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China's dominance of rare earth production gives it influence over many key industries

But in reality, China is simply too messy to turn this advantage into the dominance some policymakers desire

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China policy watch: rare earths Rocky road for China Inc(ohherent)

China's rare earths policy is Exhibit A for critics who believe that "China Inc."—a complex of Chinese companies acting on orders from government bureaucrats in Beijing—twists the rules of international trade to the advantage of Chinese companies and China's political and strategic interests. The dollar amount is small: China controls 95% of global rare-earth production, but its total exports of these 17 elements were just US\$939m in 2010, barely 1% of the value of its own iron ore imports in the same year (US\$79 bn). Yet rare earths are critical ingredients in many high-tech products: lighting, lenses, computers, high-strength magnets, batteries, cell phones and weaponry. And since the early 1990s the Chinese government has issued a long string of policies to shape the sector.

So China's sudden decision to stop shipments to Japan in the fall of 2010 seemed a clear case of the government using centralized control of a strategically important economic sector to score political points or extract unfair monopoly rents. The 20-fold rise in international rare earths prices between mid-2010 and mid-2011, combined with fear of China's future abuse of its monopoly power, led to frantic investment in new rare-earth production sites in Australia, California, and other Asian countries.

A close look at China's rare earths sector reveals a messier reality. Despite the appearance of centralized control, China's rare earth production and trade is highly fragmented and will continue to be so, because of the interests of companies and the local governments that back them. China Inc. ought to stand for "China Incoherent." China now dominates global rare earth mining, but internal dissension means Beijing will not be able to exploit this advantage. As a result, China will consistently fail to achieve its major objectives: consolidating the industry, gaining control of global prices, and obtaining downstream technologies from foreign competitors. For the global market, even though prices may not soon fall back to levels seen in early 2010, this means that shortages of rare earths will not be as severe as many have expected, and foreign companies will not have to part with their most sacred technologies to maintain their access to supplies of crucial raw materials.

1- Production and policy: both fragmented

China's supremacy in the recovery of rare earths is recent. Through the 1970s, the US was the world's largest provider of rare earths and developed highly advanced separation and processing technologies. But production costs rose, in part due to more stringent environmental regulations. China stepped into the breach, and in the mid-1980's surpassed the US to become

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Concerns over the environmental impact of rare earth mining have risen in recent years

The volume of China's rare earth exports has tripled over the past decade

the world's largest supplier of raw rare earths. Despite having less than one-third of known global reserves, China's dominance has only grown since, and it accounts for over 90% of global production.

While China as a whole dominated global shipments, the domestic industry—like most of China's mining industries—remained chaotic. Mining and processing were fragmented among many small companies. Prices were very low, derided as “potato prices” by local players. Chinese processing technology remains relatively backward, and higher value added downstream sectors have not flourished.

Since the late 1990's Beijing has tried to remedy these problems. It has tried to cut production, stabilize prices, and force Chinese rare earths firms to move up the value chain. A more recent aim is to reduce the industry's enormous environmental damage. In Inner Mongolia, the heart of the global rare earths industry, open pit mines at Baiyun Ebo throw lung-clogging dust into the air. In the nearby city of Baotou, the tailings left over after processing sit in a pool that might leak and threaten the local water supply. In southern China, rare earths are mined with rudimentary tools, and the chemicals used to separate rare earths from other minerals are poured over hillsides, leaving a messy sludge that contaminates land and water. As one Chinese analyst told me, “If you used all of the money China has made on rare earths over the past several decades it would still not be enough to clean up the environmental pollution.”

Policy formation is as fragmented as the industry. Premier Wen Jiabao, a geologist by training, has played a key role in setting rare earths policy since he took office in 2003. But working-level responsibility is spread among at least four agencies: the Ministry of Land and Resources (MLR), which licenses mines; the National Development and Reform Commission



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Four central agencies, technical experts and local authorities all influence rare earth policymaking

BRE, the single biggest rare earth miner, also has a big say over how policy is actually implemented

Rare earths are found in small amounts mixed with other minerals, so they require a lot of effort to extract

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(NDRC), which oversees overall industry development; the Ministry of Commerce (Mofcom), which provides export licenses and sets export quotas; and the Ministry of Industry and Information Technology (MIIT), which since 2008 has taken over the NDRC's traditional turf as industry regulator. The central authorities depend heavily on the advice of technical experts, most of whom are wary of unfettered market forces. Key providers of expertise are the Beijing-based China Rare Earths Society and the Baotou Rare Earths Institute.

