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EXPORT RESTRICTIONS ON STRATEGIC RAW MATERIALS AND THEIR IMPACT ON TRADE AND GLOBAL SUPPLY

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ABSTRACT

Barriers to trade come in a variety of forms. This paper examines one such barrier, export restrictions, and how it impacts trade and global supply in selected strategic metals and minerals. The metals and minerals examined in the paper are of particular interest for a number of reasons: they are generally geographically concentrated in a few countries, many are used in the production of high-technology goods in strategic sectors and there are few substitutes for these raw materials given the present state of technology. For all these reasons, importing countries are dependent on a reliable supply of these raw materials. Export restrictions may be applied for a number of reasons: protection of the environment, preservation of natural resources, protection of downstream industries, or as a response to a number of different market imperfections. This paper examines the motivations for using export restrictions and finds varying impacts on trade and global supply. In one case, the export restrictions put into place did not fulfill their objective of environmental protection. In another, the presence of export restrictions in one country put pressure on other exporters to apply restrictions suggesting the potential for competitive policy practices in restricting exports. In a third case study, export restrictions were seen to impact investment decisions by potential suppliers worldwide by introducing an added element of risk in the industry. The impact of export restrictions on strategic metals and minerals are exacerbated in many cases because producing countries have a quasi-monopoly on supply. Since these metals and minerals are essential in the production of some high-technology products and are not easily replaceable in the medium term, industry participants in some importing countries are concerned about future access at sustainable prices.

Keywords

Export restrictions, strategic metals, raw materials, minerals trade, export taxes, export duties, export quotas, quantitative restrictions, VAT rebates, export licensing, trade, trade policy, trade policy instruments, environmental technology, mineral reserves, geographical concentration, natural resource preservation, molybdenum, chromite, chromium, rare earths.

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EXECUTIVE SUMMARY

This paper examines the presence and impact on trade and global supply of export restrictions applied to selected metals and minerals. Export restrictions come in a variety of forms. They include quantitative restrictions (quotas), export taxes, duties and charges and mandatory minimum export prices. In so far as they can affect export volumes, the reduction of VAT rebates as well as stringent export licensing requirements may also be considered forms of export restrictions.

The strategic metals and minerals selected for this study have a number of shared characteristics which in turn determine their impact. Their exploitable mineral reserves are generally found in one or a few geographical regions of the world implying that their potential mining and export are concentrated in a few countries. For most of these strategic raw materials, the top three producing countries account for over half of world production. In some cases, production is so concentrated that over half of world production occurs in a single country. This in turn leads to a dependence on such imports by countries that consume these materials or the finished goods produced from them. It also suggests that countries producing these raw materials may influence their prices and quantities made available on world markets.

The metals and minerals in this study are generally used as inputs into high-technology or strategic sectors. Although often needed only in small quantities, these metals are increasingly essential to the development of technologically sophisticated products. They play a critical role in the development of innovative "environmental technologies" to boost energy efficiency and reduce greenhouse gas emissions. Hydrogen-fuel based cars, for example, require platinum-based catalysts; electric-hybrid cars need lithium batteries; and rhenium super alloys are an indispensible input for modern aircraft production. In addition, there are few substitutes available in the short-term for these raw materials.

There is no formal mechanism, such as within the WTO, for reporting export restrictions and taxes in the international domain. One of the aims of this study is to gather as much information as possible on the export restrictions that are applied on the metals and minerals examined here.

Export restrictions are applied to many of the metals and minerals under examination. Three case studies illustrate their impacts on exports and on global supply. A number of insights regarding the impact of export restrictions can be gleaned from these case studies:

- Many export restrictions are put into place for environmental reasons or to preserve natural resources. In order for them to satisfy this objective, however, they must result in lower production levels. In one case study, molybdenum, it can be seen that this was not the outcome of the imposition of export restrictions.

- In other cases, export restrictions are imposed in order to encourage supply of raw materials to domestic producers of downstream semi-processed goods. As many of these raw materials are produced in a limited number of countries, export restrictions that are imposed in one country may motivate other countries to follow if importers massively move to buy their raw materials. The restrictions imposed by the first country then lose their effectiveness. This can in principle lead to a situation of competitive policy practices – and of higher and higher export taxes. This risk was apparent in one of the cases under examination, namely exports of chromite.

