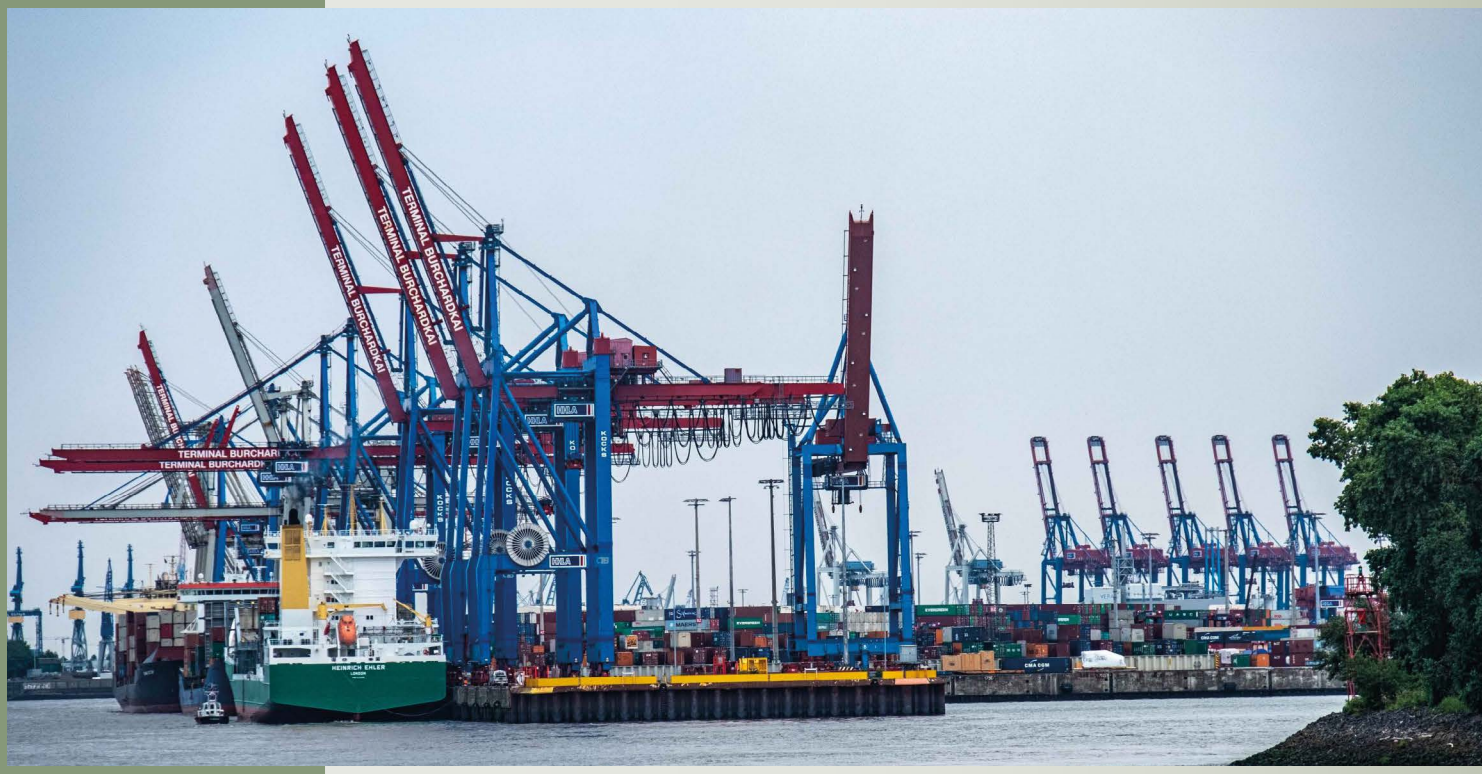
Research Network
Sustainable Global Supply Chains



Sustainable global supply chains in times of geopolitical crises

Sustainable Global Supply Chains Annual Report 2023

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SWP Stiftung Wissenschaft und Politik German Institute for International and Security Affairs

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Abbreviations

ASEAN	Association of Southeast Asian Nations
BRI	Belt and Road Initiative
CBAM	Carbon Border Adjustment Mechanism
CDA	Community Development Agreement
CDDC	commodity-dependent developing country
CET	clean energy technology
CNL	National Commission of Lithium / Comisión Nacional del Litio
CRM	critical raw material
CRMA	Critical Raw Materials Act
CSDDD	Corporate Sustainability Due Diligence Directive
DRC	Democratic Republic of the Congo
ESG	environmental, social, and governance
EU	European Union
EV	electric vehicle
FDI	foreign direct investment
FTA	free trade agreement
FTS	first-tier supplier
GHG	greenhouse gas
GHG3	greenhouse gas Scope 3
GVC	global value chain
H&E	high-tech and electronics
HCI	heavy chemical industry
HQ	headquarters
IRA	Inflation Reduction Act
KITE	Kiel Institute Trade Policy Evaluation
LNG	liquefied natural gas
MFA	Multi-Fibre Arrangement
MSP	Minerals Security Partnership
NZIA	Net-Zero Industry Act
PPP	public–private partnership
PTA	preferential trade agreement
REE	rare earth element
ROCE	return on capital employed
ROO	rules of origin
SADC	Southern African Development Community
SDS	Sustainable Development Scenario
SEC	US Securities and Exchange Commission
T&A	textile and apparel
UFLPA	Uyghur Forced Labor Prevention Act
UK	United Kingdom
US	United States
USCC	US-China Economic and Security Review Commission
WTO	World Trade Organization

Foreword by the **network hosts**

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In an era marked by interconnected global economies and rapid geopolitical shifts, understanding the intricate impacts of these developments on supply chains has become paramount. Interdisciplinary research on global supply chains offers a comprehensive lens through which we can unravel the complexities of global supply chains and understand current developments. The intricate linkages between geopolitics and supply chains become evident when considering the impacts of trade agreements, tariffs, and political instability on the movement of goods. Economists can analyze financial and economic repercussions, political scientists can assess the power dynamics of the actors involved in global supply chains, and environmental experts can evaluate the ecological footprint of these developments. By synthesizing these viewpoints, an interdisciplinary perspective not only paints a more comprehensive picture, but also identifies potential vulnerabilities and opportunities for innovation within supply chains.

One critical aspect that demands attention is the increasing importance of sustainability in supply chains. As the global community grapples with the consequences of climate change and environmental degradation, the need for sustainable practices has never been more pressing. An interdisciplinary perspective, once again, plays a pivotal role by integrating environmental and social responsibility with economic viability to craft solutions that support political decision-makers in shaping the future of global supply chains.

The Research Network Sustainable Global Supply Chains was initiated by the Federal Ministry for Economic Cooperation and Development (BMZ). It currently comprises about 100 internationally leading scientists from all over the world and is jointly coordinated by our four institutes. Its tasks are: to conduct and generate research that contributes to making supply chains more sustainable; and to collect and synthesize the best international research on this topic and make it accessible to policymakers and other societal actors. In addition to its own research, the network organizes academic conferences and discussions with policymakers and organizes a blog. With this second Annual Report, we highlight new research, provide a forum to debate controversial supply chain topics, and identify policy-relevant research gaps for the network's future work. At the same time, the report is an invitation to participate in the discussions on how investment, production, and trade will be reorganized in a global economy that has to respond to geopolitical challenges.

Foreword by the **Federal Ministry for Economic Cooperation and Development**

2023 was an intensive year as regards our global supply chains. The Act on Corporate Due Diligence in Supply Chains entered into force in Germany on January 1, and the World Health Organization declared an end to Covid-19 as a global health emergency. Undoubtedly, these were two positive developments. Nevertheless, the progressing climate crisis, Russia's war of aggression against Ukraine and its impacts – for instance on the Global South – the escalation of violent conflicts, and geopolitical tensions are posing great challenges.

A brief foreword can hardly capture the full extent of these challenges. Fortunately, this is not necessary, as renowned scientists have explored some of these complex issues in depth in their contributions to this annual report. So instead I would like to use this foreword to recall what motivated us to address global supply and value chains. The conviction that all people – regardless of their gender, gender identity, sexual orientation, skin color, disability, or other identity characteristics – should participate as equals in social, political, and economic life is at the heart of our feminist development policy.

A significant share of the 450 million people who work along global supply chains cannot participate in this way. They often work under inhumane conditions with insufficient social protection, frequently accompanied by human rights violations and environmental degradation. The resulting negative impacts especially affect women and marginalized groups. Fair wages for workers are a crucial lever to remedy some of these ills along global supply and value chains. Incomes and wages that enable people to meet their basic needs and save money for emergency situations help to make societies more crisis resilient. They give people better access to healthcare and help to reduce child labor.

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Dr. Bärbel Kofler

Parliamentary State Secretary to the Federal Minister for Economic Cooperation and Development

However, fair wages alone cannot prevent all human rights violations and the environmental degradation caused in the context of economic activity. A comprehensive, sustainable transformation of global supply chains is needed to improve living and working conditions worldwide, promote sustainable development, and counter current and future crises. Given its high complexity as well as the dynamic and number of stakeholders involved, this transformation is not an easy task.

Without science we will not be able to meet this challenge. The work of the scientists who research the dynamics and challenges along global supply chains provides the basis for making globalization fairer for everyone. The qualitative and quantitative data that is collected and the scientific findings derived from this database help us to identify risks, pinpoint malpractices throughout supply chains, and monitor the effectiveness of corrective measures. This provides essential information not only for policymakers, but also for companies that are concerned about the social and environmental sustainability of their activities and want to meet their due diligence obligations.

That is why I extend my deepest gratitude to all the members of the Research Network Sustainable Global Supply Chains and to all those who have contributed to the 2023 Annual Report. Your work is helping to make global supply chains more sustainable and organize globalization so it is fairer.

Sustainable global supply chains in times of geopolitical crises

Sustainable global supply chains in times of geopolitical crises

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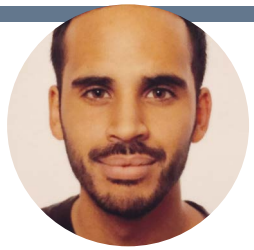

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Over the past few years, multiple crises have shaken the foundation of our global economy and the structure of global supply chains. Just as backlogs, supply chain shortages, and price spikes caused by the Covid-19 pandemic began to slowly subside, Russia's invasion of Ukraine sent another shockwave through the world – both in political and economic terms. While European countries scrambled to find new energy sources with which to replace Russian gas, many countries in Africa and the Middle East faced a sharp increase in food prices due to declining grain exports from Ukraine and Russia as a result of sanctions against Russia and blockades of Ukrainian export routes (Buchholz, 2022; European Council, 2023). Meanwhile, continuing trade tensions between the United States (US) and China, along with the looming threat of another security crisis over the question of Taiwan, have cast a shadow over the global economy. The presence of these multiple crises and their implications for the global economy have kindled renewed discussions on the (re-)configuration of global supply chains and the nature of the global economic system.

These discussions are by no means new. In 2007/08, the global financial crisis exposed the vulnerabilities and trade-offs that come with unpre–cedented levels of global interdepen–dency built up over two decades of "hyper-globalization." The world economy subsequently entered an era of "slowbalization," characterized by a shift toward more regionalization of supply chains and less political support for open trade amid rising geopolitical tensions (Aiyar & Ilyina, 2023).

Fast-forward 15 years and we are now witnessing the lingering effects of a global pandemic, a war on Europe's borders, and ongoing trade frictions between the world's biggest economic powers. Where exactly these new developments will be taking us in terms of global economic integration is still being debated. Some, such as Shivakumar et al. (2022), go as far as proclaiming a "Great Rewiring" of global supply chains; The Economist (2022) speaks about a "once-in-a-generation reimagining of global capitalism." According to the World Economic Forum, there are indeed signs that the current state of "slowbalization" is heading toward further deglobalization (Keller & Marold, 2023); yet, other researchers, such as Antràs (2020), Williamson (2021), and Coe (2021), argue that "such predictions either exaggerate the extent to which such restructuring will happen in practice [...] or are premature" (Gong et al., 2022, p. 167).

Meanwhile, what can already be observed after three years of multiple crises is a general shift by multinational corporations away from their "just-in-time" logic toward a "just-in-case" system, "acknowledging the need for globalized production to be more resilient to shocks" (Brakman et al., 2020; Gong et al., 2022). Scattered evidence of reshoring manufacturing activities from low- to high-cost locations has been observed in some industries and sectors (Dachs et al., 2019; Lund & Steen, 2020). While some argue that reshoring manufacturing operations would enhance resilience and reduce reliance on systemic rivals such as China, the process of decoupling from global value chains (GVCs) comes with its own set of challenges and costs. Felbermayr et al. (2021) delve into the potential repercussions of of the EU decoupling from China on trade and overall welfare, specifically real income. Their analysis explores various scenarios involving a shift in production toward the domestic economy, driven by a doubling of non-tariff barriers. They find that the increase in import barriers significantly curtails imports from third countries, leading to price increases and decreased exports due to the reduced competitiveness of European firms. Consequently, these adverse effects translate into lower real incomes for EU citizens. More generally, Felbermayr et al. (2022) and Grazia Attinasi, Boeckelmann, & Meunier (2023) come to similar conclusions in a scenario of fragmentation of the global economy into a Western and an Eastern bloc.

Nonetheless, following the supply shortages of medical face masks and other medical equipment in the wake of the Covid-19 pandemic, the European Union (EU) has examined the efficacy of reshoring product branches deemed "critical" – including pharmaceuticals, medical products, semiconductors, and solar energy technology components – in order to increase Europe's resilience to exogenous shocks (Raza et al., 2021). With the European Chips Act passed in 2022 and the European Raw Materials Alliance, the EU took first steps toward increasing production capacities within Europe. In a similar vein, the US CHIPS and Science Act as well as the 2022 Inflation Reduction Act (IRA) seek to bring manufacturing back to the US, especially in sectors that are critical for the digital and energy transition.

These industrial policies come with a massive price tag of state invest–

ments and subsidies: The IRA provides nearly USD 400 billion in tax breaks and public spending, while the European Green Deal Investment Plan foresees EUR 1 trillion in public-sector investments. The goal of each plan is to attract (once outsourced) businesses and manufacturers back to the local or regional market and catalyze investments in domestic manufacturing capacity. This readiness to spend vast amounts of state money characterizes the changing Zeitgeist of post-Covid-globalization. Globalization today is not only about efficiency, but also about security, resilience, and strategic autonomy. Business partners are no longer chosen simply based on the price they can offer, but also for their reliability, stability, and normative alignment.

The justification for this heavy extra-government spending is often attributed to the necessity for a "decoupling" from China, that is, diversifying sourcing and manufacturing options and intentionally diverting supply chains to non-Chinese partners. Using the slightly less confrontational term of "derisking," the EU is similarly attempting to mitigate the perceived risks associated with their economic and trade ties with China. The essence of this approach is "a series of policies, positions and strategies that officially do not target China, but seek to resolve many of the concerns vis-à-vis China" (Chimits et al., 2023).

In order to put this new strategy into practice, the US and the EU are also relying on another buzzword that has entered the political discourse: the concept of "friendshoring." It was first used by US Treasury Secretary Janet Yellen in April 2022 and describes the process whereby supply chain networks and foreign direct investments are streamlined through countries regarded as geopolitical and economic allies (Atlantic Council, 2022). Efforts to rebuild supply chains around "trustworthy" partners can already be observed in certain sectors. For instance, the US-led Minerals Security Partnership (MSP), a consortium of 13 countries and the EU,[1] has built a coalition of "like-minded" countries to secure a stable supply of critical raw materials, also in an attempt to counteract Chinese dominance in this sector (Vivoda, 2023). Until a few years ago, companies in the chemical, IT, and automobile sectors eyed China as their biggest and most important investment market; now, they are keen to shift at least some of their production and investment to countries such as Japan (Kölling, 2023). Whether these strategies will actually lead to the intended effect of cutting, or at least reducing, economic ties with China remains contested and to be proven. Preliminary data indicates, however, that while US-China trade has subsided over the past few years and trade with preferred countries such as India, Canada, and Vietnam has increased, this may actually be the result of a trade diversion rather than an avoidance of Chinese products. Indeed, as direct imports from China have fallen, the West is increasingly importing from countries that rely on Chinese exports and whose trade

[1] As of December 2023.

relations with China have actually intensified over the same period of time (Freund et al., 2023; The Economist, 2023a, 2023b).

In this setting, geopolitics is likely to continue to play an increasingly significant role in shaping the dynamics of global supply chains. Factors such as trade tensions between major economies, sanctions, territorial disputes, and the quest for resource security are all influencing decisions about supplier selection, diversification, and risk management. Raza et al. (2021) argue that "a decisive factor determining the future international division of labour, and thus of re–shoring, is related to geopolitical developments" (Raza et al., 2021, p. 73). Indeed, Gong et al. (2022) classify geopolitics as one of four major forces contributing to the reconfiguration of global production networks and supply chains, besides the emergence of disruptive technologies, the impacts of climate change and other environmental challenges, as well as other threats posed by global crises and other exogenous shocks, such as the Covid-19 pandemic (Gong et al., 2022, p. 166).

In the following, we showcase the developments and dynamics shaping GVCs and the role of geopolitics using four examples from the following sectors: energy; food and agriculture; raw materials; and high-tech and electronics (H&E). These sectors were chosen due to their criticality for society and the industrial economy as well as their susceptibility to current geopolitical developments. Although the food and energy sectors are generally classified as critical by most countries, the raw materials and H&E sectors have gained political priority due to their criticality for the energy and mobility transition as well as digitalization and strategic areas such as the defense sector.

The energy sector

Russia's invasion of Ukraine sparked global energy turmoil. Just as the global economy was recovering from the pandemic, the war took its toll on the already strained global supply chains. In June 2022, Russia had partially interrupted its gas supply to the EU before cutting it off completely in September 2022. The resulting gas supply shortages drove up global prices in an unprecedented way. By mid-July 2022, pipeline gas prices had increased by more than 800% compared to prices before tensions had escalated (Martin & di Mauro, 2022). Although it is true that the EU in general and Germany in particular were most affected by gas shortages, the impacts of energy supply disruptions were felt around the world. Russia is one of the major global suppliers of oil and gas, accounting for 12% of global crude oil production, 16% of global oil products, and nearly one-third of global gas trade in 2021 (International Energy Agency, 2022).

Russia's upstream position along several GVCs and its high forward GVC participation have had major implications for global production hubs as well as smaller economies that depend on imports from Russia in downstream industries (Winkler & Wuester, 2022). Increased energy prices affected a number of sectors, from transportation to the production of fertilizers (see the section on agricultural value chains below), chemicals, and steel. In response to the disruption of gas supply chains, Europe managed to increase its pipeline gas

imports from existing trade partners, such as Algeria and Norway. Moreover, it imported an extra 50 billion cubic meters of liquefied natural gas (LNG) from the US, Qatar, West Africa, and Egypt (International Energy Agency, 2022). The Italian energy company ENI is also currently heavily investing in the oil and gas sector in Algeria, with the objective of becoming Europe's gateway to gas supply in the future (Sarno & Colantoni, 2023). Although Europe managed to successfully replace a large share of Russian gas with imports of LNG, the effects of gas supply disruptions were transferred to Asian countries, such as India and Southeast Asia, which had to switch to coal and heavy fuel. In the medium term, Europe is planning to secure gas supplies from North America and Qatar, whose exports to Europe are expected to increase by the mid-2020s, when the necessary adjustments and extra liquefaction capacity are attained (Eyl-Mazzega, 2023).

The energy crisis and the vulnerabilities it has exposed have not only under–scored the urge to diversify oil and gas supply away from Russia but, above all, have highlighted the need to accelerate the transition to low-carbon technologies. Today, the global share of fossil fuels accounts for 80% of the energy mix (International Energy Agency, 2022); a successful energy transition would reduce this share in favor of renewables and clean energy. Increasing the share of local/regional renewable energy sources would not only advance global climate action, but would further reduce dependence on potentially unreliable external suppliers.

Against this background, the European Green Deal already set an ambitious target of reducing greenhouse gas emissions by 55% by 2030, relative to 1990 levels, by reducing fossil fuel consumption and switching to low-carbon technologies, such as green hydrogen. Additional measures, such as carbon pricing, energy taxes, and energy-efficiency improvements, are also foreseen. The EU Green Hydro–gen Strategy aims to set up at least 40 gigawatts of renewable energy electrolyzers by 2030 and produce 10 million metric tons of renewable hydrogen between 2025 and 2030 (European Commission, 2023). Other major economies, such as the US, China, and Japan, have also embarked on new projects and strategies for the rapid deployment of clean energy. The IRA includes funds for investments in solar and wind capacity. In China, investments in renewables are also growing massively, and in Japan, the Green Transformation program provides a major boost for, inter alia, low-emission hydrogen and ammonia. Overall, global investment in renewable energy projects reached USD 330.9 billion in 2022 (United Nations Environment Programme, 2023). At the same time, investments in key future technologies, including batteries, solar photovoltaic, and electrolyzers, are growing rapidly (International Energy Agency, 2022).

These policies and programs geared toward pushing the energy transition forward will lead to major changes in the patterns and structures of global energy supply chains and foster new (potentially transformative) linkages with upstream and downstream industries. Above all, these develop–ments will also re-configure the map of global players and may unearth new risks and vulnerabilities associated with future energy partnerships.

As far as green partnerships are concerned, Africa and the Middle East are at the top of Europe's list for strategic partners. North African countries, for example, are rich in resource endowments necessary for the energy transition, and they enjoy geographical proximity to Europe, in addition to existing gas infrastructure that could later be converted to transport hydrogen. Gulf countries are also a potentially strategic partner to Europe. These countries are both rich in the resource endowments necessary for the production of low-carbon energy carriers, and they can also provide "cleaner" energy by shifting to blue (i.e., gas-based) hydrogen as a medium-term, relatively low-carbon solution.

However, political, regional, and technical challenges may undermine the development of such partnerships, thus increasing the fragility of future energy supply chains. In the Middle East and North Africa region, for example, longstanding political conflicts (such as those between Morocco and Algeria over the Western Sahara, armed conflicts in Libya, and the Israeli-Palestinian conflict) could destabilize future energy supply. Against the backdrop of the ongoing geopolitical conflict with Russia, current and future energy partnerships in the region may also be undermined by the strong political and economic relations that several countries in the region have with Russia, particularly in the food and energy sectors (Aboushady & Faus Onbargi, 2023). As far as hydrogen "colors[2]" are concerned, there has been a recent discourse shift in favor of blue (i.e., gas-based) hydrogen. On the one hand, countries rich in fossil fuels (such as the Gulf countries) are accelerating investments in blue hydrogen to compensate for a future decline in the global demand for hydrocarbons (Shehabi, 2023). On the other hand, recent studies suggest that blue hydrogen may be a more cost-effective alternative to green hydrogen in European countries such as Germany (George et al., 2022) and may be a more suitable solution to meet global energy needs, even beyond 2050 (AlHumaidan et al., 2023). Although blue hydrogen is a relatively low-carbon energy carrier, the natural gas supply chain may still be accompanied by relatively high emissions (Bauer et al., 2022). An increasing preference for blue hydrogen is therefore likely to undermine the shift to green hydrogen and slow progress toward global climate targets. Moreover, an increasing preference for gas-based hydrogen is likely to reinforce the preexisting dependencies on resource-rich countries and potentially amplify the effect of supply shocks on global supply chains.

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[2] The colors of hydrogen define the emissions/pollution that accompany its production. In this regard, grey hydrogen is hydrogen produced from steam methane reforming without carbon capture and therefore involves emissions. Blue hydrogen is produced from steam methane reforming but involves carbon capture and storage, thus providing a relatively cleaner option to grey hydrogen. Finally, green hydrogen is produced from water electrolysis powered by renewable energy sources and is therefore considered the cleanest type of hydrogen. For more details, see Incer-Valverde et al. (2023).

At the same time, a potentially accelerated decarbonization is likely to also have adverse – and sometimes contradictory – consequences for global supply chains. On the one hand, decarbonization will increase the global demand for the upstream industries necessary for the energy transition and may put a strain on the supply of critical raw materials. On the other hand, the return of industrial policies means that there will be heavy subsidies for the green energy sector and related upstream industries as well as the increased protection of downstream sectors. For example, the implementation of the EU's Carbon Border Adjustment Mechanism (CBAM) may penalize the EU's partners by imposing a new (non-trade-related) barrier on their exports of energy- (and carbon-) intensive industries, at the same time that the EU is increasing imports of energy and critical raw materials from these very same partners. A recent study by the African Climate Foundation and LSE (2023) estimates that the implementation of the CBAM could decrease aluminum exports from Africa to the EU by up to 13.9%, iron and steel by 8.2%, fertilizer by 3.9%, and cement by 3.1%.

Disruptions of agricultural value chains: The case of the war in Ukraine

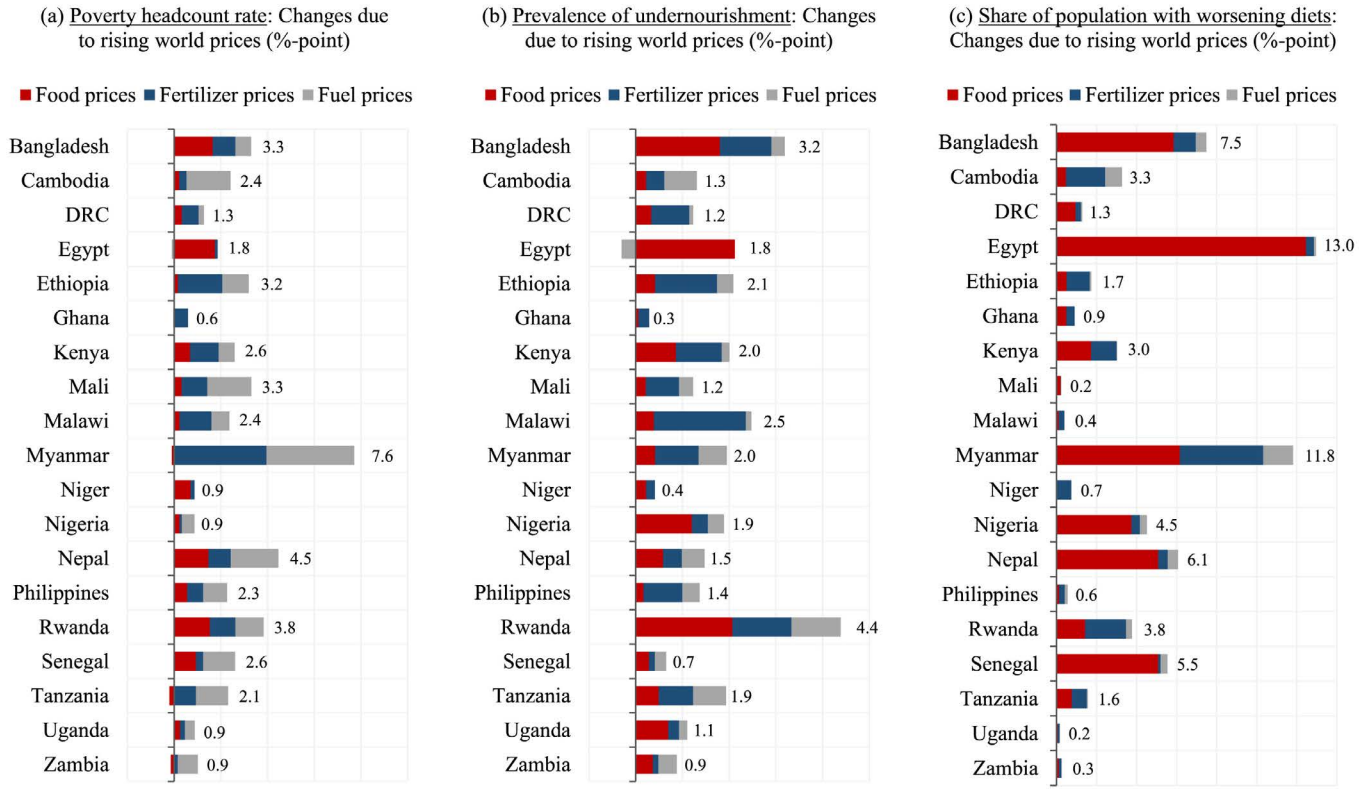
Russia and Ukraine both play a key role in world food markets, so any disruption in the region has global implications (Glauber et al., 2023). In recent decades, the Black Sea region has become a major supplier of grains, oilseeds, and vegetable oil. Prior to the conflict, Russia and Ukraine accounted for 12% of total calories traded in the world and 30% of global wheat and barley exports. They were among the top five global exporters of wheat, barley, sunflower seeds, and maize. In addition, Ukraine supplied about half of the global market for sunflower oil. Many low- and middle-income countries, especially in the Middle East and North Africa, rely heavily on imports of wheat, barley, and maize from Russia and Ukraine. These commodities play a vital role in diets, both directly (wheat, vegetable oils) and indirectly through the livestock industry (maize, barley, but also wheat and sunflower meals).

Beyond food products, key inputs to the food system are also affected. As was shown in the previous section, Russia is a major source of natural gas, exporting about 20% of globally traded natural gas (Glauber et al., 2023). Along with its ally Belarus, Russia is an important exporter of potash, phosphate, and nitrogenous fertilizers, for which natural gas is a critical input. The disruption of Ukraine's exports, as a direct result of the war, and of Russia's exports, as an indirect result of international sanctions and subsequent increases in global food prices, thus pose a threat to food security and nutrition for many countries. Many countries in Europe, sub-Saharan Africa, and Latin America have been heavily dependent on these fertilizer supplies. Rising energy prices resulted in higher production costs for fertilizers, which has negatively affected agricultural production and resulted in compromised food affordability, food safety, and nutritional security in several developing countries. In this regard, poorer and vulnerable populations were hit harder by the global food supply shocks (Dyson et

al., 2023). According to recent World Bank estimations, it is projected that 61 million people will be food insecure in East and South Africa by March 2024 (World Bank, 2023).

Several studies have provided ex-ante assessments of the likely impacts of these market disruptions on international agri-food trade and production as well as local welfare indicators. Arndt et al. (2023) use national economy-wide models developed at the International Food Policy Research Institute (IFPRI). These models capture all producers (sectors) and consumers (households) in an economy and track how they interact with each other in markets for commodities and production factors. They measure the near-term impacts of the war-induced price increases in food, fuels, and fertilizer on agri-food systems, poverty, and food insecurity for 19 developing countries. Their simulations suggest that agri-food production would fall in all countries under consideration (except for Uganda), and most strongly in Myanmar and Rwanda (by more than 4%); 27.2 million and 22.3 million more people would be pushed into poverty and hunger, respectively, due to rising world prices. Household welfare indicators would deteriorate in all sample countries, but with considerable cross-country differences in magnitude (see Figure 1).

Figure 1: Estimated impacts of rising food, fuel, and fertilizer prices on poverty and food security



Source: Arndt et al., 2023

Balma et al. (2023) investigate the possible long-term consequences of the conflict on food imports and prices in African countries. To do so, they employ the Kiel Institute Trade Policy Evaluation (KITE) model. KITE is a computable general equilibrium model of international trade that pays particular attention to intra- and international input–output linkages based on the global input–output database GTAP, that is, it accounts for the fact that countries are closely linked through GVCs. Balma et al. (2023) consider several scenarios, including a most plausible one where Ukraine's supply of wheat and other grains is heavily impaired, and trade costs with Ukraine and Russia are rising due to disrupted trade routes in the Black Sea and sanctions. The effects of such a shock are fairly heterogeneous across countries due to differences in import dependence and consumption structures. The reduction of wheat imports under this scenario would be greatest for Egypt (-13.3%), Tunisia (-12.3%), and Ethiopia (-10.8%). For other cereals, Tunisia (-15.2%), Egypt (-13.4%), and Cameroon (-11.9%) would be the most severely affected. The most notable long-run price increase for wheat would occur in Kenya (5.8%), Uganda (5.2%), and Tunisia (4.3%).

In summary, the war in Ukraine has adversely affected food value chains and local welfare but impacts vary widely across countries and depend crucially on country-specific production and trade structures. Moreover, the war had adverse effects on food security in developing countries.

The raw materials sector: From neglected to critical

Following Russia's invasion of Ukraine in February 2022, much of the attention in European countries turned to the challenge of securing alternative energy sources to replace Russian gas. However, besides being a major energy supplier, Russia is also an important exporter of various metals and minerals, including nickel, copper, aluminum, and platinum group metals. Prior disruptions in the construction, automobile, and power sectors caused by sanctions on Russian aluminum imposed during the Trump presidency prompted US and EU decision-makers to refrain from including the raw materials sector in their economic sanctions against Russia. As a result, Russian nickel and aluminum exports to the EU and US have increased by as much as 70% since the onset of the war (Reuters, 2022; Trading Economics, 2023).

Europe's and the US' reliance on Russian gas and minerals has underscored the risks and consequences associated with a high single-supplier concentration. Apart from Russia, this is particularly true for mineral supplies from China. Over the past two decades, the People's Republic has developed a quasi-monopoly in global raw material supply chains. In 2017, China held the largest share of global mineral extraction and accounted for more than 50% of the world's mineral processing capacity (Schüler-Zhou et al., 2020, p. 13). China currently produces around 86% of the world's supply of rare earth elements (Van Wieringen & Álvarez, 2022); the EU's demand for rare earth magnets is almost completely met by Chinese imports. For this reason, the EU, the US,

and several other countries around the world (among them Australia, Japan, and Canada) have pursued efforts to decrease their economic dependence on China.