But Beijing does not monopolize policy formation. Local governments in the main rare earth mining provinces—Inner Mongolia, Sichuan, Jiangsu, Jiangxi, and Guangdong—also play a role, as do the city governments of Baotou (in Inner Mongolia) and Ganzhou (in Jiangxi). The general pattern has been for local governments to pretend to agree with central aims, and then go about doing whatever is needed to help their local firms.

Finally, there are the big companies. The most important firm is Inner Mongolia Baotou Steel Rare Earths (Group) Hi-Tech Co., Ltd. (BRE), a unit of state-owned Baotou Steel Group. BRE owns the Baiyun Ebo Mine, 180 kilometers north of Baotou, and just about every other company operating legally in the province depends on them for raw materials. Not surprisingly, a revolving door shuffles leaders between BRE, the Inner Mongolian and Baotou governments, and the Baotou Rare Earths Institute.

What the heck are rare earths, anyway?

Rare earths are the set of lanthanide elements on the periodic table with atomic numbers 57-71. Scandium (#21) and yttrium (#39) are also considered rare earths because they share similar properties. They are grouped into two categories: "light" (lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, and gadolinium) and "heavy" (terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium, and yttrium).

Rare earths, particularly light ones, are relatively abundant in the earth's crust, but these elements are justifiably considered rare in several senses. Their overall known reserves are much lower than iron, coal, and many other industrial minerals (though cerium is more plentiful than nickel or copper). More important, rare earths tend to be found in low concentrations within other mineral deposits, so recovering them is expensive. After mining, rare earths must be separated from the other minerals into a concentrate by applying acids and other solvents; they are then processed into rare earth oxides (REO); and lastly the REOs may need to be combined with other metals or materials into alloys before being ready for applications.

Rare earths are used in a wide variety of commercial and military high-technology products. Lanthanum, one of the most common, is used in batteries, camera lenses, and as a catalyst in oil refining. Neodymium, samarium, gadolinium, and dysprosium are used in powerful magnets, for instance those used in wind turbines. Cerium, europium, terbium, and yttrium are placed in phosphoric compounds and used to enhance vivid colors in televisions and liquid crystal displays. Samarium cobalt metals are used in navigation systems, while yttrium, gadolinium, and thulium are used in lasers.

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The rare earths industry is tiny in scale but is still difficult for Beijing to control effectively

Yet almost everyone in the industry agrees that government intervention is necessary and desirable

BRE and other big companies are always consulted during policy debates, and they frequently criticize the overabundance of small-scale, private competitors, whom they accuse of depressing prices because of their crude mining and processing technologies and their lack of concern for the environment. None of these firms has anything close to veto power over national policy. But in practice, they are often free to modify or ignore policies if doing so suits their purpose. And unlike in most other sectors, they have made little effort to increase their collective influence through trade associations. There is no national trade association for rare earths firms, although the central government has been trying without success to organize one since 2006. The six regional trade associations are all essentially extensions of local government, not voices for industry.

Despite this fragmentation, the scales should weigh heavily in favor of Beijing, mainly because the rare earth sector is tiny both in value and in the number of people it employees: the biggest company, BRE has a payroll of just 3,700 employees. This contrasts to the oil, coal, steel and petrochemicals industries, each of which has several companies with billions of dollars in revenues and tens if not hundreds of thousands of employees. If Beijing cannot ride herd over the relatively puny rare earths industry, it is unlikely to be able to enforce its writ on larger and more influential sectors.

2- Don't trust the market

The one thing that all of these players can agree on is that market forces are not to be trusted. In months of research from Beijing to Inner Mongolia, I found almost unanimous agreement that administrative intervention was the only way to consolidate the industry, raise technology, and deal with pollution. As one observer put it, China “needs a mandatory plan, or there will be disorderly competition.”