- Export restrictions can impact potential investments in mining facilities worldwide. In the case of rare earths, the possibility of export restrictions being imposed makes industry participants assess the risk in the industry differently. Investments in the mining industry, which are necessarily long-term and require large amounts of capital and know-how, may be affected by the possibility of sharp changes in world prices either due to the imposition of export restrictions or to their sudden removal.

- Several objectives motivate implementing export restrictions on strategic raw materials. In some cases, these can be understood as a response to market imperfections. The question remains, however, whether export restrictions are the most effective tool to achieve the desired outcomes. Possible future work in this area could include comparing different types of policy measures with a view to identifying the trade-offs that they engender.

EXPORT RESTRICTIONS ON STRATEGIC RAW MATERIALS AND THEIR IMPACT ON TRADE AND GLOBAL SUPPLY

1. This paper seeks to shed light on the presence and impact of export restrictions on selected metals and minerals. Export restrictions usually take the form of quantitative restrictions or taxes imposed by the exporting country. In general, export restrictions are not notified to any international body and there is therefore no comprehensive list of such measures that one can refer to. Nor are such restrictions *per se* included in WTO disciplines, although Article XI of the GATT does stipulate there is a general prohibition on quantitative restrictions.[1] A notable exception, however, exists for reasons that relate to the "conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption" (Article XX, GATT).

2. The strategic metals and minerals selected for this study have a number of shared characteristics. First, the exploitable mineral reserves are generally found in one or a few geographical regions of the world implying that their potential mining and export are concentrated in a few countries. This in turn leads to a dependence on such imports by countries that consume these materials or the finished goods produced from them. It also suggests that producing countries may control the prices and quantities of the raw materials made available on world markets. Second, the strategic minerals and metals covered in this study are generally used as inputs into high-technology or strategic sectors; many are used in the development of environmental technologies. Third, there are few substitutes available in the short-term for these raw materials. Although generally used in small quantities, they are often essential for the development of technologically sophisticated products.

3. The raw materials covered in this analysis do not necessarily satisfy all of the above criteria, but can be viewed as representative of materials which share several common characteristics. Due to the specific nature of these characteristics, export restrictions on these raw materials result in economic impacts which can be distinguished from those of other products.

4. Many of the strategic metals and minerals are inputs into products in fast-changing markets. Technological change often brings sharp changes in demand, which, in turn, may lead to strong price volatility. An example is the tantalum capacitor industry. Two-thirds of world tantalum production is used in electronic components. When the tantalum price increased sharply in the late 1990s, the electronics industry encouraged capacitor designers to improve their niobium capacitors and multiple ceramics capacitors in order to replace the tantalum components. The demand for tantalum, and its price, fell sharply as a result.

5. The global economic crisis has weakened demand for many strategic metals and minerals since mid-2008. In the case of some metals and minerals examined here, however, the fall came earlier – in late 2007 or early 2008. This was due to some over-buying by China, in particular, and over-optimistic forecasts of growth more generally by raw materials producers and consumers.

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1. "… no prohibitions of restrictions other than duties, taxes or other charges, whether made effective through quotas, import or export licences or other measures, shall be instituted or maintained by any contracting party on the importation … or on the exportation or sale or export of any product destined for the territory of any other contracting party" (Article XI, GATT 1994).

6. This study takes a medium-term view. In many OECD countries, the geological structures are well known. Prospecting activity continues, however, in some OECD countries – one example being Canada.[2] There are new mining possibilities in some areas where past prospecting has been patchy, for example, Mongolia. Since the time span between prospecting and actual extraction of minerals can sometimes be measured in decades, some industry investments are necessarily long-term. Known reserves of the minerals examined here are included in this report, but in principle these may change in the longer term.

7. In some cases export restrictions may be introduced in the pursuit of macro-economic objectives. For example, fiscal revenues or broad development objectives may underlie export restrictions in specific sectors. Although the general economic context in which export restrictions are introduced is important, it is beyond the scope of this paper which focuses on the specific sectoral and product impacts of export-restricting policies.

