, such as fiscal policies related to environmental governance, emissions fees, or emissions trading are not yet fully developed. China at present grants free allocations under its ETS. It relies on command-and-control measures (e.g., investments of state-owned enterprises in clean energy) and subsidies (solar panels being the most notable case) in its other climate policies beyond ETS.

The use of carbon pricing and green subsidies to support the green transition is warranted because of the presence of negative externalities – specifically, the social costs of GHG emissions from economic activities, which are not borne by the buyer or seller. Carbon pricing is generally preferred over green subsidies because it allows the market to efficiently determine emissions reductions without the targeting challenges and budgetary strains associated with subsidies, while also generating government revenue. Unlike subsidies, which can lead to increased energy demand and do not necessarily promote a broader transition away from fossil fuels, carbon pricing directly incentivizes firms to reduce emissions based on their own cost-effectiveness. However, green subsidies also have some advantages over carbon pricing, as they address multiple market failures and provide financial support to incentivize investments in green technologies that may be underfunded due to their broader societal benefits.

In developing countries with limited capacity to tackle climate change, regulations can effectively reduce GHG emissions and provide policy makers with valuable experience for future market-based strategies. However, regulations with domestic content requirements can lead to trade fragmentation and higher costs, hindering the green transition. In practice, many countries adopt a mix of policies, with the emphasis on each varying based on economic context and political willingness.

The varying use of carbon tax, subsidies, and regulations is expected to lead to differing impacts of climate policies on developing countries. A carbon tax raises the price of carbon-intensive ("brown") goods, reducing their domestic demand and imports, and gradually increasing domestic sales and imports of low-carbon ("green") products as they become relatively cheaper.[6] A green subsidy on consumption (like EV rebates) lowers green product prices, boosting domestic sales and imports unless domestic content rules apply. A green subsidy on production (such as tax credits for renewable energy production) also decreases green product prices, boosting their domestic sales and exports. Both types of subsidies over time lead to reduced sales and imports of brown products by making them relatively more expensive. Regulatory caps requiring the purchase of emissions permits cut domestic production of brown goods while potentially increasing imports unless a carbon border adjustment mechanism is in place. Over time, in the absence of market failures, caps promote domestic sales and imports of green goods. The effect of caps is weaker or stronger than taxes depending on whether permit prices are lower or higher than the carbon tax.

Despite differences in approach and implementation, climate policies enacted by the EU, US, and China share some common impacts on trade. These policies restrict market access for sectors with high CO_2 emission intensity or a significant environmental footprint. Additionally, these policies accelerate the transition to renewable energy, driving demand for transition minerals while reducing demand for fossil fuels (as seen in the US IRA for EVs, the EU's green industrial policy, and China's EV incentives). As demand

[6] Note, however, that if green goods face large externalities in the sense that the benefits are not significantly captured by the producer, the production of green goods will be suboptimal in the absence of subsidies.

shifts towards less carbon intensive products, developing countries that produce goods and services in a sustainable way and with low carbon intensity will be able to expand their exports to those markets. Furthermore, some countries will also be able to expand their participation in clean energy and green technology GVCs. However, these climate policies may also distort competitive advantages through industrial subsidies for green technologies, such as those for green hydrogen or battery plants (as seen in the EU's green industrial policy, the US IRA, and China's EV production incentives).

The positive effects of carbon pricing, green subsidies, and regulations on emissions can be undermined and lead to significant trade distortions when combined with discriminatory measures, such as domestic content requirements. The trade impact of these climate policies depends on how they are applied, the scope of product coverage, the characteristics of the product, and its position in the value chain. The introduction of domestic content and other eligibility requirements creates distortions, leading to inefficient resource use and potentially smaller reductions in emissions. See Section 3 for the framework employed to analyze such impacts.

2.2 Main elements of EU, US, and China climate policies with impacts on developing countries

2.2.1 Carbon pricing and preventing carbon leakage

The EU ETS places a price on carbon and has been in place since 2005. It is the EU's key tool for reducing CO_2 emissions.[7] Under the ETS, companies covered by the system must buy every year allowances in the market for their CO_2 emissions. A cap is set on the total amount of allowances each year, which decreases over time to encourage companies to cut emissions. The EU ETS currently covers around 10,000 companies in the electricity and heat generation sector, energy-intensive industries (e.g., oil refineries, steel, cement, glass, and paper production), and the commercial aviation sector (for flights within the European Economic Area).

As part of the **EU fit for 55 package, which targets a 55 percent reduction in GHG emissions by 2030, the EU ETS is undergoing reforms that include:**

- More ambitious emissions reduction targets and fewer allowances on the market.
- Gradual expansion to maritime transport between 2024 and 2026, as well as a new, separate ETS for buildings, road transport, and small industries not covered by the existing EU ETS.
- Gradual phasing out of free allowances for certain sectors in parallel with the introduction of the CBAM – a carbon pricing system for energy-intensive products imported into the EU to prevent carbon leakage.
- Increased funding for modernization and innovation funds to decarbonize ETS sectors.
- A €65 billion increase in the social climate fund to protect vulnerable people and firms from the carbon pricing impact of the ETS for buildings, road transport, and fuels for select sectors.

The CBAM is a regulation that was adopted in April 2023 and will be phased in from 2026 to 2034 (Official Journal of the European Union 2023a). It is designed to counteract carbon leakage potentially caused by the EU ETS – which occurs when industries with high GHG emissions relocate to jurisdictions with less stringent climate policies outside the EU or import high-carbon goods instead of producing them. CBAM will require non-EU producers to buy certificates for their CO_2 emissions that have not been paid

[7] European Commission, "What is the EU ETS?"

for domestically, mirroring the effects of the EU ETS and creating a level playing field for businesses. The certificates also encourage non-EU producers to reduce their emissions. In its first phase, CBAM will cover the following sectors with high carbon emissions and high risk of carbon leakage: iron and steel, cement, fertilizers, aluminum, hydrogen production, electricity, and certain precursors (e.g., cathode active materials), as well as a limited number of downstream products (e.g., screws and bolts). The scope of CBAM is expected to expand to more sectors over time.

At present, the EU grans free allowances under the ETS to energy-intensive industries within the EU that are at risk of carbon leakage, but this is set to change. These free allowances will be gradually eliminated between 2026 and 2034 with the introduction of CBAM.

Like the EU, China has established an ETS, launched in 2021, which is the world's largest ETS in terms of covered emissions. [8] It covers more than 4 billion tCO_2, accounting for over 40 percent of the country's carbon emissions. The system currently regulates more than 2,000 plants in the power sector, including combined heat and power plants[9] and captive power plants[10] in other sectors. It is an intensity-based system, with allowances allocated using benchmarks for each fuel and technology, based on actual production levels. Unlike in the EU, all allowances are allocated for free, subject to a cap. Compliance obligations are limited and vary between types of power generation. The ETS will initially cover coal- and gas-fired power plants, but it will gradually expand to seven other sectors.

Market instruments have only recently played a role in reducing China's emissions (WBG 2022). The country has been testing emissions trading with pilot programs in seven provinces and cities since 2013. Trading on the national ETS began in July 2021.

2.2.2 Targets and incentives for energy efficiency, clean energy and electromobility

The Renewable Energy Directive (RED), updated in 2023, is pivotal to the EU's clean energy agenda. Initially enacted in 2018 (EU/2018/2001), it was revised (EU/2023/2413) to help achieve the 'Fit for 55' package and to bolster efforts to decrease dependence on fossil fuels following the Russian Federation's invasion of Ukraine. The directive now sets a binding target for the EU to obtain at least 42.5 percent (up from the previous 32 percent) of its energy from renewable sources by 2030, with an aspirational goal of 45 percent. The EU has grown its renewable energy share from 19.1 percent in 2018 to 23.0 percent in 2022.[11]

The Energy Efficiency Directive (EED) is another key policy in the EU's clean energy strategy. The EED (EU/2023/1791) establishes the 'energy efficiency first' principle and mandates a 11.7 percent reduction in energy consumption by 2030. Effective from 2023, it is part of the broader EU Green Deal and REPowerEU plan, aimed at doubling the rate of energy efficiency improvements to meet the goals of the Paris Agreement.

China's 14th Five-Year Plan on Renewable Energy Development, covering the years 2021 to 2025, aims to escalate renewable energy usage significantly. The plan targets a 50 percent increase in renewable generation, reaching 3.3 trillion kWh, and aims for renewables accounting for 33 percent of the electricity consumption. Additionally, it mandates that over 50 percent of the incremental energy consumption—

[8] International Carbon Action Partnership, "China National ETS."
[9] Combined heat and power is a facility that generates electricity and thermal energy simultaneously at the same location, enhancing overall energy efficiency.
[10] A captive power plant is an electricity generation facility utilized for internal energy consumption.
[11] https://www.eea.europa.eu/en/analysis/indicators/share-of-energy-consumption-from

including both electricity and non-electric forms of energy, during this period comes from renewable sources. Key initiatives include enhancing solar and wind power, particularly in resource-abundant regions, offshore wind expansion, and energy storage solutions, through a combination of public investments and increased private sector participation. These efforts are being led by massive investments from both state-owned and private companies as part of China's broader commitment to a green transition and achieving carbon neutrality, supported by research that underscores the country's significant potential for renewable energy expansion (IEA, 2024).

The US IRA offers tax credits for companies and consumers, grants, and technical assistance to encourage clean energy production and consumption. However, to qualify for certain tax credits and incentives, countries must source critical minerals and clean energy components from the US or from nations with which the US has a free trade agreement (FTA), ensuring compliance with domestic sourcing requirements. The full list of measures is long but those that are expected to affect developing countries most, directly or indirectly, involve:

- **Clean energy tax credits:** 10-year extensions of existing credits for wind and solar (e.g., the production credit is currently approximately 2.6 cents/KWh), along with provisions for heat pumps, rooftop solar and standalone energy storage, such as batteries. These credits are increased if prevailing wage and domestic content requirements for steel, iron, and manufactured products are fulfilled.
- **Support for domestic clean energy manufacturing** (~$60 billion): A five-year production tax credit for companies involved in clean energy manufacturing (e.g., $3/kg of solar-grade polysilicon, $10 /battery module), which includes the production of solar panels, wind turbines, and batteries, as well as critical minerals processing; and the construction of clean technology manufacturing facilities, subject to domestic sourcing requirements (see Section 2.2.3 for a detailed description).
- **Incentives for EV adoption:** A $7,500 rebate is granted for new EVs and a $4,000 tax credit for used EVs subject to an income limit of $300,000 for a couple and $150,000 for individual filers. New vehicles must be priced below $80,000 for vans, SUVs, and pickups; and under $55,000 for cars, with certain domestic sourcing requirements applicable (see Section 2.2.3).
- **Grants and loans to promote EV manufacturing:** Grants (~$2 billion) to help convert existing auto manufacturing factories into EV and component production facilities, and loans (~$20 billion) to establish new EV manufacturing sites.

