

Rare Earth Metals: Politics, Trade and Prices

By the conceptual team of Global Arena Research Institute (published August 2024)

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“Working and conceptual papers” are analytical reviews of existing resources, including academic literature, think tank analyses, and inputs from formal institutions such as the World Bank, European Commission, and OECD. They are not intended to present original research but rather to build a background for developing research concepts used in data-driven analytics. Originally intended as internal working material, these papers are published when they are deemed to be of broader public interest. This paper is part of a series of “conceptual papers” produced as part of a project supported by the International Visegrad Fund and Konrad Adenauer Stiftung in Prague.

Executive Summary

The goal of this paper is to provide a conceptual background for further data-based research on the politics, trade and prices of rare earth metals. The paper explains the evolution of prices for rare earth metals and explains which factors influence the prices of these metals. Rare earth metals are a group of elements employed extensively in high-technology applications and China is the world’s leading rare earths producer.

The main points and findings:

- The key factors for rare earth metals market growth are linked to the growing product demand across Asia-Pacific, and, more significantly, to the global **shift towards clean energy**.
- Towards the end of 2020, the global market for lithium started to recuperate following two years of low prices, pushed by the **increased demand for electric cars**.
- The **first rare earth crisis** occurred in 2010 and 2011. During this time China had used its market power to strengthen its domestic industry and to disadvantage companies worldwide.
- **Geopolitical tensions** between Japan and China were sparked in 2010 when a Chinese fisherman was arrested near the Senkaku Islands. As a result, China blocked the export of rare earth metals to Japan for several weeks. The supply disruption led to insecurity in the market and **prices have skyrocketed**.
- The substantial price increase of the metals in 2011 made these metals even more critical and valuable for other countries, including the US. US production could not keep up with China’s political measures, cheap labour costs and low environmental protection standards, leading to a **push for recycling**. Recycling not only provided a secondary source of supply, but had a positive impact on the environment with decreased mining, which in turn minimized the impact of waste and toxins entering water sources.

- The rare earth metals industry was severely impacted by **Covid-19**. In the initial stages of the pandemic, factories in several countries were forced to shut down as the governments implemented strict lockdown measures to curb the spreading of the virus.
- Events such as armed conflicts, national industrial growth, recessions, and inflation have affected metal prices. Other factors that can affect metal prices include the construction of new production facilities as well as unexpected mine or plant closures (often due to natural disaster, supply disruption, accident, strike, etc).
- Other factors influencing the price of rare earth metals are globalization, government policies and geopolitics. On a domestic level, another factor affecting rare earth metal pricing is the Chinese Export Control Law - where new regulations give more control to governments regarding exports.

Introduction

As the world moves towards a cleaner, greener future, the uses for these metals are expected to increase rapidly. According to Financial Times, the electric vehicle **demand outlook** sees the lithium market move into a deficit in 2022 with **material shortages emerging from 2025**. Many of today's sophisticated technologies including those in the automotive, renewables and defence sectors depend on an abundance of rare earths metals. For example, rare earth metals are used in rechargeable batteries for electric and hybrid cars, advanced ceramics, computers, DVD players, wind turbines, catalysts in cars and oil refineries, monitors, televisions, lighting, lasers, fiber optics, superconductors and glass polishing.

Several rare earth elements, such as neodymium and dysprosium, are critical to the motors used in electric vehicles. Some rare earths are essential in military equipment such as jet engines, missile guidance systems, missile defense systems, satellites, as well as in lasers.

Being that China is the world's leading rare earths producer, there is wide-scale concern that may soon restrict or even ban the export of particular rare earths in order to guarantee supply for its own rapidly expanding domestic demand in sectors such as wind energy, electric bikes and hybrids. There is indeed some concern that China may reduce quotas and taxes in order to depress world prices and hurt prospective producers. With its ever growing manufacturing capacity and interest in clean technology applications, China has an expanding internal demand for rare earths metals.

During the (ongoing) trade war, the prices of rare metals have already increased, in particular after the Chinese President Xi Jinping brought the sector to the spotlight through visiting a rare earth processing firm in southern China.