8. This study begins by outlining the specific nature of the selected minerals and metals examined here: their uses, and where production and reserves are found. The presence of export restrictions on these products is then examined. Three case studies of the impact of export restrictions in different raw materials – molybdenum, chromium and rare earths – shed some light on potential global effects on producers and consumers of the raw materials and their downstream products. A concluding section offers general insights and questions the use of export restrictions from efficiency and a policy perspective.

Uses of selected metals and minerals

9. The metals and minerals under study here are generally used as inputs into high-technology or strategic sectors (Table 1). Although often needed only in small quantities, these metals are increasingly essential to the development of technologically sophisticated products. They play a critical role in the development of innovative "environmental technologies" to boost energy efficiency and reduce greenhouse gas emissions. Hydrogen-fuel based cars, for example, require platinum-based catalysts; electric-hybrid cars need lithium batteries; and rhenium super alloys are an indispensible input for modern aircraft production. The European Commission has stated that the EU will not master the shift towards sustainable production and environmentally friendly products without such metals (EC, 2008).

10. Many of the metals under study here are also used in sectors such as semi-conductors. The semi-conductor industry is dominated by Chinese Taipei, South Korea, United States, and Japan. The role of the semi-conductor industry is one of a technology enabler: the semiconductor industry is widely recognized as a key driver for economic growth throughout the electronics value chain. The semiconductor market represented USD 213 billion in 2004 and the industry was one enabling factor in the generation of USD 1 200 billion in electronic systems business and USD 5 000 billion in services, representing close to 10% of world GDP that year. The semi-conductor industry is also a high-growth industry, experiencing 13% growth on average per annum over the last 20 years.[3]

11. Many of the metals studied in this paper are also combined with steel to create alloys with particular properties – withstanding friction or heat for example – and are therefore necessary inputs into the automotive and airplane industries. All countries with major automobile or aircraft industries (*e.g.* Brazil, China, European Union, India, Japan, Korea, United States) are therefore users of some of the strategic metals examined here.

2. "If there are known deposits in an area, it is best to look next door" for further potential reserves, indicated one mining industry specialist.

3. www.semi.org

12. Lithium is one of the strategic raw materials that has become an important component in hybrid vehicles. Lithium compounds are used in batteries, especially rechargeable batteries. Several major automobile companies are pursuing the development of lithium batteries for hybrid electric vehicles — vehicles with an internal combustion engine and a battery-powered electric motor. Demand for rechargeable lithium batteries has also continued to grow for use in cordless tools, portable computers and telephones, and video cameras. Non-rechargeable lithium batteries are used in calculators, cameras, computers, electronic games, watches, and other devices.

