



Climate Policy and Cartelization Risk for Critical Minerals: An Application to the Copper Market

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The demand for critical raw materials, such as copper, nickel, and cobalt, is surging due to the global shift toward cleaner energy systems. However, this growing demand raises concerns about potential market cartelization, as resource-rich countries could organize to control the supply. This possibility might pose serious challenges for countries and industries reliant on these materials.

This study focuses on the copper market. The potential cartelization risk is assessed using a resource extraction model, calibrated on market data, to compare competitive and monopolistic scenarios. It assesses the potential gains from cartelization, showing that a copper cartel could achieve profits about 50% higher than a competitive market over the long term.

Global demand for key minerals such as copper, nickel, cobalt, and Rare Earth Elements (REEs), crucial for advancing green technologies, has surged in recent years. These minerals are often found in geographically concentrated deposits, a feature that might facilitate the control by a restricted number of countries, limiting the competitiveness. Historically, mineral commodity markets have witnessed various cartels. For instance, the Organization of the Petroleum Exporting Countries (OPEC) has successfully controlled oil prices since its formation in 1960, thanks to the concentration of global oil reserves among its members. OPEC's market power is still ongoing, as it controls a significant portion of global oil production and reserves. Other examples include the Intergovernmental Council of Copper Exporting Countries (CIPEC) and the International Bauxite Association (IBA), which, despite some early accomplishments, eventually disbanded due to organizational challenges and geopolitical issues.

The geographical concentration of critical mineral reserves raises similar concerns. For example:

- The Democratic Republic of Congo (DRC) holds nearly half of the world's cobalt reserves;
- Mozambique dominates global graphite reserves;
- Argentina, Bolivia, and Chile (i.e., the "lithium triangle") hold half of global lithium reserves;
- China controls 34% of copper reserves, and Indonesia holds over 20% of nickel reserves.

These geographical concentrations might enable resource-rich nations to actively collaborate in controlling the market. Concerns were raised about the potential formation of an

Organization of Metal-Exporting Countries (OMECE) or smaller cartels for specific metals like copper, nickel, and lithium. Such developments could allow countries to influence global prices and production, potentially impacting the downstream supply chain.

Historical examples like OPEC, CIPEC, and IBA demonstrate that while resource concentration is necessary for cartel formation, it is not sufficient. For a cartel to succeed, its members must:

- Coordinate production and enforce agreements;
- Ensure relevant additional gains from cartelization, to be likely outweighing the hard-to-estimate economic and political costs of collaboration.

This study assesses the potential for cartel formation in the copper market. This focus is motivated by copper's historical and technological significance, availability of data, and extensive research background. Our research uses a two-fold approach:

- Developing a comprehensive model of the copper market, incorporating demand, supply (both primary and secondary), reserves, and stock dynamics;
- Simulating two scenarios: a competitive and a cartelized market, where production quantity and market price are set endogenously, respectively.

By comparing potential price trajectories and the corresponding profits in these scenarios, the study evaluates whether the benefits of cartelization outweigh the associated costs.

Market price (Figure 1) is almost always higher in the cartelized scenario than in the competitive one, signaling the market power exerted by cartel members and the consequent allocative inefficiency. Moreover, despite the initial cartel volatility, in both cases the market price exhibits an upward trend. This dynamic is in line with the Hotelling's rule, according to which the price of an exhaustible resource rises as its depletion nears.