Furthermore, the rare earth metals industry was heavily impacted by the Covid-19 pandemic. In the initial stages of the pandemic, factories in several countries were forced to shut down as the governments implemented strict lockdown measures to curb the spreading of the virus. After the

lockdown measures were lifted and restrictions were eased, rare-earth metal manufacturers were once again allowed to resume operations but only at a limited capacity and under several additional rules and regulations.

Rare Earth Elements as a Geopolitical Weapon

According to the American consulting firm, Horizon Advisory, China values the industry for its potential to acquire geopolitical dominance rather than the sector's commercial value. China's dominance in mining metals that are critical to high-tech manufacturing has long been a focus of American lawmakers concerned over the supply of these metals. China provides the largest variety of metals to the United States. Extracting them is expensive in part because they are difficult to mine.

According to the 2020 Mineral Commodity Summaries by the U.S. Geological Survey (USGS), the U.S. is dependent on China for rare metals and about 80% of US rare earth imports come from China.

Besides the oil industry, the US military also depends on rare earths. Many of the most advanced US weapon systems, including smart bombs, unmanned drones, cruise missiles, laser targeting and radar systems rely on rare earths.

According to a report released by the U.S. Department of Commerce in 2019, if China or Russia were to stop exports to the United States and its allies for a prolonged period, extended supply disruption could cause significant shocks throughout U.S. and foreign critical mineral supply chains. A complete ban of rare earth exports would however not be practical as American companies could secure supplies from other countries such as Malaysia and Japan, though at much higher costs.

Senator Joe Manchin, the ranking member of the Senate Committee on Energy and Natural Resources, said in 2020 at a hearing that the U.S. needs to focus on investing in innovative mining and mineral processing practices, developing viable substitutes for critical materials that can be found inside the U.S., and implementing smart policies for recycling critical materials.

There have been several efforts in Congress to push for production of minerals in the United States, including bills aimed at providing tax relief for the rare earths industry, promoting domestic rare earths mining and developing new recycling technology. The desire for clean energy, especially electric vehicles, is driving the demand for rare earth metals supplies and is likely to have an impact on the prices of these products.

China is the world's leading rare earths producer and as they are dominating the sector, the prices spiked during the first rare earth crisis in 2010 and 2011.

During this time China had used its market power to strengthen its domestic industry and to disadvantage companies worldwide. This situation got worse in 2010. Geopolitical tensions between Japan and China sparked when a Chinese fisherman was arrested near the Senkaku Islands, a territory of which both countries have claimed ownership. In retaliation, China blocked the export of rare earths to Japan for several weeks. The supply disruption led to insecurity in the market and the prices skyrocketed.

Many companies worldwide that were using rare earths were unsure how long they could sustain production. Japan's overall industry structure, which included leading firms in the fields of electric vehicles, flat panels and consumer electronics as well as future technologies like robots, made the country highly vulnerable to supply disruptions.

The Chinese supply disruptions sparked a boom of rare earths companies and mining projects around the world seeking to create a reliable supply of rare earths outside of China

Many rare earths mining projects outside of China failed to thrive when rare earth elements prices fell again.

US production could not keep up with China's political measures, cheap labour costs and low environmental protection standards. The necessary environmental protection would have been expensive for US rare earth mines.

In recent years, the US sought to reestablish itself as a major world supplier of rare earths. After being shuttered for years, the US only rare earth mine, located in Mountain Pass, California, came under new ownership in 2017 and resumed production. However, the mined material that it produces is still sent to China for processing. That is about to change as the company MP Materials is working to bring online facilities at Mountain Pass that would allow it to process its mined minerals, instead of sending them to China for processing.

The company aims to accomplish this in 2021 and to establish the ability to refine and separate rare earth metals in the coming years.

Over the past few decades, China has also become a technological leader in the separation and processing of rare earths. Almost all processing of rare earth ores mined in the world takes place in China.