Table 1. Main uses of strategic metals and minerals

Antimony	Batteries ; antifriction alloys ; medicines, antiprotozoan drugs, small arms, buckshot, and tracer ammunition; matches
Chromium	Jet engines and gas turbines ; cookware and cutlery ; magnetic tape used in high performance audio tape ; high temperature refractory applications, like blast furnaces, cement kilns
Cobalt	Used in surgical instruments and hard metals for cutting tools and drills used in metal-working and mining industries; prosthetic parts such as hip and knee replacements ; batteries ; adhesion of the steel to rubber in steel-belted radial tires
Copper	Piping, electrical applications, construction industry and household uses
Gallium	Semiconductor use is now the primary industrial market for gallium, but new uses in alloys and fuel cells continue to be discovered.
Germanium	Semiconductor material used in transistors and various other electronic devices. Its major end uses are fiber-optic systems and infrared optics, but it is also used for polymerization catalysts, in electronics and in solar electric applications.
Indium	Liquid crystal displays (LCD) for televisions used for the manufacture of thin film solar cells Used in light-emitting diodes (LEDs) and Laser Diodes (LDs)
Lithium	Electric and hybrid car batteries
Manganese	Standard and alkaline disposable dry cells and batteries ; stainless steels ; aluminum alloys (ex. Beverage cans)
Molybdenum	Missile and aircraft parts; valuable catalyst in petroleum refining ; filament material in electrical applications alloying agent for ultra-high strength steels
Nickel	Many industrial and consumer products, including stainless steel, magnets, coinage, rechargeable batteries and special alloys
Platinum, palladium	Jewelry, laboratory equipment, resistant thermometers, dentistry, catalytic converters ; many electronics including computers, mobile phones, multi-layer ceramic capacitors, component plating, low voltage electrical contacts, and SED/OLED/LCD televisions ; fuel cells
Rare Earths[1]	Automobiles, including hybrid vehicles, air conditioners, wind power generators, fluorescent lights, plasma screens, portable computers, hand-held electronic devices
Rhenium[2]	Jet engine parts, platinum-rhenium catalysts, which are primarily used in making lead-free, high-octane gasoline.
Silicon	Power transistors ; the development of integrated circuits such as computer chips as well as in construction industry as a principal constituent of natural stone, glass, concrete and cement
Silver	Jewelry, high-value tableware, utensils, and currency coins, electrical contacts and conductors, mirrors and in catalysis of chemical reactions. Its compounds are used in photographic film.
Tantalum	Electronic components, mainly capacitors and some high-power resistors ; tools for metalworking equipment and in the production of superalloys for jet engine components, chemical process equipment, nuclear reactors, and missile parts.
Titanium	Strong lightweight alloys for aerospace (jet engines, missiles, and spacecraft), military, industrial process (chemicals and petro-chemicals, desalination plants, pulp, and paper), automotive, agri-food, medical prostheses, orthopedic implants, dental and endodontic instruments and files, dental implants, sporting goods, jewelry, mobile phones, and other applications
Tungsten	Light bulb filaments, television tubes, X-ray tubes (as both the filament and target), superalloys, and hard metals for cutting tools and drills used in metal-working and mining industries.
Vanadium	High speed tool steels used in surgical instruments and tools

1. Rare earth elements or rare earth metals are a collection of 17 chemical elements in the periodic table, namely scandium, yttrium, and the fifteen lanthanoids.
2. Obtained as a by-product of molybdenum and copper refinement

Main producers and reserves of strategic metals and minerals

13. Many of the strategic metals and minerals used in such industries as electronics, alternative energies, energy storage and conservation, specialised tool making and the automotive and aircraft industries are produced in a small number of countries. For most of these strategic raw materials, the top three producing countries account for over half of world production (Table 2). For some raw materials, close to the entire world production takes place in the top three mining regions. This is the case for rare earths, where 99.7% of world production occurs in the top three producing countries, and for vanadium (98%), antimony (95%), platinum (93%), and gallium and germanium, where all of world production occurs in two or three countries. Notable exceptions in the metallic minerals covered by this project are silver (where 44% of world production occurs in the top three producing countries) and nickel (47%).

14. In some cases, production is so concentrated that over half of world production occurs in a single country. This is the case for China as regards rare earths, antimony, tungsten, indium, silicon, gallium and germanium, South Africa as regards platinum and Australia as regards tantalum.

Table 2. Top three producing countries for selected metallic minerals

Metal	First		Second		Third		Cum. %
Gallium[2]	China	83.00%	Japan	17.00%	--		100.00%
Germanium[1]	China	79.00%	USA	14.00%	Russia	7.00%	100.00%
Rare Earths	China	96.99%	India	2.18%	Brazil	0.53%	99.69%
Vanadium	South Africa	38.33%	China	33.33%	Russia	26.67%	98.33%
Antimony[2]	China	91.19%	Bolivia	2.13%	South Africa	1.82%	95.14%
Platinum	South Africa	76.61%	Russia	12.52%	Canada	3.61%	92.74%
Palladium	Russia	42.80%	South Africa	38.91%	Canada	6.08%	87.79%
Tungsten[2]	China	75.09%	Russia	5.86%	Canada	4.76%	85.71%
Tantalum	Australia	53.37%	Brazil	22.09%	Rwanda	9.45%	84.91%
Lithium[2]	Chile	43.86%	Australia	25.22%	China	12.79%	81.87%
Molybdenum	USA	28.97%	China	28.21%	Chile	21.23%	78.41%
Indium	China	58.10%	Japan	10.56%	Korea	8.80%	77.46%
Chromium[2]	South Africa	44.65%	Kazakhstan	17.21%	India	15.35%	77.21%
Rhenium	Chile	48.68%	Kazakhstan	14.11%	USA	13.58%	76.37%
Silicon	China	57.85%	Russia	11.22%	Brazil	4.73%	73.81%
Cobalt	Congo	44.57%	Canada	11.56%	Zambia	10.86%	66.99%
Manganese	South Africa	21.66%	China	20.22%	Australia	15.88%	57.76%
Titanium	Australia	22.17%	South Africa	19.34%	Canada	15.97%	57.48%
Copper	Chile	35.62%	USA	8.33%	Peru	7.76%	51.72%
Nickel	Russia	17.47%	Canada	15.82%	Indonesia	13.35%	46.64%
Silver	Peru	17.23%	Mexico	14.36%	China	12.45%	44.04%