This strategic recalibration is occurring amid a global "race" for critical raw materials needed for the energy and mobility transition, digitalization, and other strategic areas, such as the defense sector. Many countries and supranational organizations – including the EU, the African Union, and the Association of Southeast Asian Nations – are therefore working on strategies that not only seek to diversify global trade partners on raw materials, but also to increase the availability of and access to critical minerals[3] overall (Carry et al., 2023). Most of these strategies follow a three-step approach: (1) increasing domestic/regional mining and processing capacities, (2) establishing and reinforcing international raw materials partnerships and forums, and (3) boosting raw material circularity through improved resource efficiency and recycling. Additionally, these strategies are often complemented with industrial policy initiatives aimed at mid- to downstream industries, such as battery and cell manufacturing. For example, parallel to the EU Critical Raw Materials Act (CRMA), the EU proposed a Net-Zero Industry Act (NZIA) to boost the EU's net-zero industrial manufacturing capacity. Similarly, the US' IRA contains provisions for both the mining and manufacturing sectors. Amidst this trend of "re-industrialization," we anticipate (and to some extent already observe) the relocation of mineral and manufacturing supply chains to regions that, until now, have been keen to offshore many of these industrial branches to other parts of the world – mostly due to higher cost-efficiency and less-stringent social and environmental regulations. One year since the IRA came into effect, more than USD 110 billion has been invested into clean energy manufacturing projects; at the same time, US battery cell manufacturing capacity has increased by 67% (Benchmark, 2023). Meanwhile, reshoring mineral supply chains is a more capital-intensive and time-consuming endeavor that is contingent on the geological availability of mineral reserves, the economic viability of industrial production, community acceptance (the so-called social license to operate), and lead times of 10 to 15 years between exploration and production. Due to these extended timelines, the impacts of industrial policy programs on the mining sector will only become evident in a few years.

In the meantime, importing countries are actively seeking to rekindle old raw materials partnerships or form new ones with resource-rich countries (Ansari et al., 2023). In June 2022, the US launched the international Mineral Security Partnership, a coalition of "like-minded" countries (and the EU) to identify "projects along the full clean energy value

[3] There is no universal definition of which raw materials are categorized as critical. The EU's list of critical raw materials is different from the lists published by the US, Canada, and Australia, although there are significant overlaps. Generally, the criticality of raw materials is contingent on their economic importance and supply risk.

chain, from mining, extraction, and secondary recovery, to processing and refining, and ultimately to recycling" (U.S. Department of State, s.a.). The MSP's stated principle is to "elevate environmental, social, and governance (ESG) standards across the global minerals sector" (U.S. Department of State, s.a.). However, the rise of such initiatives prompts several questions and concerns. Firstly, forming a supply bloc under the premise of "friendshoring" risks leaving "non-aligned" (developing) countries on the sidelines and potentially intensifying a bloc formation between developed and developing countries as well as the "political West" and those aligned with China, Russia, and other autocracies (Benson & Kapstein, 2023; Müller, 2023; Zissimos, 2022). Secondly, artificially limiting trade partners based on normative alignment and production standards could inad–vertently lead to renewed supply squeezes and vulnerabilities, rather than strengthen supply resilience (Maihold, 2022; Sandkamp, 2022). Thirdly, initiatives such as the MSP are faced with the challenge of scaling up mining and processing capacities under significantly shorter lead times while simultaneously upholding high environmental, social, and governance (ESG) standards. Although their members prominently declare that they adhere to high, internationally recognized ESG standards, several mining projects have already come under scrutiny for a lack of recognition of Indigenous Peoples' rights and environmental standards (see Glick & Rubio, 2023).

The high-tech and electronics sector

The H&E sector is a fundamental pillar of the global economy, underpinning technological advances and facilitating innovation across industries. Its contributions extend beyond specific products, shaping the infrastructure and capabilities of sectors ranging from healthcare and finance to national defense and the military. Because H&E products and components are so critical to a country's future economic, technological, and military trajectory, the sector is increasingly at the crossroads of geopolitical power plays.

The H&E sector is made up of a wide range of components and products that rely on a variety of raw materials, such as plastics, ceramics, and glass and, most importantly, metals such as copper, lithium, tin, silver, gold, nickel, and aluminum. As noted above, China is the leader in the extraction of many minerals and, more importantly, accounts for most of the world's mineral processing, particularly of rare earth elements. This concentration of mineral processing in China has been a key element that has also allowed the country to take a leading position in the production of many (though not all) upstream H&E components, such as electronic integrated circuits, electric motors and generators, and batteries. However, China's dominance in the H&E sector is not limited to electronic components, as it has also become the leading exporter of consumer electronics such as smartphones and, in recent years, the largest exporter of electric vehicles (EVs), making it the world's third-largest exporter of passenger cars, just behind Japan and Germany (The Economist, 2023c).

Concerns about national security, competitiveness, and intellectual property have led to efforts by countries to seek greater control over their own H&E value chains in order to reduce dependence on foreign – particularly Chinese – suppliers. Because the H&E sector is so diverse, the geopolitical forces affecting specific value chains – and thus the actions taken by governments – vary by components and product. In general, however, there are two main ways in which countries have sought to increase their autonomy and reduce their dependence on foreign countries: first, by increasing investment in domestic production capacity; second, by implementing restrictive trade measures. Such policy measures have been implemented particularly in the industries for semiconductors and batteries – two critical sectors for the digital and energy transition.

The semiconductor industry has seen an unprecedented boom in demand in recent years with the rise of artificial intelligence. The global semiconductor value chain is highly specialized, concentrated, and capital-intensive (Poitiers & Weil, 2021). It is mostly "fabless" technology companies – those that focus on chip design and innovation but do not have their own manufacturing facilities – such as US-based NVIDIA driving the design and R&D of cutting-edge, high-end chips, and semiconductor foundries such as Taiwanese TSMC manufacturing the chips. Because these high-end chips are a cornerstone of today's electronic devices, underpinning a wide range of industries, from consumer electronics to automotive, policymakers have taken decisive action through a range of comprehensive industrial policy measures designed to enhance strategic autonomy. The most notable example is the aforementioned CHIPS and Science Act, introduced by the US in 2022. The act aims to incentivize local chip manufacturing through USD 39 billion in subsidies and 25% investment tax credits. At the same time, in October 2022, the US imposed an export ban on advanced chips and chipmaking gear to China, with the explicit aim of limiting China's technological advancements due to foreign policy and national security concerns.

The batteries industry is another H&E sector that has emerged as a focal point of national industrial policies, attracting substantial attention and strategic investments from governments across the globe. The escalating demand for batteries is poised to continue its upward trajectory, which is primarily being driven by the surging interest in EVs. Particularly noteworthy is the fact that in 2022, approximately 60% of global lithium consumption, 30% of cobalt consumption, and 10% of nickel consumption were attributed to the growing EV battery market (International Energy Agency, 2023). Geographically, the landscape presents intriguing dynamics: China is anticipated to account for a substantial share of the lithium-ion demand, with projections indicating a 45% contribution to the total lithium-ion demand in 2025 (Fleischmann et al., 2023). However, the most pronounced growth is anticipated in the EU and the US. The aforementioned regulatory initiatives, coupled with a broader trend emphasizing localized supply chains, are driving this geographical shift. As a consequence, cell suppliers are strategically announcing capacity expansions in these regions and positioning themselves in closer proximity to automotive manufacturers.

The H&E sector has demonstrated notable resilience, even amidst the challenging backdrop of the Covid-19 pandemic. Importantly, some countries, such as Vietnam and Mexico, may even have benefited from the recent geopolitical tensions between the US and China (Alfaro & Chor, 2023), as their exports of electrical and electronic equipment to the US have increased as a result. This, in turn, has had a significant impact on employment patterns, especially within Vietnam, where this sector dominates job creation. Notably, a substantial portion of these employment opportunities are occupied by women, who are often engaged in middle-skilled roles involving machine and equipment tasks (ILO, 2022). On the other hand, however, questions have been raised about the social sustainability of the electronics industry, particularly with regard to issues of decent working conditions, equitable wages, and the protection of workers' rights. As the industry's influence continues to grow, striking a balance between economic progress and ensuring the well-being of workers remains a critical consideration for achieving a sustainable future.

Conclusion and outlook

The developments of the past few years have had a profound impact on the global economy and the international order. Geopolitical tensions and interests play an increasingly significant role in shaping the dynamics of global trade and have led to a reevaluation of supply chain strategies. The control over key industries, such as energy, raw materials, and semiconductor manufacturing, has not only become an economic concern, but it is increasingly seen as a matter of national security (Shivakumar & Wessner, 2022). Calls for strengthening "strategic autonomy" in critical sectors and supply chains have gained traction. As illustrated by the analysis of four different sectors, this is mostly pursued through the relocation of certain supply chains to domestic markets and the diversification of the supplier portfolio.

At the same time, research shows that reshoring GVCs from low- to high-cost markets or "like-minded" countries is likely to increase consumer prices and produce inefficiencies. Consequently, many of these political programs come with large state subsidies and financial incentives for businesses and investors. This renaissance of industrial policy hints at a new outlook on global supply chains that embraces a willingness to secure control over certain industries, even at the cost of reduced efficiency and higher consumer prices. This new approach diverts from the 1990s logic of global trade and instead has geopolitical implications built into the equation.

Private companies now also need to consider geopolitical risks as part of their risk management strategies. This includes assessing the impact of potential conflicts, trade disruptions, and regulatory changes on their operations and supply chains. The interdependency among different sectors and GVCs must be more strongly taken into account in the future. Take, for example, the sectors analyzed here: Access to and stable supply of energy is the bedrock of industrial activity; the supply of gas as a critical input for nitrogenous fertilizers has major implications for the food and agriculture sector. The transition to clean energy technologies – in an attempt to advance global

climate action but also to strengthen local energy autonomy – requires the availability of critical raw materials; at the same time, the beneficiation and processing of raw materials is highly energy-intensive. The manufacturing of semiconductors and all other products of the H&E sector would also not be possible without the necessary raw materials.

Although this interdependency itself is nothing new, it is the increasing intersection between geopolitics and the global economy that is forcing both companies and states to look at their global supply chains in a more holistic way. In the automobile industry, for instance, vertical integration along the global supply chain is increasingly seen as a strategy to circumvent supply shortages and choke points that would affect manufacturing (see Special on Raw Material Value Chains).

Future research on GVCs should take all the developments of the past years as a vantage point to further investigate – and better understand –the interplay between geopolitics and the global economy. Is reshoring of certain supply chains really going to increase the resilience of, and strategic autonomy over, critical industries? Does an alliance of "like-minded" countries serve to create a new playbook for global trade and economic activity, or does it inadvertently feed into the unfolding bloc confrontation and create new vulnerabilities and trade frictions? And what does all this mean for sustainability and equality? Do we end up in a scenario in which security of supply trumps sustainability, and in which resource-rich countries of the Global South continue to be merely the suppliers of raw materials needed for industrial production? Or can we leverage the current reconfiguration of GVCs to make social and environmental sustainability an integral part of global trade? And who defines what is social and environmental sustainability anyway? The EU is about to adopt the most comprehensive law on supply chain due diligence to date; several European countries, Canada, the US, the UK, and Australia have also passed national supply chain laws. Although these were deemed a success for those advocating for increased supply chain governance, critics accuse the Global North of exclusivity, disregarding the needs and interests of producer countries in the Global South, and reinforcing existing power asymmetries (Dehbi & Martin-Ortega, 2023; Lichuma, 2021). Thus, as we continue to develop and adapt supply chain governance, we should also ask the question of how we can make these processes more inclusive and mindful of the different needs and interests among producer and consumer countries.

This Annual Report seeks to shed light on some of these questions. The first section, "Debates & Perspectives," features international GVC researchers exchanging their views and arguments on the questions of **friend- and reshoring, local value addition,** and the **merits and dangers of industrial policies**. The following three "Specials" dive deeper into the dynamics of **textile** and **raw material value chains,** as well as the **role of international sanctions in GVCs.**

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Debates & Perspectives

The Debates address policy-relevant controversies in global supply chain research. We invite leading researchers with different views on the respective topic to share their ideas and challenge each other. The debates help to identify policy options for making global supply chains more sustainable.

Reshoring strategic sectors to the EU: A path to economic self-sufficiency or recipe for inefficiency and hindrance to GVC upgrading in the Global South?

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Carlo Altomonte: Exports have been at the heart of the European growth model over the last 20 years, representing an essential source of income for most Member States.

Access to markets was guaranteed through the globalization process and by the rules of the World Trade Organization, which were strenuously defended by the European Union (EU), thus preventing to a large extent the adoption of protectionist policies. The key inputs for production were guaranteed, outside the EU, by a European energy policy centered on access to low-cost energy from external suppliers: Up until 2020, the EU imported 57.5% of the energy it consumed, around 25% of which was coming from Russia. Finally, the security of markets was guaranteed, once again at low cost, due to the relative higher share of military expenditures of the United States (US) via the Alliance of the North Atlantic Treaty Organization (NATO).

Against this background, since the early 2000s Germany began to record significant and growing current account surpluses, contributing to the gradual growth of net exports in the Eurozone, which in turn was a major driver of the economic growth of the Old Continent as a whole. As an example, research shows that the foreign value-added share of German exports rose from 17% in 1995 to 28% in 2011 (Altomonte & Colantone, 2017), just before the European debt crisis. Thus, Germany coherently used an increasingly high share of foreign inputs (especially European ones) to fuel its exports to the rest of the world. For example, looking at the final destination of Italian exports outside of the EU, in 1995 some 14% of them went through Germany and France before being sent abroad. Over time, this share remained about the same for France, but by 2011 about 25% of Italian exports to Germany were re-exported to third countries.

For the last two decades, such a production system, which makes European exports largely dependent on the availability of raw materials and intermediate goods imported from elsewhere, has been considered successful, allowing EU producers to increase efficiency and reduce production costs. However, recent adverse events have shed light on the fragility of a production system that relies on the provision of a large fraction of foreign inputs. In particular, the widespread lockdowns during the pandemic and the resulting shutdown of numerous factories set off a chain of events that led to extended delivery times, shortages of essential materials, skyrocketing shipping costs, and disruptions in the production of final goods – all of which had negative impacts on the European supply and export system. The war in Ukraine and the resulting cuts in the provision of gas, raw materials, and food commodities have exacerbated this development.

In this context, EU institutions have increasingly adopted policy approaches that seek to strengthen the idea of European "strategic autonomy": namely the capacity of the EU to act autonomously – that is, without being dependent on other countries – in strategically important policy areas. The concept originated among EU policymakers in 2013 in the areas of defense and security, but due to the adverse developments mentioned above, the focus has recently shifted to mitigating economic dependence on foreign supply chains, thus encompassing all major EU economic policy areas.

In particular, on February 1, 2023, the European Commission presented "A Green Deal Industrial Plan for the Net-Zero Age," which is designed to respond to the US Inflation Reduction Act (and related subsidies) by supporting the scaling-

up of EU net-zero manufacturing capacities. Within the plan, the idea of reducing the EU's dependence on key imported raw materials and intermediate goods from outside the Union plays a central role. In particular, the plan articulates a Net-Zero Industry Act (NZIA), which identifies key technologies and products (among which are batteries, heat pumps, solar technologies, electrolyzers, windmills), to boost internal production and for which it will be required to manage dependency risk. In parallel, the EU has launched a Critical Raw Materials Act (CRMA), which aims to make the EU more self-reliant in the mining, processing, and recycling of 34 critical metals and minerals. This is to be achieved by accelerating and financing national programs for exploring geological resources within the EU as well as limiting the sourcing of critical minerals from third countries by 2030.

Although the policy direction seems clear, the key question behind this new, "strategic" approach to globalization by European policymakers is obviously related to its feasibility. Questions arise as to whether this more inward-looking restructuring of European production processes is feasible – let alone efficient – and what the consequences of such a potential restructuring will be for other countries. In other words, one has to ask to what extent the EU will be able to substitute international inputs with domestic – or better, "strategically autonomous" – ones while maintaining a competitive production and exporting capacity of final goods and services.

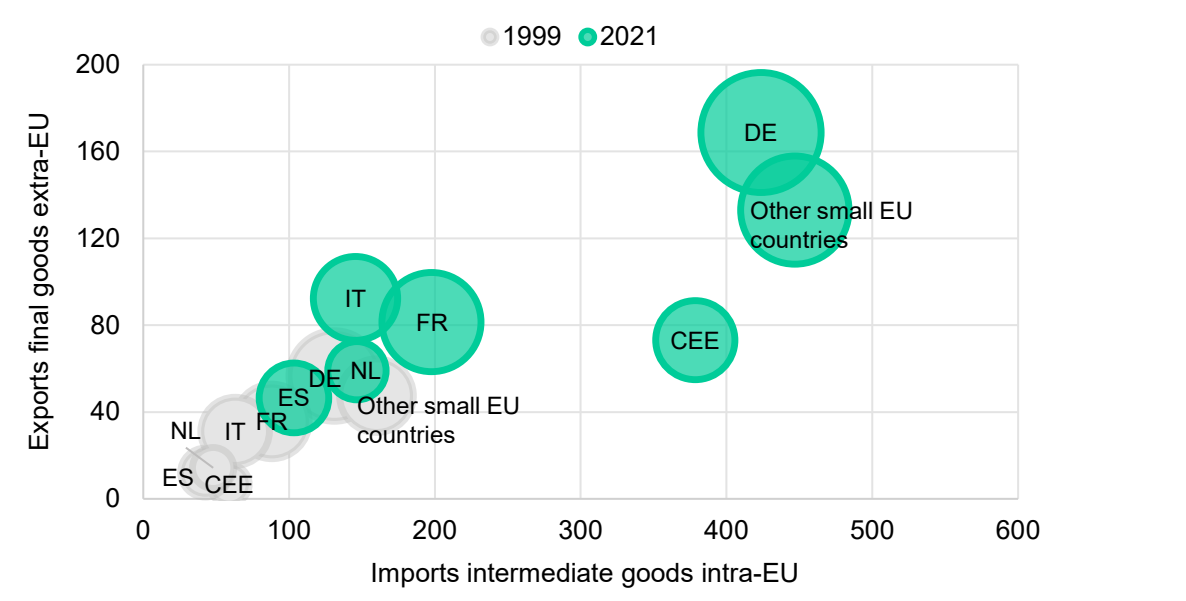
As a matter of fact, Eurostat and OECD TiVA 2021 data shows a strong positive correlation between intra-EU imports of intermediate goods and extra-EU exports of final goods (Figure 1, Panel a). Moreover, this correlation has intensified over time, with each Member State strengthening its backward linkages at the regional level and forward linkages at the global one. In other words, throughout the last 20 years, Europe has been integrating its internal value chains upward, relying more and more on internally sourced (i.e., within the single market) intermediates in order to increase its exports to third countries. As can be seen in Panel a of Figure 1, the magnitude of backward regional integration (on the horizontal axis) and forward global integration (on the vertical axis) has increased for all countries from 1999 to 2021, leaving Germany as the most integrated area, whereas the Netherlands and Spain are significantly less connected, for example. On the other hand, Central and Eastern European countries experienced an impressive rise in the volume of imports of intermediate goods over the period in question. This is consistent with the idea that these countries have been progressively integrated into the upper part of European value chains since the start of the enlargement process. Numerically speaking, intra-EU imports rose from approximately EUR 50 billion in 1999 to almost EUR 400 billion in 2021, making Central and Eastern Europe one of the first destinations for European intermediate products.

It is then possible to analyze this pattern with reference to the most recent data from the pandemic period (Figure 1, Panel b), that is, a comparison between pre- and post-pandemic levels (2019 vs. 2021). The latter provides useful insights into whether the idea of a further strengthening of regional backward linkages is a feasible policy response during a time of economic shocks. Interestingly, Panel b shows an even stronger regional backward integration, that is, more intra-EU trade of intermediates, with similar levels of extra-EU exports (confirming the post-pandemic rebound of trade volumes).

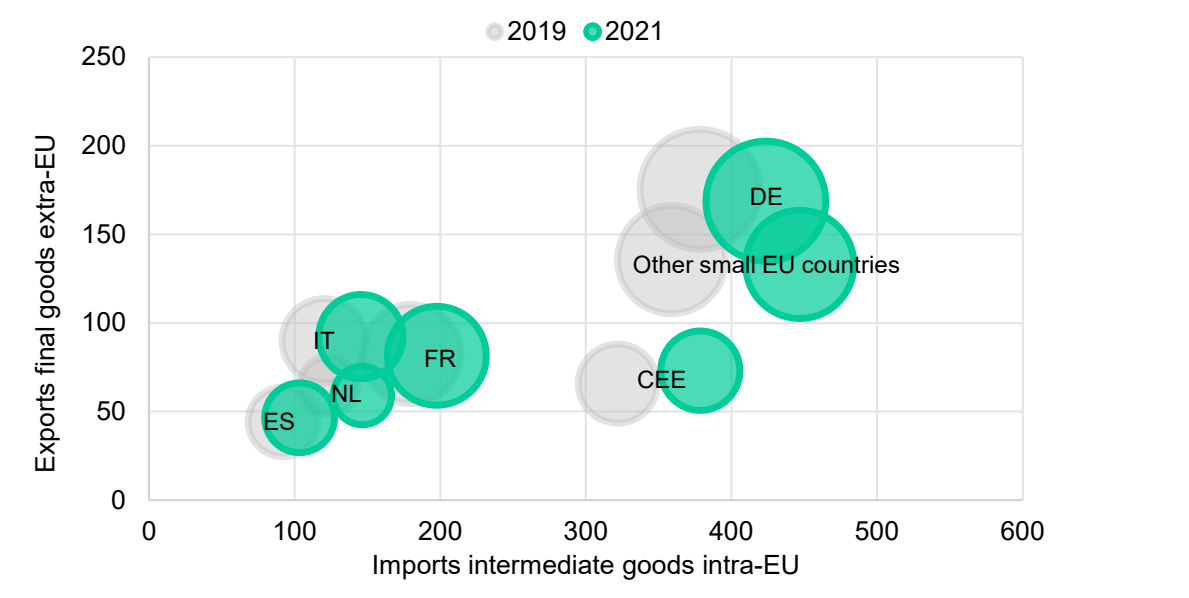
Overall, the descriptive analyses presented so far suggest that strengthened regional integration has played an essential role in ensuring the functionality of the European value chains: The productivity of European hubs and their

Figure 1: EU imports of intermediate goods from EU countries and EU exports of final goods to extra-EU countries (EUR billions)

Panel a) Historical evolution of trade flows (EUR billions)



Panel b) Evolution of trade flows pre- and post-pandemic shock (EUR billions)



Source: Altomonte and Di Sano (2023) on Eurostat and OECD TiVA 2021 data.
Note: The size of the bubbles is determined according to value added in gross exports for the same year. The category of intermediate and final products is constructed using BEC classification Rev. 4 (United Nations, 2002).

exporting capacity are strongly correlated with the smooth provision of intermediate goods from other Member States located upstream along the supply chain. Moreover, the reactions of European firms to the pandemic disruption have translated into a further increase in upward integration, all while preserving their extra-EU export ability. The latter confirms the idea that increasing the regional "autonomy" of the European value chain – in line with the policy direction promoted by the recent NZIA and CRMA initiatives – is a strategy that European firms have already successfully adopted over the past years. It remains to be seen, of course, whether the target level of internal integration envisaged by the policymakers (in terms of intensity and coverage of intermediate inputs) can be achieved by market forces, or whether targeted policy action is needed to promote a particular outcome.

Karina Fernandez-Stark and Penny Bamber: Europe's current approach to international trade policy, often framed as "strategic autonomy," should be interpreted as "strategic diversification."

In practice, the approach involves expanding the EU's supply base to reduce reliance on specific trade partners, rather than opting for isolation. Given today's context of converging global crises and the bloc's resolute commitment to spearheading the Green Transition, this is simply a smart value chain strategy.

Over the past three decades, the EU has adopted a dual-pronged approach for participating in international trade, simultaneously deepening engagement in both regional and global value chains. Both intra- and extra-regional exports have steadily increased. On the one hand, EU firms have harnessed the extensive complementarities across the region's diverse membership to add value to exports. This approach has positioned the EU as the world's most integrated trade region, with this integration continuously progressing. On the other hand, EU firms also rely heavily on global trade opportunities to remain competitive. Imports of intermediate goods are primarily sourced from extra-regional suppliers; non-EU suppliers, led by China, account for two-thirds of these intermediary inputs. What is more, these foreign imports have almost doubled in the past five years alone (Eurostat, 2023).

This strategy has yielded significant success. European firms lead global industries, from aerospace to capital equipment manufacturing and pharmaceuticals, with key players such as Airbus, Siemens, and Sanofi dominating their respective sectors. Moreover, their decisions on foreign investment and sourcing have influenced which locations around the world participate in value chains. Leveraging the vast size of the EU's single market, these firms have wielded substantial power and influence in setting global standards in nearly every industry. Until recently, these firms operated highly efficient, just-in-time, global production systems that were considered infallible.

The series of events over the past few years have destabilized global trade patterns, as outlined by Altomonte. However, they have not led to regional retreat. Instead, disruptions have prompted deeper engagement with the EU's international trade partners, particularly regarding sustainability and resilience.

First, growing awareness of the climate crisis has heightened the sense of urgency within the EU to take decisive action. After years of advocating for sustainability through voluntary measures and diplomacy, the EU took a proactive step in 2019 to become the first market to implement legally binding economic policies aimed at achieving its net-zero commitment by 2050. Specifically, through the Sustainable Product Initiative, any product sold on the EU market – the largest and most valuable in the world – must comply with its sustainability criteria and be designed for increased durability, repairability, and recyclability. The scope of the changes necessary to attain the goals of the European Green Deal is profound, involving the introduction of new industries and the complete reconfiguration of others to ensure decarbonization. Notably, the EU's climate policy explicitly aims to drive change and influence global counterparts to undertake similar measures. Climate action has thus been integrated into its international trade agenda, demanding full participation in global dialogue and collaboration rather than isolation.

Second, the recent disruptions to the seamless operations of GVCs – particularly the US-China trade dispute, the Covid-19 pandemic, and Russia's invasion of Ukraine – served as a stark wake-up call for firms worldwide that had overly relied on a small number of international sourcing locations. Industries with value chains deeply tied to production in Asia were hit particularly hard. However, the responses by firms to these crises have not led to the end of globalization, as some had predicted. Instead, they have adopted more strategic approaches to sourcing and resource allocation, diversifying their production sites across the globe and bolstering redundancy among suppliers. At the same time, the EU initiated a foreign policy agenda that aligns with these private-sector needs. This involves identifying alternative sources of supply, forging new partnerships, and promoting trade diversification. The challenge, nonetheless, is that after two decades of Chinese-dominated globalization, there are few alternative sourcing locations ready to supply the EU and other key markets. Thus, to secure sustainable and resilient supply chains, the EU is actively investing in building the capacity of potential new trade partners around the globe – with efforts ranging from governance and infrastructure to innovation and human capital development.

Nowhere is this new engagement strategy more apparent than in the EU's raw materials sector, which is currently dominated by China. The Critical Raw Materials Act specifically seeks to diversify away from this monopoly. Increasingly taken for granted by manufacturers over the past two decades, reliable and unhindered access to and processing of certain raw materials is a growing concern today for both the EU and other large industrialized nations. Ironically, the Green Transition will drive a surge in the consumption of numerous metals and minerals over the next 50 years (Hund et al., 2020), with global material usage expected to more than double by 2060 (compared to 2011) and metals consumption to rise by 250% (Amighini et al., 2023). These metals and minerals are vital for supporting the EU's sustainability ambitions and preserving its leadership in the high-tech industries of tomorrow, spanning from aerospace and defense to digital technology, healthcare, and electric vehicles. Currently, the EU, like the US, extracts or processes very few of these materials. Since 2000, the processing

of these metals – including commodities such as aluminum, copper, iron, and rarer elements like gallium and neodymium – has progressively shifted to China. As geopolitical dynamics evolve, relying on one primary sourcing location has become untenable for firms and countries alike. China's export ban on two key minerals for the semiconductor industry in August 2023 and subsequent restrictions on graphite exports for electric vehicle batteries announced in October 2023 (Reuters, 2023) suggest that policymakers were justified when they legislated that no single third country should be responsible for more than 65% of the EU's annual consumption of each material.

Diversifying the supply chains for raw materials to a wider set of partners requires renewed global engagement. As the EU has limited domestic mining resources, a successful diversification strategy means working with new partners. In practice, the EU is undertaking a charm offensive to rekindle relationships with the newly empowered countries in Africa and Latin America that hold the bulk of global reserves in these materials. Formally, the EU launched the Global Gateway framework in 2021, which includes combinations of trade policy, technical assistance, capacity-building, and development cooperation for strategic trade partners. Under this framework, the EU courted and signed agreements with both Argentina and Chile in 2023 to secure access to crucial lithium resources. In return, the EU committed to assisting with the development of competitive and sustainable processing facilities as well as local value addition in the mining sector in both countries. Likewise, the EU is negotiating with African countries, including the Democratic Republic of the Congo, Namibia, and Zambia.

Although the bloc's sincerity may be questioned given its concurrent CRMA goal of processing 40% of materials internally, there are numerous ways to encourage industrial upgrading in partner economies. Specifically, the EU should actively foster the development of value-added domestic backward linkages, which offer long-lasting and sustainable growth opportunities for local economies. Efforts should include enhancing the local ecosystem for innovative, knowledge-based domestic suppliers, facilitating their insertion in GVCs as well as providing access to financial and technological resources often missing from the local market. For resource-rich countries evaluating raw materials agreements, this approach, which offers a way around the resource curse, will set the EU's proposal apart from those of other competitors, such as China. Given the region's goals, we expect the EU will more deeply engage in international trade. Strategic autonomy entails cultivating intelligent connections with a diverse array of partners rather than decoupling from the global economy.

Reply to Karina Fernandez-Stark and Penny Bamber:

Karina Fernandez-Stark and Penny Bamber correctly point out that the EU's notional idea of "strategic autonomy" should be operationalized as "strategic diversification," since the idea of a significant reshoring of production activities that vertically integrate value chains within the EU single market is clearly impractical, at least in the short to medium terms, if not in absolute terms.

Hence, the idea of adapting to the EU's new political needs, as expressed in the Global Gateway framework. The latter constitutes the EU's contribution toward narrowing the global investment gap worldwide, in line with the commitment of the G7 leaders from June 2021, and will mobilize up to EUR 300 billion in investments for sustainable and high-quality projects over the coming years. In this sense, it could be considered the tool through which the EU can operationalize the concept of "strategic" adaptation. This could be done by changing the emphasis (both political and in terms of resources) toward key investments / industrial policies in specific partner countries with the aim, among other things, of progressively incorporating parts of the local production system into the new "strategic" European value chains.

The key is to find the right balance between the diversification of sources – possibly toward countries linked through long-standing and mutually beneficial relationships with the EU – and the reshoring of strategic parts of the production process within the single market in order to preserve core competitive advantages in the EU. Too much diversification and the EU would be exposed to another shift in international alliances, ending up with the same threat of "weaponization" of key inputs by (currently friendly) countries; too much reshoring and the EU might lose its competitiveness in key value chains due to its higher costs.

Reply to Carlo Altomonte:

As the EU redefines its international trade approach through the Global Gateway initiative, it must recognize its place in a shifting global landscape where power dynamics are changing. The policy shift to reduce China's GVC dominance reopens the playing field to a large number of countries. Each of these new players seeks to position themselves strategically and to create smart value chain approaches of their own.

On one side, the traditional GVC leaders – the EU, the US, and other developed nations – have historically dictated global production, timing, methods, and participants. More recently, China has joined their ranks in shaping GVCs with its own strong, innovation-driven firms, which now also have a global footprint. The EU, the US, and China are all pursuing strategies to strengthen domestic production capabilities, complement them with efficient global opportunities, but most importantly to secure a supply of natural resources from abroad.

On the other side, developing countries supplying natural resources have recognized the changing global dynamics as an opportunity to pursue their own development goals. For the first time, the surging demand for metals and minerals to support the Green Transition has empowered commodity suppliers – who for years received unfair compensation – to assert themselves and seek more favorable terms of engagement. These emerging economies were largely left behind while the rest of the world enjoyed the benefits of globalization. Today, their goal is to leverage the power of their natural resources to upgrade into manufacturing and diversify their economies.

A sustainable global future hinges on achieving a more balanced redistribution of wealth and benefits across the value chain to reduce the disparities between developed and developing countries.

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Renewing industrial policy: A strategic path to economic development in the Global South?

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Jewellord Nem Singh: When Dani Rodrik (2008) called for the normalization of industrial policy, the world was searching for a new governance paradigm amidst the rubble of the 2007 economic crisis that swept Western financial markets.

During this time, Latin America was experiencing an unprecedented commodity boom (2003–2012), in which resource-rich countries viewed the renegotiation of contracts with multinationals and re-taxation of their key export sectors – notably mining, oil, and agricultural exports – as quintessential for a new paradigm based on neo-statism. Such calls for "more state" coalesced around the concepts of "resource nationalism" for mineral states, "new developmentalism" in Latin America, and the return of industrialization and structural transformation onto the development policy agenda (Aiginger & Rodrik, 2020; Bresser-Perreira, 2006; Nem Singh, 2019). At the core of these political changes lies the renewal of industrial policy as a globalization strategy for low- and middle-income countries.

An industrial policy agenda in the Global South

Between the 1980s and 2000s, the prevailing Washington Consensus rejected state intervention as a growth strategy. Under the neoliberal doctrine, supply chains aim to achieve on-time production, and market deregulation is the policy norm. State subsidies were associated with corruption and rent-seeking, whereas self-regulating markets would efficiently allocate resources in the economy. Yet, the evidence for industrial policy in East Asia – combined with the lack of credible success stories of market-based growth in Latin America and Africa – has gradually weakened support for market reforms.