The only real alternative and the main competitor for Chinese rare earth production is the Australian rare earth company Lynas which also has close ties to Japan. After the first rare earth metal crisis, Japan was actively engaged in reducing its dependency on China and invested in rare earth projects worldwide. Lynas was one of these projects. A large share of Lynas' annual production therefore goes to Japan and to other consumers with long-term contracts making it incapable of meeting US demand in the case of supply disruptions. The US remains vulnerable as long as there is no alternative rare earth value chain. Both the United States and Japan will

remain especially vulnerable during the gradual diversification process, unless their governments, at the behest of their defense departments, directly subsidize the development of alternative resources.

As rare earths have become the subject of geostrategic measures, the EU and its member states should seriously consider promoting the development of a parallel supply chain outside China in order to reduce their exposure to related supply risks. Some of the strategies implemented by the EU go through stockpiling rare earths, direct access to raw material production outside of China and the recycling of rare earths at the end of life and replacing primary raw materials by secondary raw materials, which decreases the dependency on rare earth from China. The European Green Deal targets 2050 climate neutrality and recognizes access to resources as a strategic security question to fulfil its ambition. The new Industrial Strategy for Europe sees rare earth materials as key enablers for a globally competitive, green and digital Europe. It envisions European competitiveness based on a new Alliance on Raw Materials and highlights the importance of industrial ecosystems for accelerating innovation and growth in Europe. A more resilient, more protective, more sovereign and more inclusive economic model that aligns with the Green Deal has also been prioritized by the recently launched Green Recovery Alliance.

In recent years, Beijing has also looked to reform China's rare earth industry to enhance efficiency, better protect the environment, and crack down on illegal mining. Cheap domestic supplies of rare earths gave Chinese manufacturers the opportunity to scale up the production of key products like permanent magnets, which are integral to the functioning of wind turbines, hybrid vehicles, and other advanced technologies. Beijing's policies allowed China to capture nearly all of the global market.

China has demonstrated a willingness to leverage its influence in the global rare earth industry in pursuit of its political objectives. While several major countries have sought to limit their exposure to supply chain disruptions emanating from China, they nonetheless remain deeply reliant on Chinese rare earth exports.

As China's domestic consumption of rare earths grows, the country will be increasingly reliant on imports to feed its appetite for the materials. China already became the world's largest importer of rare earths in 2020, and it is expected to become a net importer by the middle of the decade. Under these conditions, Beijing's influence over the global rare earth industry would be significantly reduced, and new players might finally find themselves able to compete.

The Covid-19 Impact and the Driving Forces of the Rare Earth Market

According to a report from Market Research the rare earth metals market is projected to grow from USD 5.3 billion in 2021 to USD 9.6 billion by 2026. The increasing use of rare earth elements that are used in the permanent magnet application are likely to drive the rare earth metals market.

The rare earth metals industry was heavily impacted by Covid-19. In the initial stages of the pandemic, factories in several countries were forced to shut down as the governments implemented strict lockdown measures to curb the spread of the virus. After the lockdown was lifted and restrictions were eased, rare earth metals manufacturers were allowed to resume factory operations again, but at a limited capacity and under several additional rules and regulations.

The Covid-19 pandemic has already by now caused profound effects at a global scale. In the automotive industry, for example, car manufacturers announced a halt in production, which is now gradually resuming again.

The coronavirus outbreak in China has had a foreseeable but unintended consequence. Truck drivers have refused to make deliveries into areas either identified as or suspected of harboring the virus. This has interrupted not only the flow of minerals into affected areas but also the refining and manufacturing of metals, food, and fuel.

Rare earth components for moving machinery, such as automobiles, trucks, trains, aircraft, industrial motors and generators, home appliances, and consumer goods, are almost all procured from China or Japan.

That flow is now slowing and will inevitably have a domino effect on American and European industries as these items cannot be re-sourced due to China's monopoly

The driving forces of the rare earth metals market are the increasing demand from end-use industries and the increasing demand for clean energy.

However, rare earth permanent magnets are expected to be the prime growth market over the next five to ten years.

These magnets find major applications in the automotive market (both conventional automotive as well as hybrid vehicles), and their demand is dependent on this market.

