

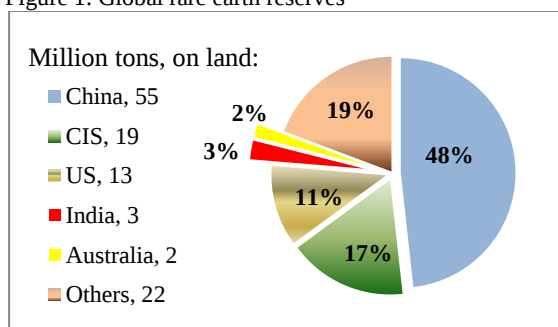
# ECN230 Case Studies on Trade Issues: On the Use of Export Restrictions

## CHINA'S QUOTAS ON EXPORTS OF RARE EARTHS

The red clay hills of southern China might seem an unlikely spot for a global tug of war, but that was what had been playing out when Beijing cracked down on the mining of rare earths, the 17 elements crucial to the electronics used in everyday life. Rare earths are crucial to everything from polishing glass to generating electricity from wind or making a BlackBerry vibrate [1]. They are the most sought-after materials in modern manufacturing. In tiny amounts, their unique magnetic and phosphorescent properties make them vital ingredients in a host of gadgets and components [7]. Rare earths are used in manufacturing sophisticated products including electronic devices, flat-screen monitors, electric car batteries, catalytic converters, wind turbines and aerospace alloys and other high-tech products ranging from computer chips, phones and televisions to the lasers that guide missiles and sophisticated radar systems [1, 2, 4]. Wind turbines and electric vehicles use two rare earth elements, dysprosium and neodymium, and rely on them to make the magnets that are essential to their generators and motors [3].

At the height of the dispute in 2011, China had at least one-third of the world's reserves of rare earths, but accounted for 97% of current production [2]. Figure 1 shows the estimated shares of reserves of rare earths in the world. Estimates by the US Geological Survey suggested a 48% share of world land reserves. Hence, China was the world's largest producer (but for some of the elements such as dysprosium its market share was nearly 100%) of rare earths [7]. Although plentiful in nature, extracting them is difficult, costly and time-consuming, and dirty, i.e., extraction produces highly toxic by-products [2, 7]. Fears were growing about the political effects of the clout China's government had over production and export.

Figure 1. Global rare earth reserves



Source: US Geological Survey in [8]

China's dominance came from heavy investments in the 1980s at a time when its economy began to open. Deng Xiaoping later said that rare earths would be to China what oil was to the Middle East. As Chinese production came on stream in the 1990s, China came to dominate production as it could mine rare earths cheaply – often at great environmental cost, causing international prices to plummet and pushing out competing foreign (e.g., US) producers out of the business through mine closures [1, 7].

In the late 2000s, Chinese officials cited environmental concerns over how rare earths were produced as the reason for a clampdown on its mining and production. However, some industry executives say protectionism and a desire for a bigger role in the lucrative sector for state-owned miners was also a determining factor. Analysts believed the clean-up programme would reduce rare earths output and tighten the international market, though exact figures were difficult to ascertain because of illegal mining and smuggling. "I would expect a shortage developing in the next two to three months," said Constantine Karayannopoulos, chief executive of rare earths producer Neo Materials when

asked in August 2011 [1]. China also argued that in addition to cracking down on illegal mines that export quotas were needed to protect resources and the environment [5].

## Background to the problem

China's grip on rare earths first made headlines in 2010, when it suddenly cut exports to Japan, but it had been squeezing the market for years. Table 1 shows the cuts in exports between 2009 and the end of 2011 from the quotas. In 2000 it exported some 47,000 tonnes of rare earths; by 2010 it exported only about 30,000 tonnes [6]. From 2006 to the end of 2011, China behaved in a way that resembles OPEC, the oil-producers' cartel, cutting exports by 5-10% per year. This decline appeared to be the result of export taxes and quotas [6, 7].