The legislation raised concerns internationally (e.g., the EU and Republic of Korea) due to its protectionist measures, prompting adjustments through implementing regulations in the summer of 2022. First, leased EVs became eligible for rebates and credits irrespective of their country of origin (including assembly and battery), size, or price. Second, the definition of a US FTA in the context of the IRA has been broadened to include any nation meeting certain criteria (reduce or eliminate trade barriers on a preferential basis, commit to not imposing new trade barriers, establish high labor and environment standards, and avoid export restrictions) (US Treasury 2023), in addition to the 21 countries that already hold an FTA with the US.[12] As of March 2024, these 21 countries are: Australia; Bahrain; Canada; Chile; Colombia; Costa Rica; Dominican Republic; El Salvador; Guatemala; Honduras; Israel; Japan; Jordan; Republic of Korea; Mexico; Morocco; Nicaragua; Oman; Panama; Peru; and Singapore.

EU Regulation 2019/631 aims to lower emissions by setting CO_2 standards for new cars and vans. From 2020 to 2024, the limits are 95 grams of CO_2 per km for cars and 147 grams for vans using the NEDC test.

[12] Office of US Trade Representative, https://ustr.gov/trade-agreements/free-trade-agreements.

From 2025 onwards, the regulation will adopt a more rigorous test procedure (WLTP), with even stricter emission limits. Starting in 2025, the limits are set at 93.6 grams for cars and 153.9 grams for vans measured with the stricter WLTP test. By 2030-2034, these targets will be halved, aiming for zero emissions by 2035, signaling a complete shift to non-emitting vehicles. A temporary crediting system will reward ultra-low emission vehicles, while manufacturers not meeting targets will face financial penalties.

The U.S. Environmental Protection Agency (EPA) has also introduced new, stringent emission standards aimed at reducing tailpipe pollution and GHG emissions, which encourages a transition to EVs. These standards are expected to result in EVs making up to 56 percent of new passenger vehicle sales by 2030-2032. The rules cover light- and medium-duty vehicles for model years 2027 to 2032 and are expected to cut CO_2 emissions by nearly 50 percent for light-duty vehicles and 44 percent for medium-duty vehicles from 2026 levels. They are not an outright EV mandate, as the rules enforce fleet-wide emissions averaging, permitting a mix of vehicle emissions provided that the overall targets are met.

Like the US, China has made use of tax exemptions for EVs, but also for plug-in hybrid EVs (PHEVs) and fuel cell vehicles (FCVs). Since September 2014, China has waived the 10 percent acquisition tax for eligible EVs (Interesse 2023). In contrast to the US IRA, these exemptions apply to both domestically produced and imported EVs. Although the initial tax exemption expired at the end of 2022, a new tax exemption commenced on January 1, 2024, and is effective until 2027. Under this renewed policy, EVs bought in China benefit from a purchase tax exemption of up to approximately $4,170 per vehicle.

China's fuel efficiency standards, overseen by the Ministry of Industry and Information Technology (MIIT), require new passenger vehicles to meet specific fuel consumption requirements based on vehicle weight and impose Corporate Average Fuel Consumption (CAFC) limits across manufacturers' fleets. Initiated in 2004 and progressively tightened, the CAFC standards set a fleet average of 5 L/100 km by 2020, with reductions to 4 L/100 km by 2025, and 3.2 L/100 km by 2030. Manufacturers can use New Energy Vehicle (NEV) credits, earned or bought through the production of EVs, to help average their fleet's performance over several years. Additionally, China's tax policy varies by vehicle size to promote fuel efficiency and includes a luxury tax to encourage prudent consumption and energy conservation.

2.2.3 Local content requirements and supply resilience of raw materials

The US IRA provides tax credits to companies involved in clean energy manufacturing, but to qualify, all steel and iron manufacturing processes must occur within the US. This requirement also applies to facilities, which must be built using domestically produced steel, iron and manufactured products. Additionally, starting in 2023, 40 percent of the value of manufactured products and components must be mined, produced, or manufactured in the US, with this percentage increasing to 55 percent after 2026 (Darboe 2023; US Treasury 2023).

The IRA also offers tax rebates and credits for EVs, subject to specific eligibility criteria. The vehicle's final assembly must take place in North America; at least 50 percent of the battery components must be manufactured or assembled in North America, reaching 100 percent by 2029; and at least 40 percent of the value of the critical minerals in the battery must be extracted or processed in the US or countries with an FTA, or recycled in North America, gradually increasing to 80 percent by 2027. From 2024 onwards, vehicles cannot qualify if their batteries have components manufactured or assembled by a foreign entity of concern. From 2025 onwards, vehicles' batteries must not contain critical minerals extracted, processed, or recycled by a foreign entity of concern to qualify (US Treasury 2023).

In response to the IRA, the European Commission introduced a Green Industrial Plan in February 2023 (European Commission 2023a). The plan aims to increase the competitiveness of the European industry

by simplifying regulations for developing net-zero industries (such as batteries, windmills, solar energy, and carbon capture and storage); providing faster access to funding for clean-tech production; and promoting the development of necessary skills. There is also ongoing discussion about temporarily relaxing state aid rules to increase public funding for energy transition industries (Bown and Clausing 2023).

One of the initiatives under the Green Industrial Plan is the EU Critical Raw Materials Act (CRMA) for the Future of EU Supply Chains (European Council 2024). It intends to help address the expected exponential increase in demand for critical raw materials and rare earths in particular, as the EU shifts from fossil fuels to clean energy. Approved on September 13, 2023, the act aims to boost the EU's critical raw materials supply and diversify its sourcing, strengthen circularity, and support innovation on resource efficiency and development of substitutes.

The CRMA identifies a list of critical raw materials and of strategic critical raw materials. Critical raw materials are those raw materials that are most important economically, as they are vital for the operation of numerous industrial ecosystems, and come with a high supply risk.[13] Strategic raw materials are a subset of critical raw materials expected to grow exponentially in supply; they have complex production requirements and thus face a higher risk of supply issues.[14] The concerns regarding supply disruptions stem from the EU's heavy reliance on a few supplier countries. The EU is almost entirely reliant on China for heavy rare earth elements (100 percent), Türkiye for boron (98 percent), and South Africa for platinum (71 percent) (European Council 2024).

The act sets the following targets for critical raw materials:

- 10% of annual consumption from EU extraction, 15% from domestic recycling, and 40% from processing; and
- EU's annual consumption of each strategic material from any single third country must not exceed 65%.

The CMRA is complemented by the EU Battery Regulation. This regulation sets additional supply chain due diligence obligations, targets for material recovery and recycling, as well as labeling and tracing obligations.

Table 1 provides the list of critical minerals identified as strategic by the US IRA and the EU CRMA. These are materials anticipated to experience a surge in demand, with trade flows that face a high risk of supply disruptions.

Table 1 List of critical minerals identified as strategic for both the EU and the US economies

Bismuth	Germanium	Neodymium	Samarium
Cobalt	Graphite	Nickel	Terbium
Dysprosium	Lithium	Platinum	Titanium

[13] Critical raw materials include antimony, arsenic, bauxite, baryte, beryllium, bismuth, boron, cobalt, coking coal, copper, feldspar, fluorspar, gallium, germanium, hafnium, helium, heavy rare earth elements, light rare earth elements, lithium, magnesium, manganese, natural graphite, nickel (battery grade), niobium, phosphate rock, phosphorus, platinum group metals, scandium, silicon metal, strontium, tantalum, titanium metal, tungsten, and vanadium.

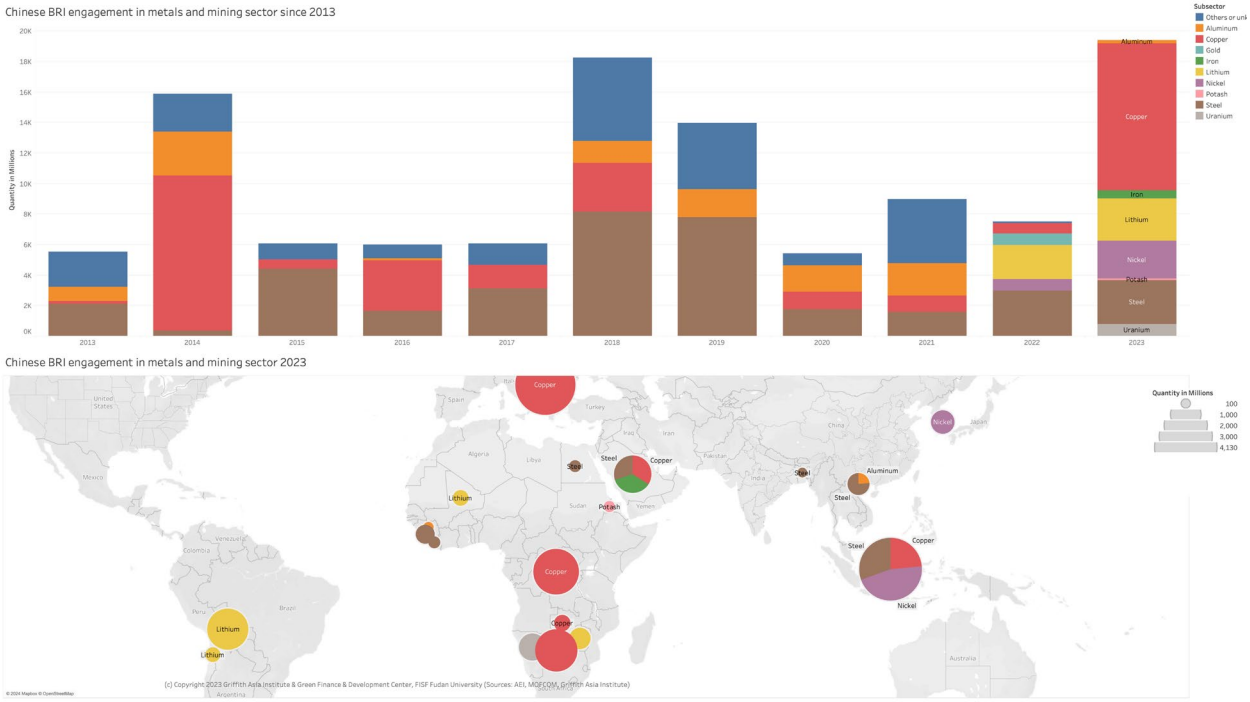
[14] Strategic raw materials include bismuth, boron (metallurgy grade), cobalt, copper, gallium, germanium, lithium (battery grade), magnesium metal, manganese (battery grade), natural graphite (battery grade), nickel (battery grade), platinum group metals, rare earth elements for magnets (Nd, Pr, Tb, Dy, Gd, Sm, and Ce), silicon metal, titanium metal, and tungsten.