The advance of industrial policy goes back to the central role of manufacturing in structural transformation. As Doner et al. (2021) argue, East and Southeast Asian states have deployed very different strategies for industrial transformation in response to geopolitical challenges during the 20th century. Broadly speaking, however, two types of strategies became dominant: extensive growth strategies – demonstrated by Thailand – which sought to compete with global industries through foreign technology acquisition and by incorporating domestic firms as part of the manufacturing supply chains led by larger multinationals; and intensive growth strategies – demonstrated by Korea and Taiwan – in which the state insisted on fostering national champions. The Korean industrial strategy supported the expansion of chaebols, or Korean business groups, which over time developed world-class engineering and design capabilities. These chaebols, such as Hyundai-Kai, have increasingly played a larger role in the export of vehicles and parts (Doner et al., 2021, pp. 28–30). These two strategies differ in terms of their policy objectives and commitment to indigenous technology formation, and they are determined by the structural conditions of a country.

Industrial policies were designed to respond to national constraints, and as such, contemporary industrial policy is also a pragmatic response to changing external circumstances, such as the rise of a China-centered manufacturing economy. Some lessons from China are instructive here. Some of the key principles of Chinese state developmentalism have now been normalized: the idea that public enterprises have a developmental role, that state-controlled banking and finance can reduce risks from volatile capital outflows, and that sectoral development strategies can be deployed to

rebuild the productive base of an economy. These policies reflect the shift in development thinking – from policies aimed at integrating into globalized supply chains toward self-sufficiency and strategic autonomy in a highly politicized world market. Whether countries embrace Hirschman's principle of building economic linkages between sectors or follow Justin Lin's concept of finding new comparative advantages, there now exists robust justification for purposeful state intervention in a complex globalized political economy.

Examining success and failures in industrial policy

The conditions upon which structural transformation can be achieved have often been classified in terms of the internal and external factors shaping political choices in developing countries. Because structural transformation is inherently complex and must be viewed over the long term, the design of industrial policies must account for distinctive national political contexts, the available policy instruments for export promotion, and the need for state capacity to mobilize domestic resources for sectoral development. In the study by Doner et al. (2021, pp. 48, 50) on the automotive sector, intensive growth strategies require institutions that are capable of coordinating multiple agents who hold the resources to be mobilized for specific policy objectives, such as technological learning. Without a knowledge base and the ability for sectoral development, industrial policies not only encounter resistance from the outside, but they can also easily be hampered by the lack of sufficient knowledge on how to coordinate policies within bureaucracies.

Furthermore, the role of external factors in generating the conditions for successful industrialization cannot be underestimated. In the Korean electronics industry, the decisions by Japanese firms to move investments into Korea and then Southeast Asia have played a decisive role in creating opportunities for technological learning among Korean companies via joint ventures (Castley, 1999, pp. 34–36). By 1980, the degree of foreign domination in the electronics sector declined, as chaebols participated in the production of consumer electronics. In the context of China's Belt and Road Initiative (BRI), Malaysia and Indonesia pursued infrastructure-led growth combined with export value-addition strategies, such as the downstream policy in Indonesia (Camba et al., 2022).

Finally, geopolitical factors have shaped the possibilities for structural transformation. In East Asia during the 20th century, the desire of governments to industrialize was intricately connected with high politics and economic security, both of which were heightened by existing geopolitical difficulties and the systemic vulnerabilities faced by states in Asia. By comparison, Latin American countries were pursuing resource nationalism and industrial policies – albeit without similar levels of consistency in East Asia – in the 20th and 21st centuries, with significantly less success, especially in promoting downstream policies in the resource sector (Nem Singh, 2019). Interestingly, success in establishing economic linkages between mining and the productive economy took place in Asia, not in Latin America. China's industry for rare earth elements was developed between the 1970s and the 2000s through consistent investments in mineral processing and increasing metal purity contents. Today, China controls both upstream and mid-stream segments of the supply chain for rare earth elements. In 2020, the Indonesian policy on local content and domestic processing requirements increased the export value of nickel. To facilitate downstream investments, President Joko Widodo banned the export of nickel raw materials that have not been refined within the country. The policy's success,

however, is arguably conditioned by its timing, whereby the unprecedented demand for nickel – and Indonesia's control over this resource – has given Widodo broader policy latitude to exploit the ongoing US-China rivalry while also promoting commodities-based industrial upgrading. Yet, to fully succeed, Indonesia needs to harmonize policies across sectors, notably by enhancing technology acquisition and skills development in more complex sectors such as nickel-based batteries and electric vehicles.

The return of industrial policy in the West

The US-China geopolitical rivalry has also impacted other major powers, leading to restrictive trade policies and efforts to "reshore" globalized supply chains closer to home markets. The global production networks of advanced manufacturing took a protectionist turn as export restrictions across segments of the supply chain were rolled out by different countries. Specifically, vital mid-tech sectors such as batteries, permanent magnets for motors, semiconductors, and electronics have experienced supply chain disruptions, triggering a wider supply chain crisis all the way down to the exports of high-valued manufacturers such as those in the automotive and electronics sectors. As geopolitical tensions intensify, China on the one hand, and the US and its allies on the other have exchanged policies imposing export restrictions, non-trade barriers, and new licensing requirements, especially on the raw materials needed to produce mid- and high-tech manufactured goods (Reuters, 2023; Ting-Fang, 2023). Ever since the Biden administration pushed for export restrictions on China, followed by Japan and the Netherlands, China has retaliated by applying a licensing system to limit the commercial transactions of key raw materials in chipmaking, such as gallium and germanium. Geopolitical tensions are unlikely to wane anytime soon. In response, developing countries must formulate innovative trade and investment strategies – in the context of US-China strategic competition – that are aligned with their respective interests in maximizing the benefits of supply chain participation.

Secondly, growing protectionism in advanced industrialized countries might slow down industrial upgrading and export earnings in developing countries. For example, the European Union (EU) passed a series of legislations, including the Critical Raw Materials Act, to support the downstream sectors within the continent. While the EU has deployed trade agreements to secure access to minerals from third countries, other legislations likewise seek to simultaneously invest in manufacturing and processing capacities. The EU has been seeking to establish a "club of like-minded countries" to strengthen supply chain resilience, thereby using its single market as leverage to promote its own environmental standards.[4]

Mineral producers may well have leverage in owning natural resources, but their limited processing capacities and lack of diversification strategies can hinder industrial upgrading. With the EU's commitment to double down on investments related to processing and extraction, the opportunity for technology acquisition and firm learning in the Global South might be more limited. Despite the growing demand for critical minerals, investments in other segments of the supply chain would be needed to realize structural transformation.

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[4] Senior Official, European Commission Directorate for Environment, Roundtable, "The State of Play for Critical Mineral Policies," Berlin Climate and Security Conference, October 6, 2023.

The most notable example here is Chile, the second-largest lithium producer, which has set out a nationalization plan aimed at creating a public enterprise for joint ventures. The ambition is to increase mineral processing within Chile and expand the level of participation of Chilean companies in clean energy supply chains. Without a comprehensive industrial policy on lithium, state ownership could deliver more windfall profits, but not necessarily value added in exports. More broadly, attempts at localizing production through resource nationalism have met with resistance, especially from the EU, as evidently shown by the World Trade Organization (WTO) dispute against Indonesia's raw nickel ban. If this is any indication, the developed world is not really walking the talk. The EU claims to support partnerships with mineral producers, but at the same time it uses global rules on trade when faced with export restrictions in the Global South, even if the policy seeks to increase value addition in mineral processing and compensate for the proximate socio-environmental hazards incurred by those living on the frontiers of extractive activities.

Finally, China's BRI revamp – by moving from multi-billion infrastructure spending toward "small but beautiful" projects – is likely to hamper the flow of resources toward the Global South. Those African, Asian, and Latin American countries that have received substantial support from China through a combination of Chinese foreign direct investment and development cooperation programs would need to recalibrate their expectations, and therefore their industrial plans, given the shrinking financial support available in the post-2022 context. This, in turn, might also require ensuring that their industrial policies are flexible, pragmatic, and capable of avoiding the excesses of state-led growth often associated with past (failed) attempts at structural transformation.

Gonzalo J. Varela: Industrial policy, often seen as a tool to stimulate economic growth, has gained popularity in policy debates. However, it is not without its challenges.

This piece presents a critical view on industrial policy from the perspective of developing economies. It argues that industrial policy can lead to distortions that decelerate rather than accelerate economic transformation, to policy capture that increases rather than decreases inequalities, and negative cross-country spillovers that deter rather than encourage the transition toward a greener, livable planet. More importantly, for developing economies facing hard budget constraints, industrial policy efforts may divert attention and resources from using alternative instruments to achieving development objectives that offer a better combination of risk and return, given countries' implementation capacities. Interventions that focus instead on preserving macroeconomic stability, maximizing gains from international integration, and building human capital will offer better long-term returns.

The green transition, the resilience of global supply chains, geopolitical tensions, and the challenges associated with automation and jobs have recently increased the profile of the debate around industrial policy as well as catalyzed its implementation across countries with various

levels of income. The recently enacted CHIPS and Science Act (CHIPS) and the Inflation Reduction Act (IRA) in the United States are examples. In a rigorous and innovative new paper, Juhasz et al. (2023) show that industrial policy has been ubiquitous, its prevalence predates the current prominence in the public debate, and that it is advanced economies that are the heaviest users of it.

Some development economists argue that richer countries grew rich because they protected manufacturing (see, e.g., "Kicking Away the Ladder" by Chang (2002)). But probably the most popular examples of industrial policy focus on the experiences of some successful East Asian countries and that of South Korea. Lane (2022), for example, shows that cheap credit used to boost production and exports of the heavy chemical and industry (HCI) sector have played a critical role in creating the modern South Korean economy. The "Made in China" project under Xi Jinping is another example, with government subsidies as a share of profits climbing from 3 to 5% between 2012 and 2020, without delivering on its promise of increased productivity, R&D investment, patenting, or profitability (Branstetter & Guangwei, 2022).

Others point out that there is a misreading of history in the argument that industrial policy (in the form of protection) helped developed countries become developed in the first place. Irwin (2023), for example, shows that, despite high tariffs, the United States developed largely as an open economy – to migration, to capital and technology, and with plenty of competition in its large domestic market. In addition, he claims that the overtaking of the United Kingdom in the late 19th century was through increases in productivity in the services sector, not in the (protected) manufacturing sector. Irwin also attributes an important role to an orderly macroeconomic framework in Korea's export boom that preceded the development of the HCI. A key role in that export take-off had to do with letting the currency depreciate after a long period of artificial overvaluation (something similar happened in Taiwan, another of the Asian Tigers (Irwin, 2021)).

There are four reasons why industrial policy is too risky for developing economies: distortions, capture, inefficiencies, and heavy reliance on implementation capacity.

First, industrial policy exacerbates distortions. Conceptually, the case for industrial policy is based on the idea that there is a market failure that prevents the growth of a dynamic, tradable sector (be it in manufacturing or in modern services), and so some form of government intervention – such as cheap credit, import tariffs, or export subsidies – is necessary to correct for that failure. In practice, however, economies – and, in particular, developing economies – are full of distortions (e.g., labor market regulations, energy subsidies, etc.). Correcting one market failure through industrial policy may not promote industrialization; in fact, it may make matters worse. An example is the Indian IT sector, which could have been seen as a target for industrial policy. However, as shown by Kochhar et al. (2006), the sector grew because manufacturing progress was limited by its own market failures (e.g., a lack of enabling infrastructure due to coordination failures, or limited access to credit due to asymmetric information). Instead, active interventions to support a specific sector can trap otherwise productive resources in unproductive uses. The experience derived from import substitution policies in the automobile sector in Pakistan serves as a case in point and has not only productivity implications, but also systemic risks: The sector has historically contributed to large current account deficits by increasing demand for imported parts and components, without

earning foreign exchange to pay for them, as its exports are virtually zero. As a result, due to this type of industrial policy, which entails strong protection measures for the automobile sector (in the form of high import duties), Pakistani consumers end up paying higher prices for lower-quality cars than they would pay in the absence of this protection, while the government receives lower import-duty revenues, since duties on parts and components are substantially lower – and often even exempt – than duties on finished cars (World Bank, 2022).

Second, industrial policy is prone to capture. As firms reallocate resources away from productive investments into lobbying, this may reduce productivity and potential growth. It may also exacerbate inequalities and limit social mobility, as it is the best-connected firms that are better positioned to lobby in order to preserve the status quo. In Pakistan, for example, Lovo and Varela (2022) show that eligibility for export subsidies is systematically associated with a firm's size. For a given sector size, eligibility for subsidies increases with the prevalence of large firms in that sector. Larger firms with deeper pockets to lobby tend to succeed more frequently in receiving new – and maintaining old – subsidies. In Nepal, despite evidence pointing to extremely limited effects (Defever et al., 2020), export subsidies targeting a handful of export products are kept in place and continue to receive additional funding. The limited information that a government's civil servants and policymakers have make "picking winners" difficult. The political economy problem of capture makes the capacity to "let the losers go" virtually impossible (which is crucial in "good" industrial policy, as cleverly argued by Rodrik (2010)).

Third, industrial policy tends to create negative cross-country spillovers that further reduce growth. It is argued that green growth will require green industrial policy in addition to getting carbon pricing right (see, e.g., Aghion (2023) and others). But unless green industrial policy is extremely well-coordinated across countries, it is likely to reduce the scope for gains through specialization. Research by Bruegel on the IRA shows that, because of domestic content requirements, foreign companies will lose customers in the United States, and therefore economies of scale (Kleimann et al., 2023). Brazil, India, and South Africa also introduced domestic content requirements for renewable energy projects. Although green sectors in the United States, Brazil, India, and South Africa may (of course) benefit, the losses elsewhere can be so large that the green transition at the global level could slow down, at least in the short run. When support to the sectors entails subsidies or tax expenditures instead, the risks of non-cooperative, wasteful race-to-the-bottom scenarios increase. As argued by Krueger (2023), relying on international production networks – even if with a more limited set of trading partners due to geo-political considerations – will result in better productivity, and therefore a faster green transition. Moreover, developing economies could stand to gain from capturing parts of these value chains, rather than losing out from these nationally focused "green" industrial policy initiatives.

Fourth, the success of industrial policy has a lot to do with the "how," in addition to the "what." It requires a civil service with high implementing capacity. In a recent study, Barteska and Lee (2023) show that the success of the export-promotion leg of Korean industrial policy of the past decades depended entirely on the quality of the bureaucrats. The authors show that export growth is only observed in destinations where the visiting Korean bureaucrats have high ability, and with there being no effects in those destinations where low-ability bureaucrats are executing export promotion. A similar contention had been put forth by Rodrik (1997): The best-functioning export-promotion programs of industrial policy

were those in which bureaucrats engaged in close, high-quality interactions with exporters. If implementation capacity is a challenge in middle-income countries, the scalability of successful industrial policy interventions in these types of contexts is questionable. Mazzucato (2021) and others argue that limited implementation capacity is a consequence – and not a cause – of a "less entrepreneurial" state in the first place. But even if that argument held, the fact that industrial policy is intensive in implementation capacity and developing countries rarely display this capacity adds yet another risk factor to the mix.

Given the combination of risk and return, developing countries have better policy options to consider than risky industrial policy. In a context such as the one we see today – when debt burdens are high and financing costs have soared – fiscally strapped economies have other, more binding priorities to deal with, and with safer development returns. These include improving educational outcomes, reducing malnutrition, investing in (and crowding in private investment for) resilient infrastructure, and protecting the poor and vulnerable, rather than directing the extra dollars to subsidizing domestic industries.[5]

Embracing the world economy through more and better integration has proven to be a better bet for productive, inclusive growth for developing countries. Trade and global integration have, in fact, raised incomes across the world while dramatically cutting levels of poverty and global inequality. China's growth had more to do with productivity improvements in agriculture and allowing foreign direct investment in manufacturing than with industrial policy (Irwin, 2023). India's reforms in the 1990s helped increase productivity (even if, as Irwin (2023) mentions, more reforms are still needed). Vietnam's export boom has been similarly facilitated by reducing trade and investment costs – thus opening markets and attracting large multinationals – along with their technology and good practices (McCaig, 2011). In Indonesia, a big chunk of the productivity growth observed in the decade post–Asian financial crisis can be explained by the opening of the services sector to foreign investment (Duggan et al., 2013). Poland's dramatic industrial development, within-firm growth in output, and productivity has had much more to do with deeper integration within the European Union than with industrial policies (Bastos et al., 2022).

In conclusion, although industrial policy may seem like an attractive option for stimulating economic growth, it comes with significant risks and challenges. Developing countries should prioritize alternative policy objectives that offer better long-term returns, such as investing in education, reducing trade costs, minimizing uncertainty for foreign investors through international agreements, and maintaining macroeconomic stability. By embracing the world economy and focusing on foundational development interventions, developing countries can achieve more inclusive and sustainable growth.

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[5] Interestingly, the type of industrial policy intervention in the US that tends to have better impact – according to a thorough evaluation conducted by the Peterson Institute – is the one that focuses on public and private R&D investment support, rather than trade or subsidy-related measures (Hufbauer & Jung, 2021). The latter two types of interventions are the ones that are more prevalent in developing countries, whereas R&D investment is extremely low.

Reply to Gonzalo J. Varela:

There seems to be an assumption that industrial policy is fundamentally incompatible with globalized market economies. As Ohno (2013, pp. 31–33) points out, the world is more integrated today than it was in the 1950s, therefore catching up and rebuilding the productive base of an economy requires more sophisticated measures of policy intervention. Although raising tariffs, subsidizing exports, and the unfettered copying of foreign technologies are banned under current WTO rules, there are various policy measures that can be utilized by developing countries which remain plausible for implementation. Some examples of these measures include: education and training efficiency; reorganizing logistics and transport; industrial cluster formation; and the legitimate formation of business associations to align business and state interests. However, the key limits of such policy measures remain – that latecomer economies must collectively lobby for international organizations in order to expand their policy space and individually implement measures that are acceptable within current global rules. While latecomers can pursue or consider macro-economic stability and human capital formation, as suggested by Gonzalo Varela, these measures fall short in contributing in any meaningful way toward the industrial upgrading and increased participation of developing-country firms in globalized supply chains. Finally, technocratic approaches to economic policy are always devoid of politics, which explains why similar measures often have varying effects across countries. Because political contexts differ even within East Asia, the actual policy design and institutional configuration of their industrial policy were also widely distinctive, thereby demonstrating that centralized states need to exercise pragmatism and sensitivity to changing external circumstances in order to develop successful industrial strategies.

Reply to Jewellord Nem Singh:

Nem Singh is right about the fact that industrial policy is increasingly compatible with globalized economies. But this is largely because global integration – both of trade and investment – has been incredibly successful in increasing global prosperity and reducing poverty rates. That is why policymakers are trying to find ways to encourage export participation in order to catch up more quickly. The question is how to catch up more quickly? Is this likely to happen through expensive firm- or sector-specific interventions that distort relative prices, by diverting resources from other important uses, and creating incentives for capture within contexts in which governance and political economy challenges are already pervasive (aka industrial policy)? Or will it rather happen by focusing on reducing trade and investment costs, preserving macro stability, and investing in foundational skills development? Investment agreements, for example, can help reduce the uncertainty associated with investing in developing countries, thereby increasing the attractiveness of foreign direct investment (FDI) (see, e.g., Gomez-Mera and Varela (2024)). FDI, in turn, is a powerful conduit for knowledge transfers, facilitates integration into global value chains, and tends to create quality jobs. Rather than embarking on risky industrial policy, policymakers could focus on promoting FDI attraction.

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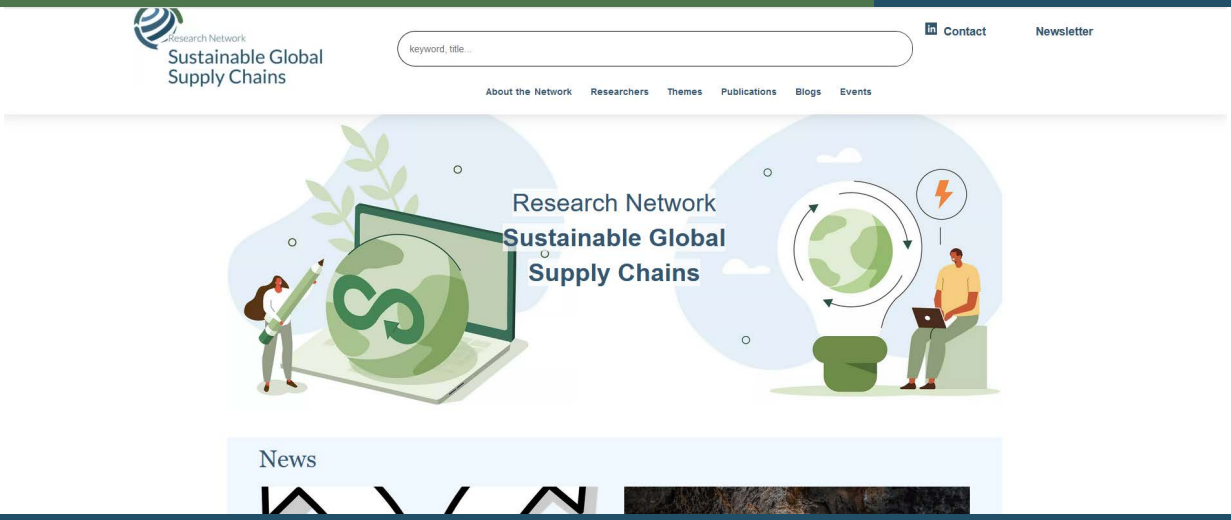

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Beyond buzzwords? Assessing the risks and rewards of friendshoring

Willy Shih is the Robert and Jane Cizik Professor of Management Practice at Harvard Business School (HBS). His expertise is in manufacturing, product development, and supply chains, and he has written or co-authored numerous cases and teaching materials in industries ranging from semiconductors, information technology, consumer electronics, aerospace, transportation equipment, manufacturing processes and tools, and intellectual property. He has 28 years in of industry experience and is a member of the Advisory Committee on Supply Chain Competitiveness reporting to the U.S. Secretary of Commerce, as well as the Industrial Advisory Committee working on the CHIPS and Science Act for Commerce.

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Willy Shih: "Friendshoring" is the latest buzzword in global trade policy, and it conveys the notion that supply chains should be relocated or concentrated in countries regarded as political and economic allies

Janet Yellen, the United State Secretary of the Treasury, introduced the term at a speech before the Atlantic Council in April 2022, shortly after Russia's invasion of Ukraine, as she tried to highlight the "power of working together with partners" (Yellen, 2022). The term was quickly adopted by many as the latest step in the evolution of supply chains. Yet, I argue that it is a step backwards from what we have experienced since the late 20th century – a time we will probably look back upon as a golden age of globalization with a relatively open trading environment and a steadily decreasing number of barriers. Friendshoring is not as simple as policymakers would like us to believe, and the difficulty and costs of disentangling the current order will be higher than many predict. It also raises the question of the durability of friendships.

Let us start with why friendshoring is difficult to realize. Supply chains are much more complex and interdependent than many people realize. The motivation for creating complex supply chain structures begins with the idea of specialization. As technologies have become more complex, it is often advantageous, and indeed sometimes necessary, to employ specialists who can focus on developing a particularized technology for others to use. One only has to look at a modern smartphone or computer to see that highly specialized skills are needed to produce the flat panel display or touchscreen, and very specialized production assets are required as well to manufacture them. The same applies to microchips, batteries, electronic storage media, and most other components. Companies that try to do everything themselves – much as IBM tried to do in the late 1980s – get left behind because assemblers and integrators can draw on the best components that the marketplace has to offer. Vertically integrated generalists, in contrast, have to be as good as the market leader in every specialty – something that is very hard to achieve. This specialization has led to supply chain tiering, in which assemblers draw from layers of suppliers, who in turn draw from the next layer of suppliers. This tiering may go many layers deep, and as you go farther down, it gets harder to keep track of everyone. It can also take the form of a product, such as a silicon microchip, that moves from country to country, where a specialist adds value before sending it along to the next processing step.

This tiering, which is driven by complexity and specialization, is often not visible to political leaders, who tend to focus on the final assembly point, or occasionally on key intermediate goods such as semiconductors. But it is often opaque for competitive reasons, as tier 1 suppliers usually do not want to disclose their tier 2 suppliers for fear of disintermediation. To some extent, the tiering was "exposed" during the Covid-19 pandemic, mostly due to surprise shortages caused by disruptions somewhere along the chain. Yet, most policymakers are not fully aware of the implications of tiering depth because they tend to only look one layer up- or downstream. Unwinding such complex supply chains in the name of friendshoring means finding new specialists in friendly countries. More likely it will lead to a "front" game of transshipping intermediate goods via a country perceived to be friendly. This can already be seen in solar panels shipped from Southeast Asian countries, where much of the componentry originates in China (Zumbrun & Ferek, 2022).

For countries such as the United States, it will mean higher costs to consumers. When supply chains are regionalized, that generally means fragmenting the supply base. This will often lead to the loss of economies of scale due to production that is concentrated or based in lower-cost regions that are not considered "friends." Moving production to the United States or Europe would also likely mean higher labor and factor costs – both directly influenced by wage rates – but also regulatory burdens such as slower construction and other legal and permitting requirements. Current inflation rates are masking some of these higher costs.

Friendshoring also means you have to worry about the health of your friends (Shih, 2023). Let us take the example of ubiquitous flat-panel displays. The assumption in the United States is that companies such as Apple and Tesla should be able to source displays in Japan or South Korea – two strong allies – without political risk. But that may not be true for long. The recent bankruptcy filing of Japanese national champion JOLED – as well as Japan Display's recent struggles – casts doubt on the long-term capacity of Japanese companies to be sources. In South Korea, LG Display and Samsung Display have been dominant players for a decade and a half. These companies had a commanding global market share as recently as 2018, so South Korea should be a reliable source of supply for decades to come, should it not? One would think so, but both companies are getting pushed out of the market by heavily subsidized Chinese players. Taiwanese companies like AUO have narrowed their focus to niche markets, such as automotive displays, yet it remains to be seen whether this business strategy is viable in the long run. And is Taiwan considered safe for friendshoring? So the story gets more complicated.

Finally, friendshoring assumes that you will be able to hold on to your friends for at least some amount of time. But alliances shift; consider how the United States was viewed in many European countries when Donald Trump was President. The bigger challenge is that, in the United States, there tend to be shifting views about other countries over time. The United States has taken a less expansive view, and sentiments about countries such as Turkey, Saudi Arabia, and many Middle Eastern countries have been variable and will likely continue to change.

Having said all these things, I am not arguing against friendshoring as a useful concept in the design of supply chains. Rather, weighing geopolitical risks in any supply chain design has considerable merit. Companies such as Toyota already factor this in when they consider the lead-time planning for parts (Shih, 2022). What is important is to understand some of the costs and limitations of the approach. Products may cost more, and we may have a smaller variety to choose from, and that needs to be balanced with changing geopolitical objectives.

Carlo Pietrobelli: In view of the growing prominence of friendshoring, the question arises as to what this means for developing countries.

In this analysis, we look at how this concept impacts developing countries, what it means to be a "friend" in international business, how developing countries fit into this picture, and the potential benefits of friendshoring for them. We discuss this from a Global South perspective and explore what steps developing countries can take to demonstrate their "friendliness" and capitalize on it.

First, reshoring and friendshoring are not new phenomena. In the recent past, the strategy of organizing international production through the international transactions of intermediate goods and services along a value chain has often involved reshoring – or moving some activities to nearby, supposed more friendly, countries – in response to market conditions. For example, when Taiwan shifted from textiles to electronics in the 1980s, it was driven by rising wages resulting from economic development, along with investments in human capital and technology infrastructure. This shift resulted from a mix of market signals and government support.

Moreover, although some reshoring of foreign direct investment (FDI) had already begun in 2007 and accelerated from 2015 onwards, factors such as increasing volatility, uncertainty, complexity, and ambiguity have disrupted FDI and global value chain (GVC) trade flows (Buckley, 2020), amplified by events such as the Covid-19 pandemic, the Russia-Ukraine conflict, and trade wars.

Nevertheless, nearshoring remains relatively uncommon and may prove challenging in the future. There are different reasons for this.

First, the technology of production fragmentation has become increasingly complex, and modularity has become massive, with an expanding number of intermediate products and suppliers in many manufacturing sectors (Thun et al., 2022). Global firms have fewer suppliers to choose from, particularly in smartphones and other information and communications technology (ICT) products, and disentangling from such thick networks proves extremely difficult.

Second, it is difficult to relocate activities to friendlier countries, as revealed by the experiences of individual companies. An example is Apple's attempt to reduce dependence on China and diversify production to other "friendly" countries, such as Vietnam and India. Apple had been developing since 2005, thanks to symbiotic relations with China, its dynamic ecosystem with thousands of suppliers, and the size of its market (McGee, 2023). As US-China relations turned sour, the reshoring of more technologically complex products to India has faced multiple barriers, ranging from the local bureaucracy and issues regarding work ethics to the difficulty of finding first-tier contract manufacturers – including Tata – and a sound manufacturing ecosystem, with there being few competent and ISO-certified suppliers (McGee & Reed, 2023).

This leads to the question of defining what constitutes a "friend" in international business. Developed and developing countries often have differing policy views. For example, developing countries may have a greater interest in free trade, while perhaps being willing to induce advanced countries to pay the largest bill for environmental sustainability. They also have distinct institutional features, levels of

development, and priorities that make them unalike. If developing countries are considered "unfriendly," they risk exclusion from Western-led GVCs. Furthermore, friendships inevitably change over time and are influenced by conscious decisions or unexpected events, and what is considered a friendship in political terms may not align with business interests. The trend toward a "fractured world" (Simões, 2023) has pushed companies to rethink their international transactions and collaborations. It has led them to explicitly consider not only efficiency and cost savings, but also the complementary objectives of resilience and security. However, uncertainty cannot be controlled, and friends cannot be easily recognized, and they are bound to change.

Now, suppose for a moment that international corporations, despite these difficulties, found it convenient to reshore to "friendly" countries, perhaps induced by the subsidies and incentives offered by advanced countries. How could developing economies benefit?

First, developing economies would need to be able to attract such investments by showing reliability, favorable conditions for production, good infrastructure, and the dynamic ecosystems of companies with the required capabilities. This is not yet happening in many economies. A new study on Latin America shows – with macroeconomic-, trade-, and industry-level evidence – that nearshoring is not occurring much, except for Mexico, where intense trade relations with the US economy have been a typical feature of this economy since the enactment of the North American Free Trade Agreement (NAFTA) in 1994 (Pietrobelli & Seri, 2023).

Second, even if multinational corporations were to decide to reshore activities, would emerging economies be ready to benefit from these flows? This requires strengthening their "friendliness" by investing in digital infrastructure; advanced human capital, especially regarding the skills related to the digital economy; trade and production logistics; investments in science, technology, and innovation; and proximity to markets (Pietrobelli & Seri, 2023). The evidence for Latin America suggests that most countries are not yet ready to benefit from friendshoring, making their growth and development dependent once again on their own – and their firms' – capabilities and investments in skills, innovation, and infrastructure.

Third, developing countries should leverage their assets and resources to address challenges such as climate change and energy sustainability. The rising demand for critical minerals and green sustainable technologies presents opportunities for knowledge, investment, and development through friendshoring in these areas.

Reply to Carlo Pietrobelli:

Dr. Pietrobelli and I appear to agree on many aspects of friendshoring, though he seems to argue more from a policy standpoint concerning actions that developing economies can take to improve their positions in GVCs. His view seems to be more tilted toward deliberate supply chain design, for example when he cites Taiwan's building of networks and firms for electronics and semiconductors in the 1980s, or when he argues that future efforts at redesign will be hobbled by complexity.

My view is that countries can mainly set conditions and build supporting infrastructure to promote the expansion of trade, and firms will respond and situate their loci of production accordingly. These conditions include trade infrastructure – such as the port facilities (including ocean and air) and hinterland transportation networks that are vital to supporting the movement of goods – but also barriers (or the removal of barriers) such as tariffs, import/export quotas and restrictions, cabotage rules, and things that impede the flow of goods. And then, of course, there are economic conditions such as labor costs, labor flexibility, the ease of constructing facilities, land availability, and things typically thought of as factor costs. These days, industrial policies – including subsidies – can have a significant role as well.

Let me highlight some examples of where conditions have had an impact. Hong Kong's absence of import and export duties and barriers and its unique position in circumventing China's cabotage rules positioned it as a supply chain hub in the 1990s and early 2000s as early movers into China established supply chain operations there. Contrasting examples are China's Belt and Road Initiative and the China-Pakistan Economic Corridor, for which the hope was to grow Pakistan's manufacturing exports. But although this provided a critical albeit incomplete infrastructure base, the efforts have been stymied by corruption, cost overruns, and other adverse impacts, which provide little motivation for producers to move there (Leahy et al., 2023).

As Dr. Pietrobelli argues, orienting a country's views in a way that makes it a "friend" will be important for many Western countries, but different institutional features such as level of development and priorities make this challenging. In the end, I believe market forces will do the work. I often think of business as operating on "playing fields" where the rules are established by governments, and businesses can choose which fields they want to play on. These rules can be very intentional, as we see with incentives for favored industries, or they can be unintentional, as with the overzealous enforcement of China's Zero-Covid policy, which drove firms to diversify production to other countries. In the end, governments set their rules and what leagues they want to be part of, and businesses choose where to play.

Reply to Willy Shih:

Professor Shih and I share a profound appreciation for the pivotal role that firms, multinational corporations, and markets play in the processes of growth and development. However, our perspectives diverge somewhat when it comes to the role of government policies in trade and investment. Professor Shih contends that countries can set the conditions and build supporting infrastructure to encourage trade, and firms will respond: "Market forces will do the work."

