

Critical Minerals: challenges for diversification, climate change and development

Mari Pangestu, University of Indonesia

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The limits to reshaping the industrial geography of critical resources for green and digital transition

- 1. Concentration in imports and exports of a few firms and a few countries and the prominent role of China has created a high degree of dependence**
- 2. There are growing reasons for reducing dependence on China**
- 3. But China's importance in production also creates strong incentives for accommodation: especially considering developing countries who are resource rich countries not part of US or EU agreements**
- 4. Cooperation can bring forward the cost- and price- tipping points for some low carbon technologies, so the speed of the energy transition is an important policy question – for ensuring we can achieve climate and development**

Presentation draws on Indermit Gill (chief economist, World Bank), The Green Great Game: Techno-nationalism, climate critical minerals and low-carbon technologies, PIIE-LKY School of Public Policy STEP Conference, Singapore, November 10-11, 2022

Based on work by World Bank Group economists:

Paulo Bastos, Ana Margarida Fernandes, Alejandro Forero Rojas, Devaki Ghose, Hiau Looi Kee, Maryla Maliszewska, Jean Christophe Mercure, Katherine Stapleton, Daria Taglioni and Enze Xie

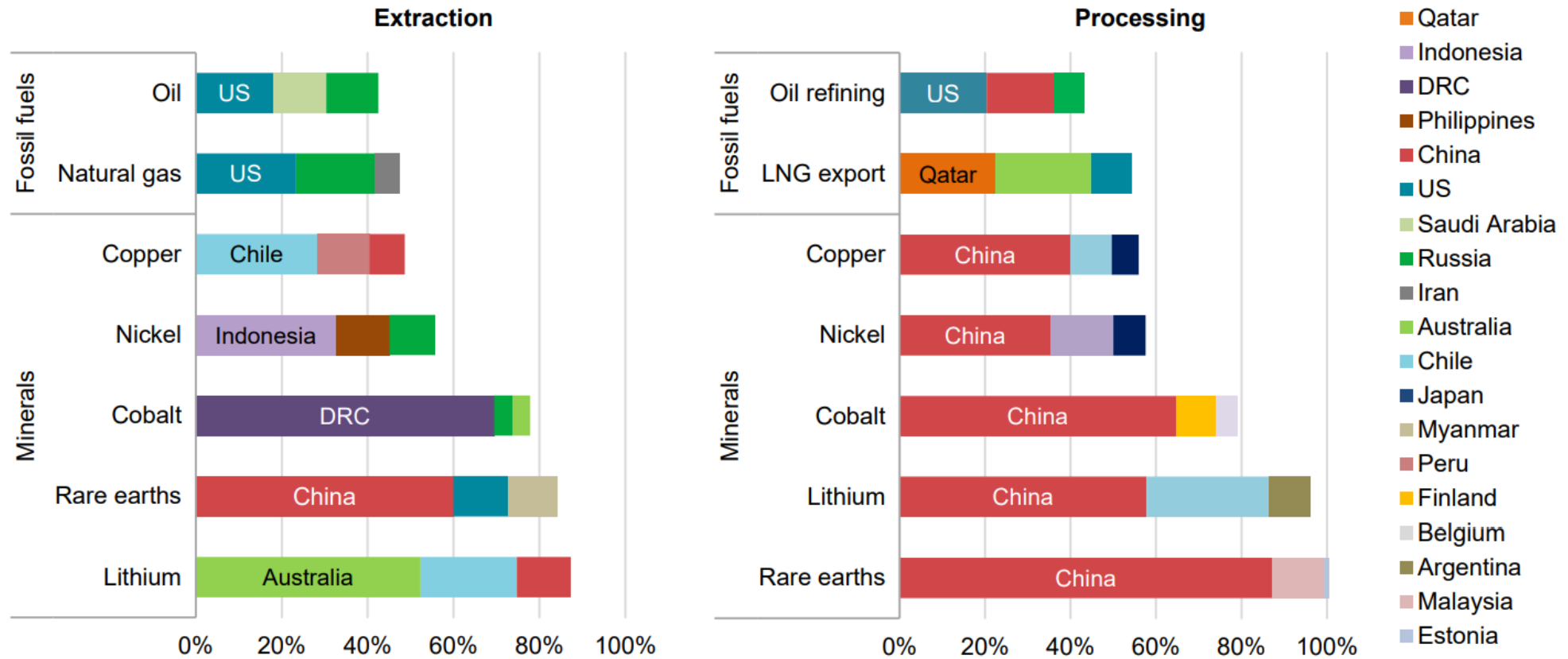
Looking at Concentration at Company level