Gallium	Manganese	Praseodymium	Tungsten

Source: Authors based on Burton (2022) and European Council (2024).

Unlike the EU and the US, which are mainly acting as buyers of critical minerals, China sources a large share of its raw materials through investments abroad, particularly through its Belt and Road Initiative (BRI). China's financial investments and contracts with the 149 BRI countries are growing, with approximately 212 deals worth around $92.4 billion made in 2023, 18% more compared to its 2022 BRI engagement ($74.5 billion). Around 21 percent of BRI investments target mining and metals, a strategically important sector for China. Figure 1 highlights the rise of Chinese BRI engagement in this sector, notably in DRC, Mali and Zimbabwe, making Sub-Saharan Africa the fastest-growing region of BRI engagement (Wang 2024).

Figure 1 Chinese BRI engagement in metals and mining sector



Source: Wang (2024).
Notes: Map data is available under the Open Database License of OpenStreetMap (https://www.openstreetmap.org).

2.2.4 Preventing environmental degradation

The EU Deforestation regulation (EUDR) aims to promote the consumption of 'deforestation-free' products and lessen the EU's impact on global deforestation, GHG emissions, and biodiversity loss (Official Journal of the European Union 2023b). To meet these goals, the EU is minimizing the risk of deforestation and forest degradation associated with products imported to or exported from the EU. Starting December 30, 2024, the EUDR mandates that companies trading with the EU in cattle, cocoa, coffee, oil palm, rubber, soya, and wood, as well as products derived from these commodities, conduct extensive due diligence across their supply chains to ensure the goods are not associated with recent

(post-December 31, 2020) deforestation, forest degradation or breaches of local environmental and social laws[15].

The new regulation seeks to:

- Ensure the products bought, used, and consumed in the EU do not contribute to deforestation and forest degradation in the EU or globally.
- Cut down carbon emissions from these commodities by at least 32 million metric tonnes annually.
- Tackle all deforestation caused by agricultural expansion for these commodities and address forest degradation.

Another piece of EU legislation aimed at preventing environmental degradation is the CS3D (European Commission 2022). This directive sets a corporate sustainability due diligence duty to address negative impacts on the environment and human rights. It applies to the company's own operations, their subsidiaries and value chains[16] (directly and indirectly established business relationships). The Directive, in general, contains more ambitious targets compared to existing national regulations. Companies must identify actual or potential adverse environmental and human rights impacts; prevent or mitigate them; integrate due diligence into company policies; monitor their effectiveness; and communicate results publicly. The rules apply to limited liability companies with over 1,000 employees and EUR 450 mln+ in net turnover globally or within the EU for foreign firms.[17] These companies must also develop transition plans to align with limiting global warming to 1.5 °C.

3. Implications of trade-related climate policies for developing countries

The climate policies presented in the previous section will negatively affect trade in some sectors of developing countries, but also create opportunities in others, as will be shown in this section. The sign and magnitude of the impact of a climate policy varies depending on its product coverage and on the developing country's particular conditions. As this paper takes a global rather than a specific country perspective, its assessment is limited to developing countries' exposure to these policies. The evaluation of exposure will focus on countries' trade structures and, in the case of critical minerals, also resource endowments. To quantify the impact of these climate policies on trade flows, detailed analysis of production capacities, technologies, competitiveness, macroeconomic conditions, business environment, and private sector competitiveness specific to each country is needed, including consideration of second-order effects, which is beyond this analysis.

The analysis focuses on three main channels of impact of these climate policies: supply and demand changes in trading goods sectors (services are excluded due to data constraints), price alterations, and

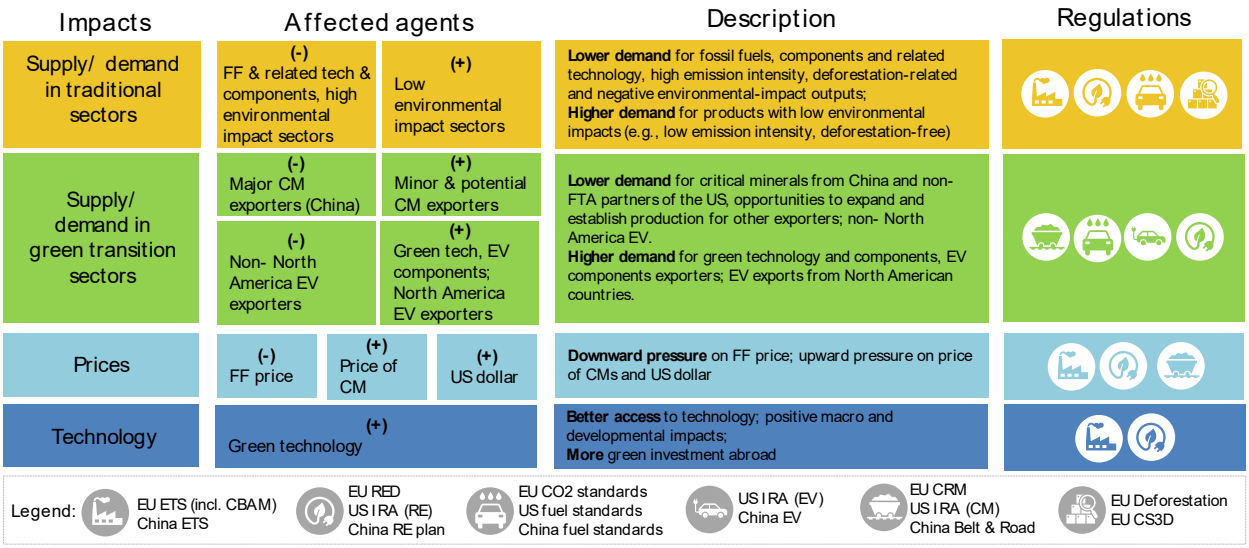
[15] Originally due to take effect in the last days of 2024, the law is now expected to come into force on 30 December 2025 for large companies and 30 June 2026 for micro and small enterprises. In its decision to delay the legislation, the European Parliament also adopted the creation of a new category of countries posing "no risk" on deforestation. It is yet unclear which developing countries will be classified as "no risk", as country benchmark precise criteria will be released in mid-2025. It is expected that those with stable or increasing forest area development would face less stringent requirements due to negligible risk of deforestation.

[16] The downstream chain of activities is limited to distribution, transport, and storage (waste management is now excluded) directly engaged by the firm, other than those subject to national export controls in EU member states.

[17] A staged approach is being used: a three-, four- and five-year application period for companies with more than 5,000, 3,000, and 1,000 employees and €1,500 million, €900 million, and €450 million turnover, respectively.

changes in technology access. Figure 2 presents the general framework for analyzing these impact channels.

Figure 2 Main impacts and affected agents of the EU, US, and China climate policies



Source: Authors.
Notes: CM stands for critical minerals, EV for electrical vehicles, RE for renewable energy, and FF for fossil fuels.

The analysis of supply and demand changes in trading goods sectors focuses on the sectors most affected, which are traditional sectors and green transition sectors. Traditional sectors include energy-intensive and trade-exposed (EITE) sectors, such as manufacturing, as well as other trade-exposed sectors that have important environmental impacts, such as agriculture. Green transition sectors are those related to the green transition, such as EV manufacturing, critical minerals, and renewable energy. Sectors that are not traditional nor green transition sectors, such as low-energy-intensive manufacturing and low-impact agriculture, are not discussed as they are less influenced by the select climate policies.

These climate policies are expected to reshape supply and demand in traditional sectors, particularly in fossil fuels, energy-intensive production, and environmentally harmful processes. Overall, outputs from these sectors will likely decline, offset by increasing demand for eco-friendly products and goods with low environmental impact. This shift is expected to directly affect countries' trade.

Green transition sectors, such as those linked to EVs, batteries, and critical minerals, are also expected to be impacted by these climate policies. Dominant exporters of critical minerals, such as Chile (lithium), China (heavy rare earth elements), South Africa (platinum) and Türkiye (boron), will likely not benefit that much from the increased demand and will lose market share because the EU and US are diversifying away from dominant players. Conversely, non-dominant exporters and new exporters could find opportunities to expand or start extracting and processing key minerals for the green transition, provided they meet eligibility requirements. Developing country exporters can also gain from the rising demand for green products and components resulting from these climate policies. In 2022, the exports from developing countries of critical minerals and green products and components (such as EV, EV components like batteries, solar panels, wind turbines, and components for renewable energy) to China, the EU, and the US stand at $157.6 billion and $ 185.6 billion, respectively.

The following subsections look at countries' exposure to the climate policies through its trade sector at a more detailed product level within traditional sectors and within green sectors. Within the former, fossil fuels, energy-intensive products, agricultural goods and textiles are considered. Within the latter, critical minerals, EV and components, as well as renewables and components are examined.

A country's exposure to the effects of a policy through its trade sector can be evaluated across two distinct dimensions. **The first dimension, labeled "sector exposure," captures how much a sector's exports are focused on the market where the policy adjustment occurs**. Higher exposure means the sector is more susceptible to the policy's implications, which could result in notable alterations in employment and production within that sector. Even if the sector's export volume to that market is small compared to other exporters, it can still experience significant impacts if a large share of its exports goes to that market.

The second dimension, termed "economic exposure," focuses on the broader repercussions on a country's economy. This is measured by the share of the affected products' exports to the destination market in relation to the country's GDP. This dimension is important as a sector may be highly concentrated in the affected market yet face minimal economic impact – at least in the short run – due to the low economic weight of the affected exports.

The last subsections of this section review the impact of these policies on other aspects of the economy. They cover the impact on prices and access to technology.

3.1 Impacts on traditional sectors

This subsection will review the effects of the select climate policies on traditional sectors. It will consider impacts on fossil fuels and related technology, energy-intensive products, agricultural goods, and textiles.

3.1.1 Fossil fuels and related technology

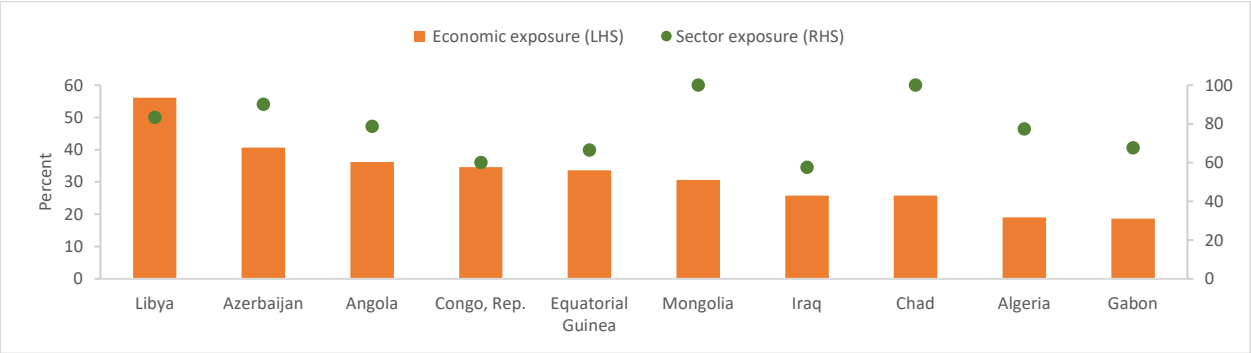
The EU ETS, EED, RED, US IRA, and China's Renewable targets and ETS are expected to significantly affect fossil fuel demand and related technologies. In the EU, carbon pricing incentivizes the adoption of energy-efficient technologies and shifts towards renewable energy. In the US, subsidies make green goods cheaper than their carbon-intensive alternatives, reducing demand for the latter. China's ETS encourages energy efficiency in coal- and gas-fired plants. These trends will likely decrease exports of fossil fuels and components for fossil-based technologies from developing countries to these regions. This encompasses all fossil fuels for the EU, refined and crude petroleum (potentially including gas) for the US, and coal and gas for China. Additionally, climate policies across the world to meet NDCs will further reduce fossil fuel demand and exports worldwide (see Brenton et al., forthcoming, for details).