In my view, the conditions conducive to trade and foreign investments, including reshoring and friendshoring, encompass a much broader array of elements. I begin with the premise that markets are affected by remarkable and widespread failures. In certain instances – particularly in developing countries, but often also in advanced economies – markets do not even exist and must be created. This underscores the government's role in building the "playing fields," defining the rules of the game, as well as establishing and supervising the institutions and intermediaries that constitute the essential elements for trade and industrial development. An active government role in defining and implementing policies can signal "friendliness" and foster trade and investment. Crucially, the lack of coordination in investment and policy decisions hampers the development process, giving rise to highly inefficient and often markedly unequal economies and societies. The identification and execution of effective policies require the participation and collaboration of business, government, and civil society.

At present, a glaring market failure is undeniably manifested in the oversight of negative externalities in market prices. "Forgetting" the significant environmental and social costs of unregulated production is detrimental. Letting firms optimize their returns based on market prices as if no pollution and climate change existed is damaging and urgently needs to be corrected.

There is ample room and a pressing need for vertical and sector-focused policies, even in the era of globalization, value chains, and reshoring. GVC-oriented policies should not only attract investors and lead firms, but also encourage countries and firms to capture the gains of GVCs with selective industrial and innovation policies, and to make GVCs inclusive and resilient (Pietrobelli et al., 2021).

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Special:
Running the race for critical minerals – between geopolitical rivalries and sustainable development

Running the race for critical minerals – between geopolitical rivalries and sustainable development

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Limiting the global average temperature rise to 1.5°C and achieving net-zero emissions by 2050 requires rapid global action to decarbonize and digitalize our industries and societies. This, in turn, has spurred global demand for the minerals needed for the production of clean energy technologies (CETs), electric vehicles (EVs), and digital infrastructure. According to the International Energy Agency's (IEA) Sustainable Development Scenario (SDS), total demand for these minerals will quadruple by 2040 (IEA, 2021). Global demand for lithium – a key ingredient of lithium-ion batteries used in electronic devices and EVs – will rise by 90% by 2040. Demand for rare earth elements (REEs) is expected to grow sevenfold in the SDS, likely facing supply constraints in the years ahead (IEA, 2021).

At the same time, the perspective on global supply chains has changed. Supply interruptions in the context of the Covid-19 pandemic, Europe's energy crisis following Russia's invasion of Ukraine, as well as the continuing Sino-American rivalry have put a spotlight on the question of security of supply and the role of geopolitics in the global "race for critical minerals." Russia's invasion of Ukraine has sparked a discussion about critical dependencies in mineral supply chains. Russia is no longer considered as a supplier for a certain group of companies for minerals and metals (e.g., for nickel), leading companies reliant on these materials to seek new economic partners. In addition, the conflict has drawn attention to other countries that are considered unreliable partners.

The G7 – most notably the United States (US), the United Kingdom (UK), and Japan, but also the European Union (EU) – and many European countries want to reduce excessive dependencies in the minerals sector by reshoring certain segments of the value chain to their domestic markets (incentivized by heavy industrial policy programs) as well as by diversifying their supplier networks. This redrawing of the global minerals map has implications for both consumer and producer countries. As consumer countries (mostly in the Global North) work toward greater supplier diversification, mineral-rich countries (especially in the Global South) may be presented with new opportunities to leverage their natural resources for economic and social development. As such, they are seeking to shed their status as mere "raw material exporters" and reach higher levels of industrial upgrading and integration into global value chains. At the same time, high environmental, social, and governance (ESG) standards must be anchored in the mining sector by both consumer and producer countries, or else they risk being overrun in the race for critical minerals.

This article seeks to shed light on both ends of the supply chain. In a first step, we analyse the current (geo)political and economic dynamics shaping the global minerals sector and showcase different policy responses from importing countries. We then examine as to how far these new policies – especially the much discussed strategies of reshoring, nearshoring, and friendshoring of global mineral supply chains – can realistically be implemented. In a second step, the article explores the policy responses from mineral-producing countries and the distinct approaches being taken by Chile and Indonesia – two particularly

resource-rich nations – in fostering value addition in their respective mineral sectors. Following this, we take a closer look at what the current dynamics might mean for sustainability in mineral supply chains, and what are likely to be the biggest challenges, but also the opportunities for mineral-rich countries as the demand for certain minerals rises.

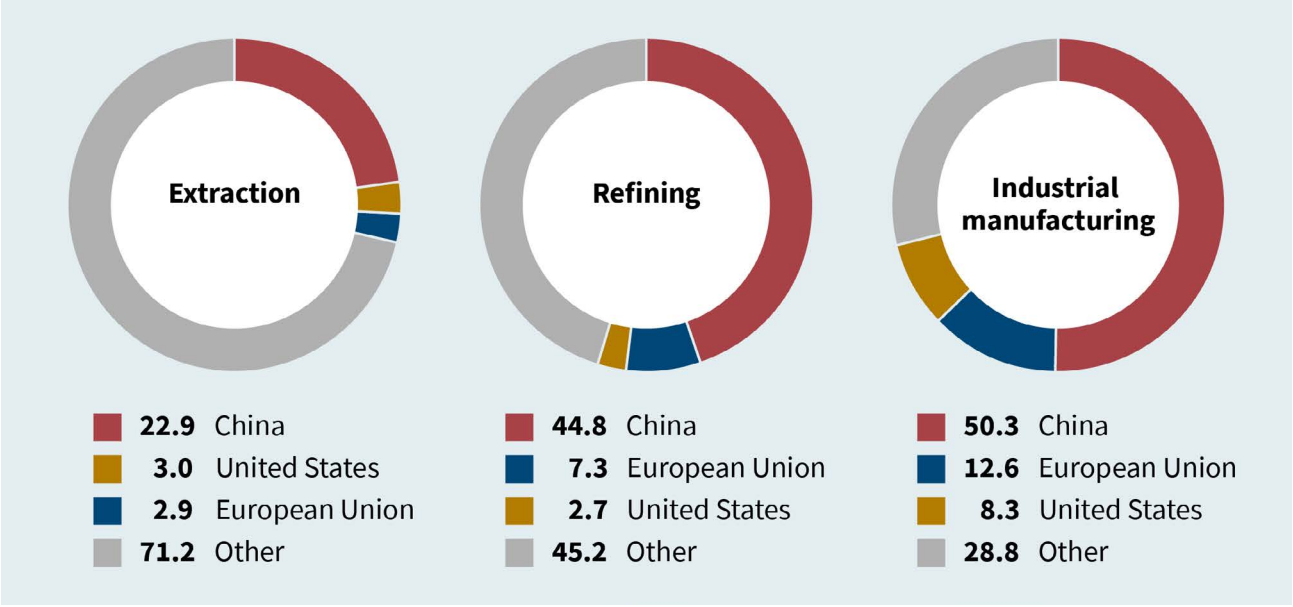
Criticalities and new strategies of importing countries

Back in 2019, Meunier and Nicolaidis noted a progressive geopolitization of European trade and investment policies characterized by tariffs, retaliatory measures and counter-retaliation, and a "rhetoric of trade negotiations [that] has given way to the language of economic battlefields and trade warfare" (Meunier & Nicolaidis, 2019, p. 103). Similarly, access to critical minerals is increasingly embedded in a context of global systemic rivalries and bloc formations. Russia's tight grip on Europe's (and especially Germany's) energy supply and China's dominance over mineral supply chains have prompted an intensive debate in highly industrialized Western countries on the criticality of their mineral supply.

The EU published its first list of critical raw materials (CRMs) in 2011 comprising 11 CRMs; a revised version released in 2023 lists 34 CRMs, including a sub-group of "strategic" minerals. For the EU, the criticality of a mineral is determined by its economic importance, EU and global supply concentration, EU import reliance,

Figure 1: National and regional shares of extraction, refining, and manufacturing for selected metals

%; base metals (aluminium, lead, nickel, tin, zinc); 2019



Source: Deutsche Rohstoffagentur (DERA), ROSYS – Rohstoffinformationssystem, https://rosys.dera.bgr.de (accessed 22 August 2022)

input of secondary materials, and technical substitutability (European Commission, 2023a, p. 14). The 2022 US list of critical minerals includes 50 mineral commodities considered "critical to the U.S. economy and national security" (United States Geological Survey, 2022). Similar lists have been published by Canada, South Korea, Japan, Australia, and the UK. As evidenced by the parameters used by the EU and US to determine the criticality of a mineral, it is not only the growing demand for certain minerals, but also the high market concentration and supply dependency that are at the center of the current political debate. This issue is particularly important for the US and the EU, since their industries are highly dependent on mineral imports from China.

China's influence on the global minerals market has grown significantly over the past two decades and now extends over large parts of the value chain – including extraction, processing, and component manufacturing. For example, the EU's demand for REEs and magnesium is almost exclusively met through Chinese imports; the US receives more than half of its needed supplies for 25 minerals from China (United States Geological Survey, 2023, p. 6). Aside from extraction, China has also established itself as a central player for the smelting and refining of minerals, accounting for more than 50% of the world's refined supply of natural graphite, dysprosium (an REE), cobalt, lithium, and manganese (IRENA, 2023, p. 35). A 2022 study by the IEA found that China's share within all the manufacturing stages of solar panels (from the extraction of polysilicon to the manufacturing of cells and modules) exceeds 80% (IEA, 2022). Through its unique leverage over these supply chains, China has not only been able to influence the global supply, but also the demand and price of solar photovoltaics (IEA, 2022, p. 7).

Western importers are increasingly worried that China is using its strategic position in mineral supply chains as a weapon for its (geo)political interests. This worry is substantiated by previous announcements of the Chinese leadership to impose trade embargoes on certain minerals in reaction to political or trade disputes; most recently, China responded to the US' export controls on semi-conductors with export restrictions of graphite. Around 90% of the world's graphite is refined in China, giving the People's Republic decisive power over its supply (The Economist, 2023). Within this context, the question of control over mineral supply chains has also progressively found its way into the national security debates of the US, France, Germany, and Japan, owing to the fact that, apart from clean energy technologies, minerals are also critical for the defense sector (Girardi et al., 2023).

Against this background, several importing countries have been working on policy strategies to secure access to critical minerals amidst rising geopolitical tensions and geo-economic competitiveness. The US in particular has adapted its economic policies and is increasingly relying on market-interventionist industrial policies, with the Inflation Reduction Act (IRA) being the most important one. Jake Sullivan, National Security Advisor to Joe Biden, has gone so far as to label this "The New Washington Consensus" (United States White House, 2023). The EU and its Member States have also followed suit with initiatives

such as the EU Critical Raw Materials Act (CRMA), which is currently under discussion along with several national initiatives (see Infobox). These new minerals policies provide for greater state intervention and aim to secure the supply of minerals. The strategies mostly follow a three-step approach: 1) increasing local mining and processing capacity, 2) diversifying international partnerships on minerals, and 3) boosting material efficiency and the circular economy of minerals. Despite similar objectives, the strategies of the US and other countries differ in terms of their scope, the depth of intervention, and the economic capital used to restructure supply chains.

The US Inflation Reduction Act, signed into law in August of 2022, provides around USD 370 billion in state funding for programs aimed at curbing inflation, advancing the green transition, and relocating key industries back to the US. With regard to the minerals sector, the IRA offers a 10% tax break to companies extracting critical minerals within the US. Minimum requirements already apply and are set to increase progressively over the coming years (Yergin et al., 2023). From 2027, 80% of the market value of critical minerals used in EV batteries must come from domestic extraction or from supplier countries with which the US has a free trade agreement (FTA). Similarly, as of 2029, 100% of battery components shall be manufactured or assembled in the US.

Presented as Europe's response to the IRA, in March of 2023, the European Commission proposed the Critical Raw Materials Act and the Net-Zero Industry Act (NZIA). The former sets benchmarks for the extraction (10%), processing (40%), and recycling (25%) of critical minerals within Europe. Going forward, it foresees that only 65% of the EU's demand for a critical mineral may be sourced from a single country. Although this policy is mainly targeted at reducing the supply dependency on China, it could also affect other suppliers of the EU, including South Africa (some platinum-group metals), Brazil (niobium), Turkey (boron), and Chile (lithium) (European Commission, 2023b). The NZIA complements the CRMA, as it seeks to boost the production of strategic net-zero technologies comprising renewable energy sources; batteries and storage; carbon capture and storage; and grid technologies (European Commission, 2023a). The goal is to cover at least 40% of the EU's annual deployment needs for these strategic technologies with EU manufacturing capacity by 2030 (European Commission, 2023a).

The limits of reshoring and nearshoring

The discussion about the implementation of industrial policy instruments by importing countries has triggered an intensive debate on the economic and political sense of re-, near-, and friendshoring strategies. Critical voices warn that the implementation of new industrial policies – especially the IRA – could lead to a global subsidy race and contribute to a further politicization of supply chains (Grimm et al., 2023; Jansen et al., 2023). While it is too early to assess the long-term implications of this new political approach to mineral value chains, initial empirical evidence suggests that – although reshoring downstream segments of the value chain (e.g., battery cell manufacturing and downwards) may yield the desired effects of domestic job growth and boost critical industries – domesticating the upstream part of the supply chain (i.e., mining and refining) will not likely be achieved in such a short time frame and without an extensive reform of the current political and economic frameworks by states and regions. This shows the key challenges in the diversification of these supply chains, especially at the stage of mining.

One of the main objectives of the Inflation Reduction Act, the CRMA, and the NZIA, as well as similar policies being pursued by Canada and Australia, is the relocation of mineral, EV, and CET supply chains to domestic or other "friendly" markets. By offering tax breaks, streamlining investment and permitting processes, and facilitating private and public funding, businesses and investors are enticed to return to markets that would otherwise be uncompetitive. Roughly one year after the implementation of some of the programs, a preliminary impact assessment shows significant variations, depending on the stage of the value chain. On the downstream side, policies being pursued by Western countries have stimulated investment in EV and CET supply chains. The number of gigafactories[6] across the world is projected to rise from 240 in 2023 to more than 400 by 2030. Although China is currently home to 82% of the world's battery production capacity, including seven of the ten largest battery makers, these policies will likely reduce this number to 68% by 2030. In Europe, Germany, Hungary, and France will be the hotspots for future gigafactories. However, due to "Europe's less exclusionary approach" toward China, it is projected that in 2030, 31% of the EU's battery production will be owned by Chinese companies, as compared to just 9.2% of North America's battery production (Benchmark, 2023c).

Encouraged by the ambitious benchmarks and financial incentives set by minerals policies, considerable investments have been announced for domestic mining projects. However, in contrast to the building of gigafactories, relocating mineral extraction to domestic markets hinges on a far greater number of factors and preconditions – first and foremost the geological availability of resources,

[6] The term "gigafactory" was originally coined by Tesla, Inc., and describes a large factory producing batteries for electric vehicles. The term is now being used generically, irrespective of the car manufacturer.

the economic viability of production,[7] the available energy and transport infrastructure, as well as social and environmental licenses to operate. Existing mineral reserves[8] in the US and Europe are largely untapped, as the mining sector has been retreating over the past decades. Lead times for a greenfield mining project to advance from exploration to operation can take up to 20 years, and permitting requires extensive social and environmental impact assessments and community engagement. For instance, at the start of 2023, the Swedish mining company LKAB announced the discovery of the largest European REE deposits in Sweden, spurring hopes of increased European supply autarky and reduced dependence on Chinese imports. However, even with LKAB's previous experience, the company is expecting large-scale production to commence only within the next 10 to 15 years (LKAB, 2023). Measures to reduce lengthy permitting timeframes are included in many of the aforementioned policies (e.g., the EU wants to limit the permitting timeframes for new mining projects to 24 months, and for processing and recycling projects to 12 months), but these policies have yet to come into effect. It remains unclear as to how much effect they will actually have on accelerating permitting processes without infringing on social and environmental standards (see section below on sustainability).

This analysis shows that reshoring and nearshoring critical mineral supply chains to domestic markets will only be possible for certain minerals, and increasing demand will likely surpass available supply. Although domestic battery recycling will reduce the net demand for primary minerals in the long run as EVs start reaching their end of life, it will take some time to develop the necessary infrastructure and technology for EV battery recycling. Projections for Europe suggest that, by 2040, up to 40% of Europe's demand for cobalt and 15% of nickel, lithium, and copper demand will be met by secondary sources (Schmaltz, 2023). This illustrates what has become known as the "raw material disconnect," whereby the demand and capacity for battery cell production vastly outpaces the supply of the required minerals. This supply squeeze of primary materials and components has already led to some delay in the opening of battery gigafactories in Europe; some gigafactories might not be able to open at all (Murray, 2022).

Even as the EU and US set out to increase their local and regional mining and processing capacities, they will both continue to rely on certain raw and refined mineral imports from global trade partners worldwide. It is also noteworthy that the focus of new investments and business announcements lies on new mining activities and the development of

[7] Economic viability of mineral production changes depending on commodity prices, demand forecasts, and extraction methods.

[8] Reserves describe measured and indicated deposits that have been deemed economically viable. Many countries have large mineral resources that are not currently considered to be reserves. These resources may become economically viable in the future, at which point they would be converted into reserves.

gigafactories, while less is heard about plans for new processing and refining plants. This is all the more important, as the processing and refining stage of the mineral value chain currently presents the biggest choke point – and therefore supply risk – because China dominates global processing capacities. Players in the G7 are already identifying with which resource-rich countries new arrangements in the minerals sector can be implemented.

The EU is already expanding its "strategic partnerships" on minerals, having struck the first agreement with Canada in 2021, followed by partnerships with Ukraine (July 2021) as well as Kazakhstan and Namibia (November 2022). Memoranda of understanding in preparation for strategic partnerships have been signed with Argentina (June 2021), Chile (July 2023), Zambia and the Democratic Republic of the Congo (DRC) (October 2023), and, most recently, Greenland (November 2023). Meanwhile, the US has engaged in negotiations with Saudi Arabia about intensifying their cooperation in the minerals sector – a move that would both serve the US' interests to decrease China's quasi-monopoly, as well as jumpstart Saudi Arabia's mining sector (Ansari & Schrolle, 2023). Apart from bilateral agreements, the US also initiated the Mineral Security Partnership, a consortium of 13 countries (as of November 2023) and the EU with the goal of developing diverse and sustainable critical energy mineral supply chains through joint strategic projects along the value chain (United States Department of State, 2023). This increased interest in new partnerships in the minerals sector has also changed the perspective of countries rich in minerals.

Perspectives of resource-rich countries

The increasing global demand for minerals described above has prompted several policy responses in resource-rich countries, aiming to maximize economic benefits and rents by fostering the growth of the downstream sector, encouraging value addition, and mitigating environmental and social impacts. At the same time, the growing awareness of leveraging the demand for minerals to their advantage has led several resource-rich countries to consider which minerals are central to their own economies and green transformation (Department of Mineral Resources and Energy Republic of South Africa, 2022; Ministério de Minas e Energia Secretário de Geologia, Mineração e Transformação Mineral, 2021; Ministry of Mines Republic of India, 2023).

Efforts to develop a common strategy to benefit from the global resource demand can also be observed in certain regions. These have been most visible in Africa, whereas regional efforts among countries in the Association of Southeast Asian Nations (ASEAN) as well as those in Latin America and the Caribbean have been much more limited. Currently, the African Union is working on a "Critical Minerals Strategy" to help resource-rich African countries advance industrial upgrading and integration into battery and EV value chains (African Natural Resources Management and Investment Centre, 2022). Efforts to promote regional integration are most pronounced in the Southern African Development Community (SADC), as several countries are advancing plans to build a regional "battery cluster" (Foli, 2020; Southern African Development Community,

2023). In contrast, a concerted regional approach toward minerals and other downstream supply chains is mostly absent in the ASEAN and Latin American and Caribbean regions. Although ASEAN has established several forums (such as the ASEAN Ministerial Meetings on Raw Materials) to implement its Minerals Cooperation Action Plan, concrete plans and outputs have barely materialized. Similarly, Latin and Central American countries have been slow in formulating regional strategies for mining and downstream value chains, also due to diverging political and economic interests (Müller et al., 2023).

Meanwhile, on the national level, countries endowed with highly demanded or scarce mineral reserves have recognized the unique window of opportunity presented by the rapidly growing demand. They have a vested interest in ensuring that the green transition does not simply fortify their extractive periphery status, but instead contributes to their industrial upgrading and integration into up- and downstream value chains. To achieve this, mineral-rich countries in the Global South are employing diverse policy tools to strengthen their mineral sectors. The range of policies extends from export restrictions (e.g., Zimbabwe, Namibia, Indonesia, Malaysia), increasing taxes and royalties (e.g., Argentina, Chile, Tanzania, Zambia), nationalization of critical resources (e.g., Mexico, Zambia, Zimbabwe), to contract renegotiations with mining companies (e.g., DRC, Mongolia, Peru) (van Halm, 2023).

Despite these efforts, it remains challenging for countries in the Global South to take advantage of their mineral endowments. There is an extensive body of literature analyzing the defiances for non-renewable mineral producing countries to translate revenues gained from extraction into long-term socioeconomic development and economic diversification. Commodity-dependent developing countries (CDDCs) have an interest in scaling up their mineral production without falling into the traps of the so-called Dutch Disease,[9] but instead increasing their value chain integration and value-adding activities.

Avenues for local value creation in mineral supply chains

Local value addition and value chain integration is most often pursued through the creation of downstream linkages into local mineral beneficiation and manufacturing (as illustrated below for the examples of Indonesia and Chile). As a large percentage of minerals extracted in CDDCs is exported to other countries (mostly China) for further processing (IRENA, 2023; Sun et al., 2017; van den Brink et al., 2020), investments in local smelting and refining capacities appear to be low-hanging fruit. However, the operation of smelters and refineries is both capital- and energy-intensive,

[9] The Dutch Disease describes an economic phenomenon by which booming extractive industries crowd out other sectors (such as trade or manufacturing), thereby causing further adverse effects such as currency appreciation and economic volatility (Corden & Neary, 1982; Mien & Goujon, 2022).

while profit margins are minimal (often in single-digit percentages) compared to other stages of the value chain (Fernandez-Stark & Bamber, 2021; Organisation for Economic Co-operation and Development, 2021). Expanding local processing facilities must therefore go hand in hand with investments in the domestic energy grid in order to provide for stable – and preferably renewable – energy supply. Recycling facilities, particularly for electronic waste such as lithium-ion batteries, require specialized expertise and technological infrastructure, while proximity to the consumer end-market (where recyclable materials originate) and the necessary infrastructure for secure transport should also be taken into consideration (Müller et al., 2023).

Significantly higher profit shares are generated at the manufacturing stage of the value chain, which is most often located outside of extraction countries. For example, lithium mined and processed in Chile or Australia is primarily used in the production of lithium-ion batteries in China, Japan, and South Korea, with the EU and US emerging as additional future production hubs. As with mineral processing, the production of semi-finished goods and end-products is contingent on a number of prerequisites, including a skilled labor force, the necessary technology and know-how, the proximity to consumer markets, an adequate power supply, the potential for economic scalability, and soft and hard infrastructure. Feasibility studies for local clusters – as currently underway in the SADC region – are therefore a good way to identify investment opportunities for building local content capacity and localizing additional segments of the value chain (Foli, 2020).

Aside from downstream linkages, CDDCs should also consider opportunities for increased upstream and horizontal linkages. According to calculations by the Natural Resource Governance Institute, around 45% of the annual gross revenue generated by the extractive industries flows into the supplier industry (Pitman & Toroskainen, 2020). Local suppliers are often well-positioned to develop solutions that are tailored to context-specific mining conditions, for example elevated or deep-level mining, specific weather conditions, or social dynamics (Calzada Olvera & Iizuka, 2022). Yet, research also shows that local suppliers often face challenges when trying to enter the value chain due to high entry barriers, rigid supply networks, and unequal power dynamics between lead firms and local suppliers. International mining companies are more inclined to rely on existing business partnerships and invest less in research collaboration with local providers (Molina, 2018; Stubrin, 2018).

Investments in upstream linkages have the potential to create a win-win situation for both mining companies and the producer countries (Morris et al., 2019). Collaboration with local suppliers creates jobs and capital flows, and it incentivizes local research and development, which, in turn, could contribute to making mining activities more cost- and resource-efficient and increase local community acceptance. Besides that, strengthening upstream linkages could also offer opportunities to tap into other branches of the economy, particularly the energy, infrastructure, and METS (mining equipment, technology, and services) sectors (Molina, 2018). The exploration and extraction of metals

requires specialized equipment that can be used not only in mining and metallurgy, but also in other industries such as mechanical engineering. Collaboration between different sectors has the potential to create a positive feedback loop: Mining companies can enhance their efficiency and profitability by leveraging expertise and technologies from companies in other sectors, while these companies can capitalize on existing demand to invest in the further development of their products and services, which can ideally be applied in other sectors as well (Ghebrihiwet, 2019).

Evaluating which avenue for local value creation is most useful depends on multiple factors, and hence needs to be judged on a case-by-case basis. Implementing a feasible policy mix to advance local value creation is thus a challenge that will occupy mineral-resource countries in the Global South for years to come. In the following, the cases of Chile and Indonesia are looked at more closely – two countries that, so far, have mostly focused on downstream investments.

Case studies: Chile and Indonesia

Chile and Indonesia – both currently exploring how industrial policies may serve to increase the value of their mineral sectors – share several similarities: They harbor vast resources of minerals considered critical by leading industrial countries (lithium and copper in the case of Chile, nickel and cobalt in Indonesia); up until a few years ago, their exports mainly consisted of minerals in the early processing stages; downstream capacities as well as links with other economic sectors were underdeveloped; and the majority of mining companies were owned by foreign entities. The resulting disadvantages were twofold: State revenues remained limited due to the rather low value of the mineral exports compared to downstream products, while being dependent upon the cyclical world market prices of minerals, which usually experience larger price swings than manufactured goods (Jacks et al., 2011; Stückler, 2002).

During the past 10 years, both Chile and Indonesia have been seeking to address these challenges via industrial policies and active state involvement. Their ambitions to reorganize their mineral sectors entail two key pillars: kickstarting the downstream sector to increase the value added in the respective countries and further integrate themselves in the global battery value chain, and restructuring the corporate landscape to increase state control. Yet, their policy choices to achieve these goals are quite different: Chile's National Lithium Strategy, presented in April 2023, may be described as a "soft approach" that dispenses with export restrictions and instead focuses on economic incentives like preferential lithium prices for companies that invest in value-added projects such as downstream facilities (Government of Chile, 2023). Recently, Chile's Mining Ministry proposed another strategy to boost domestic smelting and refining, this time for the copper sector: Modernizing existing refineries and smelters and building new plants in cooperation with the private sector should reduce exports of semi-processed copper, and thus reliance on (mostly Chinese) refining capacity (Atwood, 2023). Moreover, Chile is focusing on

cooperation agreements to support the establishment of its downstream sector, such as the ones with Germany and the EU, both agreed upon in 2023 (Bundesregierung, 2023; Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, 2023b).

Indonesia, on the other hand, is employing a more stringent and confrontational approach to develop its downstream sector, as it started banning the export of several unrefined minerals as early as 2014. Although this strategy has proven to be a fast way of attracting foreign investments to build nickel smelters and refineries, it has also raised international criticism, including a complaint at the World Trade Organization (WTO) filed by the EU alleging that this practice breaks free trade rules. Given the enormous expansion of processing capacity in Indonesia since the export ban and the significant rise in nickel-related exports – from USD 6 billion in 2013 to nearly USD 30 billion in 2022 (Abdurrachman, 2023) – this may still prove to be a case in point: Active state intervention, coupled with the willingness to hazard the consequences of (at least temporarily) breaching global trade rules, may under specific conditions be an effective way to boost domestic downstream investments, but it comes with a number of drawbacks (Terauds, 2017).

Their strategies also reveal some differences in their approaches to restructuring the corporate landscape: While lithium is currently produced by two private companies in Chile, its National Lithium Strategy will only allow lithium mining via public–private partnerships (PPPs) in the future. A National Lithium Company – yet to be created – will hold a majority control of at least 51% in the PPPs, which is meant to ensure greater state control and increase national revenues. In Indonesia, foreign mining companies holding mining licenses are obliged to gradually divest shares to Indonesian entities – either state-run or private – after 10–20 years of production. Depending on the mining method and on whether the company also possesses processing and/or refining facilities, after 25 years at the latest, 51% of the shares must have been transferred to Indonesian entities (Ginting & Dwitiasrini, 2021). In addition, the Indonesian government created the state-owned holding company MIND ID, to which it shifted its ownership stakes in mining companies, and thus provided the necessary capital for MIND ID to acquire majority ownership of the two largest mining companies in Indonesia: Vale Indonesia and Freeport Indonesia (Kim, 2023). The goal of Chile's and Indonesia's approaches is hence the same: expanding domestic control via majority shares and thereby incorporating the state in the production activities of mining and processing projects.

The following subsections outline Indonesia's and Chile's policy approaches in the minerals sector in more detail to provide a better understanding of their individual strategies, their effects, and actual as well as potential challenges. The concluding section of the chapter illustrates that, despite both countries' industrial policies aiming to enhance local value addition, their reliance on major mineral importers – particularly in China, the EU, and the US – could constrain their policy spaces in pursuing such objectives.

Indonesia: Incentivizing downstream investments via export controls

Indonesia ranks among the world's top-producing countries for several critical minerals, including nickel, cobalt, tin, and copper. In 2022, almost half of the world's nickel was mined in Indonesia, highlighting its global market power (IRENA, 2023, p. 39). Although nickel demand is still dominated by the stainless steel industry (60%), demand for higher-quality nickel to be used in batteries for energy storage and EVs – currently at roughly 20% – is rapidly surging and may overtake stainless steel demand in the late 2030s (Benchmark, 2023b). Initially, the country's nickel industrial strategy focused on establishing processing plants for the production of nickel pig iron suitable for stainless steel production, yet due to the increasing demand for battery nickel, its nickel strategy has now become part of Indonesia's ambition to establish an integrated EV supply chain (Huber, 2021).

In 2009, Indonesia made a first move toward expanding "the economic footprint of Indonesia's enclave mining industry" (Warburton, 2018, p. 92). The 2009 Mining Law was intended to increase the local value added and establish forward linkages by mandating certain mining companies to invest in local processing facilities within five years, after which only minerals with a defined purity level were allowed to be exported. However, by the 2014 deadline, there was a notable lack of progress, as companies largely focused on increasing the extraction and export of unprocessed minerals instead of targeting investments in processing infrastructure (Warburton, 2018, p. 94).

The Indonesian government thus introduced an additional policy in January 2014 that divided minerals into category 1 and 2 minerals. Those in the latter category – which includes nickel, bauxite, tin, gold, silver, and chromium – were banned from being exported from the country before reaching the legally mandated levels of processing. However, the ban was partially lifted from 2017 to 2020 to grant financial support to the state-owned nickel company Antam, which had suffered significant financial losses due to the export ban (Warburton, 2018, p. 98). During this period, export licenses were granted for raw nickel, copper, and bauxite only to those companies that provided evidence for the ongoing or completed construction of processing facilities and agreed to provide at least 30% of their nickel ores to domestic smelters (Republic of Indonesia, 2017). Instead of an outright ban, category 1 minerals (including copper, tin, lead, manganese, and zinc concentrates) could still be exported in raw form, but export licenses required the companies' obligation to finance smelting facilities, in addition to a significant export tax (Warburton, 2018, p. 96).

Although the mining sectors' share of total export revenue dropped significantly in the two years following the introduction of the export ban in 2014 – and government revenue losses are estimated to have amounted to USD 270 million during the period 2014–2017 – several positive effects did materialize in the long run. Before the export ban, only two nickel smelters were operating in Indonesia, whereas currently 43 nickel smelters are active,

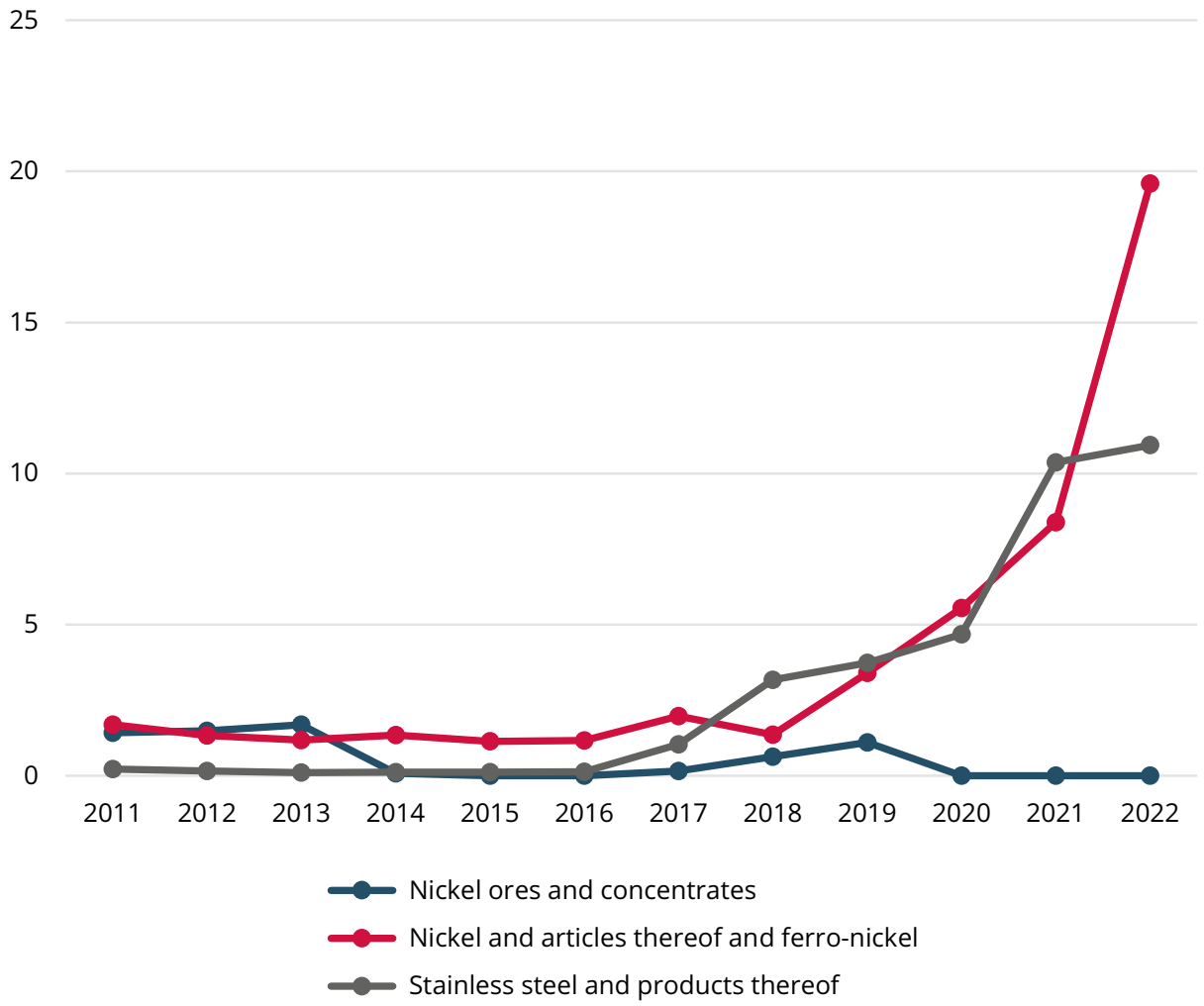
28 plants are under construction, and 24 further plants are being planned (Grace & Cindy, 2023). According to an IRENA estimate, foreign direct investment in nickel processing alone has exceeded USD 15 billion – however, the vast majority of these investments originate from Chinese companies, which are estimated to amount to a total of USD 14.2 billion over the last decade (Ho & Listiyorini, 2022; IRENA, 2023, p. 113). The resulting oligopsony, however, was to the detriment of Indonesian nickel companies during the first phase of the export ban: As they could no longer sell unrefined nickel products overseas, Chinese smelters were able to exert pricing pressure on domestic producers, who then lowered environmental and safety practices to decrease financial losses (Tritto, 2023).