Table 1. China's rare earths export quotas (tons)

| 2008   | 2009   | 2010                 |                      | 2011                 |                      |
|--------|--------|----------------------|----------------------|----------------------|----------------------|
|        |        | 1 <sup>st</sup> half | 2 <sup>nd</sup> half | 1 <sup>st</sup> half | 2 <sup>nd</sup> half |
| 47,011 | 50,145 | 7,976                | 22,282               | 14,446               | 15,738               |
|        |        | 30,258               |                      | 30,184               |                      |

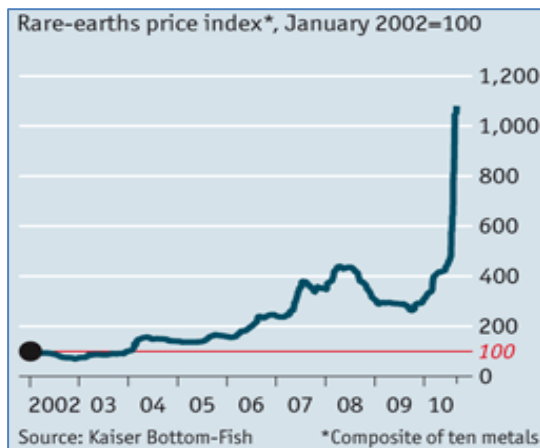
In September 2010 Japan claimed that China was blocking supplies in response to the arrest of a Chinese fisherman in disputed territorial waters. Japan accused China of suspending shipments entirely. China denied that it had interfered with shipments, but Japanese traders said that supplies were stuck in Chinese ports for a week [7]. The diplomatic dispute and the announcement that China was slashing the export quota by 40% prompted protests from Washington and Tokyo, sparking concerns for supply of rare earths and causing prices to soar. Table 2 provides a chronology of the events related to the trade dispute.

Table 2. Chronology of events, 2010-11

| 2010 |                                                                                                                          | 2011    |                                                                                                                                           |
|------|--------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------|
| July | Beijing slashes export quotas for 2 <sup>nd</sup> half of 2010, making them 40% lower than 2009                          | Feb     | China's State Council says it will strengthen oversight of the rare earths industry                                                       |
| Sep  | Japanese traders say China has halted rare earth shipments to Japan following a diplomatic dispute. Beijing denies this. | Apr     | The Environment Ministry announces inspections of rare earth firms                                                                        |
| Nov  | China resumes shipments of rare earths to Japan                                                                          | Jun-Aug | Many rare earths processors close for upgrades to conform to new regulations                                                              |
| Dec  | Export quotas for the 1 <sup>st</sup> half of 2011 are kept on par with 2010 on an annualized basis                      | Jul     | Beijing brings 2011 export quotas to the same level as 2010, but a technical change means that exports will effectively be reduced by 10% |
|      |                                                                                                                          | Aug     | Beijing begins a campaign to find and close illegal mines. Local governments are given until Nov to close mines in their area             |

Source: [1]

The squeeze came as a surge in demand for high-tech equipment sent demand for rare earths soaring. In 2003 some 85,000 tonnes were shipped, valued at \$500m. In 2010 world sales were expected to total 125,000 tonnes, worth nearly \$2 billion. Demand was forecast to increase by around two-thirds over the next five years [7]. The quota of 30,258 tonnes was 15,000-20,000 tonnes less than consumption by non-Chinese producers says Judith Chegwidden of Roskill Information Services, a consultancy [4]. The move cut supply and sent shivers through the global rare-earths supply chain. The cost of cerium oxide (often used as a catalyst) and used in glass increased sixfold since the start of 2010, and was 20 times higher than in 2005; lanthanum (petrol refining), yttrium (displays) and a bunch of other -iums zoomed upward as China squeezed world supplies (see chart, "rare-earth price index").