- A small number of companies in China export critical minerals including copper, zinc, and platinum group metals
- In other source countries, the degree of market concentration in critical materials is three times the limit as per US guidelines (> 0.25 HHI)
- In most sample countries, just one firm accounts for about 75 percent of exports of each critical mineral group
- Importance of diversifying investments to expand supply and refining capacity in resource rich producing countries, many of which are developing countries: policies in consuming countries over critical minerals will matter for investment decisions (answer is not necessarily reshoring mining and refining capacity to US and EU)

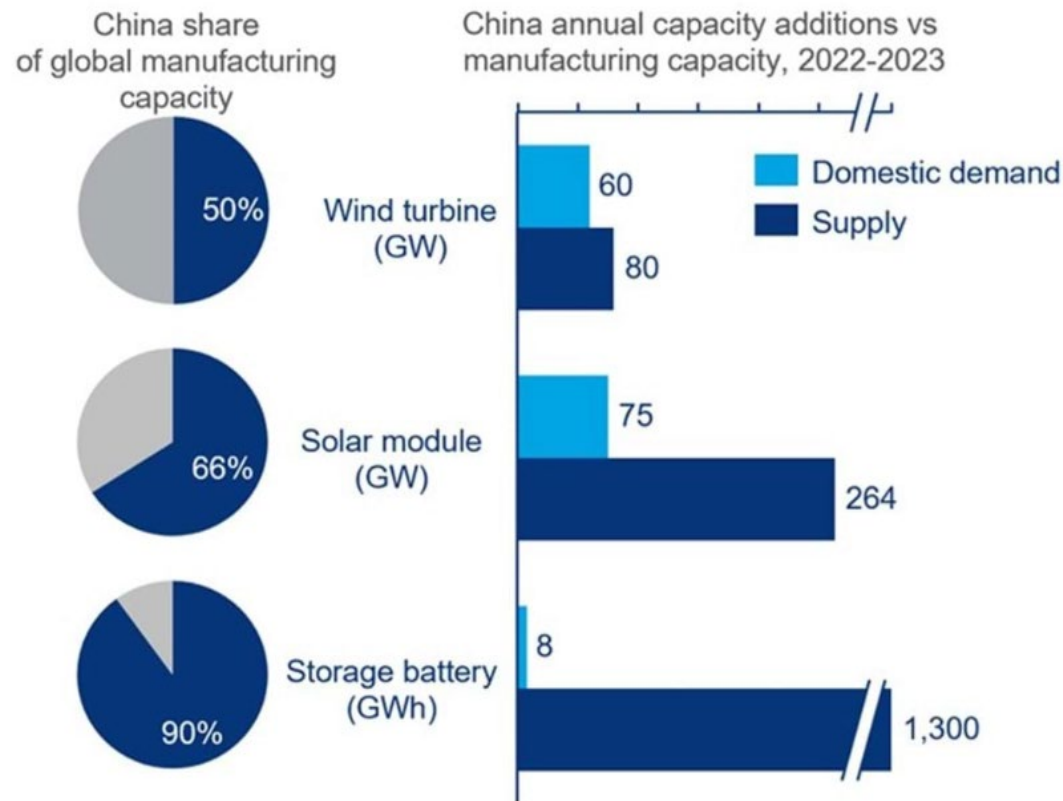
Resource-rich countries are not that different

