

A Critical Matter: Geoeconomic Fragmentation, Minerals and the Energy Transition

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Abstract

- Recent geopolitical tensions have exposed the fragility of commodity trade.
- What would be the impact of further trade fragmentation on GDP and inflation? How would fragmentation of critical minerals markets affect the energy transition?
- Novel data-set of output, use, and trade flows for fossil fuels and critical minerals.
- Impact on GDP and inflation crucially depends on the type of commodity.
- Fragmentation of critical minerals markets is particularly harmful to the energy transition, reducing investment in renewables and EVs by almost 20%.

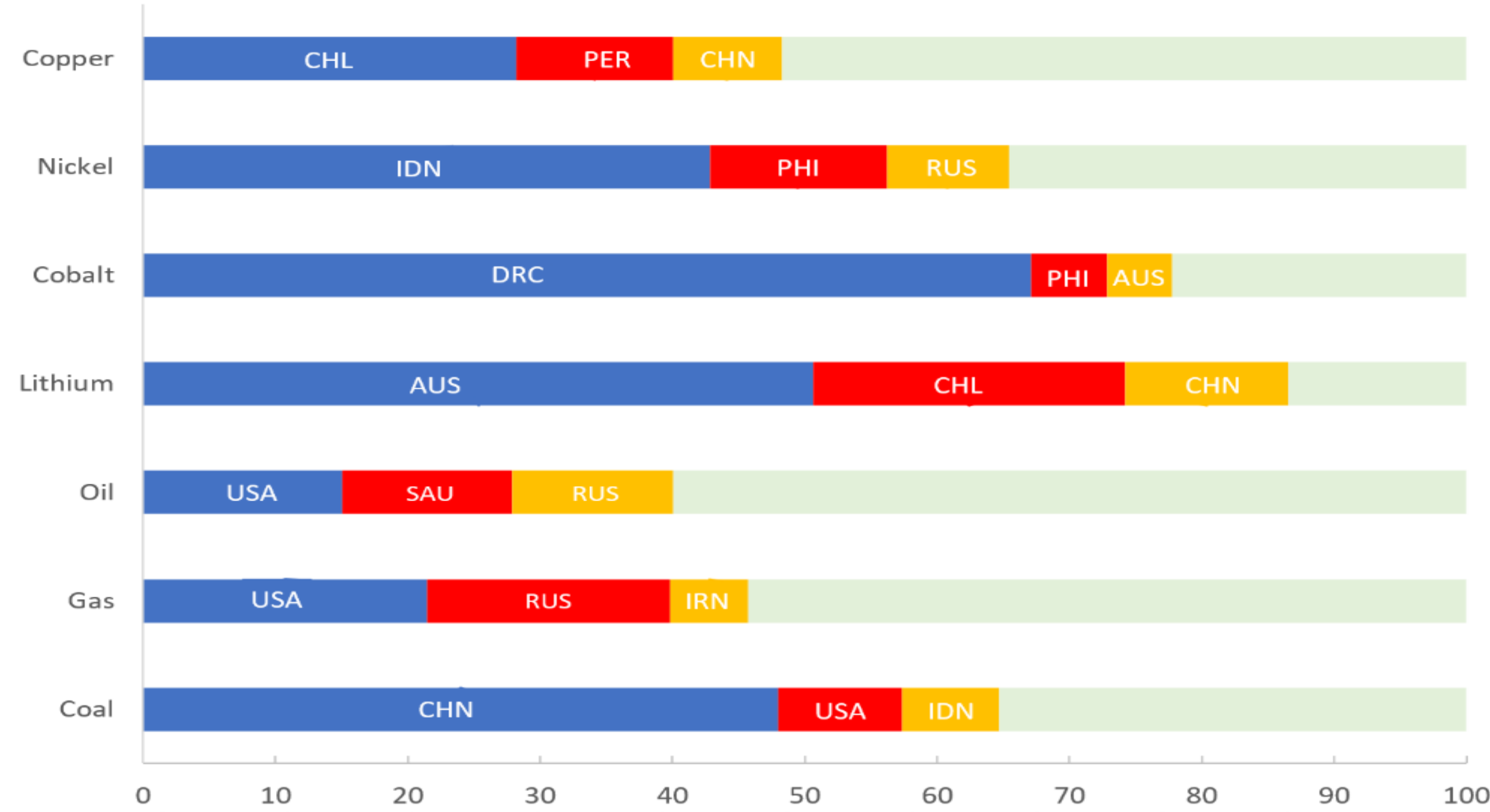
Economic Impact of Fragmentation

- Fragmentation causes expenditure switching, trade diversion and imbalances between supply and demand of commodities. Prices adjust to clear the market.
- Fragmenting critical minerals markets has a stronger impact on real GDP than fragmentation of fossil fuel markets in our stylized simulation.
- The impact on inflation is stronger for fossil fuels than mineral markets.
- Fragmentation of mineral markets has a bigger impact on the China-Russia+ bloc because manufacturing has a large share in GDP there and mining is concentrated in the US-EU+ bloc. Refining of minerals is concentrated in the China-Russia+ bloc.

Key Facts

- Critical minerals (copper, nickel, cobalt, lithium) are key inputs in the energy transition.
- Demand for these critical minerals is expected to significantly increase under the IEA's (2024) net-zero by 2050 emissions scenario.
- Most commodity production is highly concentrated in a few countries; critical minerals production is far more concentrated than fossil fuels.