### Environmental concerns

China cited "environmental" concerns as the reason for the export quotas. That is less implausible than it sounds, though there is a strong environmental argument for restricting the supply of rare earths. Rare earths are dangerous and costly to extract responsibly; China's techniques have been anything but. It has deposits in two regions: Inner Mongolia, where rare earths are a by-product of iron-ore production, and in the south of the country, where they are found in various clays. Although the extraction process in each location differs, they share a need for highly toxic chemicals. Horror stories abound about poisoned water supplies and miners [4, 6].

Beijing announced a nationwide rare earths mine inspection campaign after a series of steadily tightening rules since the start of 2011. In mid-year, some of the mines gouged out of hillsides in Jiangxi province had been broken up, others mothballed [1]. There were once many miners but the country shut down dozens of operators in Inner Mongolia and elsewhere [6]. The vision was eventually to consolidate control of China's rare earths industry under three big state-owned miners - Baogang, Chinalco and Minmetals - but that would prove an uphill battle. Parts of southern China, including Jiangxi province, were at the heart of the crackdown. Red clays in the region are rich in "heavy" rare earths, the most valuable and scarce elements. The mining for decades was a cottage industry as farmers learnt how to leach the elements out of the clay in their back yards. "My brother and I went into rare earths in 1987," recalls one motorcycle taxi driver in the town of Xinfeng. "It was tough to make any money. We had no technology and prices were so low back then" [1].

In 2011, Jiangxi was considered more strictly regulated than neighbouring provinces, but it was not difficult to find mines still operating then. Record high prices for rare earths fuelled smuggling - miners said they could make RMB30,000 from a single tonne of mixed, unprocessed

rare earths. Often, the largest mines were owned by the same local government officials in charge of enforcing the shutdowns [1].

The countryside around Xinfeng was dotted with hundreds of small open-pit mines into which miners poured water and chemicals, producing a sludge rich in rare earths. Technically, the province had only 88 licences for rare earths mines - which was to be whittled down to one mega-licence - but small producers typically eluded Beijing's reach. Farmers in Jiangxi mastered the art of these small "leach" mines, where high-potency fertiliser was often used to dissolve the rare earth. They left the land scarred by barren tailings ponds and eroded hilltops [1].

Beijing launched campaigns over the years to clean up the mines, but none as serious as that which was under way in 2011. "It used to be that if you had a relative in government or were well connected, you could still mine [even during crackdowns]," said a miner in Tongmu village. "But today it is yidaoqie - one knife cuts all" [1].

Nearby the charred remains of a small rare earths pit bore witness to the clampdown. Officials raided the mine and burned its equipment so it could not be put back into use, the miner says. Government notices on local television promised a reward of RMB20,000 (\$3,130) for anyone reporting an illegal rare earths mine, as well as pay-outs for turning in unauthorised dealers [1].

Some mines were poised to reopen once Beijing looks the other way. In the forests near the hamlet of Anxi, a new rare-earth mine lies spread out under the evening sky. It was completed just before the crackdown and has never been operated. "You never know when government policies could change," said a former miner, looking out over the pit. "This time [in 2012], this mine could easily be producing" [1].

### Ultior motives and controlling factors

China's position on the world market is clearly depicted in the chart ("rare earths"). Production levels decreased, the export quota volumes tightened, and international prices soared, peaking in 2011.



However, because the spike in rare-earth prices seems not to have taken hold within China, many saw another, more nefarious calculation behind the export quotas. It was

restricting exports to induce foreign technology firms to place manufacturing operations inside China before non-Chinese mines were on stream and its market controls ebbed [2, 7].

China also has other means of retaining control of the market besides the export quotas. Controlling the supply of rare earths means that China can also control their processing and use in finished goods, which would fit a broader effort to drive its manufacturers from low- to high-value goods. It had lots of capacity to refine rare earths, whereas most rich countries did not, so it could exercise control downstream [4, 6].

If that was the Chinese plan, time was limited [4]. In March 2012 the US, EU and Japan filed a complaint at the WTO against China over export restrictions on rare earths [5]. In February 2012 they got a boost when the WTO's appellate body ruled against China on a related case, i.e., that China's policies to restrict exports of several metals, such as bauxite and magnesium, violated its WTO obligations [6].