The application of rare earth magnets in wind turbines is expected to be another major growth market over the long term. Along with the above applications, rare earth magnets are widely used in major consumer and industrial electronic applications, such as smartphones.

Despite the general volatility of the market and frequent price fluctuations afflicting the economy, there are always consequences for the rare earth metals market. An example of this is how the global recession of 2008-09 impacted the rare earth market.

The rare earth metal prices increased suddenly in 2011 after the conflict between China and Japan. These fluctuations in prices coupled with rising energy costs are destabilizing the supply chains of rare earth elements. These factors make it difficult for manufacturers to deliver quality products.

As the prices of rare earth materials fluctuate, it depends on the manufacturers to either absorb additional costs or to increase the prices of the products. Thus, the demand for rare earth metals is dependent on the demand for its applications.

Furthermore, the demand for the applications is dependent on the end-user industries. So the rare earth metal has a double supply chain, which further increases the final price demanded by manufacturers.

When the price of rare earth materials increases, few manufacturers search for new suppliers that allow them to maintain revenue targets. This often means sourcing materials from the lower-cost economies. However, switching to a different source of raw materials carries a high risk of disrupting the supply chain.

Rare earth metals were cheaper before new applications were discovered for their use. This created a discrepancy in the supply and demand chain of the rare earth metals, which was due to an enormous increase in the prices of the metals. Earlier, the metals were not as critical as they have become over the past five years. Back then, a lot of them were wasted due to inconsistent demand and supply. Currently, the situation is different. Many critical industries, including green technology and defense use a lot of rare earth metals. The substantial price increase of the metals in 2011 made these metals even more critical and valuable for other countries, including the US, which led to a global drive for recycling. Recycling not only provides a secondary source of supply, but also has a positive impact on the environment due to decreased mining. It also minimizes the impact of waste and toxins entering water sources.

Money supply is also an important factor in determining the price. The geographic distribution of metal mining is influenced by the location of economic deposits. Consumption of these metals is distributed among several leading consuming countries and many smaller consuming countries that are geographically distributed around the world.

Mining factors affect the production cost, and therefore, the price of metals. Economic events such as wars, national industrial growth, recessions, and inflation have affected metal prices. Other factors that affect metal prices include: the construction of new production facilities, as well as unexpected mine or plant closures (natural disaster, supply disruption, accident, strike, etc).

The extent and duration of an event affect price through supply and demand. Other factors that can affect the price are globalization, government policies and geopolitics.

Globalization is important because many countries now play a role in metal production and consumption. Events in any of those countries could affect metal prices. Events between countries, such as changes in currency exchange rates, play a role.

Governments set trade policy (implementation or suspension of taxes, penalties, and quotas) that affect supply by regulating material flow. They set the rules for resource extraction. They are a source of demand when they build stockpiles and a source of supply when they dispose of them. Geopolitical events involving governments or economic paradigms and armed conflict can cause major changes or disruptions.

November last year saw the prices of all major Chinese rare earths spike, but especially those used in magnets. One of the many factors in the price surge was a new law that came into force in China on December 1st. known as the Export Control Law. This law gave governments more control over exports regarding technology and rare earth metals.

Though exports of Chinese rare earth metals have been decreasing in recent years, rare earth based magnet exports have actually been increasing because of the increased global demand, including U.S demand. In anticipation of concerns that the Chinese government could use this new law to further curtail exports, the U.S. have seemingly been buying up as much material as possible, with U.S. rare earth magnet imports reaching 480 tonnes in September of 2020, the highest monthly total since 2016, according to the U.S. Geological Survey.

Emerging economies are more likely to use rare metals than developed economies because of the huge materials needed for new infrastructure projects. Prices will depend on long-term demand in the emerging economies. Just to have an idea of the dimension of the market for the emerging economies, China and India both have a population of around 1.3 billion people, followed by Africa with a population of 1.2 billion and South America with a population of 434 million people. Their economies are expected to grow in the coming years which could keep prices high even if new producers emerge.