- Resource-rich countries are generally rich in one critical material, poor in the others
- Their markets are characterized by a high degree of market concentration of several stages of extractives value chains in the hands of few corporates
- Keeping trade open and predictable is as vital to resource-rich countries as the resource poor economies, and for expanding refining and recycling capacity in raw material producing countries (in line with international trade rules?), yet we are seeing misalignment:
 - EU Rare Earth Strategy, potential EU-US limited critical minerals agreement (like with Japan), linked to IRA credit for EV (FTA based friend shoring)
 - Resource rich countries down streaming policies: restricting exports, down streaming and local content requirements

Reasons for decoupling from China: production of climate-critical minerals is more concentrated than oil and gas



Reasons for accommodation: China's role in reducing the cost of decarbonization in other countries



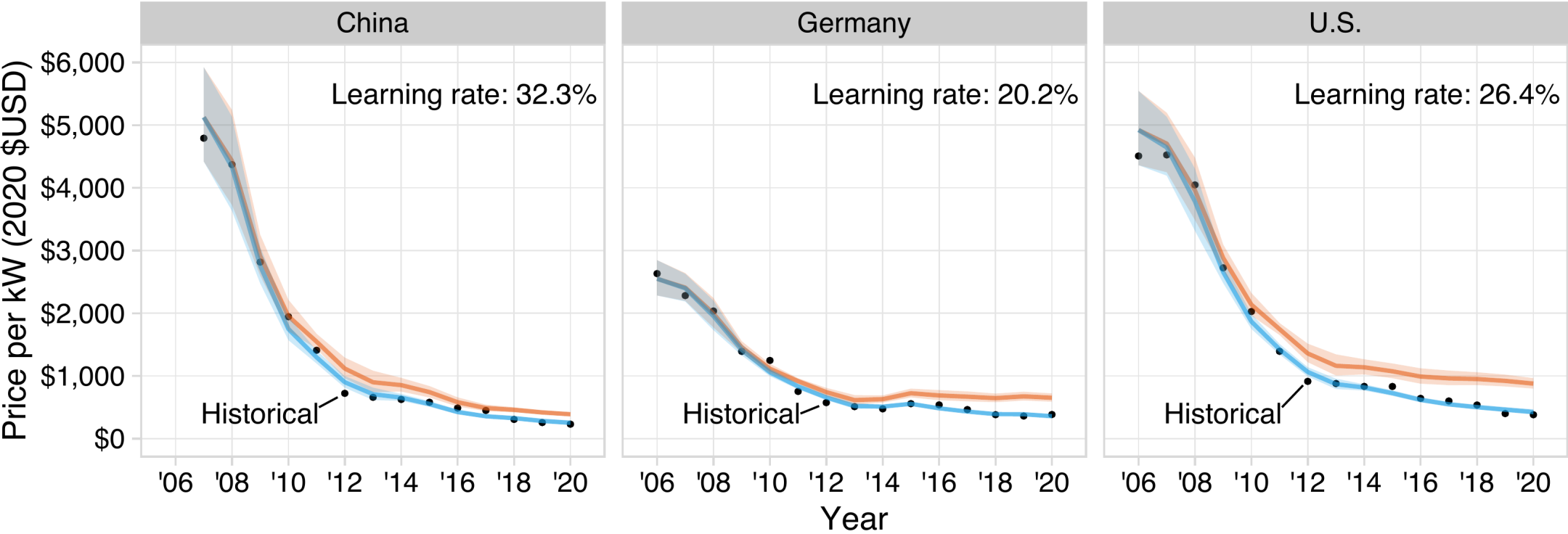
- China dominates upstream production in the solar value chain, producing around 70 percent of the world's solar panels
- China accounts for more than 50 percent of wind turbine suppliers
- China has the largest production capacity for lithium-ion batteries for vehicles with 90 percent of global manufacturing capacity in battery storage in 2021

Source: [Wood MacKenzie \(2022\)](#)

Reasons for accommodation: globalized supply chains for low-carbon products push costs down faster than national efforts

Simulations show that global supply chains for solar panels resulted in faster learning and lower global prices