### The market response

Taking the longer view, China's policies seem destined to fail. Despite its control over production and global reserves, restricted supply and higher prices had already spurred changes. Since 2010, companies in Japan and other countries responded by seeking alternatives, alternative sources, recycled substitutes and finding ways to use fewer rare earths [1, 5]. In response, prices began to fall in 2011 [5]. For the Chinese, rare earths were simply not rare enough.

Japan, with its electronics, fine-chemicals and car industries, used a fifth of the global supply, making it the world's biggest importer of rare earths [7]. So, while many observers were convinced that after two decades of economic impotence that Japan was cautious and slow to change, the very clear threat of China's hoarding of rare earths suggested that Japan could move quickly when sufficiently provoked. A disruption of supply could paralyse the Japanese economy as much as an oil embargo or food blockade. And because Japan dominated some of the technological processes that use rare earths—such as polishing hard-drive platters with cerium oxide—interrupted access would be felt worldwide [2].

The big trading houses such as Sojitz, Sumitomo and Mitsubishi were securing alternative supplies, supported by state financing. Companies such as Toyota, Hitachi, Nidec and TDK were working to reduce or eliminate the rare-earth elements needed in devices. Recycling programmes were being studied. The government earmarked \$1 billion from a stimulus package in November 2011 to secure supplies, including funding university research and projects such as robotic deep-sea mining [2].

A national stockpile of the kind that already existed for rice, cereals and petrol had been mooted. There was even talk of creating a generously funded agency to acquire stakes in non-Chinese producers, possibly using the country's vast foreign-exchange reserves (at \$1 trillion, the world's largest after China's). Japan's prime minister had

met his Vietnamese and Mongolian counterparts to discuss new production [2].

Japan had been suddenly spurred to action before. The environmental crisis in the 1960s, the oil shocks of the 1970s and the strong yen in the 1980s rallied bureaucrats, politicians, business leaders, the media and the public. High energy prices forced Japan to become one of the world's most energy-efficient countries [2].

Japan would remain dependent on Chinese rare earths for some time. The country's resource mandarins said they have no specific target for reducing this dependency, though they reaffirmed an earlier goal that Japan should control 50% of its mineral needs, including rare earths, by 2030. But the shock seemed to have reinvigorated the trade ministry [2].

High prices began to propel a supply response elsewhere in the world too. Other known sources outside China had been brought into play reasonably quickly. In time, fresh supply would take market power away from China. Within four years new production would start in Australia and in California (where it ceased in 2002) [4]. Molycorp, a US firm operating a mine called Mountain Pass, which in various guises dates back to the early 1950s, reopened for business in February 2012, what was once the world's largest source of rare earths. It intended to meet about one-sixth of global demand and said it had the potential to double that output. The mine in California closed in 2002 over environmental concerns and the then unjustifiable cost of correcting them. In July 2010 it raised \$394m in an initial public offering; its shares rose by 20% by September [4].

Capacity was also being increased at mines in India and Vietnam. The newcomers could shrink China's market share by 15%, said Dudley Kingsnorth of IMCOA. The only existing producer outside Asia not dependent on Chinese ores was Silmet, a rare-metal firm in Estonia, which says it is now besieged by eager customers. It hoped other producers would come online soon [7].

Similarly, Lynas Corporation of Western Australia had seen its shares rise eight-fold since early 2009, shortly before a state-owned Chinese company attempted to make an investment that was itself blocked by the Australian government. Toyota reported to be close to securing key supplies in Vietnam; Sumitomo, another Japanese firm, was moving forwards in Kazakhstan. "The problem of supply is easily solved," says John Kaiser of Kaiser Bottom-Fish Online, a website on mining. "It just takes three to five years and billions of dollars." China has long seen commodities in terms of security of supply. It may yet persuade others to follow suit [4].