The seeds of today's policies emerged in the early 1990s, just as China became the world's dominant producer and exporter of rare earths. The heart of the strategy has been to a) consolidate the industry, and b) strictly control trade, in order to increase the profit margins of rare earth miners and processors, enhance the government's ability to enforce environmental regulations, and induce foreign rare earth processing firms to relocate production to China and transfer technology to local partners. These policies have modestly constrained production, which since 2006 has hovered between 120,000 and 130,000 tons. But other targets have not been met: the industry has not consolidated, production continues to exceed official quotas, and foreign producers have not transferred technology. And although official data shows exports have fallen, from a peak of 57,000 tons in 2006 to 34,000 tons in 2010, gray market or smuggled shipments may now account for as much as half of rare earth exports from China. These setbacks have not led officials to reconsider the effectiveness of planned

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Officials think forcing consolidation will make it easier for them to keep output within quotas

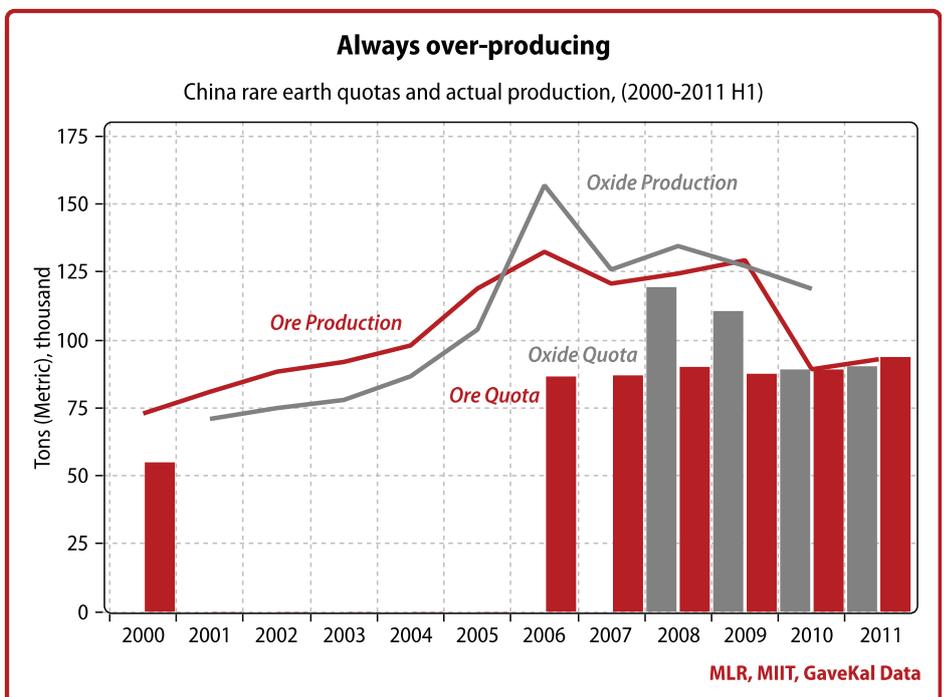
Actual production has consistently exceeded official output caps

solutions; instead, they have expanded planning to the point where producers and traders supposedly have no option but to comply.

The first step in the consolidation drive was to impose production quotas. The initial quota for raw rare earths was set in the year 2000 at 55,000 tons. When actual production blew past this figure to hit 73,000 tons, embarrassed officials stopped issuing quotas. In 2006, Beijing began issuing quotas again, with MLR setting limits for production of raw ores and NDRC (since 2008, MIIT) fixing the targets for processed rare earth oxides. But again, actual production has continued to exceed targets. Official data on raw rare earths does not include illegally mined minerals, and so like processed rare earths, raw output is likely 10-30% above quotas.

Since production caps haven't worked, officials decided they needed to reduce the number of players through forced mergers and acquisitions. Official statistics show a fluctuation between several dozen and 200 rare earths companies, but the actual figure is much higher. One executive estimated that in the 1990s, China had over 1,000 rare earth companies, compared to eight in Japan, six in the US and one in France. Central government officials would like the number of local firms down below 20.