1 Source: World Mining Data (2008).
2 USA production data withheld from world total by USGS to "avoid disclosing proprietary data".
Source: USGS (2009).

15. Although production of some strategic metallic minerals is very concentrated, this does not necessarily suggest that future production will be similarly geographically restrained. In order to determine future production possibilities, the reserve base must be examined. The reserve base includes all known deposits of the metallic minerals, whether or not they are actually mined, including deposits that are not economically viable given present technologies, prices and production strategies.

16. The future production situation is mixed. For some strategic metallic minerals, the reserve base is more geographically concentrated than the present production. For others, the raw materials are more widely dispersed (Table 3). In the case of some of the most concentrated raw materials under examination, particularly those largely found in China, such as rare earths, vanadium and antimony, the future reserves are less concentrated than present production would suggest. For others, however, such as platinum group metals and manganese, the largest quantities of which are found in South Africa, the concentration of reserves is significantly higher than that of present production.

17. In some cases, the country with the most important reserves is not presently among the top producers. This is the case for lithium in Bolivia, titanium in the United States, and silver in Poland. In these cases, mining may not be economically viable given present prices and technologies, or sufficient investments have not been undertaken to exploit the natural resources or get them efficiently to market.

Table 3. Reserve base of strategic metallic minerals

Mineral	First		Second		Third		Cum. %
Chromium	Kazakhstan	48.11%	South Africa	40.09%	India	11.76%	99.96%
Platinum[3]	South Africa	87.68%	Russia	8.27%	USA	2.51%	98.46%
Tantalum	Brazil	50.00%	Australia	46.67%	Canada	1.67%	98.33%
Manganese	South Africa	78.66%	Ukraine	10.23%	Australia	3.15%	92.04%
Vanadium	China	36.84%	South Africa	31.58%	Russia	18.42%	86.84%
Molybdenum	China	43.57%	USA	28.35%	Chile	13.12%	85.04%
Rhenium	USA	44.20%	Chile	24.56%	Canada	14.73%	83.50%
Lithium	Bolivia	47.26%	Chile	26.25%	China	9.63%	83.14%
Tungsten	China	66.96%	Canada	7.81%	Russia	6.70%	81.47%
Rare Earths	China	57.71%	CIS	13.62%	USA	9.10%	80.43%
Antimony	China	55.68%	Thailand	10.44%	Russia	8.58%	74.70%
Indium[1]	China	62.34%	Peru	3.62%	Canada	3.49%	69.45%
Cobalt	Congo	36.13%	Australia	13.84%	Cuba	13.84%	63.81%
Silver	Poland	24.60%	China	21.09%	USA	14.06%	59.75%
Titanium[2]	USA	29.90%	China	17.04%	Germany	8.33%	55.27%
Copper	Chile	36.04%	Peru	12.01%	USA	7.01%	55.06%
Nickel	Australia	19.34%	Cuba	15.34%	Canada	10.00%	44.68%

Note: Reserves data omitted for Germanium, as USGS reserves data for Germanium available only for USA reserves.

Data for gallium reserves also omitted due to unavailability. According to USGS, "Most gallium is produced as a byproduct of treating bauxite, and the remainder is produced from zinc-processing residues. Only part of the gallium present in bauxite and zinc ores is recoverable, and the factors controlling the recovery are proprietary. Therefore, an estimate of current reserves that is comparable to the definition of reserves of other minerals cannot be made. The world bauxite reserve base is so large that much of it will not be mined for many decades; hence, most of the gallium in the bauxite reserve base cannot be considered to be available in the short term."(USGS, 2009)

Silicon reserves estimates unavailable, as "the reserve base in most major producing countries are ample in relation to demand. Quantitative estimates are not available." (USGS, 2009)

1. Source: USGS (2008)
2. Titanium ilmenite
3. Platinum data consists of data concerning platinum metals group: platinum, palladium, rhodium, ruthenium, iridium, osmium.