Critical Minerals Output More Concentrated than Fossil Fuels

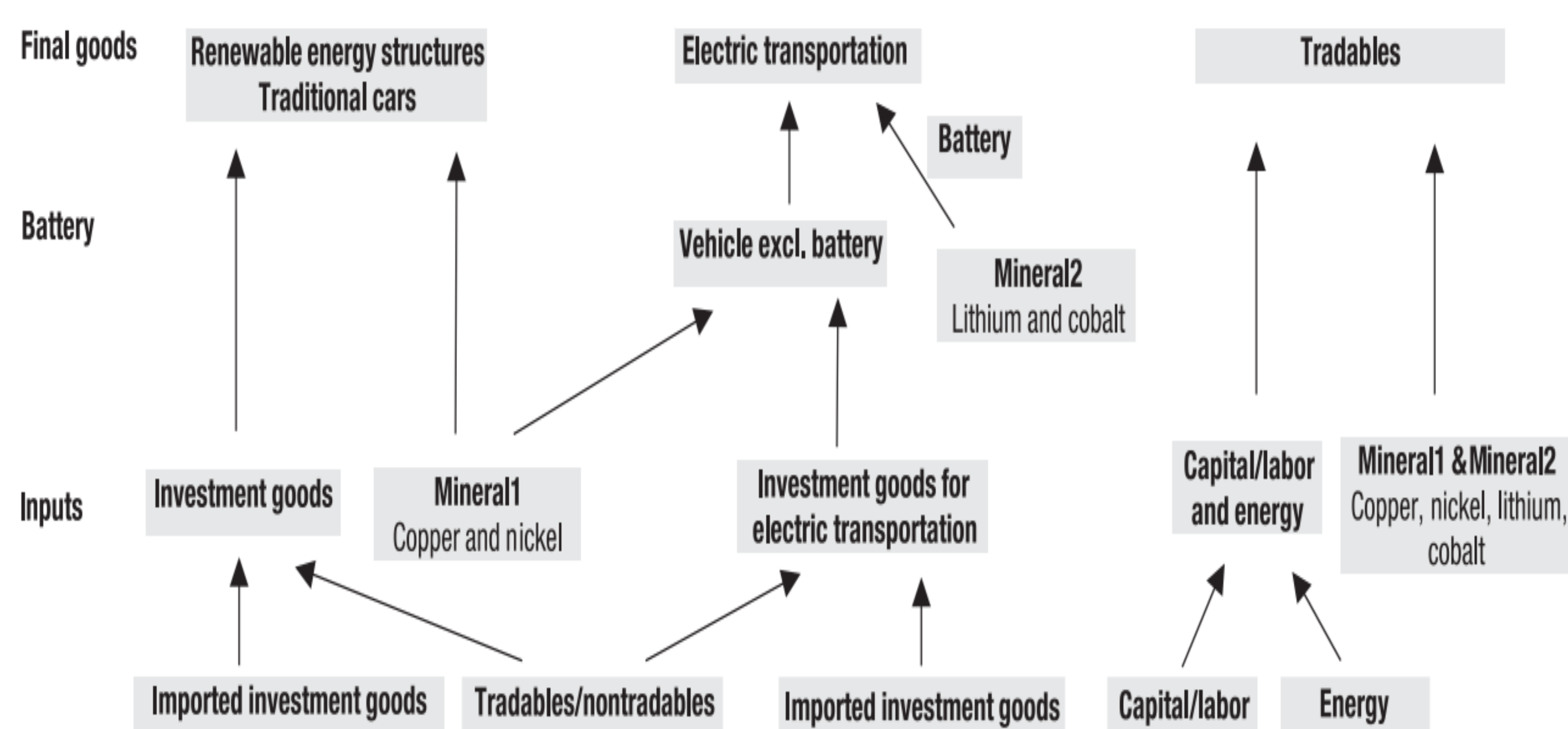


Note: This figure uses 2019 data due to data availability and to avoid biases caused by the pandemic. The figure provides the share of global production that the top three producing countries account for.

Methodology

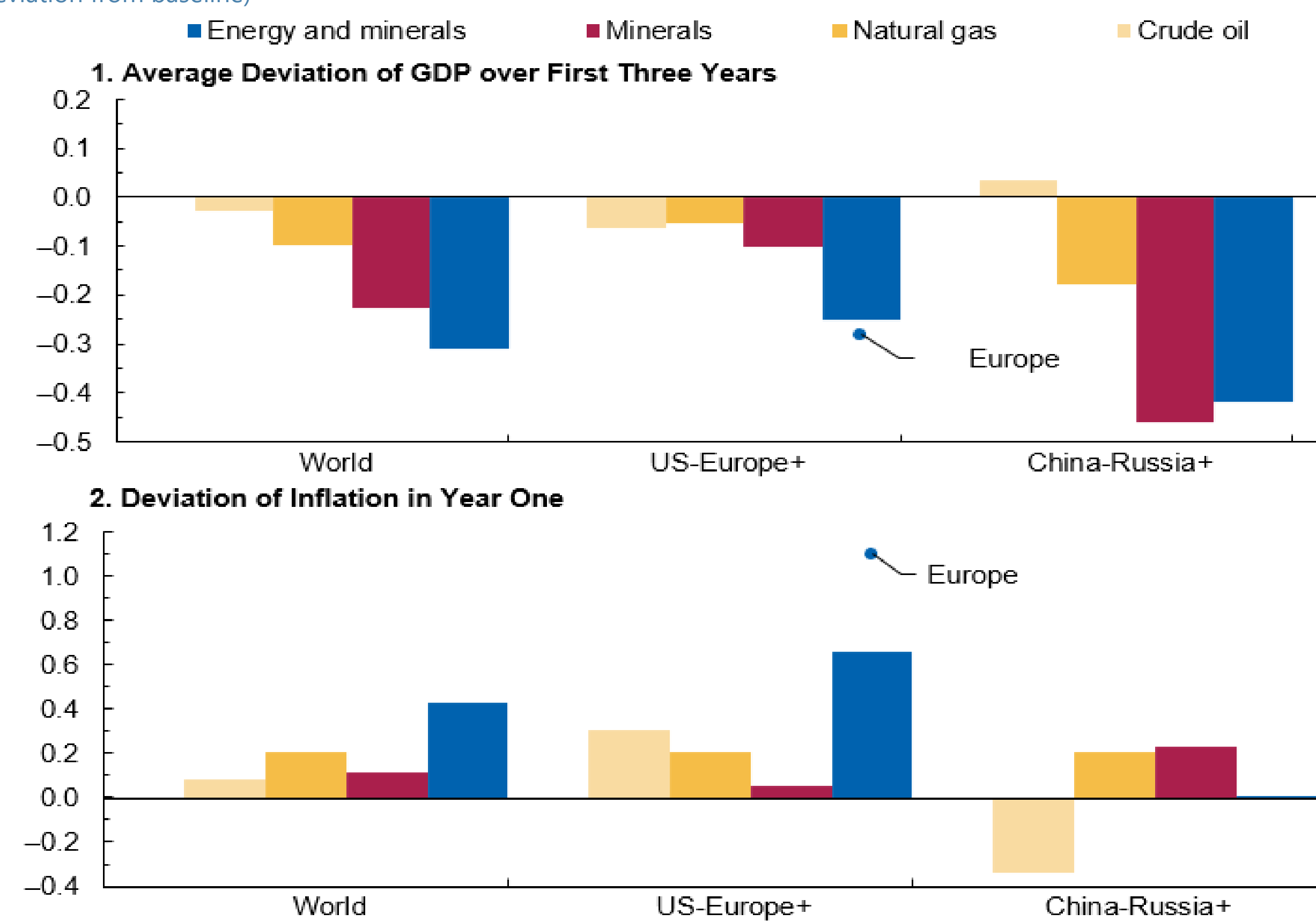
- Non-linear, multi-country New-Keynesian dynamic general equilibrium model, augmented with energy and minerals markets, building on Carton et al. (2023).
- Model features commodity production, use and trade.
- Critical minerals used in production of EVs, renewable energy structures and tradables.
- For our baseline, we assume a similar demand increase of critical minerals as IEA (2024).
- We split the world into two hypothetical blocs along the 2022 UN vote on Ukraine.
- Fragmentation implies no trade in commodities between blocs.