The first effort at forced consolidation came in 2005, when the NDRC tried to create two large groups, one based in Baotou and the other in Ganzhou, Jiangxi. But this effort failed due to opposition from the companies and their local government allies. In 2010 Beijing stepped up the pressure, as MLR and MIIT organized 15 cities in five provinces (Fujian, Jiangxi, Hunan, Guangdong, and Guangxi) to issue an industry consolidation plan. In February of 2011, Premier Wen turned up the heat, telling the State Council that the industry had to complete its consolidation drive within five years. This led to a State Council document, issued on



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Inner Mongolia wants to subsume all rare earth producers into the already-dominant BRE

Environmental codes could also be used to force smaller producers to close

Yet most government plans for industry consolidation have not been achieved

May 10, “Ideas on the Promotion of the Sustainable and Healthy Development of the Rare Earths Industry,” which lays out a consolidation plan under which 80% of southern China’s rare earth processing capacity would be controlled by just three firms.

Two days later the Inner Mongolia government issued its “Work Plan on the Integration and Elimination of Rare Earth Upstream Enterprises.” The policy set the stunning goal of moving from 36 companies to just one by the end of June. The task was supposed to be achieved by merging some firms into BRE and revoking the licenses of the rest.

Export control has been Beijing’s other main tool. Export quotas were first issued in 1999; in 2007, the government started issuing separate quotas for domestic and foreign traders. In 2010, quotas for the first time distinguished between light and heavy rare earths, which matters because light rare earths primarily come from northern China and heavy rare earths from the south. At the same time, Mofcom created a licensing system for exporters. The number of licensed rare earth trading firms fell from over 200 in 2002 to 26 (18 domestic firms and 8 foreign) in 2011. Tariff policy also played a role. Through 2005, rare earth exporters received tax rebates of up to 17%. Beginning in 2006, exports were subjected to a 10% export tariff—effectively, a 27% tax increase. The export tariff was raised to 15% in 2007, and a higher 25% tariff was set in 2008 for yttrium, europium, dysprosium, and terbium. The first two are primarily used in lasers and lighting, the latter two in magnets and hard drives.

Over the last decade a series of policy statements has set strict standards for pollution, but these have not been pursued with anywhere near the vigor that consolidation and trade controls have. Two orders were released in February and November 2011 linking environmental performance to production and export rights. Beijing has hinted it may be tougher this time around, and could even temporarily withhold BRE’s export license. But it is more likely that if these rules have any teeth, they will be used to shutter small firms as part of the consolidation drive.

3- Restrictive policies have not achieved their aims

Despite clear intentions, the central government’s aims have been thwarted by the resistance of rare earth firms and their local government backers. The industry remains fragmented, production exceeds quotas, and little foreign technology has been acquired.

Consolidation is still more of a planner’s dream than reality. Although BRE controls the Baiyun Ebo mine, only 14 of the 35 smaller Inner Mongolian firms have been closed or merged into BRE and the other 21 are still resisting, on the grounds that officials have provided no details about what would happen to the smaller firms’ management, employees, assets, and existing rare earth supplies. In other provinces, dominant producers have begun to emerge: Chinalco in Jiangsu, China Minmetals in

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Some firms have been closed but mines remain open and output is still above quotas

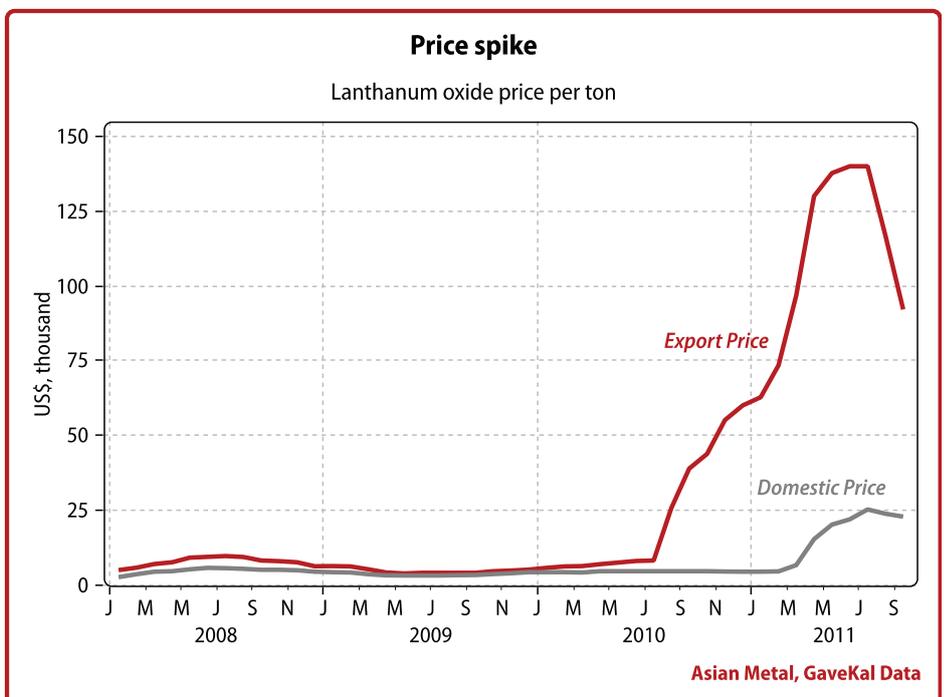
China's attempts to control rare earth output have resulted in bigger price swings