Fossil fuel sector exposure to US, China and EU policies varies significantly across developing countries. All fossil fuels exports from Chad, South Sudan, Cameroon, Mongolia, East Timor and the Republic of Yemen go to the EU, US or China, making their fossil fuel sector particularly susceptible to falls in demand from those regions (Figure 5). The fossil fuel sectors in Guatemala and Jordan will likely be heavily affected by reduced US demand as they export almost all fossil fuels to the US. Similarly, the fossil fuel sectors in Mongolia and Papua New Guinea will be significantly impacted by decreased Chinese demand since they export all fossil fuels to China. This decline in China's demand is expected to intensify in the medium to long terms as its ETS expands to other sectors.

In terms of economic exposure, the economies of Libya, Azerbaijan and Angola are poised to experience significant economic impact from reduced fuel demand from the EU, US and China. Their fossil fuel exports represent more than 30 percent of their GDP. The Republic of Congo, Equatorial Guinea,

Mongolia, Iraq, Chad and Algeria are also poised to be significantly impacted as their fossil fuel exports range between one-fifth and one-third of their GDPs (Figure 3).

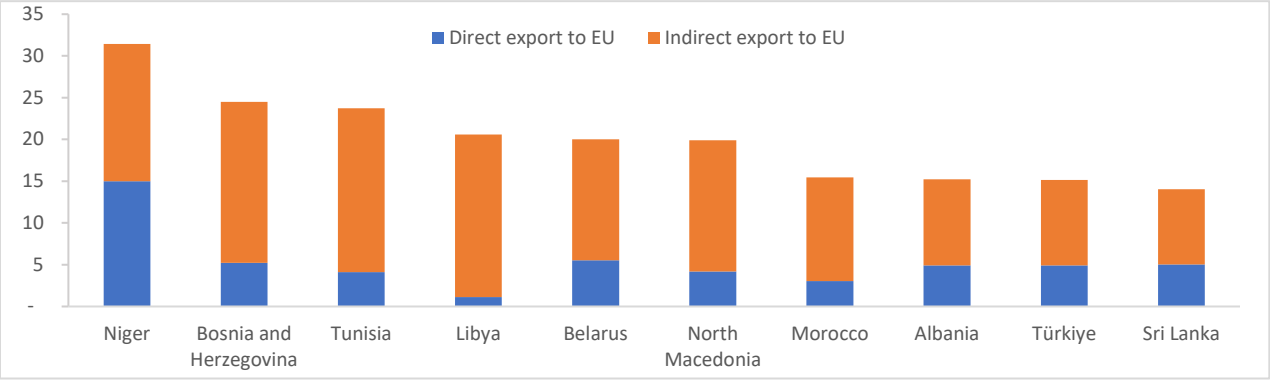
Figure 3 Top 10 developing countries according to economic exposure of fossil fuels to the EU, US, and China policies



Source: Authors' calculation based on 2022 data from the World Bank's WITS.
Note: Fossil fuels (coal, oil, and gas) data are collected based on four HS digit codes (2701, 2709, 2710, and 2711). Sector and economic exposure are export of fossil fuels to three economies divided by exports of fossil fuels to the world and by GDP, respectively.

The EU CS3D regulation will increase costs for exporters in fossil fuel sectors. Countries involved in fossil fuel sectors, even if not exporting directly to the EU, will face higher costs when participating in oil and chemical supply chains for the EU market, due to the new requirements related to information gathering and reporting. Figure 4 shows the GVC exposure to the EU for petroleum, chemical, and non-metallic mineral products,[18] considering both direct and indirect exports based on the GVC exposure index developed by Arvis et al. (forthcoming). Niger has the most exposed sector, with about one-third of its direct and indirect exports of petroleum, chemical and non-metallic mineral products focused on the EU, followed by Bosnia and Herzegovina, and Tunisia.

Figure 4 Developing countries with largest GVC exposure to the EU: Petroleum, Chemical and Non-Metallic Mineral Products (percent of domestic products output)



Source: Arvis et al. (forthcoming) and authors' calculations.

[18] GVC exposure data is not disaggregated at the fossil fuel level.

Notes: GVC exposure to the EU is the sum of direct exports to EU and indirect exports to EU over domestic output of those products. All products traded in GVCs of petroleum, chemical and non-metallic mineral products are included in the calculation.

3.1.2 Energy-intensive products

The energy intensive exports of developing countries will likely be affected by the EU CBAM, EU CS3D, and China ETS, as well as by the climate mitigation policies of other countries. This section examines the influence of the EU CBAM, EU CS3D, and China ETS specifically. For an analysis of how other countries' climate mitigation policies affect energy-intensive exports, refer to Brenton et al. (forthcoming).

The EU CBAM will raise the competitiveness of exporters that can prove lower CO_2 emissions than EU producers while reducing it for others. Suppliers from developing countries will face compliance costs due to certification challenges, but those proving lower CO_2 emissions will pay less for the carbon embodied in exports to the EU for products like iron and steel, cement, fertilizers, aluminum, hydrogen production, electricity, as well as certain precursors (i.e., cathode active materials). This could improve market access for these exporters while limiting it for the rest.

The impact of CBAM on export competitiveness of an affected exporter in a country with no carbon pricing will hinge on two factors. First, the higher its CO_2 emissions intensity compared to the average EU firm, the greater the impact due to increased carbon payments. Second, a greater level of export concentration towards the EU will amplify the impact on the exporter. Consequently, sector exposure under CBAM is dictated not only by the sector's export orientation but also by its relative emission intensity. If a country has an existing carbon pricing scheme, the exporter will receive credits for domestic carbon payments and will only need to cover the difference if the CBAM payment is higher. Given the complexity of the calculation and as most developing countries, aside from Argentina, Brazil and Mexico, do not have a carbon pricing scheme, this scenario is not considered.

The impact of CBAM on the competitiveness of exporting countries of affected products is measured using the aggregate relative CBAM exposure index.[19] This index is calculated by dividing the total excess embodied carbon payments (the carbon price times the value of exports of the affected product to the EU multiplied by the difference between the own emissions intensity and the EU average intensity) by the value of a country's total exports of the affected products to the world.

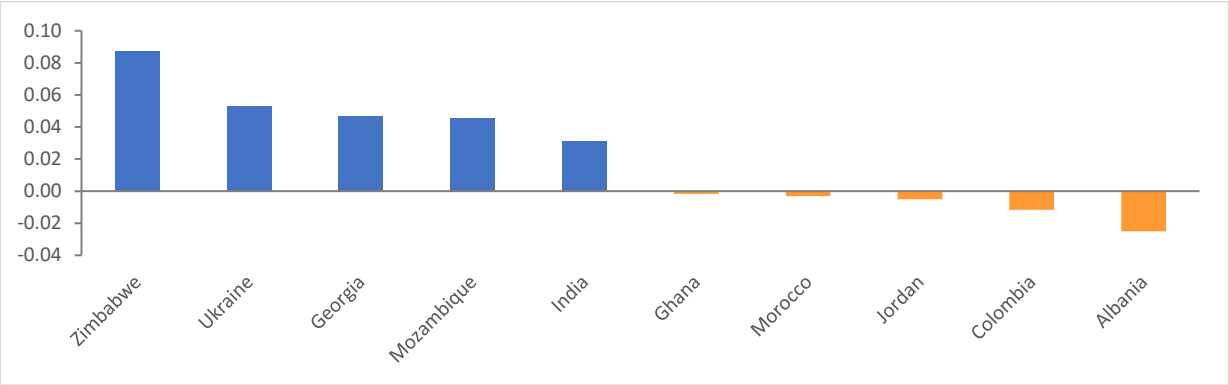
Based on this index, developing nations like Zimbabwe, Ukraine, Georgia, and Mozambique could suffer significant competitiveness losses due to CBAM (Figure 5). Higher costs from CBAM may reduce their EU market competitiveness and prompt sectoral restructuring to decrease carbon intensity. For instance, 97 percent of Mozambique's aluminum exports go to the EU, with a carbon intensity 10.3 times higher than the EU average. Similarly, 92 percent of Zimbabwe's iron and steel exports are directed to the EU, with a carbon intensity 7.2 times greater than the EU average.

In contrast, developing countries like Albania, Colombia, Jordan, and Morocco could become more competitive due to CBAM. These nations have lower carbon intensity in the production and exportation of CBAM products compared to the EU average. This provides their exporters greater competitiveness in the EU market subject to the ability to demonstrate carbon intensities. For example, Albania's emission intensity for electricity exports is almost zero because of its hydro power, compared to the EU's average

[19] For more, see: https://blogs.worldbank.org/en/trade/how-developing-countries-can-measure-exposure-eus-carbon-border-adjustment-mechanism.

of 0.15kg/USD. Similarly, Colombia's cement export emissions are 0.37kg/USD, below the EU's average of 0.5kg/USD.

Figure 5 Top 5 and bottom 5 countries in Aggregate Relative CBAM Exposure Index



Source: Maliszewska et al. (2023).
Notes: Underlying data for relative CBAM exposure index includes carbon emissions intensity data in 2017 and trade data in 2019. The formula of the Aggregate Relative CBAM Exposure index can be found at https://www.worldbank.org/en/topic/trade/brief/technical-note-for-the-cbam-exposure-index.