Indonesian companies were not the only ones negatively affected by the export ban. The EU's complaint at the WTO was based on the grounds that the ban unduly restricts the EU's access to nickel, and thus disadvantages European stainless-steel producers, for which nickel is an indispensable pre-product. Indonesia appealed the initial WTO ruling of December 2022, which upheld all EU claims and stated that the export ban violates WTO rules; the process is currently pending and expected to take several years to resolve. Interestingly, the Indonesian government seems to have been well-aware of likely retaliatory action by other WTO members, as President Joko Widodo commented in 2022: "It looks like we will lose at the WTO, but it's fine, the industry is already built" (Reuters, 2022). Meanwhile, the EU is discussing possible countermeasures under its Enforcement Regulation, which may include placing tariffs on Indonesian steel and stainless steel – as not only refined nickel exports have surged since the export ban, stainless steel production has also experienced a significant boost (see Figure 2).

Indonesia's vision to move even further up the battery value chain is starting to become a reality, as investments in cathode, battery cell, and electric vehicle production are increasing (Timothy & Andriyanto, 2023). Hence, Indonesia is seeking to replicate the success in the nickel sector with other minerals: In July 2023, the export of unrefined bauxite was banned, and there are plans of extending the ban to copper, tin, and gold (Achmad, 2023). Yet, doubts remain whether these bans will be equally successful, due to Indonesia's lower global market power for these minerals and readily available substitutes, which carries the risk that mining will simply move to other countries (IRENA, 2023, p. 115).

Indonesia's case thus highlights that, although the strategic approach to incentivize downstream investments via export controls can spur a rapid increase in foreign direct investments, it does come with trade-offs: economic losses in the short term; heightened dependency on Chinese actors, know-how, and equipment; international resistance and legal disputes; as well as environmental costs (further explored below). Though equally determined to capitalize on its resource wealth via industrial policies, Chile is pursuing a very different strategy that is likely to circumvent some of these pitfalls.

Figure 2: Indonesia's exports (USD billion)



Source: UN Comtrade

Chile: Public-private partnerships and dual pricing to increase state control and incentive downstream investments

The exploitation of minerals and metals has been a cornerstone of the Chilean economy throughout its history. The country extracts a number of minerals, yet copper and lithium are of particular importance for net-zero technologies. Chile capitalizes on its image as a mining-friendly country with liberal laws for foreign investments and – in contrast to Indonesia until recently – had already established some refining and smelting facilities both for copper and lithium. Since 2000, Chile has been the world's largest copper producer – covering 27% of global copper production in 2021 – and is the second-largest producer of lithium, with a global market share of 26% (United States Geological Survey, 2023). Whereas in the copper sector a state-owned company, Codelco, has been the top copper producer in the country for many years, its lithium resources were exploited by two private companies. After decades of

marginal production volumes, starting in 2016, global demand surged due to the use of lithium-ion batteries in EVs. Endowed with almost half of the global lithium reserves, Chile is thus well-positioned to benefit from the current rush of countries around the world seeking to secure lithium supply – hence the government saw an opportunity to get a tighter grip on lithium production in order to maximize the benefits of extraction.

Before diving into the recent developments of Chile's lithium strategy, it is important to understand lithium's particular status in Chile. In 1979, the Chilean government classified lithium as a strategic resource, driven by national security concerns related to its potential use in tritium production for hydrogen bombs (Poveda Bonilla, 2020, p. 39). This classification excludes lithium from concessional mining regimes, which grant private companies extraction rights on publicly owned lands (Sanchez-Lopez, 2023, p. 36). The Constitution of 1980 further specified that non-concessional resources such as lithium could only be mined either by state actors or, under specific circumstances, by private actors – making the process to acquire licenses for lithium extraction in Chile rather complicated (Constitución Política de la República, Articulo 19, 24°). As of now, only two companies produce lithium in Chile: the Chilean private company SQM and US-based Albemarle. Both source lithium in the Salar de Atacama – the concession area granted to the state agency CORFO – with their mining permits expiring at the latest in 2030 and 2043, respectively. Codelco is the only company that was granted a special lithium operation contract (CEOL), but it has not yet started production (Azzopardi, 2023).

Recognizing the increasing importance of lithium and rising global demand, the Chilean government created the National Commission of Lithium (CNL) in 2014 to formulate recommendations for the further development of the industry. The recommendations also entailed contract renegotiations with Albemarle and SQM, concluded in 2016 and 2018, that include changes to the royalty rates paid by the companies as well as a redistribution of fiscal benefits to local governments and communities (Poveda Bonilla, 2020; Sanchez-Lopez, 2023).

The recommendations of the CNL also influenced the development of Chile's National Lithium Strategy, announced in April 2023. The strategy seeks to increase Chile's lithium production by tapping into new lithium deposits and attracting a diverse array of international lithium companies (Government of Chile, 2023). PPPs with the participation of a National Lithium Mining Company are envisioned as being the most promising way to increase state control and local benefits of lithium exploitation. The strategy also obliges companies applying for mining concessions to present a proposal for local value creation and productive inter-linkages with other sectors of the local economy (Government of Chile, 2023).

Like Indonesia, Chile is exploring opportunities to capture a higher share of the lithium-ion battery value chain by participating in the cathode, anode, electrolyte, and early stages of battery production. This aim is also reflected in the current contracts with SQM and Albemarle, which contain the provision that a maximum of 25% of annual production may be acquired at a preferential price by companies

developing value-adding projects in Chile. This approach, called dual pricing, is already bearing fruit, as two Chinese companies have been granted the right to obtain lithium carbonate from SQM at preferential prices until 2030 after declaring massive downstream investments: BYD announced a USD 290 million investment to build a lithium cathode factory in northern Chile, while Tsingshan Holding Group pledged to invest USD 233.2 million to set up a plant to produce lithium iron phosphate, which is also used for EV batteries. Dual pricing was, however, an issue of contention in the EU-Chile Advanced Framework Agreement negotiations: Dual pricing for raw materials will only be permitted under certain conditions, including for not setting a preferential price below the previous year's lowest export price of that raw material, thus limiting Chile's leeway to incentivize local downstreaming (European Union, s.a.).

Chile's industrial policy regarding its critical minerals presents a more modest approach compared to Indonesia, combining financial incentives, cooperation agreements, and PPPs. Although this strategy is unlikely to lead to international legal disputes, it seems that investments in downstream and other local sectors are developing at a much slower pace. However, this is partly attributable to the special status of lithium as a strategic resource, which has led to a complex institutional framework governing its extraction. Hence, the National Lithium Strategy also foresees modernizing this regulatory framework: The Chilean Chamber of Deputies recently proposed a bill to incorporate lithium into Chile's general regulatory framework, regulatory framework, eliminating the need for special contracts for its extraction (Diario Constitucional, 2023). Although this is likely to attract a diverse set of lithium producers to the country, there is also cause for concern as to whether the stated goal of preserving 30% of the salt flats ecosystem by 2030 will be achieved (Fundación Terram, 2023).

Chile, Indonesia, and the Global North: Industrial policies at odds?

How do these policies in mineral-producing countries interact with geopolitical trends and industrial policies in the Global North – and how might these influence the future of Chile's and Indonesia's mineral sectors? First, it needs to be highlighted that in both cases, China is and remains a key player: Not only are investments in downstream facilities dominated by China, it is also the number one export destination for lithium salts from Chile and nickel products from Indonesia. This dominance of Chinese actors may also become a challenge, as the US – which after China and Europe is the third-largest market for EVs (IEA, 2023) – has not yet defined the "foreign entity of concern" criteria for the IRA's USD 7,500 clean vehicle tax credit. If sourcing from Chinese companies or joint ventures prevents benefiting from the IRA, the fact that most smelters and refineries in Indonesia are in Chinese hands may incentive buyers to resort to nickel from other regions (Davies & Mercedes Ruehl, 2023).

Indonesia also does not have an FTA with the US – another prerequisite to attain tax credits under the IRA. Having recognized that its reliance on Chinese investments and the lack of an FTA could be a hindrance to accessing

the US market, Jakarta has asked Washington to discuss a limited trade deal that covers critical minerals such as nickel and cobalt (Reuters, 2023). Though Chile has an FTA with the US – putting it in a more favorable position than Indonesia – it may be prudent for both countries to focus on diversifying their export destinations as well as their portfolios of downstream investors, where feasible, to reduce dependency on single countries and navigate times of geopolitical turmoil.

Apart from the IRA, the EU's Battery Regulation constitutes another industrial policy from the Global North that is likely to affect mineral demand from Chile and Indonesia, albeit with different effects. A key feature of the Battery Regulation is the Battery Passport, which – among other things – obliges manufacturers to declare the carbon footprint of their batteries. The carbon footprint requirements are implemented in three consecutive steps, with the last one being the most relevant in this context: Starting in 2028, manufacturers will only be allowed to place batteries on the European market when they can demonstrate that the batteries do not exceed a certain maximum threshold regarding their carbon footprint (Battery Pass Consortium, 2023). This is likely to be to the detriment of Indonesian nickel producers in the long run, as their method of producing nickel that is suitable for batteries is highly energy- and carbon-intensive (see below).

Chile, on the other hand, may be able to capitalize on the fact that the carbon footprint resulting from producing lithium from salt flats is much lower than from other resources (Benchmark, 2023a). Its National Lithium Strategy also emphasizes the importance of further mitigating negative social and environmental effects, thus potentially benefiting from increasing sustainability standards. Moreover, the Chilean government has committed to the implementation of the Extractive Industries Transparency Initiative (EITI) standard, and its huge potential for green hydrogen production may further decrease the carbon footprint of its mining sector – however, civil society organizations remain skeptical as to whether these ambitions may actually help to mitigate the negative environmental and social effects (Sydow & Larraín, 2023).

These two examples highlight: while industrial policies in resource-rich countries may help to develop their downstream sectors and local value creation, their reliance on major consumer markets (mostly in the US, the EU, and China) means that they are inextricably affected both by industrial policies as well as efforts to increase sustainability in the Global North. The following sections thus examine the sustainability challenges that the mining sector is facing and explore the policy responses that these challenges have generated.

Beyond extraction: Sustainability challenges in mineral value chains

The global mining industry is currently undergoing major transformations. As the global demand for the minerals needed for the green transition rises, the mining industry is presented with an opportunity to convert its image – often associated with environmental pollution and human rights violations

– by positioning itself as a crucial component in global efforts to combat climate change. Under increased scrutiny with regard to ecological and social sustainability – both from governments as well as consumers and investors – mining companies are also obliged to make matters of sustainability and social inclusiveness an integral part of their business.

Transparency and due diligence obligations in (mineral) supply chains

In the last decade, government initiatives for (mineral) supply chain transparency and due diligence have sprung up. In 2017, the EU had adopted the Conflict Minerals Regulation, requiring European importers of tin, tantalum, tungsten, and gold (3TG) to source from conflict-free suppliers that meet international responsible sourcing standards. Supply chain due diligence legislations have been introduced or are in the making in several European countries, Canada, Japan, the UK, Australia, and the US; the EU is about to pass the Corporate Sustainability Due Diligence Directive (CSDDD), the most comprehensive mandatory supply chain regulation to date. Unlike the Dodd-Frank Act and the Conflict Minerals Regulation, the CSDDD applies a horizontal approach rather than focus on one specific industry sector. Nonetheless, it comprises a list of high-risk sectors (including the mining sector) that are subject to broader applicability and scope of the law. Once the provisional agreement reached in December 2023 is endorsed and formally adopted by the European Council and Parliament, the Directive will be transposed into domestic laws within two years by EU Member States. China has also taken action: In 2015, the China Chamber of Commerce of Metals, Minerals & Chemicals Importers & Exporters (CCCMC) published Due Diligence Guidelines for Chinese companies active in the minerals trade (CCCMC, 2015). Although voluntary, the guidelines mark an important step in China's approach to corporate social responsibility in international mineral trade, especially given the importance of China in global mineral supply chains.

Yet, these government-led supply chain obligations and initiatives are outnumbered by a plethora of industry-led initiatives. Through increased involvement in the upstream supply chain, international lead firms can leverage their power to also set certain standards. Certification schemes such as the Initiative for Responsible Mining Assurance (IRMA) and material-specific frameworks such as The Copper Mark present attractive formats for industry actors, especially as the CSDDD is likely to recognize certain multistakeholder initiatives and certification schemes as part of its "smart mix" approach. Above that, original equipment manufacturers also have a vested interest in actively shaping industry standards in order to avoid a "race to the bottom" and create a level playing field among competitors.[10]

As the number of supply chain governance initiatives grows, the challenge will be to streamline and integrate these different tools and processes as best as possible in order to make their implementation manageable for companies and supervising agencies, but also to avoid creating an inscrutable environment

[10] Interview with a representative from the automobile industry, October 2023.

of regulatory heterogeneity (Schleifer & Fransen, 2022). Moreover, current approaches to increased supply chain due diligence, such as the EU's CSDDD, are often criticized for their exclusionary character, that is, not taking into account the perspectives, needs, and interests of producer countries, despite the extraterritorial effects of these legislations (Luthango & Schulze, 2023). As supply chain governance mechanisms are evaluated and adapted, they should strive for a more inclusive approach, especially as producer countries in the Global South have equally advocated for and developed their own sustainability standards over the past years. As the demand for certain minerals spurs increased mining activities, regulatory frameworks for responsible mining must incorporate producer countries' interests concerning long-term economic development as well as social and environmental sustainability. It is also in the interest of consumer countries to pay more attention to the needs and interests of producer countries as they seek to forge new raw material partnerships and present themselves as attractive bidders in an increasingly competitive race for these minerals.

Achieving social and environmental sustainability in mining projects

One of the biggest challenges of the upcoming years will be to navigate the apparent conflict of interest between scaling up mineral production to unprecedented levels of intensity and pace while safeguarding high ESG standards. Both the CRMA and the IRA foresee a massive expansion of domestic mineral production by the end of this decade (European Commission, 2023a, p. 19). At the same time, many mining companies as well as state policies have subscribed to the notion that mining shall only take place under strict ESG standards that include close engagement with, and the consultation of, affected communities[11] as well as environmental impact assessments. By its nature, the process of building trust with mining-affected communities, creating appropriate community development and benefit plans, and undertaking multi-seasonal environmental impact assessments takes time.

Mining companies as well as policy-makers should therefore adjust their expectations to realistic timeframes for the development of new mining projects. This would not only allow for more realism and honesty in the political debate around the diversification of supply chains. In the worst case, accelerating permitting processes for new mining projects will prioritize security of supply over matters of sustainability or induce a race to the bottom with regard to ESG

[11] In countries with Indigenous populations, this is often also mandated under the framework of the Declaration on the Rights of Indigenous People (UNDRIP).

standards, which will ultimately also infringe on the resilience of mineral supply chains (Eggert & Hartmann, 2022; Fahimnia & Jabbarzadeh, 2016). In this regard, it is worrisome to learn of fast-tracked mining projects funded by Western companies that have been accused of foregoing community concerns about environmental harm (as in the case of a new lithium mine in the US; see Morin, 2023) or enforcing the eviction of local communities for new mining projects (as e.g. in the DRC; see Ruf, 2023). If allowed, this "double standard" of industrialized countries that are tying mineral partnerships with producer countries from the Global South to high ESG standards and value chain due diligence – while at the same time decimating their own social and environmental regulations for mining activities at home – would actively undermine their credibility with international partners and jeopardize the opportunity for a renewal of mineral partnerships between consumer and producer countries (EU Raw Materials Coalition, 2023).

An essential element of responsible mineral extraction is mining companies' engagement with surrounding communities. To this end, mining companies increasingly turn toward Community Development Agreements (CDAs), also sometimes known as Impact Benefit Agreements, which seek to address the community's interests and needs for long-term development, and thereby contribute to a more equitable distribution of the positive and negative effects associated with mining activities. Despite criticism of the unequal bargaining relationship between communities and companies, the design and enforceability of such agreements, and the shifting responsibility to provide public services away from the state to private industry actors (McEwan et al., 2017; Nwapi, 2017; O'Faircheallaigh, 2013, 2015), CDAs will likely continue to play an important part in the relationship between mining companies and mining-affected communities.

It is therefore important that they cater toward the long-term needs of communities and take into account possible upcoming transformations in the mining industry. For instance, the progressing automation of mining activities will change the landscape of the mining sector, as it reduces the number of entry-level jobs, which have often been held by members of surrounding mining communities (Paredes & Fleming-Muñoz, 2021). New mining projects therefore need to design community development plans that – at least to some extent – decouple community benefits from the mining project and infrastructures, for example by offering vocational training that allows for easy transferability and applicability in a post-mining setting. In a similar vein, CDAs should include post-mining revitalization provisions to restore ecological health and biodiversity as well as opportunities to repurpose mining sites for future economic or social activities (Gastauer et al., 2018).

Increasing levels of value chain activity in mineral supply often correspond to a higher energy demand and might therefore also lead to additional CO_2 emissions, especially when they rely on fossil fuels. For example, in Indonesia, the increased energy demand for smelting operations has created a significant rise in CO_2 emissions due to the large share of coal in Indonesia's energy mix – in

2022, Indonesia burned more coal than ever before, with the expansion of nickel smelting being a key driver (Jong, 2023). Moreover, deforestation, water pollution, land grabbing, and conflicts with Indigenous groups pose other serious challenges that come with increased mining and processing activities (Morse, 2021). It is therefore critical that the expansion of local processing capacities goes hand in hand with programs to advance the green energy transition and strategies to address environmental challenges. An increasing focus on circularity – both on the process and product levels – is hence key to maximizing resource efficiency while minimizing environmental impacts (Assumma et al., 2022; Upadhyay et al., 2021).

Conclusion

Global geopolitical dynamics are increasingly affecting the organization of mineral value chains. The criticality of certain minerals for the green transition, defense sector, and digitalization paired with the high geographic and supplier concentration for some minerals is feeding fears that the access to and control over critical minerals will be weaponized in international relations. The race for critical minerals is thus embedded in a wider systemic rivalry between major global economies on the one hand (especially the EU and the US), and China, Russia, and their allies on the other hand. Nonetheless, also within each of these blocs, the pursuit of a steady supply of critical minerals has fanned competition. As a result, the US and the EU – along with a number of industrialized countries – have launched comprehensive industrial policy programs and diplomatic efforts to reduce import dependence and diversify their supplier networks. To this end, the new political dictum to reshore and nearshore certain mineral value chains is likely going to yield only mixed results.

Although relocating downstream segments of the value chain may prove to be relatively feasible, the possibility to reshore and nearshore the upstream part of the mineral value chain is limited by a number of factors, first and foremost the availability of geological reserves and the viability of production. Even as permitting processes and financial investment opportunities are streamlined, the mineral disconnect between the upstream and downstream supply chains will likely remain a challenge for importing countries in the years to come. This means that many countries will continue to be dependent on imports of minerals from different countries worldwide.

The current situation therefore offers an opportunity for resource-rich countries that are keen on seizing this opportunity by developing new critical mineral and green industry strategies. Some argue that producing countries now have a better bargaining position and can therefore make better deals that reflect their long-term needs and interests due to the increasing competition among consumer countries (Müller, 2023). This Special shows that countries such as Chile and Indonesia are already demonstrating initial successes. At the same time, current developments must be examined in the medium and long terms. Furthermore, both Indonesia and Chile have already been more strongly integrated into supply chains and have pushed ahead with

their own industrialization projects. To gain a better understanding of the successes and failures of minerals policies in resource-rich countries, it is therefore also important to take a closer look at the interests and strategies of countries that were less industrialized in the past and have less favorable conditions. It is already clear that new developments in the fields of clean energy technology, innovation in mining, and the digital sector are opening up new supply chains without pre-existing supplier networks, which may allow local suppliers in producer countries to enter the supply chain more easily.

Last but not least, the question arises as to whether issues of sustainability in the extraction and processing of minerals are being neglected in light of the current pressure to secure supplies. This concern is not unjustified, especially as even actors in the EU are advocating for lowering standards (Zimmermann, 2023). In addition, studies indicate that mineral imports from countries with currently low standards are also necessary to ensure security of supply. A study conducted in 2023 by Johns Hopkins University analyzed the potential for mineral production in the US and its key partners to satisfy future demand.[12] The study examines a subgroup of metal producers comprising democratic countries and those that are classified as "like-minded" partners by the US. The authors find that, although known reserves in all democratic countries would theoretically be sufficient to cover global deployment needs in 2030, this would require unprecedented levels of mining production and international coordination. Moreover, significant supply shortfalls and bottlenecks for cobalt, graphite, lithium, nickel, silver, tellurium, and tin occur when a) calculating with US FTA partners only (as incentivized by the IRA), and b) employing a more restrictive classification of democratic and like-minded countries, which would exclude mineral producers such as Argentina, Brazil, Bolivia, Indonesia, Mexico, Peru, Poland, and South Africa (Allan et al., 2023).

However, the mining sector is a risk sector because the extraction of minerals is always associated with high risks regarding compliance with sustainability and human rights standards. Political decision-makers should take these risks seriously, especially as weaker sustainability standards may be suitable for approving projects quickly in the short term, but can lead to negative externalities in the medium and long terms. These not only have a negative impact on people and the environment, but they can, in turn, become a supply risk themselves if they lead to strikes or protests on the ground. The implementation of new mining projects in the EU should therefore be accompanied by high standards. The EU should also seek dialog at an earlier stage when setting

[12] It should be noted that quantifying future demands remains subject to fallibility, as technological progress – especially with regard to material efficiency, substitutability, recyclability, and circular economy – might change the landscape of mineral supply and demand significantly in the future.

standards with extraterritorial effects. The discussions about EU due diligence regulations show that such initiatives are not rejected per se by others, but are often perceived as protectionist instruments due to the lack of involvement of economic partners. An early exchange can enable the EU to shape its standards in such a way that they can be realistically implemented by economic partners.

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Special: Toward shorter and greener supply chains? Understanding shifts in the global textile and apparel industry

Toward shorter and greener supply chains? Understanding shifts in the global textile and apparel industry

Felix Maile is a PhD Researcher at the Department of Development Studies at the University of Vienna. His PhD investigates the role of financial markets and shareholder value on the sourcing strategies of apparel retailers and brands, the related power dynamics along the apparel GVC, and what this means for value capture in supplier countries. He is further interested in the role that finance plays in decarbonizing globalized industries, and the related distributional effects between financial market actors and multinational corporations from advanced economies, and governments and firms in low- and middle-income countries.

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1. Introduction

Since the outbreak of the Covid-19 pandemic, the textile and apparel (T&A) industry has been subject to unprecedented market volatility. Massive numbers of order cancellations and related losses in supplier countries were followed by a rapid recovery in orders, only to be succeeded by supply overstock and declines in demand. At the same time, there have been intensified discussions about transformations in the sector, which include digitalization and the shift to online sales; environmental sustainability in terms of low-carbon and circular production and supply chain laws; and de-coupling from China given the US-China trade war and the Uyghur Forced Labor Prevention Act (UFLPA). These transformations have

sparked debates on the nearshoring of apparel assembly closer to key end markets of the European Union (EU) and the United States (US) as well as on the verticality of textile production, that is, the integration of spinning yarn, weaving or knitting fabric, and sewing apparel in one country or region.

Geoeconomics – that is, policies centering on strategic access to resources or end markets and transnational economic governance to support domestic sectors or firms – and geopolitics, that is, policies focusing on security- and military- but also value-based considerations of territorial control (e.g., Raza et al., 2021), are not at the forefront of all of these transformations, but they play a prominent role. Also, historically, geoeconomic and -political endeavors have been central in the development of the T&A industry. This has been most pronounced through industrial and trade policy, such as Multi-Fibre Arrangement (MFA) quotas, regional and bilateral trade agreements, and other types of preferential trade agreements (PTAs), where economic concerns are often uneasily interlinked with security concerns (Gereffi & Frederick, 2010; Staritz, 2011; Whitfield et al., 2021). In recent years, geoeconomics and -politics have again become more prominently related to tensions between China and the US, and more generally around global economic governance – tensions that have been accelerated by Russia's invasion of Ukraine.

There is, however, little systematic evidence on the scale and drivers of the portrayed transformations in the T&A industry and their implications for supplier firms and countries. The report aims to answer a) to which extent these shifts are materializing and leading to shorter and greener T&A supply chains, and b) which factors (geoeconomics/-politics, regulations, strategies of firms, technology) are driving them.

The methodology is based on the business strategies of top buyers and transnational first-tier suppliers (FTSs). Even though the T&A sector is a classic buyer-driven global value chain (GVC) with large buyers such as retailers and brands being the lead firms, large globally acting FTSs – headquartered predominantly in South Asia and East Asia – have emerged since the 1990s. With buyers focusing on the high-value activities of design, branding, and marketing, these FTSs and other suppliers are the ones engaging in production-related investments, and transnational FTSs often pioneer new trends and implement shifts in geographical sourcing to new "low-cost locations." They also tend to serve as role models for smaller supplier firms. Therefore, the methodology includes interviews with selected representatives of FTSs, in addition to a few buyers as well as industry experts (see Appendix I for a list of interviews). The interviews with FTSs focus on a set of firms from South Korea, Hong Kong, and Sri Lanka, given the central role of these locations (in addition to Taiwan and China and, on a smaller scale, India, where getting access was difficult). The FTS and buyer strategy analysis is supplemented with a review of the corporate reports of selected FTSs and buyers and, where available, the financial data analysis of listed companies, as well as trade and industry magazines. To assess the geographical restructuring of the industry, a systematic media analysis of global investments in nearshoring

and verticality since the beginning of the Covid-19 pandemic is also conducted, triangulated with trade data from UN Comtrade.

The report begins with a short overview of the development of the global T&A industry since the second half of the 20th century, and the importance of geoeconomics and -politics. It then introduces the role of top buyers and transnational FTSs in the T&A GVC. The main section assesses the scale and drivers of the abovementioned transformations. The last section concludes.

2. Geoeconomics and -politics and the development of the T&A industry

Given its low entry barriers (low fixed costs, relatively simple technology) and labor-intensive nature, the T&A sector has provided employment for large numbers of unskilled – mostly female – workers and export income for countries around the world. At the same time, it came with low wages and problematic working conditions for apparel assembly workers (Marslev et al., 2022). Moreover, industrial development effects have often been limited, and when they occurred, they happened through the more capital-, scale-, and skill-intensive textile sector (Whitfield et al., 2021). This also explains why apparel assembly has always shifted to peripheral regions. Historically, this included, firstly, moving to non-union states in the US South; to Northern Ireland in the United Kingdom (UK); to Central Europe and later Eastern Europe, North Africa, Central America, and the Caribbean; and finally to new low-cost regions in countries of the Global South in Asia and also Africa (Marslev, 2019; Pickles et al., 2015; Whitfield et al., 2021). The uneven distribution of outcomes is also related to the intense competition and asymmetric governance structure of the buyer-driven GVC of the T&A sector, where buyers act as lead firms managing the far-flung global networks of supplier firms that produce T&A products according to their requirements.

Geoeconomics and -politics have always played a central role in the T&A industry and its transformations, largely through trade policy (Dickerson, 1999; Pickles et al., 2015). Preferential market access, quotas, tariffs, and complex rules of origin (ROO) shape the decision-making processes of buyers and suppliers, and they are important determinants of how, where, and by whom rents are produced and captured. These policies, in turn, are shaped by the interests of – and power relations between – different types of firms and states and their respective positions within the global T&A industry. Domestic textile industries generally aim for protection, whereas increasingly powerful buyers are interested in cheap imports and therefore seek trade liberalization and expanded access to global locations (Pickles et al., 2015). Many trade policies do address (geo-)economic interests but are blended with geopolitical endeavors. Both the US and the EU present trade policy as security and development policy, which has become ever clearer in agreements such as the African Growth and Opportunity Act and the Qualifying Industrial Zones with Egypt and Jordan in the case of the US, and the Euro-Mediterranean Partnership in the case of the EU.

In the 20th century, the declining competitiveness of labor-intensive production in the core (Europe, North America) prompted a regionalization of apparel assembly to lower-cost regional[13] supplier countries. But different types of outward processing schemes – where capital-intensive textile inputs needed to be sourced from core countries – protected the textile industries in the Global North (Pickles et al., 2015). This was followed by the globalization of the industry and the shift toward low-cost production in Asia, starting in the 1950s with Japan and expanding in the 1970s to Taiwan, Hong Kong, and South Korea. It was in the interest of the US that these countries' T&A sectors grew and had positive development effects to counter communism; but these countries also grew because there was increasing demand and, at this time, few countries and firms were competing for T&A production (Whitfield et al., 2021).

In the 1950s, the interests of the domestic textile industry in Europe and North America drove quotas, first for cotton-based textiles and later for synthetic textiles, which led to the MFA quota system in 1974. Although the motivation was the protection of textile production, the quotas fostered the dispersion of apparel assembly, as buyers searched for new supplier countries once established ones such as Japan, South Korea, Hong Kong, Taiwan, and later China and India reached their quota limits (instead of moving back to the core). In particular, supplier firms from Hong Kong, Taiwan, and to a lesser extent South Korea spread their operations to other Asian countries and, in the 1990s, also to Latin America, the Caribbean, and African countries (Gereffi, 1999; Gereffi & Frederick, 2010).

With the creation of the World Trade Organization (WTO) in 1995, quotas were phased out at the end of 2004. Nonetheless, tariffs and different types of PTAs still remain important and are linked to geoeconomic and -political interests. In the US, tariffs also vary for different product categories, with polyester-based T&A products having substantially higher tariffs than cotton-based products, as the polyester-based textile industry is more competitive. PTAs are governed by ROO, which have a crucial impact on outcomes. ROO state which production steps or shares have to take place in a country in order to benefit from preferential access and avoid trans-shipment and "light" processing to circumvent tariffs from non-beneficiary countries. Stricter ROO can support backward integration in supplier countries, but they may also hinder market access for lower-income countries, which face challenges in developing textile industries, given their higher scale and capital intensity.

Hence, in the second part of the 20th century, T&A production consolidated in key countries in Asia at the expense of higher-cost regional supplier countries. But regional sourcing remains important in the context of fast fashion, in which buyers require short lead times and flexibility as well as regional trade agreements that provide tariff reductions. Therefore,

[13] We refer to "regional" in terms of the proximity to the end market, both for the Global North and the Global South.

there has always been a multi-tiered production structure, with global and regional suppliers playing a role. Table 1 shows that regional suppliers to the US and EU-15 accounted for 4.8% and 12.2% of global apparel exports in 2022, respectively; in the US market, they accounted for 16.4%, while in the EU-15 market it was 17.2% (which is explained by the smaller size of the US market; see Appendix II for US an EU apparel imports). However, they had declined from 35.4% and 27.7% in the US and the EU-15 market from 2000 levels, respectively. This is largely explained by the increasing share of China throughout the 2000s and early 2010s after its entrance into the WTO in 2001 and the phaseout of the MFA at the end of 2004.