Jiangxi, Guangsheng in Guangdong, Wolfram in Fujian, and a conglomerate headed by Hanlong in Sichuan. That Chinalco and China Minmetals are centrally-managed state-owned enterprises may help Beijing, but officially there are still 113 rare earth mines; this count doesn't include the unregistered mines that pop up like weeds when prices rise.

Total production of rare earth ores and processed rare earth oxides has almost always been well above the quotas (see "Always over-producing," p.5) . In 2010, the amount of mined ores closely approximated the quota set by the Ministry of Land and Resources, but this is more a coincidence than the result of good planning; and processed rare earths reached almost 119,000 tons, far above the 89,000 ton quota set by MIIT. In 2011, the entire annual production quota was surpassed in the first seven months.

The difficulties in controlling production have been reflected in extreme price volatility since 2010. In response to Premier Wen's stern message in February and the consolidation plans issued by the State Council and Inner Mongolia in May, prices jumped rapidly. But the forced consolidation quickly ran into opposition. And the rise in prices encouraged all firms, registered or not, to ramp up mining and processing. Companies set for closure received approval to finish processing all of their supplies already on hand. As a result, the official annual mining target was already surpassed by late summer. In southern China, producers had planned to process around 13,000 tons of dysprosium, but the actual figure, according to an industry source, is closer to 40,000 tons.

Export trends are similar. Before 2010, although export quotas were gradually tightened, external demand never approached the quota ceiling. But the quota dropped by 18,000 tons in 2010. Seeing a good business opportunity, approved traders began to sell their quotas to others. In 2010,



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The late-2011 price spike undermined controls by encouraging smuggling

And Chinese consumers of rare earths bore most of the brunt

China's official export statistics don't capture all the rare earths being received by trading partners

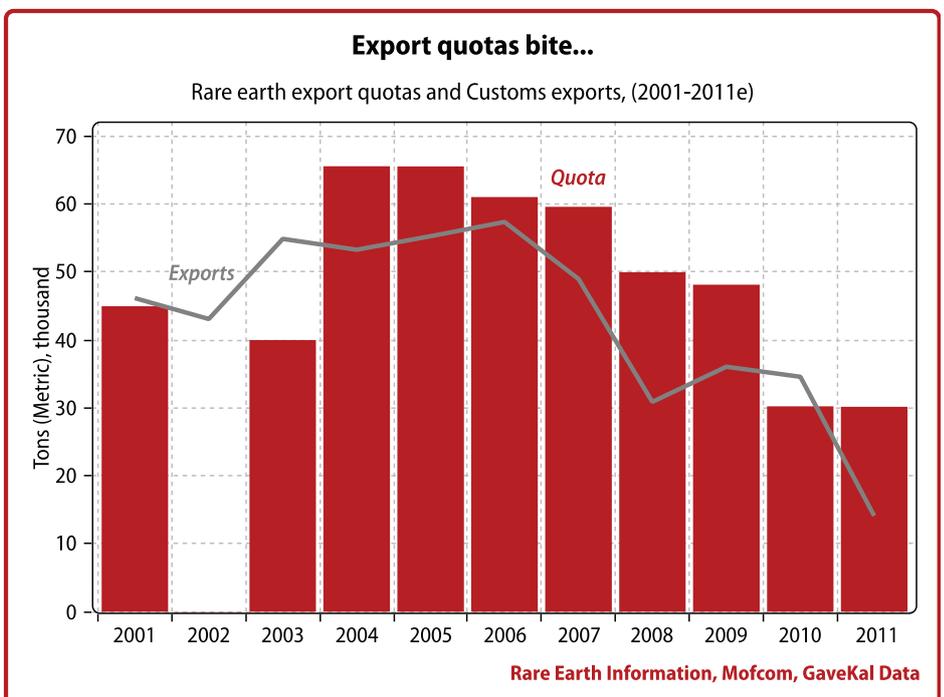
although only 31 companies had export licenses, according to Customs, 84 companies engaged in rare earths exports.