In general terms, costs of mineral extraction are increasing because of lower ore grades and increasing capital costs. China's costs of production are likely to rise as environmental and social costs and the potential for rising labor costs begin to be incorporated into China's REE production and processing operations. China would likely be unable to increase production significantly to drive prices down, as they have done in the past, because of higher costs, internal demand for domestic consumption, and the value-added export market. While sustaining high prices may attract some investors, both the technology capacity and skills are necessary to carry out the work.

According to the 2020 Global Market Insights Inc. report one of the strong driving forces behind the rare earth market is that promoting the rising demand for clean and renewable energy is promising public policies towards renewable energy consumption. Furthermore, apart from the rising demand for energy, there are immense oil and gas price fluctuations. Since renewable energy plants depend little on these commodities, the adoption of renewable energy is likely to grow over the coming years, further assisting in the growth of new energy plants.

The Asia Pacific region is likely to be the largest regional market, expected to account for more than 55% of the global demand by 2026. The growth is attributable to the presence of vast rare earth metal reserves in the region.

Furthermore, China is one of the key consumers of rare earth in the overall Asia Pacific region. The demand for rare earth metals in China will grow 11%. In addition, stringent government efforts for controlling illegal mining activities will further boost the regional market growth over the upcoming years.

So we can conclude that the three key reasons for rare earth metals market growth is due to the growing product demand across Asia-Pacific, increasing adoption of magnets and the global shift towards clean energy. Metal prices are affected by factors external to the metals industry.

The metals industry is a part of the world and national economies, so changes in those economies can affect metals' prices. Some situations that could affect prices in the near future include possible export limitations, changes in China's economic growth, and continued Indian economic growth. Global warming is becoming an issue. High fuel prices raise transportation and production costs. Independent of any metal industry factors, the price of metals changes with the changing value of the U.S. dollar, which has been generally declining. As a result of these factors, the price of metals has been increasing.

Conclusion

There have been measures introduced by nations at the policy level to both address China's monopoly position and bolster their own domestic production of rare earths. In Africa, the European Union, Australia and the Americas, concerns about China's control of the market have been pushing exploration and development projects, while leading to greater attention from political leaders.

On the other hand, the combination of the current reorganization and consolidation of the REE value chain in China and the expansion of extraction and processing facilities around the world could give consuming countries more opportunities to diversify their sources of imports. Together with the development of recycling solutions and availability of substitutes, diversification would contribute to reducing countries' dependence on rare earth imports from China, while also easing pressures on price.

Given its increasing importance, it would be important to monitor this market more carefully. In this regard, international cooperation is probably needed to ensure that data and information on REEs are consistent and reliable. This would contribute to enhancing market transparency and encouraging a more sustainable approach to the extraction and processing of “REE”.

According to statistics that were made in 2020 by Statista related to the distribution of rare earths production worldwide they concluded that production has increased in China and now is with 57.57% followed by the U.S with 15.63%, Myanmar with 12.34%, Australia with 6.99% and India and Russia with 1% each.

Many people do not realize the enormous impact the rare earth elements have on their daily lives, but it is almost impossible to avoid a piece of modern technology that does not contain any.

In conclusion, policies for the prevention of the dispersion of rare earths elements should be pursued. This includes innovations in whole life management and development of recycling infrastructure. Future amendments to the End of Life Vehicle Directive should encourage collection and recycling of rare earth containing parts and components.

Transparency of the supply chain should be encouraged to give manufacturers knowledge of the environmental impacts of the supply chain and to provide a choice.

Finally, because China is the dominant global supplier of rare earths and there is an increasing demand for these materials, there is fear amidst several countries of the world, especially in the USA. Beijing has demonstrated a willingness to leverage its weight in the global rare earth industry in pursuit of its political objectives and use it as a geopolitical weapon against the West.

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Companies worldwide which are using rare earth materials are unsure about how much longer they can sustain production. Japan's industry which is comprised of leading firms in the fields of electric vehicles, flat panels and consumer electronics as well as future technologies like robots might experience a pronounced impact on supply chains if production can not be sustained.