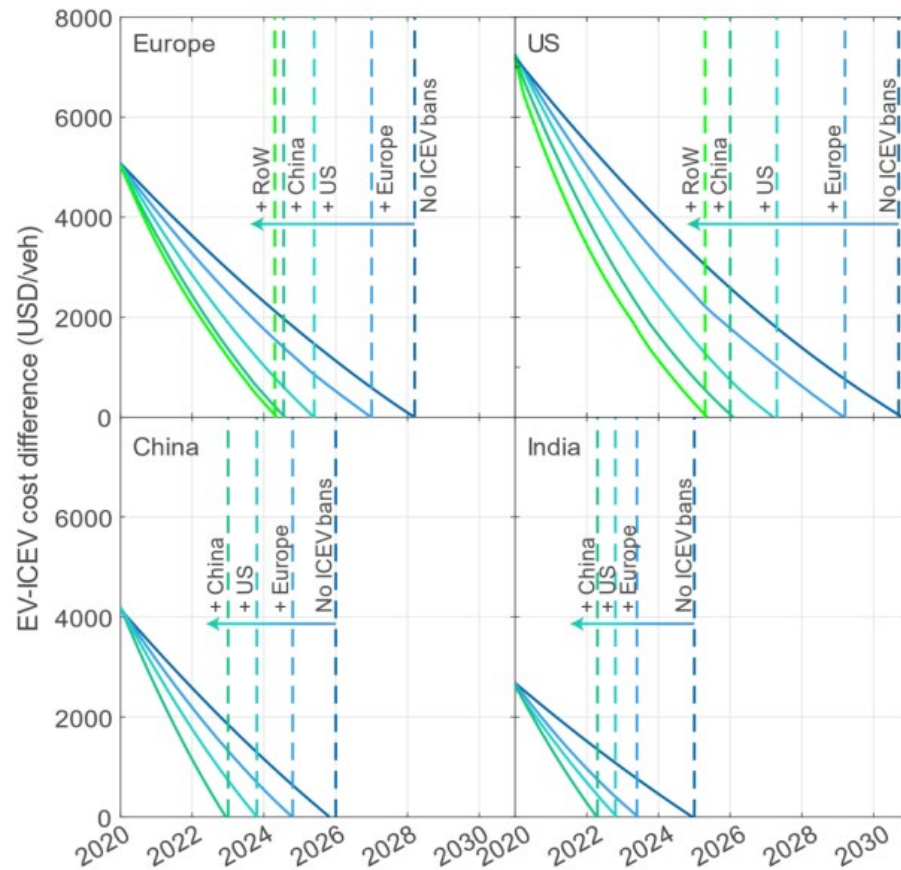
Estimated Module Prices Under Global vs. National Market Scenarios



Source: [Helveston et al. \(2022\)](#)

Reasons for accommodation: US-EU-China cooperation in low-carbon supply chains hastens technology tipping points

Analysis of cost parity between ICEVs and EVs for different scenarios of international cooperation



- For example, international cooperation will bring forward the point at which EVs reach cost parity with internal combustion engine (ICE) vehicles
- This matters a lot for energy transition costs in lower-income countries
- Coordination between China, the US and the EU is particularly important; India not yet so important

Source: [Lam and Mercure \(2022\)](#)

Recognizing security and techno national objectives, but need to also recognize economic costs of full decoupling and partial import substitution: higher cost and prices and inability to be part of sustainable supply chain borne by developing countries

Full decoupling - costs:	Partial import substitution when feasible - costs:
Very high capital costs	High capital costs
Possible systemic failure	Reshoring in one segment may create a spate of new import dependencies
Accelerated brain drain	Segment targeted for decoupling may not be the correct one
Early obsolescence of lumpy, non-market-driven investments	
Loss of export scale/revenue (walled garden), including in complementary products	
Loss of product and system functionality	
Interruptions in ongoing collaborative technological learning across global industrial ecosystems, possibly including learning from global standard-setting activities and participation in open-source projects	
Interruptions in human resource development	