Table 1: Top global apparel exporters

	2000	2005	2010	2015	2019	2022
World	100%	100%	100%	100%	100%	100%
China	24.9%	33.8%	42.9%	37.0%	30.3%	25.9%
Bangladesh	2.5%	3.0%	5.1%	8.0%	9.7%	11.9%
Vietnam	0.9%	1.8%	3.3%	6.2%	8.1%	8.9%
Turkey	3.5%	4.8%	4.5%	4.3%	4.7%	5.2%
India	2.6%	3.6%	4.0%	4.0%	3.9%	3.7%
Cambodia	0.6%	1.0%	1.3%	2.4%	3.1%	3.3%
Indonesia	2.4%	2.1%	2.4%	2.7%	2.4%	2.5%
Pakistan	0.9%	1.0%	1.1%	1.4%	1.7%	2.2%
Myanmar	0.4%	0.1%	0.2%	0.4%	1.5%	1.7%
Sri Lanka	1.4%	1.2%	1.2%	1.3%	1.3%	1.4%
EU-15 regional supplier	12.1%	13.6%	11.5%	10.9%	11.8%	12.2%
CEE20	5.6%	5.5%	4.1%	3.9%	4.1%	4.0%
MENA4	3.0%	3.2%	2.9%	2.7%	3.0%	3.0%
Turkey	3.5%	4.8%	4.5%	4.3%	4.7%	5.2%
US regional supplier	11.6%	7.9%	4.8%	4.7%	4.5%	4.8%
Central America	3.6%	3.0%	2.2%	2.4%	2.5%	2.8%
South America	5.4%	3.5%	1.9%	1.6%	1.4%	1.4%
Caribbean	1.6%	0.9%	0.4%	0.5%	0.5%	0.4%
Mexico	4.6%	2.5%	1.3%	1.1%	0.9%	0.8%

Source: UN Comtrade (2023)

The focus of supplier countries has been on liberalization and the spread of export processing or special economic zones to provide infrastructure and fiscal incentives for T&A production. Some countries have also offered substantial subsidies, from cotton to T&A production. The most prominent examples are the remaining high cotton subsidies in the US, and China's and India's subsidies on apparel exports (Baffes, 2011; Mukherjee et al., 2019). Some supplier countries have also tried to use industrial policies to pursue T&A-based development strategies to incentivize or demand, for example, local input sourcing. Such policies are more prevalent in countries with a historic tradition in T&A production, such as in South Asia. In addition, countries with large domestic apparel markets have a long tradition of protecting their domestic markets (Pickles et al., 2015).

Regarding end markets, Europe, the US, and Japan remain the major importers in the global apparel industry, together accounting for 78.1% of global apparel imports (see Appendix III). However, end markets in the Global South have gained in importance. In large emerging retail markets such as China and India, which in 2021 accounted for USD 285 billion and USD 73 billion, respectively, the share of domestic production is more than 96% (UN Comtrade, 2023). This suggests that global buyers are increasingly dependent on China and other large Global South markets as end markets, which also means that they are vulnerable to changing market access regulations for stores and online sales.

3. The role of buyers and transnational FTSs in the T&A industry

Despite consolidation at the buyer level, there is still variety between different end markets in terms of size, with US buyers generally being larger, whereas European end markets have more small- and mid-sized buyers. In 2022, the top 10 global buyers accounted for only 10% of the global market share, which is substantially lower than in sectors such as chocolate and PCs, where the top four lead firms alone accounted for 55% and 74% of the global market share, respectively (Staritz et al., 2022; Statista, 2023). Table 2 shows the top 10 apparel lead firms in 2022, including apparel specialty retailers that operate large retail fleets and brands which sell the greatest share of their goods in department stores. Given that demand in major end markets has been sluggish since the 1980s, there has been intense price competition at the retail level. But buyers managed to secure high profitability, as shown by an average return on capital employed (ROCE) of 18% since the early 2000s (Orbis, 2023). Lead firms exercise purchasing power by setting prices and defining the requirements for suppliers (lead times, flexibility, non-manufacturing capabilities such as input sourcing, logistics, supply chain financing, design, social and environment compliance) and create profits mainly based on "cost markups," as they reduced their sourcing costs substantially in the context of oligopsonistic market structures (Marslev, 2019). The distributional outcomes of these market structures have been coined "supplier squeeze" (Anner, 2020), whereby suppliers have

Table 2: Top 10 apparel lead firms (2022)

Firm	HQ	Firm type	Revenue in USD millions (2022)	Return on Capital Employed (ROCE) (2020–21)	No. of apparel suppliers (2022)
TJX	US	Apparel retailer	49,270	25.8%	N/A
Nike	US	Brand	49,107	19.7%	388
Shein	CH/SG	Apparel retailer (online)	22,700	N/A	ca. 7,000
Adidas	DE	Brand	22,008	11.9%	424
H&M	SE	Apparel retailer	20,504	31.4%	605
Fast Retailing	JP	Apparel retailer	17,152	14.0%	432
GAP	US	Apparel retailer	15,898	14.9%	N/A
VF	US	Brand	11,791	11.9%	808
PVH	US	Brand	8,965	6.4%	553

Source: Orbis (2023), annual reports, websites
Note: The list includes corporations that generate the majority of their income from apparel products and excludes multi-product retailers (such as Walmart) and luxury brands (such as Dior), as their supply chains include substantial shares of non-apparel goods.

to fulfill higher requirements in terms of quality, lead times, and flexibility, but it results in stagnant or constant prices. This is also visible in the financial results of the top 10 lead firms. Total costs for the sourcing needed for these firms to achieve their revenue targets declined from 58% in 2000 to 50% in 2010; these percentages have since stagnated (Orbis, 2023).

There are profound differences among supplier firms regarding their size, the functions they perform, and their capabilities. Since the 1970s, transnational FTSs have emerged to operate their own far-flung global production and sourcing networks (Appelbaum, 2008; Azmeh & Nadvi, 2014; Merk, 2014). Many of them grew in tandem with buyers and now account for substantial shares of the sourcing volumes of specific buyers. The first generation emerged

Table 3: Top four transnational FTSs from Hong Kong, South Korea, and Sri Lanka

Firm name	Country	Revenue in USD millions (2022)	Global sourcing network, including former locations
Crystal Group	HK	2,491	Vietnam, China, Bangladesh, Sri Lanka (8 former locations)
Esquel	HK	1,300	China (9 former locations)
TAL	HK	700	Vietnam, Thailand, China, Ethiopia (7 former locations)
Epic Group	HK	500	Bangladesh, Ethiopia, Jordan (1 former location)
Youngone	SK	3,911	Bangladesh, El Salvador, Vietnam, Ethiopia, India
SAE-A	SK	1,314	Guatemala, Nicaragua, Indonesia, Vietnam, Haiti, Costa Rica, Dominican Republic (1 former location)
Hansae	SK	959	Nicaragua, Vietnam, Indonesia, Guatemala, Myanmar, Haiti (2 former locations)
Hansoll	SK	676	Guatemala, Vietnam, Indonesia, Cambodia, Nicaragua (1 former locations)
MAS	SRI	2,400	Sri Lanka, India, Haiti, Bangladesh, Indonesia, Kenya, Jordan, Vietnam, Dominican Republic, Mexico (3 former locations)
Brandix	SRI	747	Sri Lanka, India, Bangladesh, Haiti, Cambodia (2 former locations)
Hela	SRI	226	Sri Lanka, Ethiopia, Kenya, Egypt
Hirdaramani	SRI	N/A	Sri Lanka, Bangladesh, Vietnam, Ethiopia

Source: Annual reports, websites of FTSs

from Taiwan, Hong Kong, and South Korea in the 1970s and 1980s, when local firms began to offshore apparel assembly due to rising labor costs in their home countries, and when the MFA quota restrictions came into force in 1974. Since the 2000s, some larger supplier firms from China and Sri Lanka – and more recently Indian firms, – have transnationalized as well in response to rising labor costs at home and begun offering their buyers "multi-country sourcing."

Transnational FTSs have played a key role in integrating new countries into the apparel GVC (Gereffi, 1999) and offer "one stop shops" for buyers that cover the entire supply chain beyond manufacturing, including: product design; fabric development; sourcing of textiles and accessories; quality control and implementation of social and environmental compliance; digitized product flows; and logistics and warehouse capacities across multiple locations. Table 3 shows the top four transnational FTSs from Hong Kong, South Korea, and Sri Lanka. Firms from Hong Kong have particularly high capabilities in implementing IT-related services. Korean transnational FTSs have high capabilities in textile manufacturing and focus on verticality in their sourcing locations. Transnational FTSs from Sri Lanka have grown rapidly in recent years by establishing themselves as key suppliers of more complex products, such as intimate apparel and sportswear.

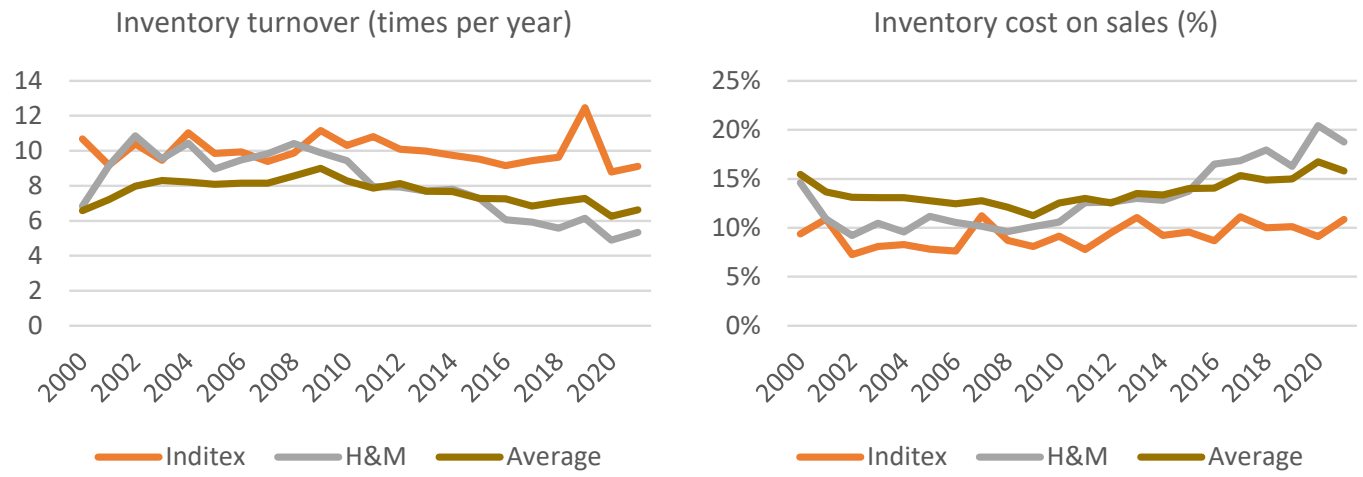
4. Key transformations in the T&A industry

4.1 Digitalization: Reduce inventory costs via online sales?

In response to sluggish demand since the 1980s, lead firms in the T&A industry followed fast fashion strategies to increase sales and profits, which transformed T&A GVCs substantially. Pioneers of that model, such as Inditex (which is the parent company of Zara), H&M, and Fast Retailing, grew rapidly by replacing the traditional fashion calendar (two to four collections per year) with monthly (or bi-monthly) collections, in combination with the rapid expansions of their physical store networks. This required a more "responsive" supply chain in which suppliers could shift quickly to different styles and reduce lead times – from more than one year to less than two months (Taplin, 2014; Tokatli, 2008). As a result, the industry's sales volume doubled between 2000 and 2020, and particularly the revenue of large brands and retailers engaged in fast fashion soared by 405% in that period (Orbis, 2023).

At the same time, the fast fashion model led to a failure in managing inventory efficiently. This produces immense levels of waste (as discussed in Section 4.2), reduces margins, and binds working capital. Despite the narrative of just-in-time production, buyers have large inventories, and much of their assortment is either sold with high markdowns or not at all. It is estimated that 30% of all apparel goods produced remain unsold, with inventory costs totaling up to USD 210 billion globally in 2018 (van Elven, 2018). Figure 1 (left) shows the annual inventory turnover of the top 10 lead

Figure 1: Inventory turnover (per year) and inventory cost on sales for top 10 lead firms



Source: Orbis (2023)

firms and measures how many times they are able to replace their supply stocks. It suggests that firms became slightly more efficient in managing their inventories during the 2000s, but this trend reversed after 2009, with Inditex performing slightly better. Figure 1 (right) shows that high inventory levels bound substantial amounts of working capital and accounted for more than 15% of generated sales revenues in 2021. The main strategy that buyers are currently pursuing is better anticipation of consumer demand. As the consumer data that can be generated in physical stores is limited to sales numbers, lead firms have turned increasingly to online sales to anticipate consumer demand more accurately, in addition to being able to pursue more aggressive online advertisement strategies.

The industry experimented with online sales throughout the past two decades, but the entrance of so-called ultra-fast fashion brands in the years prior to the Covid-19 pandemic and their rapid growth during the lockdowns made online retailers more popular. These firms demonstrated speed to market on an unprecedented scale, with delivery times of less than two weeks and up to 4,500 new products per week (Wahnbaeck, 2019). The major brands are from the UK (Asos, Bohoo, Pretty Little Thing) and also most prominently Chinese-owned Shein, which is based in Singapore. They deploy "test and react" models to anticipate trends based on social media analyses and "heat maps" on their websites. They then produce micro-orders, often in nearshoring or onshoring facilities. Those orders that perform best are then produced on a larger scale, mostly in offshoring locations. Despite the extremely short delivery times, most ultra-fast fashion firms still operate supply chains dominated by suppliers in Asia (ASOS, 2021; López et al., 2021).

The extreme example of an ultra-fast fashion model is Shein. It develops algorithms to replenish individual articles automatically based on tracked user data from its app. This is possible because its supply chain includes 6,000 firms, which are connected to Shein's online sales via real-time data. As online consumers pay up front, Shein has no working capital that is bound. Shein requires suppliers to produce small minimum order quantities of 100 to 500 pieces, with assembly setups being modified on a day-to-day basis, which puts enormous pressure on management and workers. The model allows Shein to have an inventory turnover that is three times higher than those of other lead firms, reducing the rate of unsold inventory on overall sales to 2% (Yang et al., 2023).

Other lead firms are following the model of online retailers. Nearly two-thirds of respondents to a survey conducted by the consulting firm QIMA in 2020 expressed that Covid-19 had further encouraged their efforts to digitalize their supply chains (Barrie, 2020). E-commerce and the use of social media as a way of obtaining customer loyalty also increased sharply as a result of Covid-19. For the top 10 buyers (except TJX and Shein), online sales accounted for 26% of all sales in 2022. Only a few large buyers, such as Primark, have not yet engaged in online sales, as they regard the investment costs to be too high and see profit margins being potentially squeezed by high levels of returns. Increasing online sales requires changes in supply chains, such as increased verticality and multi-tiered production structures, including onshore distribution networks and to some extent nearshore or onshore assembly in addition to offshore capacities. Therefore, the geographical configuration of the T&A industry will be affected if more buyers shift to this business model. Transnational FTS production and sourcing networks have to follow buyers' strategies, as they are the ones that invest in production facilities. They may also need to hold a larger number of inventories for buyers and invest in warehousing.

Shifting to online sales also has social and environmental implications. Plank et al. (2014) show how fast fashion led to problematic working conditions in regional supplier countries, where shorter lead times and increased flexibility translated into a flexible workforce, intensified working processes, and delayed wage payments. This tends to be accelerated with ultra-fast fashion online retailers, where time and flexibility pressures are even higher, both on the factory floor but also in warehouses and for logistics (López et al., 2021). Apparel waste is a key environmental concern in the T&A sector, and handling various inventories more efficiently can help reduce this waste. But online sales come with their own environmental problems, such as increased packaging linked to micro-shipments and particularly high levels of returns. More importantly, the key aim of (ultra-)fast fashion is to increase consumption, and therefore production, which is directly opposite of reducing overall environmental impacts and emission levels.

4.2 Environmental sustainability: Transparency, renewable energy, recycling, and alternative fibers as new norms?

The rise of the fast fashion model transformed the T&A sector into the second most pollutive industry globally. Its CO_2 emissions doubled between 2000 and 2020, accounting for 8% to 10% of all emissions globally. Furthermore, textile dyeing and bleaching accounts for 20% of global industrial water pollution, and residuals of man-made fibers are responsible for one-third of oceanic primary microplastic pollution. Additionally, the industry produces more than 90 million tons of textile waste annually (Anguelov, 2015; Niinimäki et al., 2020). The bulk of the industry's emissions and pollution are a result of fiber production (38% of CO_2 emissions) and textile production (29%). Cotton production is predominantly based on the intensive use of water, fertilizers, and pesticides. The creation of oil-based, man-made fibers, the spinning of yarn, and weaving and knitting all require huge amounts of energy that is predominantly generated via fossil fuels (McKinsey, 2020). Recently, however, a set of regulations in the three largest end markets (US, EU, Japan) focuses more on environmental sustainability.

The first set of regulations contains mandatory corporate sustainability reporting. What is unique is that this reporting not only includes greenhouse gas emissions arising from a firm's own operations (Scope 1 and 2), but also those generated in their supply chains. The EU's Corporate Sustainability Reporting Directive entered into force in January 2023 and requires all listed firms and larger non-listed firms to report emissions, set targets, and show progress (European Commission [EC], 2022). The same applies to listed US firms under the new Climate Disclosure Rule of the US Securities and Exchange Commission (SEC). The Financial Services Agency in Japan will introduce similar requirements on climate reporting for listed firms in 2024 (Fuminaga & Nagano, 2022).

The second set of regulations includes mandatory supply chain due diligence laws that require lead firms to increase transparency in their supply chains (e.g., France in 2017, Germany in 2021, and the EU in 2022). While at this point the regulations are still being debated in the trilogue negotiations between the European Commission, the Council of the EU, and the European Parliament, once implemented, the EU Corporate Sustainability Due Diligence Directive obliges EU-based firms to identify potential negative impacts on human rights and the environment and to take measures to prevent or mitigate these impacts. Although the actual text of the Directive is still subject to negotiations, it is clear that its impact depends on the extent to which the whole supply chain is covered and whether buyers' sourcing practices are addressed, given the context of the supplier squeeze (see also Sustainable Terms of Trade Initiative, 2021). Japan is preparing a similar law; in the US, the NY Fashion Sustainability & Social Accountability Act only focuses on fashion firms operating in New York state.

The third set of regulations is industry-specific and broader in scope, aiming to move away from the fast fashion business model toward a circular economy approach. The most prominent regulation is the EU

Strategy for Sustainable and Circular Textiles, which was adopted in March 2022 and implements the EU Circular Economy Action Plan in the T&A sector. The strategy aims at creating a market where recycling technologies are used on a large scale. This includes the rollout of 16 regulations that contain requirements on eco-design to ensure repairability and recyclability, and a minimum threshold for the recycled content of new apparel goods. The strategy further requires extended responsibility by the producer: Lead firms selling on the EU market need to invest in collection, re-sorting, and recycling infrastructure and are prohibited from selling or destroying unsold inventory without ensuring its re-use. Furthermore, the strategy aims to address "greenwashing" by requiring that the sustainability claims of lead firms are comparable and verifiable (EC, 2023).

As a response to these regulatory shifts, lead firms are particularly active in two areas. The first is reducing emissions in the retail space – which only account for a marginal share of emissions – and, more importantly, in their supply chains. But there are also stark differences among the top 10 firms, as can be seen in Table 4. Firms such as H&M aim to achieve much higher reductions in their supply chain emissions (-56%) compared to Nike (which committed to stabilize – but not reduce – its supply chain emissions). Overall, 361 firms that operate in the T&A industry – including the top 10 lead firms – set goals for reducing emissions as part of the Science Based Target Initiative (SbTI, 2023). However, lead firms shift the financial, organizational, and technical responsibilities for reducing greenhouse gas Scope 3 (GHG 3) emissions onto their suppliers in most cases.[14] FTSs have to switch to renewable energy in their factories, source fabrics from mills that reduce their emissions, and upgrade their machineries and facilities with energy-efficient components. The progress has to be reported via reporting schemes such as the Higg Index, which was designed by the Sustainable Apparel Coalition, which covers 157 buyers and 40% of the industry (Sustainable Apparel Coalition, 2023).

Offering these new sustainability services to buyers does not result in higher prices. Instead, they become new minimum requirements (as was the case before with social compliance becoming a new minimum criterion for buyers entering supply chains and not for extra rewards) (Khan et al., 2020; Khattak et al., 2015). Ponte (2019) asserts that buyers demand increased environmental standards from suppliers without rewarding them in terms of higher prices, more secure orders, or co-financing of investments, all of which accelerate the supplier squeeze. As one sustainability representative of a transnational FTS

[14] Although there is no multi-country and industry-wide study on this issue, there are studies on individual country experiences in Pakistan, Sri Lanka, and Ethiopia (see Khattak et al., 2015; Khan et al., 2020; Jensen & Whitfield, 2022). All interviews that we conducted with FTSs and our observations on industry meetings and in industry magazines suggest that supplier firms do not receive higher prices to compensate for measures that they themselves have invested in.

stated: "We are not only suppliers but also the think tanks of buyers." As firm-level investments – for instance rooftop solar installations – cannot provide the amounts of renewable energy required, many government and T&A industry associations in producer countries have positioned themselves as sustainable sourcing locations by developing or expanding a renewable energy market. These substantial government investments – for example those offered in Bangladesh, Vietnam, and India – are increasingly expected by buyers as a minimum requirement.

The second way in which lead firms have been active is by scaling the share of fibers that produce substantially fewer CO_2 emissions during production and are recyclable. Currently, the industry has a recycling level of only 1%, and even for this small share the predominant feedstocks are PET bottles and not apparel. But in recent years, many startups have pursued the development of chemical procedures that allow for fiber-to-fiber recycling, including for apparel from polyester and blended materials, which have so far been particularly difficult to recycle. Some lead firms, most significantly H&M, signed off-take agreements to accelerate the commercialization of these technologies, or even invested in these startups. On top of that, many startups now develop man-made cellulosic and bio-synthetic textile fibers, which share similar features with man-made polyester and cotton fibers. New feedstocks could be comprised of biomass from agricultural waste and fungi cells such as mycelium (Bio Market Insights, 2022; Whitfield, 2022). Most of these technology providers are located in the Global North and receive funding from lead firms or venture capital. It is likely that firms which successfully commercialize a new technology can capture higher value, whereas FTSs and textile mills will have to pay license fees to use these new fibers.

Some retailers also offer "fair fashion" by building up "sustainable brands" or using specific labels based on higher social and environmental standards or declare that they produce regionally, for example in Europe. A few brands, such as H&M, have also begun to experiment with rental concepts. But these initiatives are a small niche and so far have had no larger-scale transformative impact, as the market for "ethical fashion" is estimated to account for only USD 5–10 billion per year, which equals to 0.15–0.3% of the global market (Research and Markets, 2023). In sum, it remains questionable as to whether the abovementioned sets of initiatives have been effective in creating a sustainable T&A industry, as lead firms are still pursuing the central strategy of increasing consumption and production without moving away from the (ultra-)fast fashion business model. The EU Textiles Strategy on Circular Economy is the only initiative that aims to go beyond this model.

4.3. "China+1 strategy": De-risking from Xinjiang but not from China?

China was the largest T&A producer in the world throughout the 1990s. Since the early 2010s, Chinese firms have responded to rising labor costs by increasing automation, increasing economies of scale and scope, expanding the ecosystem of suppliers for accessories, and pursuing outward investment, particularly in Vietnam (Altenburg et al., 2020). On top of that,

Table 4: Environmental sustainability goals of top 10 lead firms

Firm name	Goals on GHG 3 emissions (own emissions)	Goals on GHG 3 emissions (supply chain)	Goals on renewable electricity in supply chain	Concrete goals on fibers
TJX	-55% (2017–30)	None	None	None
Nike	-70% (2015–30)	+/-0% (2020–25)	None	50% sustainable or recycled materials by 2025 (sustainable materials include organic and third-party certified cotton)
Inditex	-90% (2020–30)	-20% (2018–30)	None	100% cotton and polyester from more sustainable sources by 2023 100% polyester and linen from more sustainable sources by 2025
Adidas	-30% (2017–30)	-29% (2017–30)	Adoption of renewable energy for core apparel and textile suppliers	"Nine out of ten Adidas articles should be sustainable, meaning that they are made with environmentally preferred materials"
H&M	-56% (2019–30)	-56% (2019–30)	100% renewable energy by 2030 in entire supply chain	100% recycled or more sustainable by 2030 30% recycled fibers by 2025
Fast Retailing	-90% (2019–30)	-20% (2019–30)	None	None
GAP	-90% (2017–30)	-30% (2017–30)	None	100% BCI cotton by 2025, now at 79% 45% of polyester from recycled sources (rPET), currently at 10%
Shein	-42% (2021–30)	-25% (2021–30)	None	None
VF	-55% (2017-30)	-30% (2017–30)	Support for selected suppliers to install renewable energy	100% cotton sourced is grown in the US, Australia, or under a third-party cotton-growing scheme by 2026 (currently at 79%) 50% of polyester will originate from recycled materials by 2026 (currently 26%)
PVH	-30% (2017–30)	-30% (2017–30)	None	Sourcing 100% of sustainable (certified or organic) cotton and viscose by 2025 100% of sustainable polyester by 2030

Source: Annual reports, SbTI (2022)

China also became a huge end market, accounting for USD 310 billion (Judd & Jackson, 2021). Given the strong concentration of T&A sourcing in China, buyers have discussed a "China+1 strategy," which entails a reduction of exposure in China and a diversification of sourcing to other countries – without leaving China, however. This strategy has become particularly important for US buyers since 2018 in the context of rising tensions between the US and China, which led to the US imposing a tariff rate of 15% on USD 31 billion worth of T&A products; the rate was later reduced to 7.5% (Lu, 2020). In a survey conducted by the consulting firm QIMA in 2020, 95% of US-based companies surveyed said they wanted to change their supply structures due to the Covid-19 pandemic and the trade war with China, whereas this was true for fewer than half of the interviewed European firms (Barrie, 2020). In another survey with US buyers conducted in July 2023, 61% indicated planning to replace China as their main destination for apparel sourcing, with 80% preparing to reduce apparel sourcing from China over the next two years (United States Fashion Industry Association [USFIA], 2023). As trade data shows, the respective shares in the world market for China, the US, and the EU-15 declined from 42.9% to 25.9%, from 39.8% to 22.4%, and from 31.3% to 20.1% between 2010 and 2022, respectively (see Table 1 and Appendix II). Nevertheless, China remains the number one apparel exporter, and its role as a textile exporter to other apparel-producer countries also continues to be crucial.

However, the "China+1 strategy" – and hence "de-risking" from China, that is, reducing the risk of high exposure to sourcing from or production in China – acquired a new dimension when the US introduced the UFLPA in the US in 2021, which was followed with plans by the EU to introduce a similar law. The UFLPA presumes that any good which was made in whole or in part in Xinjiang was made with forced labor from prisons or detention camps. The law identified the cotton–textile–apparel industry as one of four target sectors. US importers need to prove to US Customs and Border Protection authorities that goods imported from companies that have operations in China were not produced using forced labor. They must do this by providing transaction and supply chain documentation or via DNA isotope tests of the fibers. Given that 85% of China's cotton production is based in Xinjiang and China accounts for 20% of the global cotton supply, this affects all major buyers selling in the US, but also textile mills and apparel manufacturers across the globe. At the same time, China is a key polyester-based fabric supplier accounting for two-thirds of global polyester production, which in turn makes up to 50% of global textile production. The polyester mills are located in the Eastern Jiangsu and Zhejiang region and are not affected by the ban (Decon, 2021). Up to now, only seven cotton and T&A firms out of the 36,000 estimated T&A manufacturers based in China have been registered in the so-called entity list (Homeland Security, 2022). For those firms that are on the entity lists, even foreign subsidiaries are not allowed to sell to the US market. The Hong Kong–based Esquel Group, which operates three spinning mills in the Xinjiang region, is the largest supplier to have been put on the list. It announced the closure of its Sri Lanka subsidiary due to order cancellations from US buyers (Wickramasingha, 2023).

US and European buyers try to navigate between the UFLPA on the one hand, and China's existing importance as a supply base on the other. Reducing the level of sourcing of raw materials for textiles from China is even more challenging than shifting apparel assembly. In the abovementioned survey with US buyers, more than 70% of respondents stated that they have no short-term alternatives for various yarns, fabrics, and textile accessories from China (USFIA, 2023). Balancing these issues becomes even more delicate for those firms for which China constitutes a major end market. In the case of Russia, all top 10 lead firms (except Shein) withdrew their retail businesses after Russia's invasion of Ukraine. Depreciation costs were not overwhelmingly high; only Inditex and H&M made more than 2% of their revenue in Russia, and none more than 5%. However, the picture is different in the case of China, where all major firms – except Shein and TJX – generate at least 5% of their revenue, and three firms (Nike, Fast Retailing, PVH) more than 15%. Furthermore, Chinese suppliers still account for more than 20% of the supply base for seven of the top 10 lead firms. Already prior to the implementation of the UFLPA in March 2021, the Chinese government was calling for a public ban of H&M, Adidas, and Nike, which had published critical statements on the human rights situation in Xinjiang. These brands were removed from online search engines, which effectively cut off their access to Chinese consumers, and their stock prices dropped by up to 6% within days. The targeted brands relativized their statements and instead publicly underlined the importance of the Chinese market. Other brands, such as VF, PVH, and Inditex, removed similar statements before being targeted by the Chinese government (Chua, 2021).

Another area of geoeconomic and -political tension is the expansion of Chinese-owned online retailers such as Shein and Temu in Global North end markets, and particularly the US, sparking a debate on tightening regulations for these companies. Shein started operations in 2012 and became the fourth-largest apparel company in 2022. Chinese online retailer Temu launched its US business in 2022 and has already gained 100 million active customers in its first year. A recent report published by the US-China Economic and Security Review Commission (USCC) regards these two firms as posing "data risks" similar to those of other Chinese players such as Huawei and TikTok, and it recommended that the US Senate considers several regulatory gaps. These include Shein's exploitation of the "de minimis rule," which exempts shipments that fall under the threshold of USD 800 from any import duties, meaning that Shein does not have to pay any tariffs on its direct-to-consumer orders. The USCC further stressed the lack of transparency in Shein's supply chain, as the UFLPA does not apply to de minimis orders or the violation of intellectual property rights by copying the designs of other brands. Furthermore, the US SEC called for a detailed investigation of Shein's supply chain before Shein could pursue its envisioned initial public offering in the US (USCC, 2023). As a reaction, Shein aims to appear as a non-Chinese company and diversify its supply chain closer to end markets. It de-registered its China HQ, relocated it to Singapore, and opened a regional HQ in Dublin. It further aims to increase production in Latin America and re-enter the Indian

market – from which it was banned in 2020, together with 85 other Chinese companies due to geopolitical tensions on the Chinese-Indian border; in the European market, it started sourcing from 1,000 suppliers in Turkey (Ndure, 2023).

4.4 Shorter supply chains: Increased investments in nearshoring and verticality?

The three shifts discussed above (online sales/speed model, environmental sustainability, geopolitics/de-risking from China) have important spatial implications. The Covid-19 pandemic and related supply chain distortions and cost hikes for transportation have spurred debates about nearshoring. But, as our interviews suggest, the main driver of the nearshoring of apparel assembly – and particularly verticality of textile supply – is speed to market, linked to online sales, in order to reduce inventory. According to an industry expert, some lead firms are beginning to regard verticality, in combination with environmental sustainability, as equally important as labor costs. But, particularly for US buyers, geoeconomic and -political tensions and the China-US trade war also play an important role, as shown in the abovementioned survey. Another survey by McKinsey from 2021 that covers 10 large US and European buyers suggests that 70% of these companies were planning to increase nearshoring, and 25% were even planning to relocate back to the country where the head office is located, with Turkey and Central America being the most favored nearshoring destinations (Heidrich et al., 2021). However, a quick realization of this plan was hampered by constraints on increasing capacity, both for apparel and particularly for textile supply in the short term. As an industry consultant on nearshoring investments in Central America said about the year 2022: "Buyers are trying to buy more in Central America, but can't – suppliers are maxed out."

Although trade data does not yet show any large shifts to nearshoring or verticality, we can observe increased investments in assembly that are closer to end markets, and particularly in regional verticality and ecosystems regarding accessories (e.g., buttons, zippers, elastics, labels). The transnational FTSs that invest in nearshoring often do this in connection with micro-onshore factories and/or warehouse capacity in end markets. Investments in Central America are particularly strong due to the US-China trade war and also given that the US government is pushing these investments as part of its "strategy for addressing the root causes of migration in Central America," which includes a public–private "Partnership for Central America" (US White House, 2023). This has resulted in numerous investments in T&A capacity, but also large purchase commitments by US buyers. According to the White House, its "Call to Action" led to USD 585 million in investments and sourcing commitments by US buyers in the first two years; this has been paired with USD 680 million in investments for renewable energy production in regions that can provide energy for nearby industry (Safaya, 2023).

Table 5 shows the announced investments in regional verticality for textile production, and into the nearshoring and onshoring of apparel assembly, based on a systematic media analysis of the two main apparel industry

Table 5: Announced investments on verticality, nearshoring, and onshoring (March 2020 – July 2023)

Country	Verticality	Nearshoring	Onshoring
Mexico	4	5	
Haiti		1	
Guatemala	3	3	
Dominican Republic		1	
Costa Rica	1	1	
El Salvador	2	3	
Honduras	5	3	
Brazil			1
US	7		5
Sri Lanka	1		
Bangladesh	1		
Vietnam	2		
India			1
Italy	1		
Jordan		1	
Egypt	2	3	
Turkey	1		

Source: Based on key word searches for "verticality," "nearshoring," and "onshoring" in Just Style magazine and the Sourcing Journal, March 1, 2020, to July 31, 2023

publications, Just Style magazine and Sourcing Journal. Between the beginning of the Covid-19 pandemic – when debates on nearshoring began to gain more traction – and July 2023, there were announcements on 28 investments in verticality, 21 for nearshoring, and 6 for onshoring. The combination of verticality with the scaling-up of assembly production in nearshoring locations was particularly pronounced in Central America and Mexico.