Source: USGS (2009).

Presence of export restrictions

18. There is no formal mechanism, such as within the WTO, for reporting export restrictions and export taxes in the international domain. Export restrictions and taxes are therefore made known by a variety of ways and differ by country. One of the aims of this study is to gather as much information as possible on the export restrictions that are applied on the metals and minerals examined here. Some of this information has been gathered from different national geological services. Other sources include reports in the specialized industry press and on specialized websites, the few articles that have been written on this issue, statements by importing countries, data from private firms, and a survey of known export restrictions by OECD members and selected non-members. The information included here regarding the presence of export restrictions on the 21 metals and minerals covered by this study can therefore only be considered as indicative.

19. Export restrictions come in a variety of forms. They include quantitative export restrictions (quotas), export taxes, duties and charges and mandatory minimum export prices. In so far as they can affect export volumes, the reduction of VAT rebates as well as stringent export licensing requirements may also be considered forms of export restrictions. One of the most used forms of export restrictions is export taxes or duties. Export taxes can take the form of an *ad valorem* tax, specified as a percentage of the value of the product, or as a specific tax specified as a specific amount to be paid per unit or per weight of a given product. Export quotas are restrictions or ceilings imposed by an exporting country on the total volume of specified products. Export licensing requirements regulate which exporters can effectively sell their products abroad. In the case where licensing requirements are particularly stringent, procedures are complex or costly, or the number of exporters accorded licenses is small, license requirements may affect the volume of exports. Another less obvious form of export restriction is the reduction of VAT rebates. If, in a given country, exporters receive a full rebate on VAT for their traded products, with the exception of some targeted products, the volume of exports of those products may be affected. Producers may choose to supply more products to domestic markets and export products that are further downstream (or upstream) in the production chain so as not to be penalized for exporting non-rebated products.

20. Export restrictions of all kinds exist among major exporters of the 21 metals and minerals under study. Appendix Table 1 lists all known export restrictions applied to the products examined here. Quantitative restrictions can be found on 13 of the 21 metals and minerals in at least one exporting country in at least one year since the late 1990s. Export taxes ranging from 3% to 30% are levied on some of the 21 metals and minerals. Some export taxes are combined tax rates, which imply an *ad valorem* rate, with a maximum or minimum rate per unit or unit of weight of the exported good. Tungsten waste and scrap exported from Ukraine, for example, is subjected to a tax of 30% but not less than 10€/kg.

21. In some cases, non-automatic export licensing is used. Although non-automatic export licensing is not a restriction in itself, if the licenses are granted in a stringent or non-transparent fashion, export volumes may be affected. There are many types of legislation other than export taxes and restrictions that significantly impact the mining industry. These may include licensing for mining, prospecting and exploration, production quotas and taxes, and the complex issue of mining rights. A case in point is the mining of the platinum group metals in South Africa which is not subject to export restrictions and taxes, but is regulated through other mechanisms (Box 1).

Box 1. Other legislation that regulates the mining industry
The case of the Platinum mining industry in South Africa

At present, the platinum mining industry in South Africa falls under three key pieces of legislation: the Mineral and Petroleum Resources Development Act 2002 (and subsequent Mineral and Petroleum Resources Development Amendment Bill, 2007), the Mineral and Petroleum Royalty Bill 2008, and the Precious Metals Act 2005.

The Mineral and Petroleum Resources Development Act encompasses the Mining Charter. This sets out the rules governing the application for, and issue or transfer of mining rights in South Africa. It includes statutory provisions for Black Economic Empowerment and the increased participation of historically disadvantaged South Africans in the mining industry.

The Mineral and Petroleum Royalty Bill (final draft released in June 2008) introduces royalties on platinum group metals production as well as other commodities. The royalty rate that applies to a particular company is calculated using a formula based on earnings before interest and tax. The royalties were due to be applied from 1 May 2009 but have been postponed until 1 March 2010. The effective rate on refined platinum is likely to be around 2.7%.