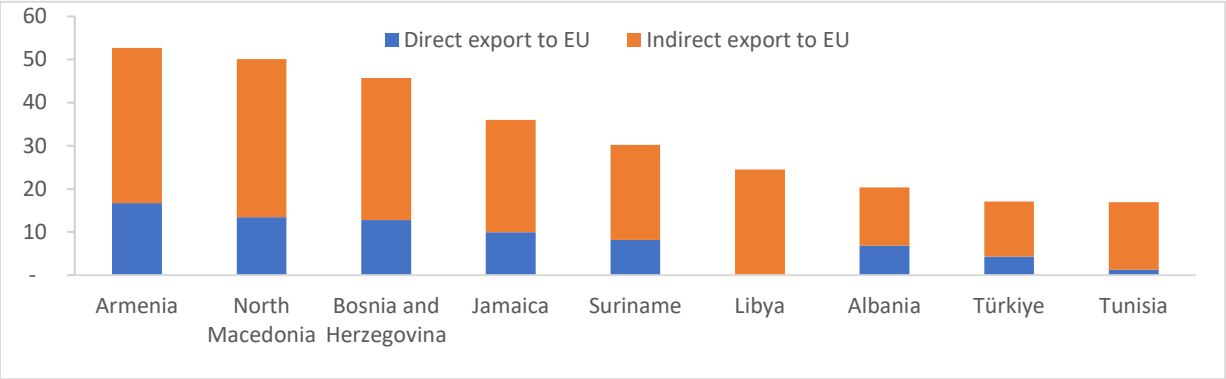
Regarding developing countries' economic exposure, the economies of Mozambique and Ukraine are the most susceptible to CBAM.[20] In 2022, affected product exports to the EU accounted for 9.3 percent of Mozambique's GDP to the world and 2.8 percent of Ukraine's.

The CBAM sets a precedent that is likely to motivate other countries to implement similar schemes, potentially exacerbating effects on developing countries. Canada, the UK, the US, and Japan are all contemplating the creation of their own carbon border adjustment mechanisms (Law 2023). Additionally, the range of products and emission scopes included under the EU CBAM is expected to broaden over time.

The EU CS3D regulation is set to impact GVC metal exports to the EU, both directly and indirectly. Figure 6 highlights Armenia's metal GVC sector as the most affected, with over half its domestic metal products output destined directly or indirectly for the EU. Macedonia and Bosnia and Herzegovina follow closely. Other countries may also be exposed indirectly if they supply metal inputs to firms serving the EU market.

[20] Note that the underlying trade data for the relative CBAM exposure index is from 2019, prior to Russia's invasion of Ukraine. Using 2022 data, the CBAM exposure index value for Ukraine is likely to be higher due to its heightened export concentration towards the EU.

Figure 6 GVC exposure to the EU: Metal products

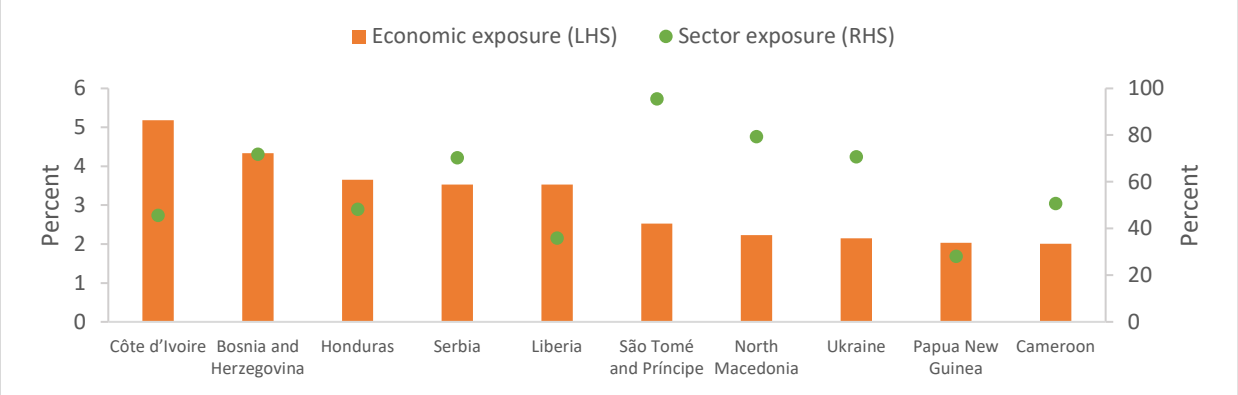


Source: Arvis et al. (forthcoming) and authors' calculations.
Notes: GVC exposure to the EU is a sum of direct exports to EU and indirect exports to EU over domestic output of metal products.

3.1.3 Agricultural goods

The EU Deforestation Regulation (DR) will impact agricultural and forestry exports from many developing countries by imposing strict tracking and environmental standards. These requisites will increase costs, and they could decrease exports of affected products to the EU, especially from smaller farmers, who may struggle with meeting the information requirements and the necessity to use geolocation technology for traceability. Consequently, some producers might redirect their exports to markets with less stringent regulations, potentially diminishing the regulation's effectiveness.

Figure 7 Top 10 developing countries according to their economic exposure to EUDR



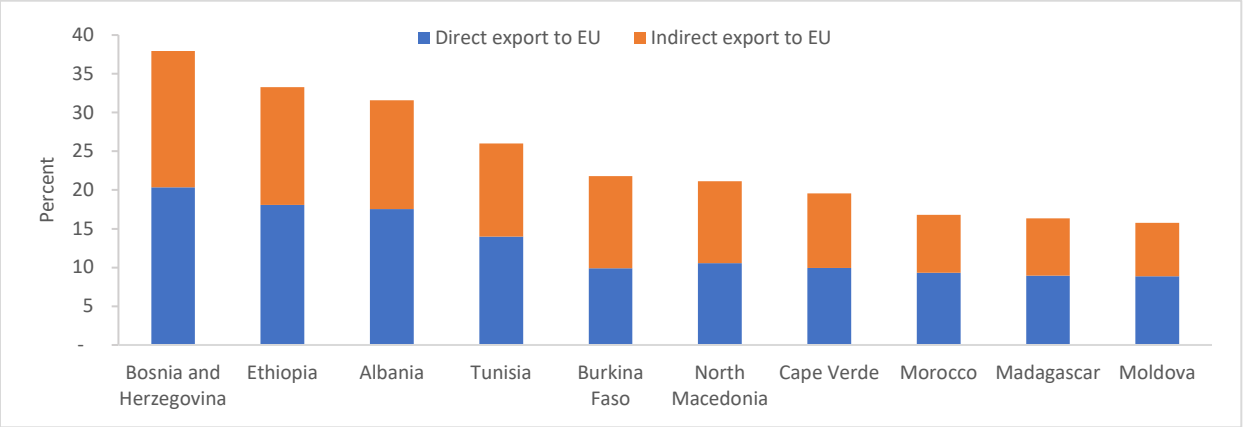
Source: Authors' calculation based on 2022 data from the World Bank's WITS.
Note: Sector and economic exposure are export of EUDR affected products to three economies divided by exports of EUDR affected products to world and GDP, respectively.

Sectors of affected products that are heavily reliant on the EU as a market are likely to be the most affected by this regulation. São Tomé and Príncipe and Guinea-Bissau have the most exposed sectors. For São Tomé and Príncipe, 96 percent of its global exports of affected products goes to the EU, and 95 percent of Guinea-Bissau's corresponding exports head to the EU. The countries whose economies are most exposed are Côte d'Ivoire and Bosnia and Herzegovina as affected exports to the EU represent 5.2 percent of Côte d'Ivoire 's GDP and 4.3 percent for Bosnia and Herzegovina (Figure 7).

3.1.4 Textiles

The EU CS3D regulation is set to affect all industries with significant environmental footprints, including textiles. Bosnia and Herzegovina, Ethiopia, Albania, and Tunisia are the countries with textile sectors most exposed to this regulation, as over a quarter of their textile exports are bound (directly or indirectly) for the EU (Figure 8).

Figure 8 Global value chain exposure to the EU: Textiles



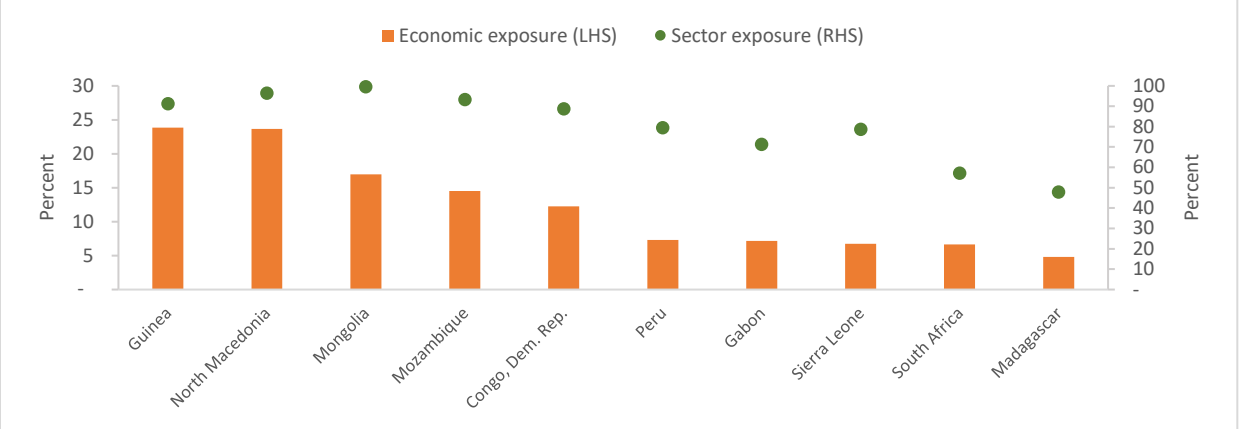
Source: Arvis et al (forthcoming) and authors' calculations.
Notes: GVC exposure to the EU is the sum of direct exports to EU and indirect exports to EU over domestic output.

3.2 Impacts through green transition sectors

3.2.1 Critical minerals

The critical mineral policies of the EU, US, and China will affect developing countries differently. Mongolia, North Macedonia, and Mozambique have the most exposed sectors as their mining sectors are almost entirely directed to these regions (Figure 9). The economic exposure is greatest in countries like Guinea and North Macedonia as a quarter of their GDP is from mining exports to these regions.

Figure 9 Top 10 developing countries according to economic exposure to impacts of EU, US, and China policies on exports of critical minerals



Source: 2022 data from the World Bank's WITS.
Note: Sector and economic exposure are export of critical minerals to three economies divided by exports of critical minerals to world and GDP, respectively.

The EU's CRMA will increase costs for exporters of critical minerals to the EU, but it will also increase the EU's demand from non-dominant mineral exporters. The CRMA's environmental and social requirements on production will increase costs for exporters from developing countries. Its diversification targets aimed at reducing disruption risks will impact market access. In the short term, exports from established but non-dominant exporters are expected to rise in response to the EU's growing demand (Table 2). Developing countries like Guinea (bauxite), Kazakhstan (titanium and phosphorus), and Mexico (fluorspar) may benefit.[21] In contrast, dominant exporters such as China (providing 100 percent of the EU's heavy rare earth elements), Türkiye (supplying 98 percent of boron), Chile (providing 79 percent of the EU's needs for lithium), and South Africa[22] (providing 71 percent of platinum) might see decreased exports due to the EU's diversification efforts.