China's recent policies regarding the regulation of the rare earth materials flow stem from multiple potential aims. Aside from trying to gain geopolitical advantage by governing the rare resources, China is dealing with an internal narrative which aims for "economic resource nationalism". By shifting the economic profit from foreign producers to domestic entities it becomes easier to centralize and oversee the supply chain from the position of the state. This narrative is aligned with similar Chinese economic policies intended to create strong and socially responsible domestic actors. Another circulated explanation is that China's restrictive rare earth policy can be justified by growing environmental concerns which prevent the maximization of the supply chain. (Vekasi, 2018)

<https://www.cambridge.org/core/journals/japanese-journal-of-political-science/article/abs/politics-markets-and-rare-commodities-responses-to-chinese-rare-earth-policy/98B93458FD59C59EF676F9A2FBD8868F>

Environmental implications and internal struggles in the Covid section. For a more balanced view:

- Rare earth elements mining investment: It is not all about China

https://www.sciencedirect.com/science/article/pii/S0301420717300090?casa_token=FtZ5KBPZ1YAAAAAA:bw7BoIbryj86Bh3bmsxxjjbdr8km0bvCZZsinUlxKpzneNV2iEm2SJoxLE6pkWOkbPHSZ095UfB

- Scenarios of rare earth elements demand driven by automotive electrification in China: 2018–2030

https://www.sciencedirect.com/science/article/pii/S0921344919300606?casa_token=oCnw5Bvy7usAAAAA:M7WNBBrFBePYVsthMRCsA3ICODEIyrYYzw9-TJHTVxro4W8SAbGs2CEumGyP4BIf_YAYMKfWDMFnw

- China's Control of Rare Earth Metals

<https://www.nbr.org/publication/chinas-control-of-rare-earth-metals/>

The timeline is quite blurry. There are often jumps from current affairs to old conflicts and back to the present which can be confusing for when you want to predict/forecast future scenarios. (see page 6 especially). I would follow this logic:

1. Past incidents, facts, experiences which contributed to prices changes of rare earth materials over time.
2. Recent situations (before Covid)
3. Covid Impact
4. Future projections

The paper's goal as stated in the beginning is to

- provide conceptual background
- explain the evolution of prices for rare earth metals
- explain which factors influence the prices of these metals

If we look at the conclusion, we don't really see the achieved goals:

I can conclude that policies for the prevention of the dispersion of rare earths elements should be pursued. This includes innovations in whole life management and development of recycling infrastructure. Future amendments to the End of Life Vehicle Directive should encourage collection and recycling of rare earth containing parts and components.

Transparency of the supply chain should be encouraged to give manufacturers knowledge of the environmental impacts of the supply chain and to provide a choice.

Finally, because China is the dominant global supplier of rare earths and there is an increasing demand for these materials, that makes concern and fear grow in several countries of the world, especially in the USA. Beijing has demonstrated a willingness to leverage its weight in the global rare earth industry in pursuit of its political objectives and use it as a geopolitical weapon against the West.

It is highly focused on China and the narrative seems subjective ("China is bad" type). I would conclude like this:

In conclusion, this paper set the conceptual background of the flow of rare earth materials, the global players involved and the current process impacted by the Covid-19 crisis. Following the detailed explanation of the evolution of the global rare earth elements supply chain, the paper delved into variables which impact the prices and which entities are in control of setting the

standards, Finally, we analysed the main factors influencing changes in price such as geopolitical motivations, environmental factors and internal policies narratives.

This paper was produced by the conceptual research team of the Global Arena Research Institute (GARI) as part of the preparatory work for utilizing GARI's signature digital twin of the globalized environment. Supported by the International Visegrad Fund, Technology Agency of Czech Republic (TACR) and the Konrad Adenauer Stiftung, GARI is at the forefront of integrating leading-edge computing technologies with socio-economic and political analysis. These internal conceptual working papers lay the foundation for our digital twin's application, offering critical insights and frameworks that enhance our understanding and foresight into global and local processes across various domains, including economy, trade, politics, defense, society, energy, and the environment.