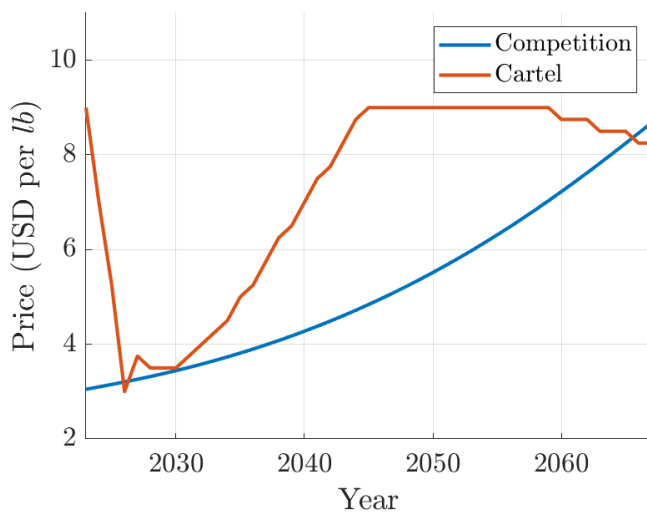


Figure 1

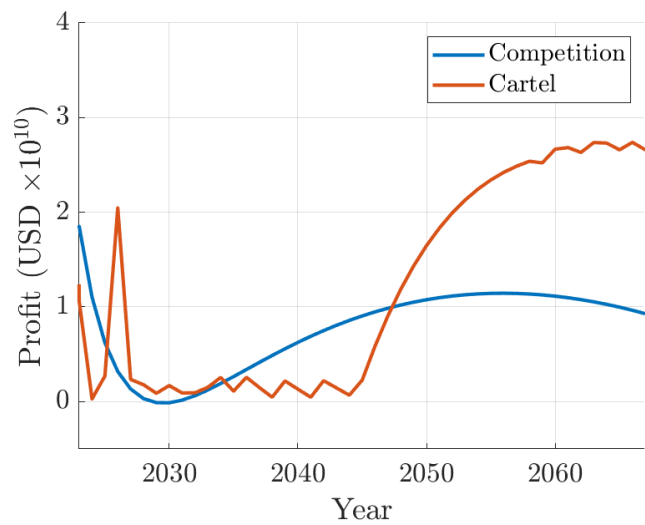


Figure 2

Notes: Figure 1 shows the optimal price trajectory, and Figure 2 the consequent profit dynamics, over a 45-year time horizon, for both the competitive and cartelized scenarios.



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As for yearly profit (Figure 2), despite the initial price-induced volatility in the cartelized scenario, we observe that, for the first two decades, potential cartel members would make higher gains in the competitive scenario. Only around the midpoint of the depicted time frame, a flip occurs. Although profit is closely linked to market price, the dynamics of these two variables are different, as profit also depends on the quantity supplied to the market. Moreover, it is important to note that profits in the cartelized scenario exhibit fluctuations that cartel members would probably prefer to avoid, and that consuming countries could anticipate and counteract through stockpiling.

Another important information is provided by the cumulative profit over the considered time horizon. Specifically, over 45 years, the cumulative profit of potential cartel members is 3.47×10^{11} USD if they act as competitive players, compared to 5.41×10^{11} USD if they actually form a cartel. Given that the decision to form a cartel is a lengthy process based on long-term projections, the fact that cartelization yields higher gains than perfect competition in the long run might still provide valuable insights to potential cartel members. On one hand, if cartel members were to adopt a long-term perspective, they might find it worthwhile to wait decades to maximize their profits. This approach could be sustainable, particularly when reserves are abundant and won't be depleted for a long time. On the other hand, cartels might instead take a shorter-term view, due to the higher risks of external disruptions, especially when reserves are in less stable or less developed countries. Factors like political instability, challenges in maintaining cooperation among members, or even abrupt regime changes can shorten a cartel's expected lifespan and reduce its viability. As a result, it is difficult to predict with certainty

whether a cartel might form in the global copper market. However, our findings highlight the presence of conditions that could support its formation, consistent with earlier studies that have observed oligopolistic tendencies in the copper market.

Addressing the risk of cartelization in the copper market requires proactive measures from governments and regulators. Strengthening supply chain resilience is one key strategy. This might involve developing new copper mining sites in diverse locations or forming strategic partnerships to reduce reliance on a few dominant suppliers. Trade diversification could also help counterbalance the influence of any potential cartel.

Another approach is to explore alternatives to copper where feasible. However, this is challenging because of copper's unique properties, which make it difficult to substitute in many critical applications. In some cases, copper itself is used as a lower-cost substitute for more expensive metals, like silver. For this reason, investing in technologies that reduce copper intensity or adopting alternative energy solutions, such as less copper-dependent sub-technologies, could be impactful.

Then, boosting the supply of recycled copper could also play a significant role. Expanding domestic smelting capacity for copper scrap and increasing recycling rates could help mitigate potential shortages. Tapping into existing unused copper stocks could also contribute to meeting demand more sustainably. Beyond addressing immediate supply concerns, these actions could finally also foster a more circular economy, reducing waste and enhancing sustainability.

References

Link to the full working paper discussed in this brief:

Romani, Ilenia Gaia, and Comincioli, Nicola, and Vergalli, Sergio (2024), "Climate Policy and Cartelization Risk for Critical Minerals: An Application to the Copper Market," [MIT CEEPR Working Paper 2024-18](#), November 2024.



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