Table 2 EU mineral demand forecasts in a high demand scenario

	EU demand in 2030 compared with 2020	EU forecasted demand in 2050 compared with 2020
Lithium	X 12	X 21
Graphite	X 14	X 26
Nickel	X 10	X 16
Dysprosium	X 6	X 7
Neodymium	X 5	X 6
Platinum	X 30	X 200
Aluminum	X 4	X 6

Source: Carrara et al. (2023).

In the medium to long term, as new mining operations arise elsewhere, countries with abundant reserves are anticipated to enter in or expand exports to the EU market. It takes on average 16 years from discovery to production (S&P Market Intelligence 2023), varying by mineral (shorter period for Lithium) and regulatory environment.[23] As extraction progresses, new or non-dominant exporters will find opportunities due to rising demand projected through 2030 and up to 2050, despite the EU's increased extraction and domestic recycling efforts. The European Commission's Joint Research Centre predicts significant increases in demand for minerals like lithium, graphite, cobalt, nickel, platinum, and rare-earth elements, driven mainly by the electric mobility sector (Carrara et al. 2023). For example, in a high-demand scenario, EU demand for lithium for batteries is expected to rise 12-fold by 2030 and 21-fold by 2050 compared to 2020, while aluminum demand – crucial for solar panels, wind turbines, and batteries – could quadruple by 2030 and sextuple by 2050 (Table 3).

Mineral reserve-rich developing countries may gain from this surging demand if they are able to scale up production and improve competitiveness in the EU market. Such could be the case for Mozambique (with more than half of the world's graphite reserves), the Democratic Republic of Congo (holding 43 percent of global cobalt reserves), South Africa (with 38 percent of global manganese reserves), Argentina (with 22 percent of global lithium reserves), and Indonesia (with 18 percent of global nickel reserves) (Table 3).

Table 3 Top countries in strategic critical minerals reserves, (% of global reserve)

Cobalt	Copper	Graphite	Lithium	Manganese	Nickel

[21] European Council (2024).

[22] Ibid.

[23] The average lead time was calculated for 127 precious and base metals mines that began production between 2002 and 2023 and were discovered from 1980 onward. The time ranged between six and 32 years.

Congo, Dem. Rep.	43	Chile	31	Mozambique	50	Argentina	22	South Africa	38	Indonesia	18
Australia	8	United States	10	Tanzania	12	United States	17	Australia	18	Australia	10
Indonesia	7	Peru	8	Kazakhstan	11	Bolivia	16	Gabon	11	Canada	10
Canada	6	Australia	6	Canada	7	Chile	11	United States	8	Russian Federation	9
Nauru	5	Congo, Dem. Rep.	4	Malawi	6	Australia	7	Kazakhstan	4	Philippines	8
Tonga	5	Russian Federation	4	United States	3	Canada	7	Canada	4	New Caledonia	8
Cuba	3	Canada	4	Australia	3	Germany	5	Ukraine	3	Brazil	5
Philippines	3	Mexico	4	Madagascar	2	China	4	Georgia	3	Cuba	4
Zambia	2	China	4	Sweden	2	Congo, Dem. Rep.	3	Ghana	2	South Africa	3
New Caledonia	2	Indonesia	3	Greenland	1	Mexico	1	India	2	Nauru	3

Source: Authors based on World Bank's AFE Energy Transition Material (ETM) reserves data.

The IRA is expected to boost demand for critical minerals in the US, especially for green technologies, benefiting eligible exporters. In the short-term, established producers of raw and processed critical minerals for EV batteries with a US FTA, like Mexico, are expected to see increased exports. Other top exporters to the US, like Brazil and China, could lose market access without an FTA as EV credits are contingent on a large share of the minerals in the battery being sourced from a country with an FTA. In the medium-term, as new mining enters operation, countries with large reserves of critical minerals may enter the US market or increase their exports of critical minerals for EV batteries if they secure an FTA. For instance, African countries with zinc and manganese reserves that secure an FTA may benefit from US diversification efforts. Similar short and medium-term impacts are expected for countries that export raw and processed critical minerals for other technologies (besides EV batteries) but without FTA membership affecting demand as only minerals for batteries require FTA membership for eligibility to credits. In the short term, the developing countries with mining sectors most exposed to the increased US demand are South Africa, China, and Russia. However, the exposure of these countries' mining sectors and economies is not high as their raw mineral exports to the US do not represent a large share of their total exports of raw and processed minerals to the world and of their GDP.

China's green energy transition is also anticipated to drive demand for critical minerals from developing countries. Rising EV production will increase the need for battery materials like lithium, nickel, and cobalt.[24] This demand surge benefits developing countries' mining and refining. The implementation of China's ETS might lead to increased demand for components necessary to upgrade coal and gas-fired plants in China. Although the current structure of China's ETS does not promote a higher adoption of renewable energy, if this were to change in the future, the demand for minerals linked to renewable energy could rise.

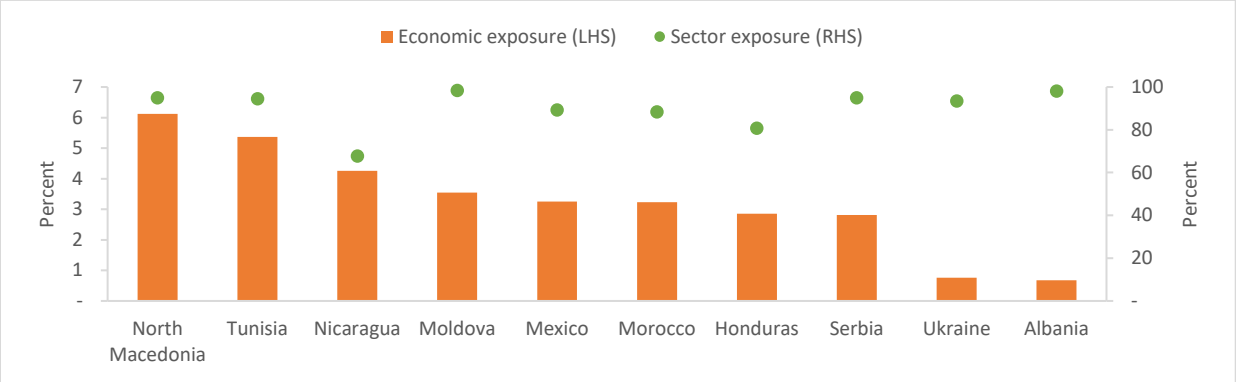
Recycling critical minerals can greatly influence trade in developing countries. As noted by the IEA (2021), the green transition will boost demand for recycling. This change will reduce dependence on suppliers and affect raw mineral exports from developing countries. Conversely, it provides an opportunity for these nations to develop recycling industries and mitigate environmental harm caused by mining. Achieving this will necessitate considerable investment in recycling technology and infrastructure to remain competitive. Strategic planning and support are essential for these countries to benefit from recycling-based trade.

[24] The demand for a specific mineral will depend on technological advances in batteries, which can result in the substitution of some minerals for others.

3.2.2 *EV and components*

The EU CO_2 emission standards, China EV policies, and the US IRA are expected to boost demand for green tech components from developing countries, particularly those used in EVs. The countries whose EV components sectors stand to benefit most are those exporting mainly to China, the European Union, and the United States. These include Moldova, Albania, North Macedonia, Tunisia, Ukraine, Mexico, Morocco, and Honduras, all of which send more than 80 percent of their EV components to those three markets. In the case of North Macedonia and Tunisia, EV components bound for those markets make up more than 5 percent of GDP – making for a potentially significant economic impact (figure 10).

Figure 10 Top 10 developing countries according to economic exposure to impacts of the EU, US, and China policies on EV components exports



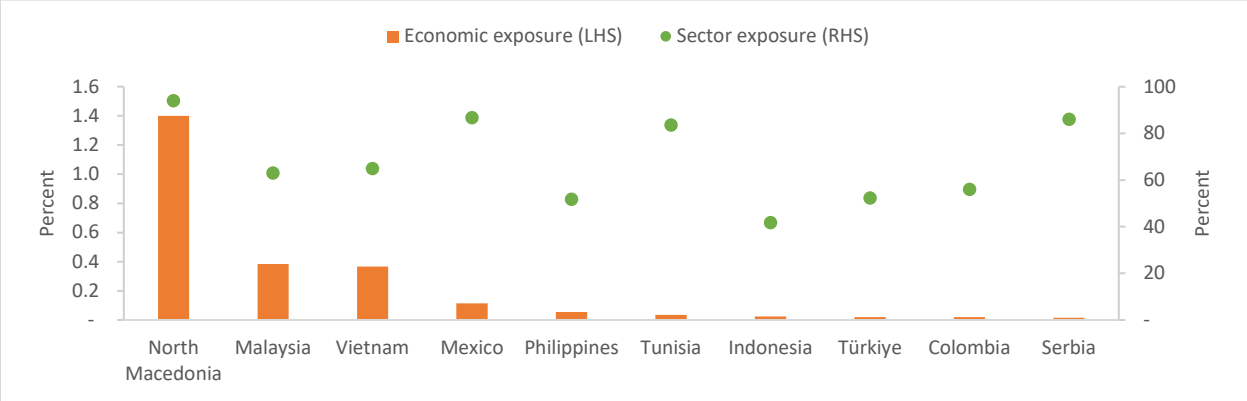
Source: 2022 data from the World Bank's WITS.
Note: Data includes components of EVs, excluding batteries. Sector and economic exposure are export of EV components to the three economies divided by exports of EV components to the world and GDP, respectively.

Regarding EV batteries, the sector is most exposed in the Democratic Republic of Congo, Papua New Guinea, Armenia, North Macedonia, and Bosnia and Herzegovina, with more than 80 percent of their battery exports going to the three regions (Figure 11). Apart from North Macedonia, where exports of batteries to the EU, US and China represent 1.4 percent of GDP, the impact of battery-related policies on the overall economy of these countries is expected to be minor since battery components form a small portion of their economies.

The impact of the US IRA will change over time in the case of EV batteries. By 2029, the US demand for imported EV batteries is expected to drop significantly due to tax credits requiring that battery components be made or assembled in North America.[25] This shift will likely boost battery and battery component exports from Mexico to the US but hurt battery exports from countries like Viet Nam and Malaysia.

[25] See section 2.2.3.