Transnational FTSs play a key role in these investments, as their ability to offer multi-country sourcing provides them with a competitive advantage over other suppliers. In a recent survey of executives from apparel lead firms, 65% of respondents are considering creating nearshoring capacity in manufacturing hubs that are dedicated to serving US and European end markets. In that context, 61% announced that forming strategic partnerships with their suppliers is key to achieving this (McKinsey, 2023). Korean FTSs made particularly high investments in textiles in Central America to create supply of regional fabric. Hansae, the second-largest Korean FTS, partnered with a local textile mill in Guatemala to expand spinning and knitting capacity. This capacity can feed into Hansae's apparel assembly plants in Guatemala, Nicaragua, and Haiti, with the goal of providing its main buyers – Target, Gap, Walmart, and Kohl's – with speed-to-market solutions. Sae-A Group, another Korean firm, invested USD 150 million into its yarn spinning capacity in Costa Rica to ensure regional fabric supply for its network of assembly plants across five countries in the region. Sri Lankan FTSs, such as Hela and MAS, invested in building a regional supply chain in East Africa. Hela, which has two factories for intimate apparel in Kenya and Ethiopia, acquired another plant in Egypt. It also partners with a textile mill in Tanzania to increase regional textile inputs. Some FTSs from Hong Kong aim to reduce textile imports from China by building verticality into their main production hubs in Bangladesh and Vietnam. Together with Hong Kong–based textile manufacturer Pacific Textiles, Crystal Group invested more than USD 500 million in an integrated textile mill in Vietnam, and it further acquired mills in Vietnam (2021) and Bangladesh (2022) to provide shorter lead times to US, European, and Japanese markets (based on Table 5). These investments underscore the selective but increasing importance of local and regional textile supply for remaining competitive in the T&A GVC as a supplier firm and location.

5. Conclusions

This report demonstrates that important transformations are materializing in the global T&A industry. Online sales have increased and are the key strategy of buyers to deal with inventories and reduce working capital. But implementing this strategy requires a change in supply chains, including smaller batch production, verticality, and a combination of onshore, nearshore, and offshore production and distribution facilities, which not all buyers and suppliers will be able to manage. Therefore, it will remain a selective strategy for specific buyers and specific product lines. If successful, this strategy will make supply chains shorter, as most strongly pronounced currently in Central America. Disruptions in supply

chains, transportation cost hikes, and geoeconomically and -politically motivated policies to support nearshoring – as is being pursued by the US government – reinforce this trend.

Environmental sustainability has become a central sourcing requirement. Emission reductions are expected as a minimum criterion for suppliers to remain in supply chains, without additional value capture, however. Access to cheap renewable energy has therefore become an important competitiveness factor, with governments investing in renewable energy capacity to attract buyers and transnational FTSs. At the same time, technological shifts in fiber recycling and new types of bio-based fibers may provide higher value capture for first-mover firms that are thus far concentrated in the Global North. Whether supply chains become greener will depend on the actual scale of implementation, particularly regarding renewable energy and low-carbon and recycled fiber, but also on the overall growth of the sector. Although environmental impacts per unit can be expected to decrease, an absolute reduction in the industry's emissions will not be achievable if the industry continues to follow its past growth strategy. A key contradiction is that industry-driven sustainability initiatives, as well as the move to online sales, are motivated by retaining the (ultra-)fast fashion sales model.

Geoeconomics and -politics have played an important role throughout the history of the T&A industry, as can be seen still in trade and industrial policies. Today, the most prominent manifestations are in four areas: (i) US tariffs and the UFLPA have accelerated the diversification of the sourcing base of US buyers away from China in particular, but China will remain important as a production and end market location; (ii) through the rise in online sales, the T&A industry has become subject to data security concerns and provides governments with the means to exclude lead firms overnight from end markets; (iii) state policies that encourage nearshoring, policies that up to now have been most pronounced in the US and target Central America (in relation to migration policies), whereas the EU has focused on creating a market for recycling technologies; and (iv) the rise in regulations for transparency and sustainability that are not directly based on geoeconomic and -political endeavors but could become interwoven with them in the future.

The transformations in the T&A industry are also being driven by the strategies of firms and related technological developments. The rise in regulations for transparency and sustainability has motivated lead firms to adapt sustainability issues more proactively (with large differences among firms, however). The increase in online sales has been driven by the strategies of firms dealing with inventories and working capital, and it was the large-scale adaptation of data analytics by ultra-fast fashion retailers that demonstrated the business case for online sales. In order to de-risk from China, increase online sales, and enhance speed to market, buyers are increasingly following a multi-tiered sourcing structure. Such structures were in place throughout the 20th century, but the nearshoring dimension of regional suppliers (which always existed) was reduced to the benefit of offshoring in the 2000s

and 2010s, particularly in the US. Supplier firms, in turn, and especially transnational FTSs, see online sales and the related nearshoring trend as opportunities to improve margins by offering unique services (McKinsey, 2023). For some FTSs, sustainability-related services also play a central role in being able to distinguish themselves in the eyes of buyers – however, without increased value capture, with the potential exception of new recycling and fiber technologies.

In light of these transformations, the geographies of the T&A industry will change within multi-tiered structures, shifting again to more nearshoring and particularly verticality, but offshore production in Asia will remain dominant. Hence, nearshoring will be selective – it is currently focused on Central America and potentially Turkey – and reshoring back to the US or Europe is so far limited in the area of small batch assembly and, more importantly, new textile and recycling supply chains. Although de-risking from China will provide opportunities for other supplier countries, the increased requirements of buyers (CO_2 emission reductions, renewable energy, even shorter lead times, higher production flexibility, multi-tier production structures, verticality, recycling) raise the entry barriers for supplier firms and might lead to further consolidation among transnational FTSs that have the necessary capacities and capabilities and can offer multi-country strategies.

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Appendix I

List of interview partners

Date	Location	Interview partner
June 2022	Industry meeting, Denmark	Industry consultant
June 2022	Industry meeting, Denmark	Sustainability manager of FTS
September 2022	Ethiopia	Country manager of FTS based in South Korea
October 2022	Kenya	East Africa regional manager of FTS based in Sri Lanka
November 2023	Online	Industry consultant for Central America
January 2023	Online	Former supply chain head of US-based lead firm
January 2023	Online	Sourcing representative of FTS based in Sri Lanka
February 2023	Online	Sourcing representative of FTS based in Hong Kong
February 2023	Industry meeting, US	Owner of FTS based in Guatemala
March 2023	Kenya	Regional sourcing officer of FTS based in Sri Lanka
March 2023	Kenya	Industry consultant

Appendix II

EU apparel imports

	2000	2005	2010	2015	2019	2022
World	100%	100%	100%	100%	100%	100%
EU-15 (Intra)	31.4%	29.6%	25.8%	26.4%	27.3%	27.7%
China	11.2%	21.7%	31.3%	26.0%	21.2%	20.1%
Bangladesh	3.7%	4.4%	6.6%	11.3%	13.3%	15.0%
Turkey	7.5%	9.4%	8.3%	7.8%	7.5%	7.8%
India	3.0%	4.2%	4.9%	4.5%	4.0%	3.4%
Vietnam	1.1%	0.9%	1.6%	2.6%	3.1%	3.3%
Pakistan	0.9%	1.0%	1.1%	1.9%	2.3%	2.7%
Cambodia	0.4%	0.6%	0.8%	2.5%	3.2%	2.7%
Myanmar	0.4%	0.2%	0.1%	0.3%	2.0%	2.1%
Morocco	3.2%	2.6%	2.0%	2.0%	2.1%	1.9%
Poland	2.5%	1.1%	0.9%	1.1%	1.3%	1.8%
EU-15 regional supplier	*27.7%*	*26.1%*	*20.6%*	*18.4%*	*17.6%*	*17.2%*
CEE20	13.0%	10.8%	7.6%	6.6%	6.2%	5.6%
MENA4	7.2%	5.9%	4.7%	4.0%	4.0%	3.7%
Turkey	7.5%	9.4%	8.3%	7.8%	7.5%	7.8%

Source: UN Comtrade (2023)

US apparel imports

	2000	2005	2010	2015	2019	2022
World	100%	100%	100%	100%	100%	100%
China	10.5%	24.0%	39.8%	36.2%	30.2%	22.4%
Vietnam	0.1%	3.8%	8.0%	12.2%	15.9%	17.9%
Bangladesh	3.3%	3.3%	5.4%	6.1%	6.8%	9.3%
India	3.1%	4.4%	4.4%	4.3%	4.9%	5.7%
Indonesia	3.5%	4.1%	6.1%	5.8%	5.2%	5.6%
Cambodia	1.4%	2.4%	3.1%	2.9%	3.2%	4.4%
Honduras	4.1%	3.7%	3.4%	3.2%	3.4%	3.2%
Mexico	14.6%	8.5%	4.9%	4.2%	3.8%	3.1%
Pakistan	1.6%	1.9%	2.1%	1.7%	1.8%	2.8%
Nicaragua	0.6%	1.0%	1.4%	1.7%	2.1%	2.8%
US regional supplier	*35.4%*	*25.8%*	*17.2%*	*16.5%*	*17.0%*	*16.4%*
Central America	11.3%	10.1%	8.8%	8.8%	9.4%	9.8%
South America	16.2%	10.7%	6.2%	5.1%	4.8%	4.4%
Caribbean	5.0%	3.2%	1.5%	1.9%	2.0%	1.6%
Mexico	14.6%	8.5%	4.9%	4.2%	3.8%	3.1%

Source: UN Comtrade (2023)

Appendix III

Top global apparel importers

	2000	2005	2010	2015	2019	2022
World	100%	100%	100%	100%	100%	100%
EU-28	*38.1%*	*44.0%*	*45.5%*	*42.0%*	*44.9%*	*49.1%*
EU-28 (excl. UK)	*30.7%*	*35.4%*	*37.9%*	*35.1%*	*38.9%*	*43.8%*
EU-15	*36.6%*	*41.6%*	*42.3%*	*38.4%*	*39.8%*	*42.8%*
United States	30.6%	27.4%	22.7%	23.4%	21.0%	23.4%
Germany	9.4%	8.8%	9.7%	9.0%	9.4%	10.4%
France	5.4%	6.1%	6.0%	5.6%	5.7%	6.1%
Japan	9.6%	7.8%	7.6%	7.1%	6.7%	5.6%
United Kingdom	7.4%	8.6%	7.6%	7.0%	5.9%	5.3%
Spain	1.7%	3.2%	3.9%	4.0%	4.6%	4.8%
Italy	2.6%	4.0%	4.6%	3.5%	3.7%	4.5%
Netherlands	2.4%	2.2%	2.6%	2.7%	3.5%	4.0%
Poland	0.2%	0.4%	1.1%	1.3%	2.0%	2.8%
Canada	1.7%	2.0%	2.3%	2.4%	2.4%	2.8%
Korea. Rep.	0.6%	1.0%	1.2%	2.1%	2.5%	2.7%
China	0.6%	0.5%	0.6%	1.4%	1.8%	2.0%

Source: UN Comtrade (2023)

Special:
Economic echoes: A review of the cascading impacts of sanctions in a globalized world

Economic echoes: A review of the cascading impacts of sanctions in a globalized world

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1. Introduction

In today's interconnected world, sanctions have emerged as pivotal tools in the arsenal of international diplomacy and economic strategy. These measures, ranging from comprehensive trade embargoes to targeted financial restrictions, aim to influence or penalize states, entities, or individuals for various political and economic reasons. Made possible by interdependent economies in an era of globalization, the economic repercussions of sanctions are extensive, influencing international trade patterns, investment decisions, consumer behaviors, and even political outcomes. The use of sanctions has therefore sparked an intense debate

regarding their effectiveness and repercussions in the sanctioned and sanctioning economies, both in the public policy circles as well as the related academic literature.

The motivation for this paper is to summarize recent findings in the economics literature regarding the economic impacts of sanctions at the macro and micro levels, focusing on the effects for directly and indirectly affected economies generally, and affected firms and consumers specifically. This paper's contribution is in its synthesis of existing research, offering a consolidated view of the economic effects of sanctions. By bringing together various studies and perspectives, this overview intends to present a comprehensive understanding of the topic.

The past decade has witnessed some of the most significant sanctions episodes in recent memory, particularly against Iran and Russia, each with distinct economic ramifications. The 2012 Iran sanctions, primarily aimed at curtailing Iran's nuclear program, resulted in severe restrictions on its oil exports as well as its banking and financial sectors. These sanctions not only constrained Iran's economy but also had ripple effects on global oil markets and international trade relations. Similarly, the 2014 Russia sanctions, initiated in response to the annexation of Crimea, targeted key sectors, including energy, defense, and finance and investment. The more recent 2022 sanctions further intensified these measures, profoundly affecting the Russian economy, and have had ramifications for global trade networks. These sanctions episodes are notable for their scale and the complexity of their international economic impacts, triggering significant shifts in trade patterns, investment flows, and geopolitical alliances.

In contrast, sanctions on smaller economies such as Myanmar and Cuba, along with targeted measures such as the Russian embargo on Turkish agricultural products, are less present in public discussions but nevertheless offer important insights into different aspects of sanctions' impacts and their reversal. The Myanmar sanctions, imposed in response to human rights concerns, were eased as the country (temporarily) embarked on a path toward democratic reforms. Cuba's experience under US sanctions, spanning several decades, has been punctuated by periods of easing and tightening. These episodes of easing of sanctions provide a unique opportunity to observe the potential economic recovery and reintegration into global trade networks, but ultimately highlight the asymmetric effect of imposing and lifting sanctions with a sluggish recovery of trade relations. Similarly, the Russian embargo on Turkish products, which came as a retaliation for geopolitical tensions and was later lifted, offers a case study on how firms adapt to the imposition and removal of trade barriers.

The main takeaways from the review of the recent literature on sanctions are threefold: (1) Unsurprisingly, sanctions are subject to a cost-benefit trade-off that ultimately is decided by policymakers: Potential political gains for a sanctioning country need to be weighed against the significant costs for firms in these countries – that is, sanctions are not free; (2) The economic impacts of sanctions go beyond the period of imposition, as persistence and path-dependence lead to lasting

effects of these measures, especially for firms in sanctioned countries; ; and (3) Plenty of unintended consequences – economic and political – accompany any episode of sanctions.

The remainder of this paper is structured as follows: Section 2 examines recent advances made in understanding the global economic implications of sanctions, focusing on findings regarding their effects on welfare. Section 3 highlights the recent work focused on the impacts of sanctions on firms. This section is further divided into two subsections: the impacts of the sanctioning (3.1) and the effects in the sanctioned economy (3.2). Section 4 reviews the recent literature on the effects of sanctions on consumers, covering aspects such as purchasing behavior and welfare. Section 5 synthesizes the novel research on the relationship between sanctions and electoral outcomes, highlighting the economic-political nexus of these measures. Section 6 concludes the paper, summarizing the primary insights from the literature and pointing out potential areas for further study.

2. The global impact of sanctions

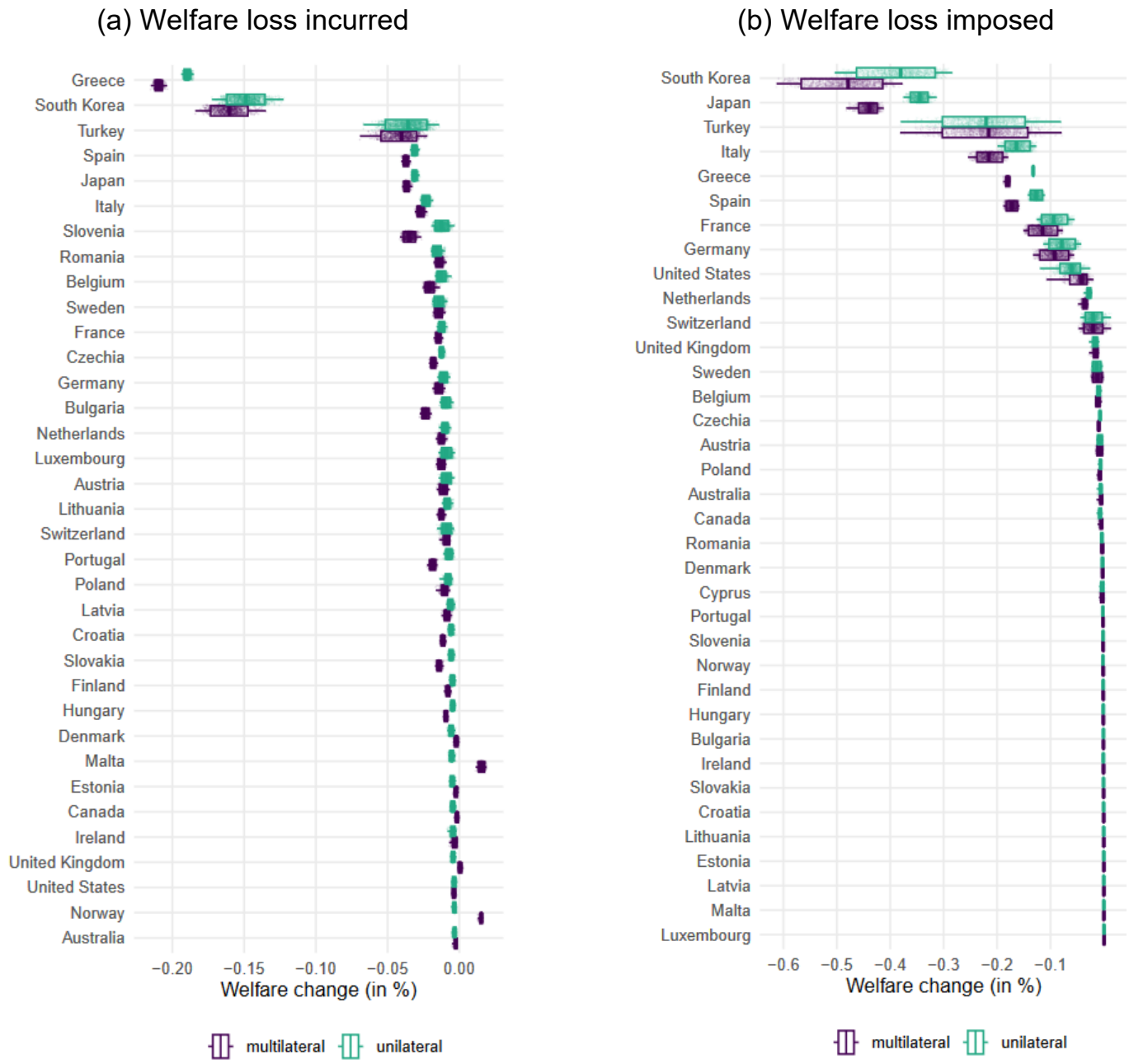
There is a long literature investigating the global or aggregate effects of sanctions, ranging from works on historical economic blockages (see, e.g., O'Rourke 2007; Irwin 2005) to novel databases featuring hundreds of even minor sanctions episodes (Felbermayr et al. 2019).

Recent methodological advances have also led to more realistic estimations of the costs of sanctions – the imposed costs on the sanctioned economy, as well as the incurred costs by the sanctioning one. A study by Chowdhry et al. (2022) is one such example that investigates these welfare costs for the case of the 2012 Iran sanctions and the 2014 Russia sanctions. The study uses a quantitative general equilibrium trade model similar to the one by Caliendo and Parro (2015) to simulate the impact of sanctions under different coalition setups. Among other issues, the paper assesses the contributions of individual coalition members, revealing that multilateral enforcement amplifies the impacts of sanctions, with welfare losses increasing notably compared to unilateral action. The research underscores the importance of coordination in increasing sanctions' effectiveness.

Figures 1 and 2 show individual sanctioning countries' "contributions" in the two sanctions episodes. The left panels show the incurred welfare losses, that is, the immediate cost of sanctions born by sanctioning countries due to participation in the respective sanctions coalition. The heterogeneity in the welfare costs is high, with some small countries or those that are geographically closely located to the sanctioned one incurring significant welfare costs. The right panels show the imposed welfare cost, that is, the cost for the sanctioned economies of Iran and Russia, due to the respective country taking part in the coalition. Here bigger economies – or those located close by – impose the greatest economic harm on the target of the sanctions.

One important result is that multilateral action against Russia resulted in lower domestic welfare losses for coa-

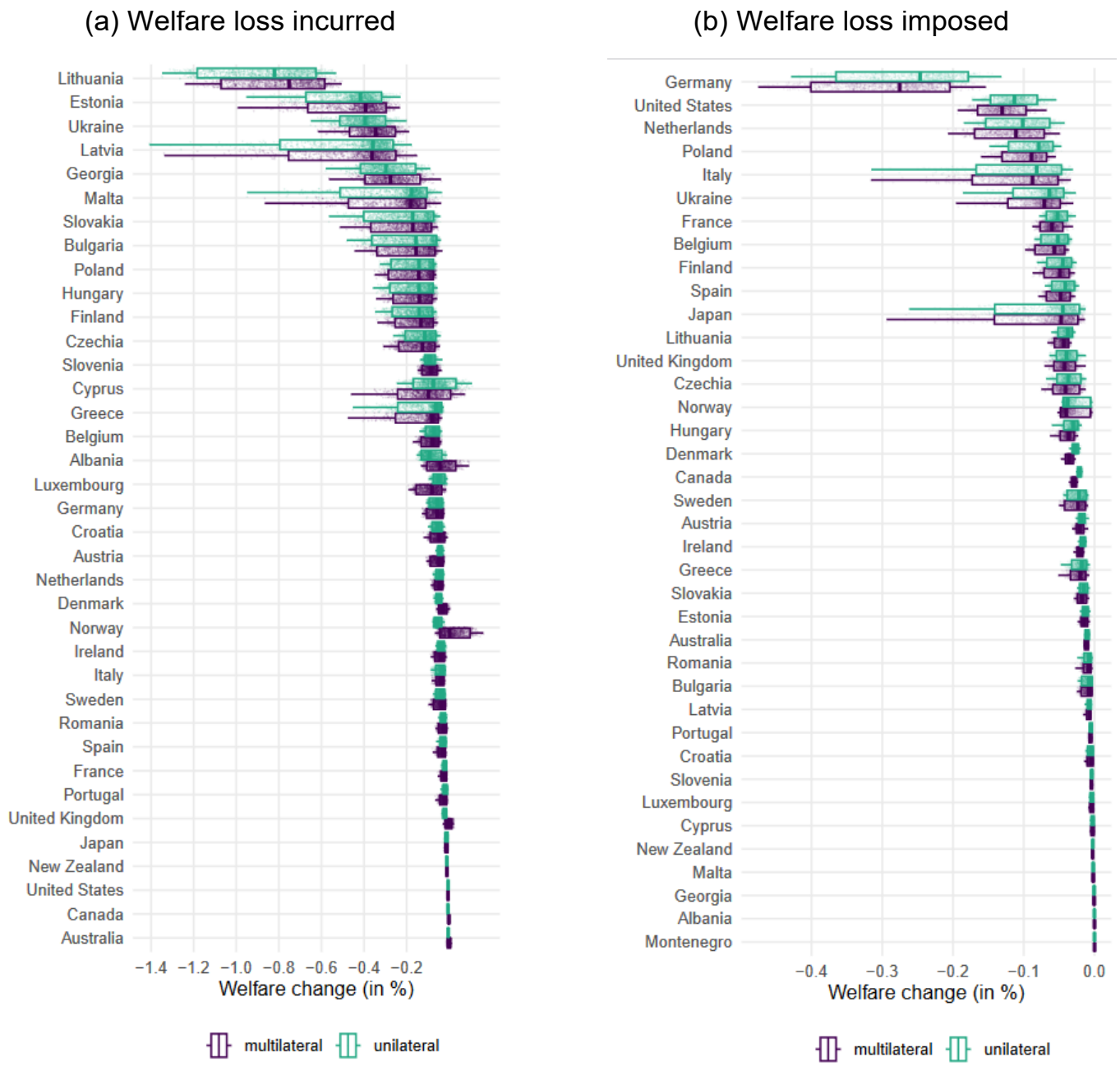
Figure 1: Individual contributions – Iran sanctions



Source: Chowdhry et al. (2022)

Note: Figures above display each country in the actual sanctions coalition against Iran and the welfare change it experiences domestically and that which it imposes on the sanctioned state. The 95% confidence intervals on welfare losses are constructed from 1,000 bootstrap replications of the simulations.

Figure 2: Individual contributions – Russia sanctions



Source: Chowdhry et al. (2022)

Note: Figures above display each country in the actual sanctions coalition against Russia and the welfare change it experiences domestically and which it imposes on the sanctioned state. The 95% confidence intervals on welfare losses are constructed from 1,000 bootstrap replications of the simulations.

lition members, whereas a full-blown multilateral embargo on Iran's oil and gas increased the domestic welfare losses for sanctioning states. This outcome is attributed to the targeted sectors and the ability of coalition members to substitute these goods with other low-cost global suppliers, emphasizing the significance of the sectoral dimension in determining the economic costs of sanctions.

In further scenarios, the paper extends its analysis by simulating the potential impacts of third-party countries joining the existing coalition, finding that China's cooperation would notably increase the welfare losses for both Iran and Russia. It also identifies the composition of an "optimal" sanctioning coalition that maximizes the ratio of the cost imposed on the target relative to the cost incurred domestically.

Methodologically, the study expands on the model of Caliendo and Parro (2015) by incorporating a transfer mechanism to equalize welfare losses among coalition members. Furthermore, the paper introduces a Bayesian bootstrap procedure to provide confidence intervals for the estimations and simulations, as is visible in Figures 1 and 2. This approach allows for a more nuanced understanding of the distribution of economic costs within the coalition and the overall impact of sanctions on global trade and welfare.

3. Firms and sanctions

Aside from recent work on the global aggregate impact of sanctions, the bulk of the recent literature has focused on the firm-level effects of economic sanctions, thanks to the increased availability of micro-level data.

3.1. Sanctioning economy

We first turn to a review of the firm-level effects of sanctions within sanctioning countries. As sanctions weaponize prior economic dependencies for political objectives, it is essential to understand why and how these measures can impact the domestic economy. These impacts manifest in various ways, including the disruption of established trade relationships, leading to higher costs for alternative sources and reduced product variety. The section starts with an analysis of the so-called extensive margin of trade, exploring how sanctions influence firms' decisions to enter or exit international markets. We then assess the intensive margin, looking at the effects on firms that continue their trading activities with sanctioned markets. Finally, the section reviews broader firm-level effects, such as the impacts on financial flows and stock market performance, and suggests additional works that explore how sanctions shape firm behavior and economic performance in sanctioning countries.

Extensive margin

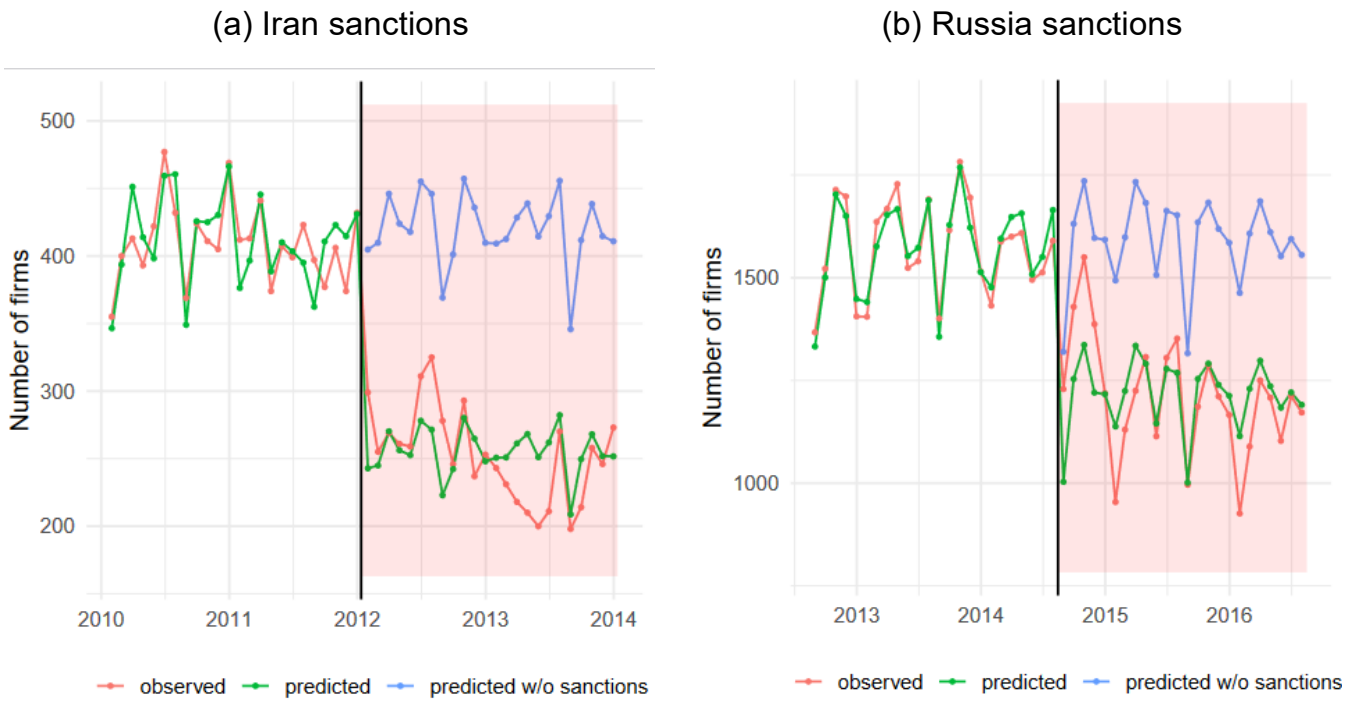
The extensive margin of trade describes the firm-level decision to enter or stay in a market. In the context of sanctions, it is obvious that for firms located in sanctioning countries, business strategies will

incorporate any changes to access foreign markets, thus leading to firms questioning whether or not to trade with partners in a (newly) sanctioned market.

Crozet et al. (2021) study this topic using state-of-the-art econometric techniques. Key questions addressed in their study include determining which firms are likely to persist in exporting despite sanctions, the significance of prior experience in the sanctioned market, and the specific traits associated with firms that remain active in these markets. To conduct this analysis, they make use of highly detailed firm-level customs data from France, examining sanctions against Iran, Russia, Myanmar, and Cuba. Their methodology hinges on a simple dynamic model of the extensive margin of trade in the spirit of Helpman, Melitz, and Rubinstein (2008). The model yields a gravity equation for the extensive margin of firm-level trade that can be estimated structurally with a two-/three-way fixed effects Probit model and a suitable bias correction.

The study of Crozet et al. (2021) builds on an extensive dataset sourced from French customs, encompassing the universe of French firms engaged in exporting activities. The dataset includes monthly records spanning from 2009 to 2016, covering approximately 150,000 firms that export to more than 200 different destinations. A key finding from their analysis is the mitigating effect of previous experience in a sanctioned market, as firms with prior engagement in these markets tend to be less adversely affected by sanctions. The intensity of trade finance also plays a significant role, indicating the importance of financial mechanisms

Figure 3: Impact of sanctions on the extensive margin of trade



Source: Crozet et al. (2021)

in sustaining trade under sanctions. The study also presents evidence suggesting that firms may circumvent sanctions via neighboring countries, as firms present in those are more likely to exit a sanctioned market ceteris paribus. Notably, the effect of lifting sanctions does not symmetrically reverse their imposition.

Figures 3a and 3b show the quantitative results of their main estimation: For both sanctions episodes, the 2012 Iran sanctions and the 2014 Russia sanctions, the number of monthly active firms drops significantly after the introduction of sanctions. The close co-evolution of the red line denoting the observed number of firms – and the green line denoting the predicted number of firms in the economy under sanctions – highlights the quality of the model's prediction. The blue line, finally, denotes the number of firms in the assumed counterfactual world where sanctions were not imposed: The number of firms here that are active on the Iranian and Russian markets, respectively, is between 25% and 60% higher.