The Precious Metals Act makes a number of stipulations about the development, local beneficiation (smelting, refining, etc.) and sale of precious metals. Permits are required to refine and export precious metals. The written approval of the relevant Minister is required for the export of any unwrought or semi-fabricated precious metal.

So whilst there are no specific export duties or quantitative restrictions imposed on exports of platinum group metals from South Africa, there are a number of legislative provisions that might be viewed as restrictions on exports. Any impact on trade flows is indirect and therefore difficult to ascertain.

Source: South African Department of Minerals and Energy; South African Chamber of Mines. **www.bullion.org.za**.

22. A large number of quantitative export restrictions or high export taxes exist in some countries on "waste and scrap" of the selected metals examined in this paper. This may be partly due to the difficulties in verifying the purity of the contents or their origin. An industry specialist indicated that there have been cases in which exports of some metals that have been declared "waste and scrap" are actually closer to a purity that could be classified as powder or unwrought metal, for the purposes of avoiding import duties or due to licensing issues. A government official of one country which imposes export restrictions and taxes on waste and scrap indicated that it was due to difficulties in determining the origin of the materials: "it is to avoid individuals pulling up railroad ties" and other articles made from the metals.[4]

Policy objectives of export restrictions

23. Export restrictions are used by policymakers to respond to a number of social, economic and political objectives. These include objectives such as environmental protection and promotion of downstream industries, revenue maximization, and preservation of reserves for future use. Export restrictions are therefore sometimes in place in sectors where global reserves are sufficient to respond to demand but reserves in the specific country applying the measure are not.

24. Environmental protection is among the most frequently cited policy objective of export restrictions. The mining or processing procedures can be either highly energy consuming or polluting. In some cases, export taxes on relevant products are applied to make it less profitable to maintain mining or processing facilities, and thereby aim to reduce production.

25. Another consideration for policymakers implementing export restrictions is the promotion of downstream processing industries. This can occur when foreign demand raises the price of raw materials, which may be too high for the domestic downstream industry. Policymakers may also resort to using export restrictions in the case when processed products generate a higher value-added than raw materials used for those products.

4. Russian government official presentation at the OECD Workshop on Raw Materials, 30 October 2009.

Impact of export restrictions on selected strategic minerals, metals and their products

26. Export restrictions and taxes exist on a number of products in a number of countries (Appendix Table 1). A few of these have been selected for more detailed review to ascertain whether or not the presence of export restrictions has impacted trade and production levels and, if so, in what ways. In this section, the impact of export restrictions in molybdenum and rare earths in China will be examined, as well as the impact of those on chromium in India.

Molybdenum

27. According to available information, China placed an export tax of 10% on molybdenum concentrates and oxides and ferromolybdenum and a 15% tax on molybdenum powder, unwrought molybdenum and scrap on 1 January 2007. This tax was raised to 20% on exports of ferromolybdenum in 2008. In mid-2007, an export licensing system was implemented raising the level of criteria for potential exporters of molybdenum and its products. On 1 July 2007, the VAT rebate was rescinded on molybdenum hydroxides and reduced to 5% on more processed molybdenum products. In 2007, an export quota was also placed on molybdenum and its level was further reduced in 2008.

28. The rationale given by the Chinese government for the imposition of the export restrictions measure was for environmental reasons (residue from the mining industry, for example, and excessive use of energy to process products of the extractive industries) and for reasons of preservation of natural resources. China holds 44% of known worldwide reserves of molybdenum and is responsible for 28% of its production.