Figure 11 Top 10 developing countries according to economic exposure to impacts of EU, US, and China policies on battery exports

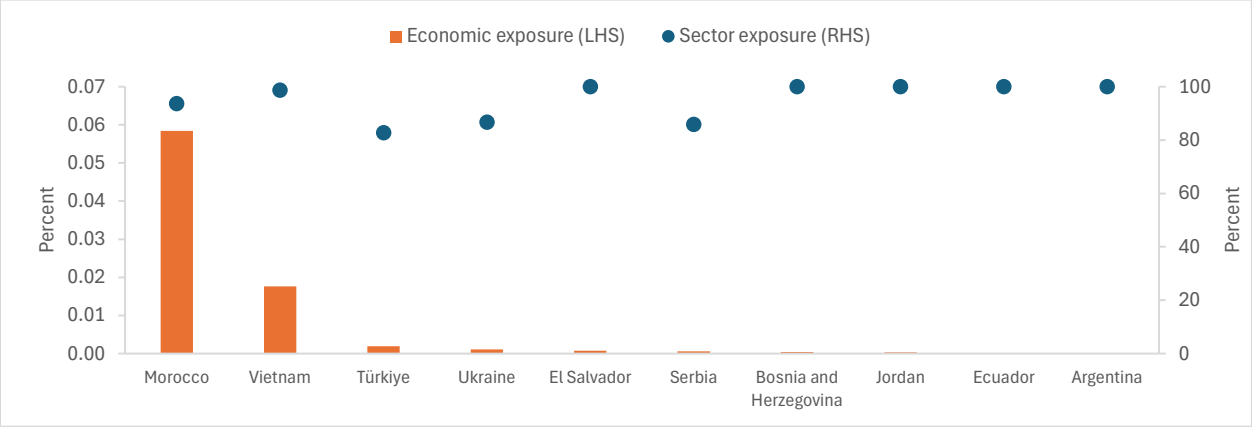


Source: Authors' calculation using 2022 data from the World Bank's WITS.
Note: Data includes components and end-products. Sector and economic exposure are export of batteries to three economies divided by exports of batteries to world and GDP, respectively.

Unless leasing rates increase significantly in the US, EV exports to the US from developing nations like Viet Nam are expected to decline. This is due to rebates requiring final assembly in North America, decreasing US imports from outside that region. However, this decline may be partly or fully offset by a regulation enabling leased EVs to qualify for rebates regardless of origin. This regulation prompted an increase in EV leasing from under 10 percent in December 2022 to 34 percent by March 2023 (Bown 2023). The US government aims for at least 50 percent of all new vehicle sales to be electric by 2030 (White House 2022). Should leasing rates increase significantly, Viet Nam would stand to benefit (Figure 14).

The EU's zero-emission regulation by 2035 aims to reshape the automotive industry, significantly impacting developing countries that export EVs. As traditional combustion vehicles are phased out, EU nations will likely rely more on EV imports to meet this new demand, especially if domestic production lags. Developing countries with automotive manufacturing capabilities are poised to attract investments in their EV sectors and boost exports. Morocco, Türkiye, and Viet Nam are expected to benefit as they adapt their industrial policies to meet EU standards, positioning themselves as major players in the sustainable vehicle market. Though their EV sectors' exposure to the three markets is high, the economic exposure of developing countries to EV policies remains low because their EV sectors are still emerging (Figure 12). For example, while 94 percent of Morocco's EV exports went to these markets, they only constituted 0.06 percent of its GDP in 2022.

Figure 12 Top 10 developing countries according to economic exposure to impacts of EU, US, and China policies on EV exports

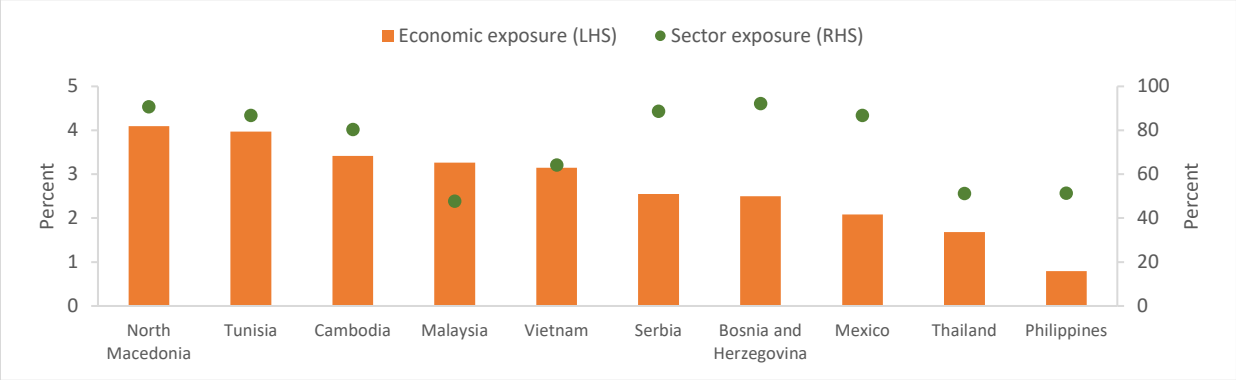


Source: Authors' calculation based on 2022 data from the World Bank's WITS.
Note: EV data is based on HS code 870380. Sector and economic exposure are export of EVs to three economies divided by exports of EVs to world and GDP, respectively. Mexico's EV exports to three markets accounts for 82 percent of its EV exports to world and 24 percent of GDP, respectively.

3.2.3 Renewables and components

EU, US, and China policies on renewables are likely to increase demand for renewable energy tech and components. The renewable energy tech and components sector (solar and wind products) is most exposed in Bosnia and Herzegovina, North Macedonia, Serbia, Tunisia, and Cambodia, with more than 80 percent of this sector's exports going to the EU, US or China (Figure 13). In these countries the overall economy is exposed to the policies as renewable energy tech and components exports represent between 3 and 4 percent of GDP.

Figure 13 Top 10 developing countries according to economic exposure to impacts of EU, US, and China policies on exports of renewable technology and components (solar and wind)



Source: Authors' calculation based on 2022 data from the World Bank's WITS and on the product list from Rosenow and Mealy (2024).
Note: Sector and economic exposure are export of renewable technology and components to three economies divided by exports of renewable technology and components to world and GDP, respectively.

3.3 Impacts through prices

The US IRA and EU policies are expected to exert downward pressure on global oil prices over the medium to long-term by reducing demand as renewable energy becomes more prevalent. The US government is targeting 100 percent carbon pollution-free electricity by 2035 (White House 2023a), and the EU aims to cut emissions by 90 percent by 2040, both targets will reduce their oil demand. The fall in oil prices will hurt the revenues of oil exporters but benefit importing countries, reducing the latter's economic incentive to decarbonize. The overall impact of the US IRA, EU policies, and China's ETS on gas prices are uncertain. Gas demand could either increase or decrease since gas can also be used as input for blue hydrogen.

Conversely, these policies are expected to exert upward pressure on international prices of critical minerals over the medium to long term due to increased demand, particularly for EV batteries, compounded by unequal treatment according to sourcing origin, which will inhibit US import demand from certain countries. This price pressure would be additional to that exerted by the rest of the world as its demand for critical materials quadruples by 2040 in the pursuit of country climate objectives, with half of that increase coming from mineral demand related to EVs and battery storage.

Additionally, the US IRA may influence international prices of subsidized products and their inputs. IRA subsidies on consumption, like those for installing solar panels in houses, will boost US demand and drive up international prices. IRA subsidies on production, like those for renewable energy, will increase supply and lower the price of fossil fuels. In some cases, like EV subsidies, the net effect of subsidies on consumption (EV credits) and production (subsidies to EV plants) remains uncertain.

Finally, the implementation of the EU CBAM is expected to exert downward pressure on CBAM product prices in third-party countries. Exporters shifting away from the EU market due to its strict regulations will increase supply elsewhere, leading to heightened competition and lower prices.

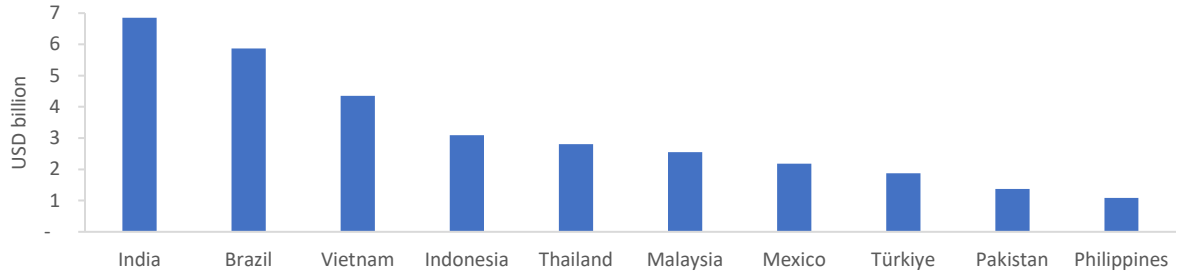
3.4 Impacts through access to technology

The Fit for 55 package underscores the importance of transferring technology to developing nations, especially in key sectors like renewable energy, energy efficiency, and sustainable transportation. Facilitating the sharing of knowledge, skills, and technologies can significantly aid these nations in adopting cleaner and more sustainable practices.

The IRA could also increase over the medium to long-term developing countries' access to cost-effective green technologies, initially developed in the US. The advancement of affordable green technologies within the US may yield global benefits as these technologies are disseminated over time. Furthermore, the hastening of learning curves in sectors like renewable energy, energy storage, EVs, critical minerals processing, heat pumps, mitigation of oil and gas methane emissions, energy-efficient systems and appliances, as well as water conservation could accelerate the deployment of green technologies.

China's climate policies are also likely to significantly boost technology transfers. These would be enhanced by China's overseas investments through the BRI, providing substantial advantages to developing countries receiving such investments. Research and development initiatives, funded by grants and coupled with insights gained from large-scale production within China's export-oriented economic framework, are expected to refine current technologies and foster new innovations. As technology matures, cost reductions would accrue, benefiting other countries. Furthermore, countries like India, Brazil, and Viet Nam, presently rely on imports from China for environmental goods, which, together with services, could enable technology improvements (Figure 14).

Figure 14 Top 10 developing countries largest importers of environmental goods from China



Source: Authors' calculation based on 2022 data from the World Bank's WITS.
Note: Data is collected based on the APEC list of environmental goods.

4. Conclusion and policy recommendations

The select climate policies of the EU, US, and China bode well for the environment but present challenges and opportunities to developing countries. These policies aim to cut carbon emissions, encourage renewable energy, and enhance environmental and social governance, which are commendable goals. However, these policies will also likely reshape trade, pricing, investment, and access to technology in developing countries, with mixed possible consequences.

The policies are likely to reduce demand for fossil fuels, energy-intensive manufactured goods, and commodities that contribute to environmental degradation. Specifically, the EU ETS, EU EED, EU RED, US IRA, and China's renewable targets and ETS will lower fossil fuel demand, negatively affecting countries whose exports heavily depend on these markets. The EU CBAM and CS3D policies will add costs to carbon-intensive exports to the EU, reducing in the case of the EU CBAM competitiveness for nations like Zimbabwe, Ukraine, Georgia, and Mozambique, while improving it for places like Albania, Colombia, Jordan, and Morocco. Additionally, the exporters of EUDR-impacted products will likely see increased compliance and due diligence costs or loss of market access to the EU.