Use of Minerals in the Model



Impact of Fragmentation on Real GDP and Inflation

(Percent deviation from baseline)



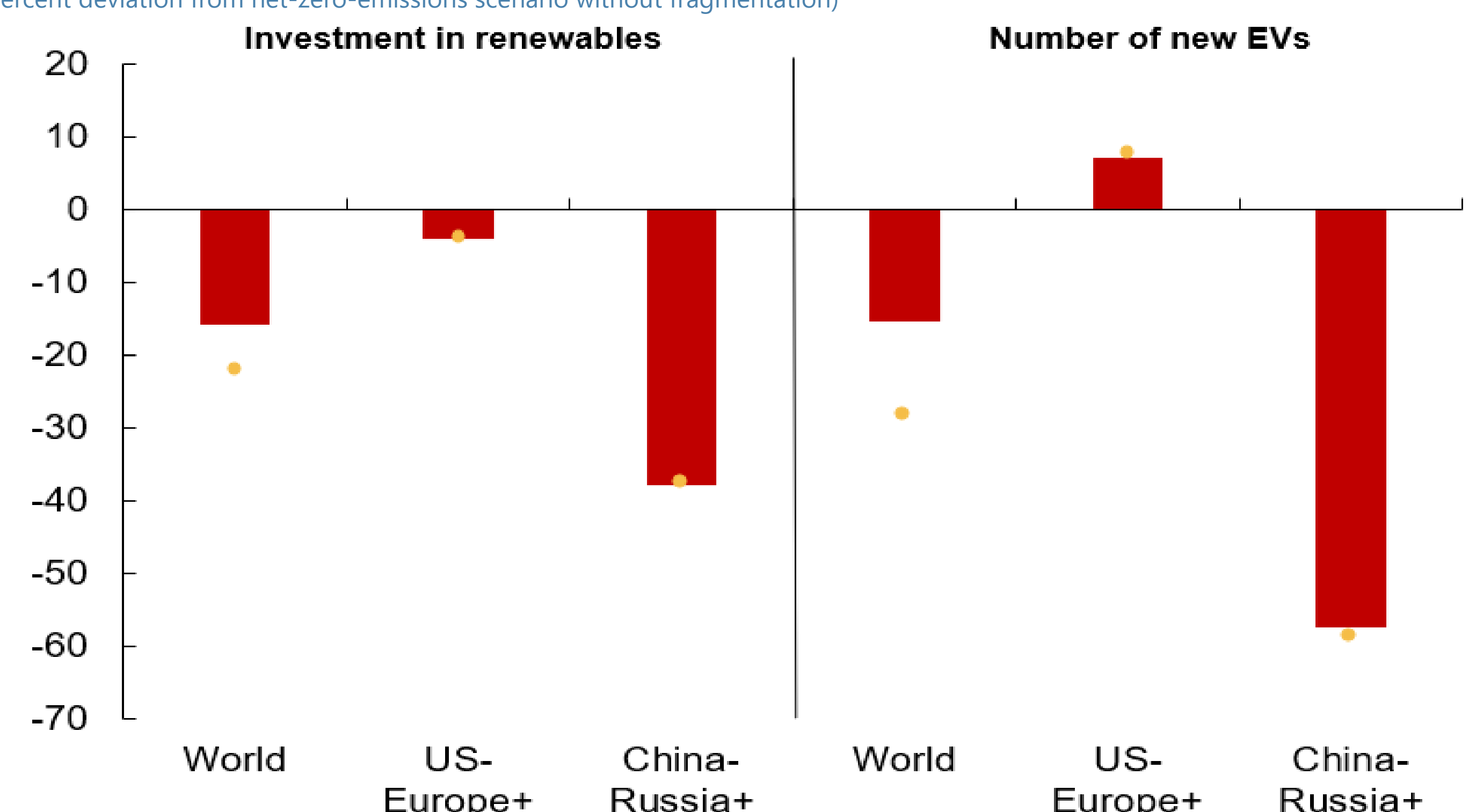
Notes: "Energy" refers to coal, natural gas, and crude oil. Region-level results are aggregated to the bloc and world levels using weights based on GDP at purchasing power parity. The bloc including the countries that voted for Russia's withdrawal from Ukraine in the 2022 UN vote is labeled the "US-Europe+ bloc," and the remaining countries are included in the "China-Russia+ bloc."

Fragmentation Slows Energy Transition

- Fragmentation of minerals markets could depress global investment in renewables and EV production by almost 20 percent compared to the baseline without.
- In the hypothetical China-Russia+ block, investment in renewables would be more than 35% lower and EV production more than 50% lower due to mineral shortages.
- In the hypothetical US-EU+ bloc, there could be a positive effect on EV production due to an oversupply of mined minerals if minerals refining can adjust fast enough.

Impact on Investment in Renewables & Electric Vehicles, 2030

(Percent deviation from net-zero-emissions scenario without fragmentation)



Notes: The bars and dots in the figure report the change in real investment in renewable energy and the production of EVs in a fragmented world relative to the net-zero-emissions path, with demand for cobalt, copper, lithium, and nickel increasing as projected by the International Energy Agency's net-zero-emissions scenario (in an integrated world). Country level variables are aggregated to the bloc and world levels using weights based on GDP at purchasing power parity in the bars and on greenhouse gas emissions in the dots. The bloc including the countries that voted for Russia's withdrawal from Ukraine in the 2022 UN vote is labeled the "US-Europe+ bloc," and the remaining countries are included in the "China-Russia+ bloc."

Conclusions

- Commodity market fragmentation has costly global implications.
- Not all commodity markets are alike. The impact of fragmentation is determined by geographic concentration, ease of switching trading partner, importance of use, substitutability, and speed of ramping up production.
- Fragmentation of critical mineral markets could slow the energy transition towards net-zero emissions goals by lowering investment in renewables and EVs.

References

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