The combination of tighter quotas, consolidation, quota trading, and high export tariffs created the impression of greatly reduced supplies going forward, and as a result led to an unprecedented jump in the price of exported rare earths in the first half of 2011, in some cases shooting up to more than ten times the domestic price (see "Price spike", p. 7).

The price spike killed legal exports and pumped up the already substantial black market in smuggled rare earth exports. Official exports for 2011 were likely only half of the year's quota. A comparison of Chinese export and Japanese import figures shows that at least 40% of Japanese imports of Chinese rare earths were never registered by Chinese customs, up from 25-30% in preceding years (see figures below and overleaf). Because of the high rate of smuggling, it is likely that most Japanese users don't pay anything near the official export price. Many Japanese buyers probably re-export rare earths to users in other countries.

The other impact of high prices, and the diversion of production into higher-priced exports, was demand destruction among domestic Chinese users. Magnet companies such as Hengdian, Zhongke Sanhuan, and Zhenghai Magnetic Materials stopped their assembly lines. Some fluorescent light makers who depend on europium did the same. Other producers stepped up efforts to reduce their use of rare earths or find substitutes. One industry analyst expects total domestic consumption of rare earths to fall to 60,000 tons in 2011, well below the 93,000-ton quota.

Beijing's rare earth policies have also failed to achieve the aim of forcing foreign value-added processors or users to China. General Electric and



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Foreign companies are largely not moving high-tech operations to China because of its rare earth supplies

The reaction to the rare earths price spike shows the limitations of China's market power

Smuggling of rare earths outside quotas remains rampant

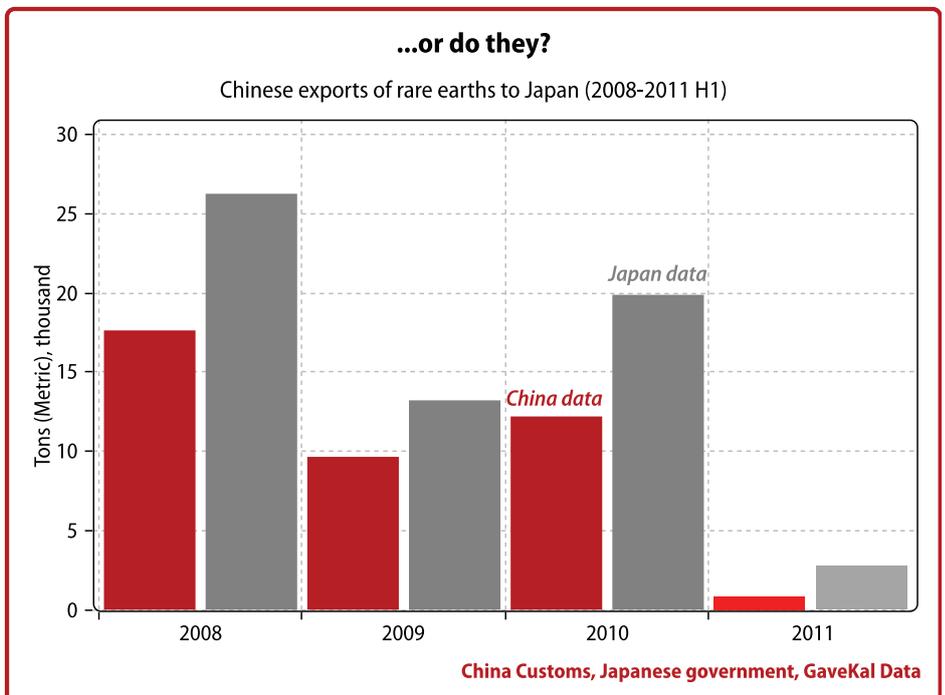
Philips have moved more of their lighting production to China, and Japanese firms Showa Denko and Santoku recently began making magnetic alloys in China. But these cases do not constitute a tidal wave of investment induced by high-priced rare earths. A Japanese official interviewed for this report does not expect many Japanese companies to follow suit, perhaps because so many Japanese have access to smuggled rare earths.