### Longer-term demand vs supply

So, while market forces and the WTO ruling made some market corrections, there were still reasons for doubt in 2012. The Chinese forced the industry to consolidate which could have slowed prices from falling to levels before 2010 [6]. There were other peculiar snags. The quantities of rare earths used in technology components are so tiny that higher prices are invisible in the cost to consumers. Recycling is tricky: just half a penny's worth of neodymium helps a mobile phone vibrate [7]. More importantly, products such as wind turbines and hybrid electric vehicles both rely on dysprosium and neodymium to make the magnets that are essential to their generators and motors. These two elements have unusual configurations of electrons orbiting their nuclei, and thus unusually powerful magnetic properties. Finding substitutes would be hard. Motors or generators whose magnets were made of other materials would be heavier, less efficient or both [3].

Nevertheless, in 2012, none of this was too much of a problem. At the then current levels of demand any problem caused by the geographical concentration of supply would thus be an irritating blip rather than an existential crisis [3].

But what if the environmentalists' dream came true? Could demand for dysprosium and neodymium then be met? That was the question Randolph Kirchain, Elisa Alonso and Frank Field, three materials scientists at the Massachusetts Institute of Technology, asked themselves. Their answer, published in *Environmental Science and Technology*, was that if wind turbines and electric vehicles were going to fulfil the role environmental planners assigned them in reducing emissions of carbon dioxide, using the current technologies, would require an increase in the supply of neodymium and dysprosium of more than 700% and 2,600% respectively during the next 25 years. In 2012, the supply of these metals was only increasing by 6% a year. To match the three researchers' projections supply would actually have to increase by 8% a year for neodymium and 14% for dysprosium [3].

That would have been hard, particularly for dysprosium. Incremental improvements to motors and generators might have been expected to bring demand down a bit. But barring a breakthrough in magnet technology (the discovery of a room-temperature superconductor, for example) the three researchers' figures suggested that the world's geologists would have done well to start scouring the planet for rare-earth ores right then [3].

#### China Decade-Old Export Quota System Ends

China dropped its decade-old quotas limiting exports of strategically important minerals that sparked a global trade dispute and led some countries to reduce their reliance on Chinese supplies. The shift came after Beijing lost a dispute at the World Trade Organization in 2013. But the policy also proved to be of little value for Beijing as many countries found other sources for the materials known as rare earths, which are widely used in high-technology industries such as smartphones and missile systems [9].

"The change is likely because of the pressure from the WTO decision," said Frank Tang, an analyst at investment bank North Square Blue Oak. "China is saying that as a WTO member, it'll have to abide by WTO rules." Chinese officials said the state, on a broader level, was also trying to reduce its role in the economy. "The most important factor for the abolition of the quota is that the government has been moving toward greater market orientation," said Jin Bosong, deputy director of the Commerce Ministry's International Trade and Economic Cooperation Research Institute [9].

The quota system was once a major global trade issue, despite China saying it was an effort to clean up a highly polluting domestic rare-earth mining industry. Since 2010, the world reduced its reliance on the minerals from China, which until recent years produced about 93% of the world's rare earths. China's share of global rare-earth output has fallen to around 86% as other producers amped up supply. China's exports now frequently fall short of maximum levels under the quota system.

In 2012, it eased quota restrictions. But after it lost the WTO case, government officials said the quota's days were numbered. In ending the quotas, Beijing would instead monitor rare-earth exports using a system of permits issued based on trade contracts, without the need for additional state approval, according to the Commerce Ministry [9].

Wang Caifeng, vice chairwoman of the China Rare Earth Industry Association, said in 2014 that the government was still working out the details of the monitoring system [9].

The world's second-largest economy exported 24,866 metric tons of rare earths in the first 11 months of 2013, well below its 2014 quota of 30,611 tons, Chinese customs said. Exports totaled 22,493 tons in 2013, sharply lower than the ministry's 30,996-ton quota. China's rare-earth export volumes began to recover from September 2013, but global supply of the minerals remained ample. In the first 11 months of 2013, the value of China's rare-earth exports fell 33% from a year earlier, according to customs data [9].

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