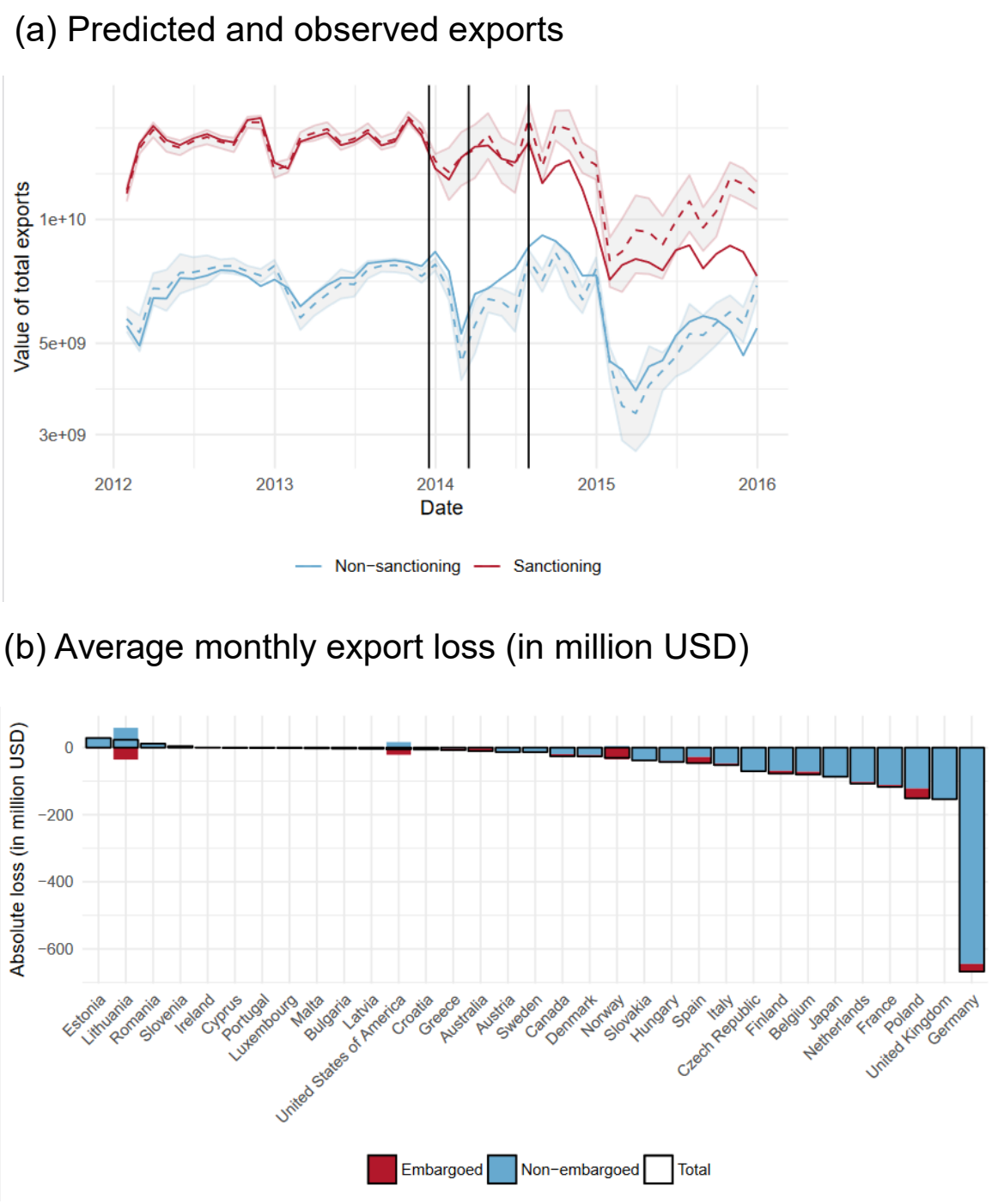
Intensive margin

Shifting our focus to the intensive margin of trade, we delve into the experiences of firms that remain active in sanctioned markets. A critical question arises: What happens to these firms that continue their operations despite the imposition of sanctions? Again, it appears natural that these firms tend to export less, though the underlying mechanisms driving this reduction in exports (and imports) remain unclear. A pioneering firm-level study in this area was conducted by Crozet and Hinz (2020), who investigate the behavior of French firms during the 2014 Russia sanctions. Their research provides valuable insights into how sanctions influence the trading activities of those firms that decide to maintain their market presence amidst challenging economic and political conditions.

Figures 4a and 4b display the aggregate economy-wide impacts of the sanctions measures for sanctioning countries in terms of "lost exports". Employing a gravity estimation and counterfactual prediction approach similar to Felbermayr et al. (2019) and Hinz (2019), Figure 4a shows the observed and counterfactual sanctions-free total exports of sanctioning and non-sanctioning countries to Russia. The difference between the dashed and the predicted red lines shows the amount of lost trade. Figure 4b shows the distribution of this measure of the cost of sanctions by sanctioning country – splitting up costs into the two categories of embargoed and non-embargoed goods. Unsurprisingly, embargoed products were hardly traded after the imposition of an embargo on select food and agricultural products by Russia, yet the bulk of the lost trade – almost 87% – is incurred in non-embargoed and hence not directly affected products. The questions is: Why?

The study analyzes this question by again employing monthly French firm-level customs declarations in a difference-in-differences setup. The challenge lies in pinpointing the exact nature of trade impediments. Crozet and Hinz (2020) provide indirect evidence by observing the heterogeneous impacts across different firm and product characteristics.

Figure 4: Lost trade for sanctioning countries of the 2014 Russia sanctions



Source: Crozet and Hinz (2020)

Table 1: Firm-level trade impact and trade finance instruments

	(1)	(2)
Sample	Products	Firms
Γ × Sep '13 - Nov '13	-0.005	-0.049
× Letter of Credit share	(0.018)	(0.035)
Γ × Dec '13 - Feb '14	-0.059[c]	-0.089[b]
× Letter of Credit share	(0.035)	(0.041)
Γ × Mar '14 - Jul '14	0.017	-0.092[b]
× Letter of Credit share	(0.021)	(0.037)
Γ × Aug '14 - Dec '14	-0.051[a]	-0.147[b]
× Letter of Credit share	(0.018)	(0.061)
Fixed effects	okt, dkt, odkm	ikt, dkt, idkm
Sample size	101260881	1831356
Significance levels: [a]: p<0.01; [b]: p<0.05; [c]: p<0.1.		

Source: Crozet and Hinz (2020)

Two potential channels of trade disruption are identified: a change in consumer preferences, akin to a boycott, and an increase in country risk, leading to disruptions in the financing of trade. Table 1 presents evidence for the latter channel. Interacting a measure for the use of a specific, widely-used type of trade credit instrument – letters of credit – Crozet and Hinz (2020) show that firms exporting products making intensive use of these trade finance instruments performed a lot worse than comparable firms. This indicates that financial sanctions that were introduced as part of the 2014 Russia sanctions had significant indirect effects in parts of the economy that were not directly targeted in any specific way.

Further related research

Other researchers have also studied the trade effects of sanctions in other sanctioning countries. Notable examples are Görg, Jacobs, and Meuchelböck (2023) looking at the intensive and extensive margins of trade for German firms in sanctioned markets, as well as Jäkel, Østervig, and Yalcin (2023) and Kohl, Berg, and

Franssen (2023), who study Danish and Dutch firms, respectively.

Four recent papers study important firm behavior outside of the domain of international trade. Besedeš, Goldbach, and Nitsch (2021) study the impacts of sanctions on the financial flows of non-financial entities. Utilizing highly disaggregated monthly data from German balance of payments statistics, they find a noticeable reduction in financial activities with sanctioned countries. Interestingly, these affected firms adapt by expanding their activities to non-sanctioned countries, often those with close trade ties to the sanctioned ones. Despite these shifts in financial activities, Besedeš, Goldbach, and Nitsch (2021) note that there is no significant impact on key firm performance indicators such as employment or total sales, suggesting a level of resilience or adaptability among these firms in response to sanctions.

Biermann and Leromain (2023) conduct an event study centered around the 2022 Russian invasion of Ukraine to assess its impact on stock market performance. The study finds that firms with significant trade activities with Russia experienced a marked reduction in cumulative returns, particularly those heavily dependent on Russian commodities. A back-of-the-envelope computation quantifies the overall impact as a decline of 0.8 percentage points in the aggregate stock market performance of sanctioning countries. Notably, European countries bore the brunt of these losses, reflecting their closer economic ties and higher dependency on Russian trade and commodities. These finding resonate with Tosun and Eshraghi (2022), who also analyze the financial market reactions to companies remaining operational in Russia during the 2022 invasion. Their findings reveal that companies continuing to do business in the Russian market faced penalties and underperformed compared to those withdrew; this was accompanied by increased trading volumes due to selling pressures.

Hart, Thesmar, and Zingales (2023) conducted a survey focusing on firms that voluntarily pulled out of Russia in 2022, a phenomenon often referred to as "self sanctions." Their findings highlight the significant role of consumer influence in these decisions, suggesting that consumer attitudes and perceptions are a major force in guiding the "morality" of firms. This consumer-driven pressure often prompts companies to align their international operations with ethical and social standards, especially in politically sensitive situations – such as a firm's activity in a country under international sanctions.

3.2 Sanctioned economy

We now turn to the impacts of sanctions in the targeted economy by focusing on a case study looking at a brief period of tensions between Russia and Turkey starting in late 2015. Russia imposed an embargo on 17 agricultural products from Turkey as a response to the downing of a Russian military aircraft by Turkey near the Syrian border. This incident marked a significant escalation in tensions between the two countries, leading to Russia's abrupt use of economic sanctions as a form of retaliation. Aytun, Hinz, and Özgüzel (2024) explore this episode to study the impacts of the embargo on the affected Turkish

Table 2: Intensive margin estimation for imposition and lifting of embargo

	Two-way	Two-way with est. FE	Three-way	Three-way with global data
Embargo x period imposition	-14.36***	-12.93***	-13.62***	-13.05***
	(0.6491)	(0.7108)	(1.042)	(0.6618)
Embargo x period lifting	-0.7000***	-0.1752**	-0.1518	-0.2994**
	(0.0837)	(0.0672)	(0.0981)	(0.1024)
Diversion x period imposition	0.0831	0.1729***	0.0607	0.6815***
	(0.0529)	(0.0478)	(0.0683)	(0.0807)
Diversion x period lifting	-0.2351***	-0.0488	-0.0977	0.2474***
	(0.0567)	(0.0567)	(0.0653)	(0.0717)
Circumvention x period imposition	-0.4435***	-0.4077***	0.0813	-0.0090
	(0.0520)	(0.0471)	(0.0832)	(0.0982)
Circumvention x period lifting	-0.2090***	-0.1058*	0.5076***	0.1572
	(0.0537)	(0.0476)	(0.0887)	(0.1030)
Est. destination × product × time FE		0.8567***		
		(0.0161)		
Observations	1,185,212	1,114,179	1,179,861	13,085,742
Origin × product × time FE	yes	yes	yes	yes
Origin × destination × product × month FE	yes	yes	yes	yes
Destination × time FE	no	no	yes	no
Destination × product × time FE	no	no	no	yes

Source: Aytun, Hinz, and Özgüzel (2024)

firms – in terms of trade effects as well as other economic outcomes.

The empirical analysis considers both the imposition and lifting periods of the embargo. Regarding the trade impacts, Aytun, Hinz, and Özgüzel (2024) investigate embargo, diversion, and circumvention effects, examining how firms adapted to the changing trade landscape. Combining Turkish firm-level customs data and UN Comtrade

product-level data also introduces a novel estimation strategy that allows for flexibly and simultaneous controlling for potentially confounding factors at the firm × time, destination × time, and firm × destination levels.

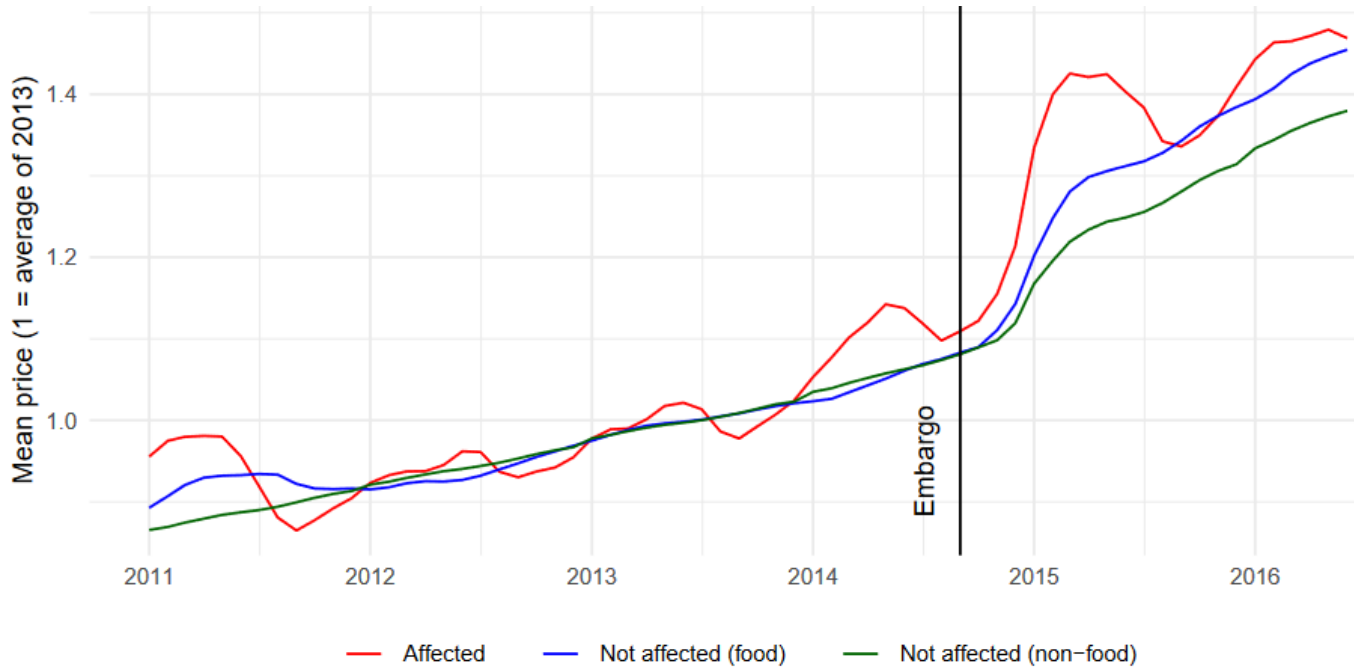
Table 2 presents the estimation results for the intensive margin of trade for affected firms, utilizing several different empirical specifications. The results across different model variations show the consistent negative impacts of the embargo during both the imposition period and persistent effects during the lifting period on Turkish exports. However, most other coefficients concerning diversion and circumvention effects vary widely across specifications with different sets of fixed effects, that is, not controlling for destination × time × product specific effects in column 1, using estimated destination × time × product effects in column 2, or controlling for higher-level destination × time effects in column 3. Column 4 presents a specification that controls for all unobserved characteristics across desired dimensions, that is, it includes destination × time × product, by combining firm and country-level data in one specification, as also evidenced by the much larger number of observations. The inclusion of these comprehensive fixed effects provides a more accurate and nuanced understanding of the embargo's impacts in terms of diversion to other markets or circumvention by turning to the exporting of other products. Notably, it shows a significant positive effect of the former during the imposition period with a persistence during the lifting period, while the latter is not observed.

In addition to trade effects, Aytun, Hinz, and Özgüzel (2024) also look into the broader economic impacts of embargoes, analyzing whether such measures have significant consequences beyond trade. The approach involves examining various firm-level activity indicators, utilizing the firm-to-firm domestic network data from the Turkish Central Bank and employment data at the establishment level from the Turkish Ministry of Economics. This comprehensive data allows for a deeper understanding of the economic interdependencies and labor market effects within the domestic economy. The empirical framework employs a classic difference-in-differences setup, with a specific focus on the treatment group comprising firms that exported embargoed products to Russia prior to the imposition of the embargo. The control group includes firms that exported embargoed products to other markets and those exporting non-embargoed products to Russia. The findings are clear: The affected firms experienced reductions in domestic sales, in their overall employment levels as well as in their total number of customers. Importantly, these effects were permanent, that is, even after the embargo was lifted, the affected firms experienced diminished outcomes compared to the control group.

4. Consumers and sanctions

Although firms face the immediate consequences of sanctions and embargoes, the sanctioned country's population is often the ultimate bearer of consequences. Hinz and Monastyrenko (2022) and Amini, Nafari, and Singh (2022) analyze the impacts of sanctions on consumers, albeit in different contexts.

Figure 5: Evolution of average prices of embargoed and non-embargoed products following the self-imposed embargo



Source: Hinz and Monastyrenko (2022)

Hinz and Monastyrenko (2022) investigate the economic implications of the self-imposed food embargo by Russia in response to the 2014 sanctions. The embargo – targeting 48 food and agricultural products from the European Union, the United States, Australia, Ukraine, and other supporting countries – affected everyday items for Russian consumers, including meat, dairy products, fruits, vegetables, and nuts. The primary goal was to impact foreign food producers, but it also had significant repercussions on the Russian economy. The study quantifies these effects, particularly focusing on consumer prices and welfare in Russia. It provides empirical evidence of price surges in embargoed and linked products by using a difference-in-differences framework to separate product-specific impacts from broader macroeconomic effects.

Figure 5 shows the main results of their empirical analysis: Utilizing a comprehensive dataset of consumer prices, disaggregated by city and date, the analysis reveals that the embargo resulted in an average price increase of at least 2.6% for embargoed products (red line) compared to non-embargoed ones, with short-term effects estimated between 7.7% and 14.9% and an average overall effect of 2.6% to 8.1%. The study also shows how these price increases spread to non-embargoed products (blue and green lines), suggesting wider economic impacts through input-output linkages.

To further understand the broader economic consequences of the embargo, the researchers constructed a theoretical trade model, inspired by Caliendo and Parro (2015), which incorporates sectoral linkages, trade

in intermediate goods, and sectoral heterogeneity in production. This model categorizes goods as tradable, non-tradable, or embargoed, reflecting their trade status across specific country pairs. Calibrated with pre-sanction data on production and intermediate input usage from 42 countries, bilateral tariffs, and pre-sanctions bilateral trade flows, the model simulates the embargo scenario as a counterfactual with prohibitive trade costs on imports of embargoed goods from sanctioning countries to Russia. The simulations suggest a welfare loss of 1.84% for Russia due to the embargo, with overall average prices in Russia predicted to have increased by 0.33%. Prices in embargoed sectors rose by an average of 7.9%, and those in non-embargoed sectors by 0.27%. These model-based results align with the empirical findings from actual price data, underscoring the significant economic impacts of the self-imposed embargo on Russian welfare and consumer prices.

Looking at a very specific issue in the context of sanctions, Amini, Nafari, and Singh (2022) investigate the effect of sanctions-induced air pollution on housing prices in Iran. Their study reveals that increased air pollution, resulting from the production of low-quality gasoline due to sanctions, led to a decrease in housing prices, with a 10% increase in nitrogen dioxide pollution resulting in a 0.6% to 0.8% reduction in housing values.

Further research

Further recent research has shed light on the economic effects of sanctions in the sanctioned economy. Three papers stand out in their analysis of the firm-level impacts.

Ahn and Ludema (2020) examine the effectiveness of "smart" sanctions, particularly in the context of the 2014 sanctions against Russia. Their model explores the regime's potential to shield strategically important firms from the impacts of sanctions. Utilizing detailed firm and individual data, the study assesses the sanctions' effects on Russian firms, finding noticeable losses in operating revenue, asset values, and employee numbers, especially in sectors reliant on Western service inputs. The research reveals that strategically important firms managed to outperform their non-strategic counterparts during the sanctions period. This finding indicates a significant shielding cost borne by the regime, which amplifies the overall economic burden of the sanctions.

The paper is complemented by recent work of Nigmatulina (2021), who investigates the impacts of smart sanctions that are designed to target the elites without harming the average citizen. Focusing on Russian firms, the paper analyzes data from 600,000 firms balance sheets between 2014 and 2020. Nigmatulina (2021) finds that these sanctions, targeting strategic and often elite-owned firms, led to rather unexpected outcomes: Contrary to the intended effect of the sanctions, the firms actually experienced a boost in capital, revenue, and assets, likely due to increased government subsidies, contracts, and short-term loans. These government interventions, aimed at protecting these firms, resulted in a misallocation of resources, worsening the overall economic situation of the sanctioned economy. The analysis concludes that the combination of sanctions and government responses not only failed to correct resource misallocation but

exacerbated it, leading to a reduction in gross domestic product of up to 1% and significant collateral damage. The findings suggest that smart sanctions, rather than weakening the elites, may unintentionally empower them further.

Draca et al. (2023) explore the political economy dimension of smart sanctions. The paper examines the effects of the (temporary) lifting of the 2012 sanctions on Iran, specifically targeting key political actors involved in Iran's nuclear program decisions: the Islamic Revolutionary Guard Corps and Iran's Supreme Leader, Ali Khamenei. Utilizing data on their holdings in firms listed on the Tehran Stock Exchange, the study assesses whether these sanctions were effective in economically impacting these elite groups. The researchers identify "information shocks" related to the progress of diplomatic negotiations and analyze shifts in firm-level stock returns. The results show that both targeted and unrelated firms reacted positively to progress in negotiations, but the impacts were significantly larger for firms owned by the targeted political elite.

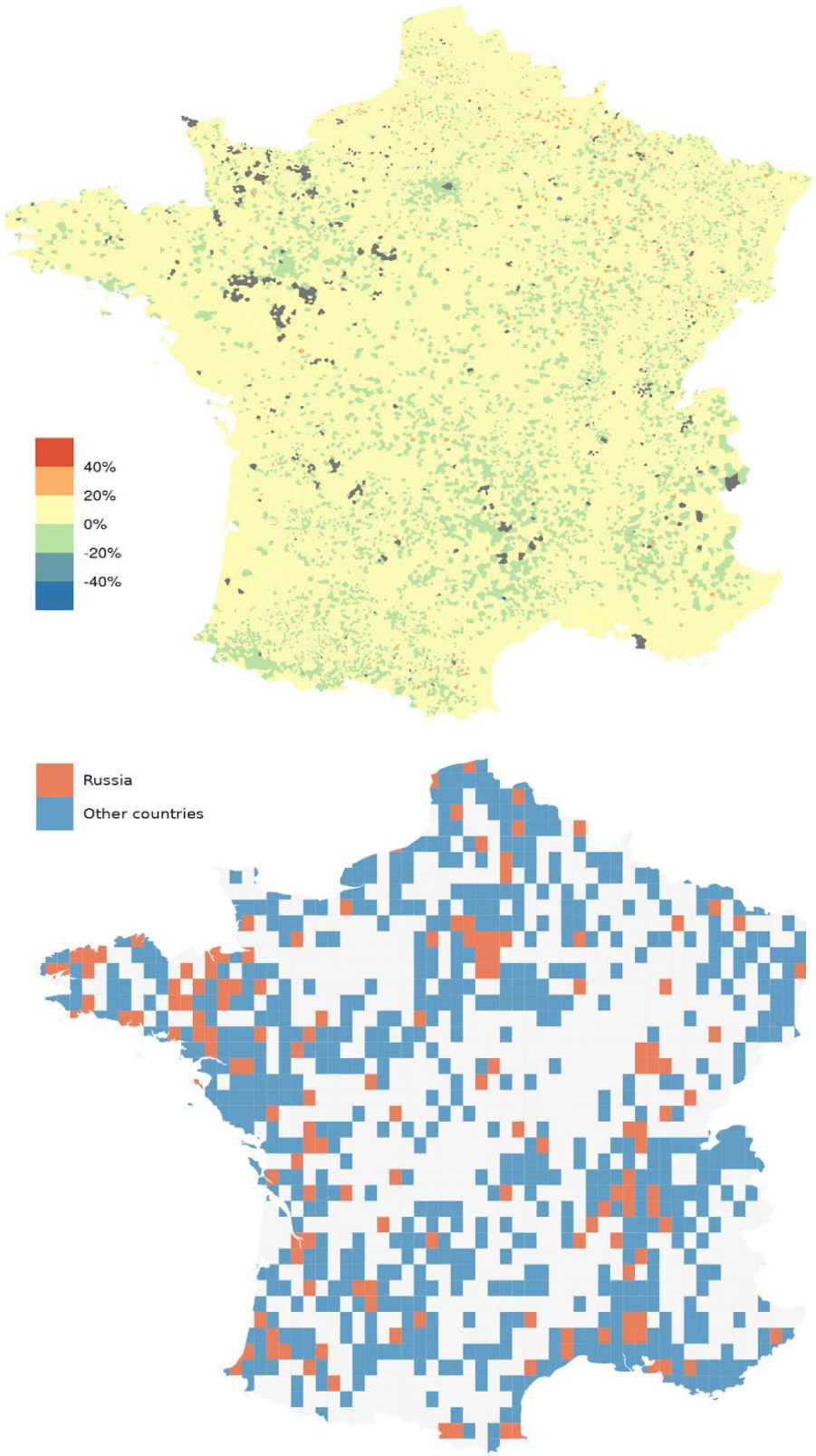
5. Beyond economics: Sanctions and elections

Aside from the economic impacts (the means to an end) the impacts of sanctions on political outcomes in general – and elections as manifestations of support in particular – have been a subject of growing interest among scholars. Here, three recent papers in the context of the 2014 Russia sanctions stand out.

Gold, Hinz, and Valsecchi (2023) examine the impacts of economic sanctions on regime support, studying the 2014 Russia sanctions and their impacts on subsequent parliamentary and presidential elections in the country. They find that larger exposure to these sanctions increased support for the incumbent government, indicating a rally-around-the-flag effect. In a similar vein, Peeva (2023) studies local proximity to sanctioned firms and the impacts of sanctions on election outcomes and also find a positive impact on support for the ruling regime.

Crozet and Hinz (2023), on the other hand, explore the consequences of sanctions on democratic elections, particularly in French municipalities affected by the Russian embargo. Their findings reveal a shift toward right-wing parties, perceived as pro-Russian and anti-sanctions, exemplified by an increase in votes for the pro-Russian candidate Marine Le Pen. Figure 6 summarizes the identification strategy of the paper: Changes in electoral support for the right-wing politician are regressed on a measure of municipal exposure to the embargo on agricultural and food products imposed by the Russian Federation. Although this shift did not significantly alter the final election result favoring Emmanuel Macron, it underscores the need for democratic governments to consider the repercussions of countermeasures such as embargoes and possibly offer compensatory aid to those affected.

Figure 6: Change in support for Le Pen and affected municipalities in France



Source: Crozet and Hinz (2023)

6. Conclusion

This overview of the recent literature on sanctions aims to provide a peek into novel research on the cascading impacts of sanctions in a globalized world. It is evident that the effects of sanctions are complex and multifaceted, affecting not only the targeted economies but also those of the countries imposing them. This paper has synthesized a diverse range of recent studies to offer a wide but by no means exhaustive view of the economic and political consequences of sanctions, presenting key insights on how these measures reverberate through the interconnected fabric of the global economy.

At the firm level, our recent research reveals a nuanced picture of how sanctions impact businesses in both sanctioning and sanctioned countries. In sanctioning countries, firms face a challenging environment marked by disrupted trade relations and adjustments in market strategies. The implications for firms in sanctioned countries are even more profound, with lasting effects on trade, financial health, and other indicators of broader economic activity. These impacts often extend beyond the period of sanctions, leading to persistent changes in economic structures and business practices. Notably, the unintended consequences of sanctions, including the strengthening of targeted elites and the emergence of alternate trade routes, underscore the complexity of these measures and their broader economic implications.

Recent research also sheds light on the significant role of international coalitions in the efficacy of sanctions. The literature indicates that the multilateral enforcement of sanctions amplifies their impact, with coordinated efforts resulting in greater economic pressure on the target. This underscores the importance of strategic partnerships and alliances in the implementation of effective sanctions regimes. However, the sectoral dimension of sanctions and the ability of coalition members to substitute targeted goods play a crucial role in determining the economic costs borne by sanctioning states.

Looking forward, the existing literature opens several avenues for future research. There is a need for further exploration of the long-term effects of sanctions on local and global economic structures as well as on firm behavior, particularly in the context of evolving global political and economic landscapes. Additionally, the emerging role of digital and financial technologies in sanctions enforcement presents a new frontier for research, with implications for global trade and financial systems. Finally, a deeper understanding of the political objectives and effectiveness of sanctions, especially in an era marked by shifting global alliances and power dynamics, remains a critical area of study.

In conclusion, while sanctions continue to be a vital tool in international diplomacy, their economic and political ramifications are far-reaching, extending well beyond the immediate targets. As the global landscape evolves, so too must our understanding of the intricate interplay between sanctions, economies, and international relations, paving the way for more informed and effective policy decisions in the future.

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Latest research insights

The Research Network Sustainable Global Supply Chains regularly delivers insightful blog posts authored by renowned scholars. These thought-provoking pieces delve into critical societal challenges associated with global value chains, and are based on ongoing or recently completed research endeavors. We would like to extend an open invitation to scholars to contribute to our network: If you would like to share your research insights that align with our research focus in a blog post, please reach out to info@sustainablesupplychains.org for further details.

Outlined below are abstracts summarizing the key themes explored in the blog posts that have been published since the release of the Network's Annual Report 2022. These abstracts provide a glimpse into the wealth of knowledge and perspectives offered by our contributors, and reflect our commitment to fostering informed discussions on pressing global issues in the field of sustainable global supply chains.

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How to align efficiency, resilience and sustainability in GVCs? A conceptual assessment

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The COVID-19 pandemic-induced lockdowns and export restrictions highlighted the vulnerability of global trade and global value chains (GVCs). What is more, many commentators argue that the likelihood of exogenous shocks that threaten international trade and GVCs will increase in the future. This includes natural disasters, pandemics, or political conflicts. The Russian war in Ukraine is the most recent and devastating example. In light of the new global context and due to the experiences during the COVID-19 pandemic, it is increasingly acknowledged in the scientific community and among policy-makers that the GVC resilience of critical and strategic products needs to be strengthened in order to guarantee security of supply. However, a major shortcoming of the current debate on how to improve GVC resilience is that it is not linked to the issue of social and environmental sustainability. We take on that discussion and propose a framework for thinking about resilience, sustainability and efficiency.

https://www.sustainablesupplychains.org/how-to-align-efficiency-resilience-and-sustainability-in-gvcs-a-conceptual-assessment/

How much trade cost will the ongoing US-China trade war generate for global value chains?

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The United States and China represent the two largest economies in the World. Since China first entered the World Trade Organization in 2001, its bilateral trade with US has grown exponentially, reaching USD 660 billion by the end of 2018. Despite the significance of this trade relationship, the nature of the trade activity was much lopsided, with the US incurring a large and ever-increasing trade deficit with China. By 2016, this deficit had reached USD 347 billion and was a major political issue of the 2016 US presidential campaign. Once in office, former US President Trump engaged in an aggressive new trade policy regime, which sought to increase tariff levels in sectors that were of strategic importance to China, such as cars, hard disks, and aircraft parts. Since the China-specific tariffs were first implemented by the US on July 06, 2018, the US and China have been embroiled in an escalating series of four additional tit-for-tat tariff rounds. Against this background, this blog post tackles the question: How much trade cost does the still ongoing US-China trade war generate?

https://www.sustainablesupplychains.org/how-much-trade-cost-will-the-ongoing-us-china-trade-war-generate-for-global-value-chains/

Can Central and Eastern European countries 'smile' more? Trade patterns through the lens of value chain functions

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A key question in the context of global value chains is: How can countries upgrade their position and focus more on high value-added activities in global value chains? This blog focuses on selected Central and Eastern European countries – the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia – and looks at their functional specialization profiles and changes in these profiles, together with crucial factors that could enable them to upgrade their positions in GVCs. Our analysis concentrates on these countries, as they are relatively homogeneous economies with similar transformation paths, strong trade relations with larger EU economies (such as Germany), and relatively high shares of industrial production in their GDPs.

https://www.sustainablesupplychains.org/can-central-and-eastern-european-countries-smile-more-trade-patterns-through-the-lens-of-value-chain-functions/

Is the global value chain also a global pollution chain?

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One of the most well-known theories in international trade and environment is the "Pollution Haven Hypothesis" (PHH). According to the theory, high-income countries with strong environmental regulations will have a comparative disadvantage in pollution-intensive industries, and will tend to offshore their polluting industries to poorer countries. Hence, developing countries will become pollution havens, while the developed ones will specialize in and export clean goods. Whereas several studies have empirically tested the PHH, they fail to account for the prevalence of global value chains – whereby goods that used to be produced within one country are now fragmented and distributed across global networks of production – as a new way of organizing production. This blog discusses results and draws policy implications from our recent study, where we account for GVCs in an empirical test of the PHH. One of the key findings is that that GVCs are evolving into global pollution chains. Dropping them from the analysis masks much of the pollution haven effect.

https://www.sustainablesupplychains.org/is-the-global-value-chain-also-a-global-pollution-chain/

The evolution of the global Information Technology Enabled Services (ITES) sector and the shrinking gains of FDI for low- and middle-income economies

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The information-technology-enabled services (ITES) sector, or business process outsourcing sector, as it is sometimes known, encompasses all services that can be digitized and delivered at a distance, including call centre services, back-office processes, data management, information technologies (IT) development, software support, transcription and engineering services. Over the past three decades, India has established itself as a leading ITES hub for clients around the world, exporting a large variety of IT and ITES services, collectively amounting to US $110 billion export revenue and employing 3.7 million workers in 2016. Its success has prompted policy-makers elsewhere to aspire to copy its experience. Jana Kleibert and I scrutinised these ideas in close detail. In our 2020 paper in the European Journal of Development Research, we compare the historical trajectories of three ITES destinations as they have emerged over time: India from the 1990s, the Philippines from the early 2000s and Kenya from the late 2000s onwards, in order to understand whether other countries can indeed follow in India's footsteps.

https://www.sustainablesupplychains.org/the-evolution-of-the-global-information-technology-enabled-services-ites-sector-and-the-shrinking-gains-of-fdi-for-low-and-middle-income-economies/

Towards a smart mix 2.0? Understanding political dynamics of heterogeneity and integration in sustainable supply chain governance

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The adoption of new due diligence regulations in the European Union and other advanced economies has further increased the heterogeneity of global supply chain governance. In a recent study, we evaluate calls for a "smart mix 2.0" that combines public regulations with private governance instruments and new partnerships with producer countries. Private sustainability standards may compensate for public regulation weaknesses. Inclusion of Southern actors may promote more context-sensitive, inclusive, and comprehensive supply chain regulatory regimes. However, achieving cooperation among actors with diverging interests and power resources is challenging. A politically grounded analysis is crucial for identifying possibilities and limitations to integration in sustainable supply chain governance.

https://www.sustainablesupplychains.org/towards-a-smart-mix-2-0-understanding-political-dynamics-of-heterogeneity-and-integration-in-sustainable-supply-chain-governance/

Taking advantage of global value chains to spread green energy technologies across countries

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Renewable energy technologies, such as wind turbines and solar photovoltaic, are key to achieve a low-carbon transition and make our planet greener. While countries in Europe have previously been the lead markets, the development and diffusion of renewable energy technologies are increasingly taking place on a global scale, including in several latecomer countries. This blog post discusses the findings of a recent article featured in World Development, that delves into how multinational enterprises' subsidiaries can positively spur the development of green innovation in countries at different levels of development and kickstart their green transition.

https://www.sustainablesupplychains.org/taking-advantage-of-global-value-chains-to-spread-green-energy-technologies-across-countries/

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Stephanie Barrientos
University of Manchester

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