Nor have China's rare earth policies resulted in technology transfer from foreign to Chinese firms. I found no examples of Japanese or American high-tech companies handing over their crown jewels; whatever production that is shifting to China is going into subsidiaries entirely under their control. The biggest losers in all of this are China's own downstream users—e.g. in electric batteries and wind power—who are stuck with higher rare earth prices and lack a flexible global supply chain to help them adjust.

4- Beijing plays lousy poker

Every action brings its reaction. In the case of soaring rare earth prices, there have been three, all of them inconsistent with the idea of an unbreakable Chinese government stranglehold on the market. First, the rise in production and collapse in demand caused prices to plummet beginning in August 2011. Things got so bad that BRE in mid-October threw up its hands and suspended production for a month. Rare earth prices may stabilize at current levels, which are well above the pre-2010 average, but they are unlikely to regain to their peaks.

Second, trade partners have begun to seek redress through the World Trade Organization. In 2009 the US, European Union and Mexico initiated a WTO case against China, asserting its restrictions on exports of raw materials violated global trade rules. China argued that WTO rules permit it to constrain exports in order to protect scarce natural resources and the



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A WTO case could be made against rare earth output caps, though the outcome is uncertain

If China continues to over-reach, it will be displaced by other sources of rare earth supply

There is no long-term global shortage of rare earths, so China's ultimate advantage is limited

health of its citizens. In July 2011, a WTO panel ruled against China. China is appealing that decision, but if the ruling is upheld it could clear the way for a WTO case against China's rare earths export controls. The outcome of such a case is far from certain: China's domestic production quotas strengthen its claim that it is restricting production and exports for environmental protection reasons. And in any case, since WTO cases take as much as three years from beginning to end, a ruling against China would not directly affect the market for several years.

Third, high prices and perceived Chinese protectionism have whetted investors' appetites for opening up new sources of supply in Australia, the US and other Asian countries. In the long run, these investments could diversify the global supply of these metals and reduce policy-induced price volatility coming out of China. But these new supplies will take some time to hit the market. Australia's Lynas Corp., which leads the pack in these new investments, has begun turning ore into concentrate at its Mount Weld facility in Australia. But processing at its Malaysia plant has been held up by the government over environmental concerns. In late October, Lynas was denied a license to ship rare earth concentrate into Malaysia, and its factory is still under construction, with production not commencing until the first quarter of 2012 at the earliest. Eventually Lynas expects to add 22,000 tons in processed rare earths on to the global market—about 17% of China's average annual production in 2007-2010, and nearly three-quarters of China's current export quota of 30,000 tons.

Even if new supply takes several years to reach the global market in quantities large enough to move prices, we should not be too concerned about a Chinese effort to corner the market. The lesson of the past few years is that in this high-stakes poker game, despite having a couple aces and a joker or two, the Chinese typically manage to blow their hand. Beijing can't keep a clear strategy because it is being pulled in too many directions at once. Right now prices reflect an uncertainty premium, but in the long run global supplies are ample. Chinese policy interventions are more likely to generate temporary swings rather than sustained high prices, and this cannot be good for any segment of the market chain. Downstream users in high-tech sectors will likely continue to look for alternative inputs, eroding the benefit to China of holding so much raw material. The highest price paid has not been by Japanese hard fiber-optics manufacturers or German x-ray developers, but rather by smaller Chinese downstream companies and by Beijing itself. Despite its intention, China's central government does not have the political will or deftness of touch to steer the rare earths industry onto a sustained healthy trajectory.