Source: Thun, Taglioni, Sturgeon, and Dallas (2022)

Perspective from Resource Rich Source Countries:

- How to be part of the friend shoring and qualify for the IRA or be part of the EU Global Alliance for Critical Minerals:
 - limited FTA on critical minerals?
 - For Indonesia and Philippines – is it possible to use the IPF and its resilient supply chain pillar, even through it is not an FTA. Or would it be a limited FTA on critical minerals?
 - Build on regional agreements and engage with both US and EU to develop sustainable supply chain for green transition and partners within regional FTA (such as RCEP) who have FTA with EU and US can play a role. But important to agree on frameworks, principles, and there will be important discussion on Rules of Origin:
 - Within RCEP – can still engage with China and other members, and export from a location that has an FTA with the US or EU
 - Example in SC – for packaging, already happening where import from China and elsewhere, packaged in Singapore and exported to the US

Perspective from Resource Rich Source Countries: how to promote downstreaming

- How to increase value added and be part of the sustainable supply chain for LCT (refining, processing, recycling and manufacturing location for EV batteries etc?)
 - Promoting further down streaming requires tackling most binding constraint – access to international markets
 - **export restrictions on raw material exports plus downstream processing requirements**, domestic market obligations, implicit subsidies connected to local content requirements (**case of ban on export of raw materials Indonesia, case of nickel** did lead to increased output of refined nickel and stainless steel, and dramatic increase in its exports), not clear whether applicable for other minerals and also led to retaliation:
 - EU (and Third Parties including China): consultations 2019, panel 2021 and rule in favor EU (violates Art XI:1 GATT on prohibition of quantitative restrictions); Indonesia appealing
 - EU anti subsidy duties on imports of stainless steel cold-rolled flat products from Indonesia and India: preferential financing and other support by China to certain enterprises producing in and exporting from Indonesia, and that nickel ore ban benefited SSCRFP producers
 - China also imposed anti dumping duties on Steel Exports from Indonesia
 - Given Indonesia's limited market – this can reduce incentive for further capacity expansion in stainless steel

Perspective from Resource Rich Source Countries: more challenging to promote further down streaming

- How to develop domestic EV capacity in country: have some of the minerals, large market and part of low carbon strategy in Indonesia
 - Shaping domestic demand for EV key to unlock investment but also need export market for scale
 - Developing battery industry is key to affordable EVL both NMC (also for export) and LFP
 - nickel reserve alone not enough need other minerals (lithium, graphite) – export ban on nickel invited retaliation and substitution (high nickel prices led push for cheaper lithium iron phosphate batteries)
 - strict local content not possible as not competitive yet.
 - Global partnership: the largest battery and EV markets (EU and US) seeking to onshore production of critical battery materials and EV, so need global partnerships
 - such as with “friend shoring partners” so can be part of global battery VC and secure key elements such as lithium and graphite to develop domestic cathode and anode industry
 - Eliminate trade barriers between Indonesia and major EV countries (China): EV factories in Thailand can export and import EV (or its parts) to and from China with 0% tariff but Indonesia 15%.

Perspective from Resource Rich Source Countries: fundamental lesson - **competitiveness rather than natural resource availability** is a more significant factor for down streaming

- Investment in refining and processing, EV batteries
 - **Availability of energy source** (renewable such as hydro, coal in the short term? Natural gas? – how will this affect being part of sustainable supply chain) and other supporting infrastructure
 - Policy and longer term considerations:
 - Restrictive trade policies alone leveraging on natural resources not sufficient to develop downstream industry (e.g. in the past Indonesia: wood processing, cocoa and recent retaliations with raw materials ban), need to become competitive
 - Business wise would happen: onsite processing reduces transportation cost (weight reduces by 2/3 for nickel and 3/4 for bauxite with processing), but **to be competitive besides infrastructure and energy source, conducive business and investment environment, skills and technology needed**
 - **incentives and subsidies can incentivize (need to be well targeted given fiscal constraints)**