Conversely, these climate policies are expected to create new opportunities in sectors critical to the green transition, such as critical minerals, EV manufacturing, and renewable energy. The US IRA and EU CMRA will boost their need for critical minerals and change their sourcing patterns. In the short term, non-dominant mineral-exporting countries will benefit from increased EU mineral demand, while countries with a US FTA will profit from heightened US mineral needs for batteries. For the medium to long term, countries rich in mineral reserves are anticipated to see export growth as new mines enter operation. EU CO2 standards, the US IRA, and China's EV policies will increase the demand for EVs and components from developing countries. However, US tax credit preferences favoring North American manufacturing may reduce battery demand from countries like Brazil while benefiting Mexico. The EU's 2035 zero-emission regulation will transform the automotive industry, likely positioning Morocco, Türkiye, and Viet Nam as key players due to their compatible industrial policies.

Several measures can be taken to lessen the possible adverse effects of the select climate policies on developing countries and to capitalize on the potential benefits. These actions should be undertaken by developing nations, the countries enacting the select climate policies, and the wider international community, as outlined below.

4.1 Recommendations for developing countries

Developing nations can mitigate the impact of EU, US, and China policies and make the most of market opportunities by boosting export competitiveness in sustainable markets and supporting the development of green transition sectors.

To boost export competitiveness in sustainable markets, countries can implement mitigation policies, promote green goods and services, enhance quality infrastructure and standards, and support sectoral restructuring. This involves implementing policies that help meet their NDC commitments and facilitate the transition to lower greenhouse gas emissions, promote renewable energy, and minimize social and environmental harm. The import of green goods and services can be encouraged by reducing tariffs and non-tariff measures, VAT and withholding taxes on green imports to enhance carbon and environmental competitiveness. The adoption of carbon pricing mechanisms will promote the de-carbonization of sectors and ease access to markets imposing CBAM, while ensuring that carbon pricing revenues are retained at home. Strengthening national quality infrastructure—metrology, certification, and accreditation—while raising environmental and carbon standards will empower regulatory bodies and economic players to trace and certify the environmental impacts in agriculture and manufacturing, meeting advanced market requirements. Special attention should be given to small and medium-sized enterprises (SMEs) to support them in managing compliance costs. Additionally, restructuring affected sectors requires helping workers transition to new jobs and assisting sectors in aligning with the environmental, labor, and social standards of trading partners, thereby showcasing firms' capabilities in sustainable markets.

To support the development of green transition sectors, it is crucial to improve the investment climate. The investment climate can be improved by adopting an integrated approach that reduces restrictions on FDI in green goods and climate-related services, enhances trade facilitation to lower costs of integrating into green value chains, and fosters public-private dialogue to identify barriers to participation in green markets.[26] Additionally, targeted support may be needed to help domestic firms build absorptive capacity to adopt green technologies and meet multinational enterprise (MNE) supplier requirements. Such approach can encourage MNEs to reduce emissions-intensive production, shift their supply chains to lower-carbon methods, and facilitate a low-carbon transition (Steenbergen and Saurav 2023).

Countries with abundant critical raw materials can also develop a comprehensive strategy to realize their potential for sustainable mineral extraction and processing. The development of mining related infrastructure and enhancement of transportation and logistics networks will provide the required access to markets. The use of energy policies that support clean energy sources through non-discriminatory, transparent, time-bound, and monitorable incentives for renewable energy projects would reduce mining's reliance on fossil fuels, making it more carbon competitive. Introducing regulations and incentives to ensure mining practices meet environmental, labor, and social standards is vital for alignment with developed markets, including efforts to minimize pollution, protect ecosystems, promote clean production, recycling and extraction methods, and ensure appropriate working conditions. Promoting the extraction and processing of critical minerals while fostering upstream and downstream industries can help leverage growing demand from the EU, US, and China and promote greater value addition. Rather than imposing export bans, a supportive business environment, along with policies for job creation, technology transfer, and local linkages, including time-bound incentives, can facilitate the integration of exporters into GVCs. Supporting SMEs and formalizing small-scale mining will further promote local linkages and inclusivity. Finally, exploring trade agreements and securing long-term

[26] See Brenton et al (forthcoming) for further details.

contracts can stabilize the mineral market, encourage investment and support the transfer of clean energy technology.[27]

4.2 Recommendations for the EU, US, and China

The continued use of protectionist instruments in climate policies could spark a wave of protectionism, hurting developing countries' growth and slowing the green transition. Policies with industrial and protectionist elements, like discriminatory subsidies and local content requirements, which are not WTO compliant,[28] disadvantage exporters from other countries. This may prompt other nations to adopt similar measures, further distorting trade to the detriment of developing countries, which have so far benefitted from open trade and multilateralism, ultimately leading to inefficient use of resources and slowing the green transition.

Green subsidies, carbon pricing, and regulations should be designed in a way that is neither more trade restrictive than necessary nor discriminatory. Accounting for the impacts on developing countries in the design of EU, US, and China climate policies, as well as of other advanced and large economies, would help ensure faster reduction in global GHGs while supporting poverty reduction and prosperity. This may involve phased approaches to give countries with weak capacity time to comply with the more stringent environmental standards and regulations and achieve carbon emission competitiveness, as well as the provision of financial and technical assistance. The EU could provide future CBAM revenues (which are foreseen to increase over time) in advance to developing countries to complement planned EU assistance and support their green transition.[29] Additionally, the EU, US, and China can facilitate the transfer of green technologies to developing countries and ease the learning curve for implementing them.

Harmonize carbon and environmental standards, regulations, and compliance procedures. This alignment would help address the proliferation of carbon and environmental standards and regulations issued both by governments and the private sector, as well as the development of different carbon pricing mechanisms. The current lack of uniformity increases global trade costs and hampers the green transition.

To reduce supply risk for strategic goods such as critical minerals, prioritize expanding global production rather than reshoring, segmentation and thinning of markets. Reshoring would probably lead to thinner more volatile mineral markets, reduced economies of scale, and a costlier and slower energy transition. Boosting FDI in developing countries for mineral extraction and processing is more effective at reducing supply risk than setting domestic targets for extraction and processing in developed nations. Replacing the FTA membership requirement for subsidy eligibility with responsible sourcing standards would diversify sources, build resilience and generate opportunities for mineral-abundant developing countries. Additional support can be provided through sharing best practices (including environmental, social, and labor standards), long-term mineral contracts (e.g., offtake agreements), and financial support.

4.3 Support by the international community

[27] See section IV of World Bank Group (2024) for further details.

[28] WTO does not allow the use of discriminatory export subsidies nor local content requirements for the provision of subsidies (Bown and Clausing 2023).

[29] Members in the European Parliament have suggested that the EU must provide financial support, at least equivalent in financial value to the revenues generated by the sale of CBAM certificates, to support developing countries' decarbonization efforts. The suggestion our paper makes is not only to provide current revenues from the sale of CBAM certificates but an advance on foreseen revenues to help finance decarbonization investments. See https://www.europarl.europa.eu/news/en/press-room/20220516IPR29647/cbam-meps-push-for-higher-ambition-in-new-carbon-leakage-instrument.

The international community can take three significant steps. First, development partners could assist in the execution of the aforementioned recommended measures for developing countries. By providing financial aid, engaging in collaborative projects, sharing knowledge, and providing capacity-building, it can help these countries adopt effective emission reduction measures, mitigate the effects of the EU, US, and China climate policies, take advantage of the opportunities these policies offer, and promote sustainable development.

Second, international collaboration is needed to develop a framework that reduces trade frictions stemming from diverse climate policies (Bown and Clausing 2023). As expected, countries employ different approaches to climate policy (e.g., cost-imposing vs cost-reducing policies) because of their particular institutional, political, and economic constraints. But such policy asymmetry leads to competitiveness impacts on trading partners. As the WTO dispute settlement system is no longer fully functioning, unilateral actions to address competitiveness concerns could lead to trade wars, undermining trade benefits. A framework should be agreed upon that reconciles different mitigation ambitions (and related instruments, as supported by the Paris Agreement) with an open, non-discriminatory, transparent multilateral trading system. Bown and Clausing (ibid) suggest three components for such a framework: First, the development of a faster dispute settlement procedure that meets the urgency of climate change. Second, agreement on a criterion to make certain green subsidies nonactionable under WTO rules[30] with the requirement that they be transparent, effective in meeting their intended environmental objective, designed in the least distortive manner, temporary, and without local content requirements. Last, the development of mechanisms that nudge countries toward greater climate policy alignment to reduce frictions. Examples of such an alignment could be the harmonization of environmental standards and regulations as well as of compliance requirements or the adoption of a global carbon price that gradually increases towards its social cost. Should the multilateral development of the framework prove challenging, like-minded countries could start with a multi-party approach similar to the Multi-Party Interim Appeal Arbitration Arrangement (MPIA) developed when the WTO dispute settlement encountered difficulties.

Finally, international collaboration is necessary to tackle the challenges of emission intensity metrics and pricing, especially for goods with complex supply chains and cross-border issues (WTO, OECD, IMF, UNCTAD, and World Bank Group WTO 2024). Efforts should streamline compliance through robust yet flexible Monitoring, Reporting, and Verification (MRV) systems and harmonized data for policy and standards compliance. Multilateral solutions are needed to address varying regulatory and compliance requirements, different carbon measurement methods, and non-recognition of domestic standards.

4.4 Further research

This paper has detailed various mitigation policies of the three largest global trading partners and the exposure of developing countries to their impacts. However, future work could expand this analysis in several dimensions. First, the analysis focuses on each policy in isolation. This allows for granularity of the sectoral and country discussion. Future research could assess all these policies in a coherent framework that takes into consideration interlinkages across sectors within countries and comparative advantages of countries globally. Second, further research on the impact of various policies on SMEs and smallholder

[30] In the case of actionable subsidies under WTO rules that reduce foreign countries' competitiveness, it will be important to agree on guardrails regarding the ways in which affected countries can respond. Such response (antidumping, countervailing duties, safeguards) should be limited to what is really needed to maintain an open trade regime and avoid escalation (Bown and Clausing 2023).

farmers would help develop tailored assistance for these groups. Third, examining how ready countries are to adhere to the diverse new regulations and due diligence directives is crucial, along with evaluating compliance costs. This requires gathering data on various mandatory and voluntary environmental standards, evaluating the availability of MRV and geolocation systems, and assessing the quality of infrastructure for compliance. This would provide a clear picture of where technical and financial support is needed. Finally, it is critical to develop further guidance on how regional or multilateral collaboration can prevent a race to the bottom as countries deploy more industrial policy instruments. This would help ensure that the ability of developing countries to leverage trade for growth and job creation is not diminished, and that global environmental objectives remain on track to be met.

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