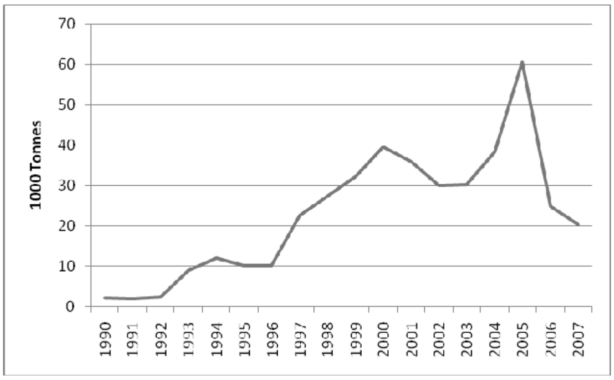
29. The recent export restrictions were implemented by the Chinese government in a different context than in the past. In 2000, the European Union suggested that Chinese suppliers of ferromolybdenum were involved in dumping practices and imposed an anti-dumping duty on imports of ferromolybdenum from China. (Molybdenum is not mined in the EU, but there is a processing industry). Chinese authorities responded in August 2001 by enforcing an export limit of 8 861 tonnes of ferromolybdenum to the European Union in order to relieve the impact of dumping duties.

30. Exports of ferromolybdenum by China fell in 2002 and stagnated in 2003 after an almost continuous climb from 1990 to2000 (Figure 1). This may have been due in part to the "voluntary" export restraint policy put into place by China *vis-à-vis* the European Union.

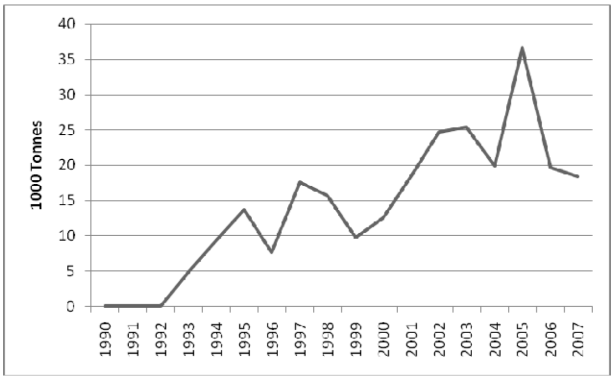
31. There is little evidence, however, that the export taxes and quotas on molybdenum and its products put into place in 2007 and 2008 have had a significant effect on exports. Exports of molybdenum ores and concentrates, oxides and ferro-molybdenum were falling in 2005 and 2006, *i.e.* prior to the implementation of export restrictions and taxes (Figures 1-3). On the other hand, exports of molybdenum articles, that have undergone further processing, increased sharply (by 120%) in 2007 despite the restrictions placed on them that year (Figure 4). Restrictions included a 15% export tax, a reduction in VAT rebate to 5%, and an export licensing system.

Figures 1-4. Exports of molybdenum and products, China

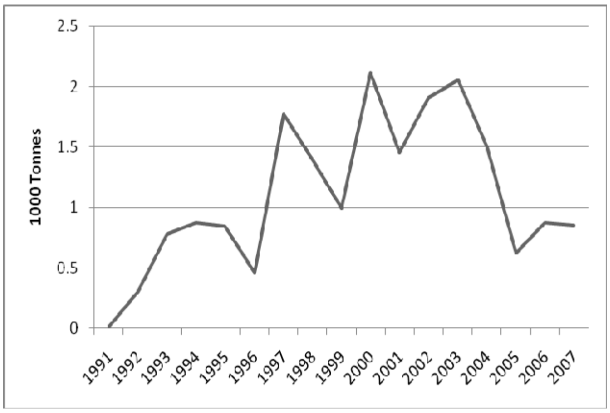
1. Ferro-molybdenum



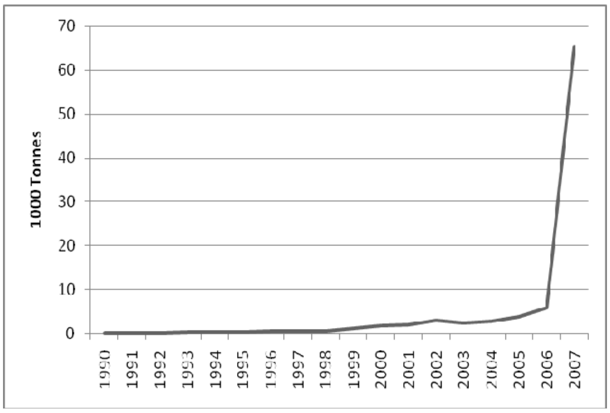
2. Molybdenum ores and concentrates



3. Molybdenum oxides

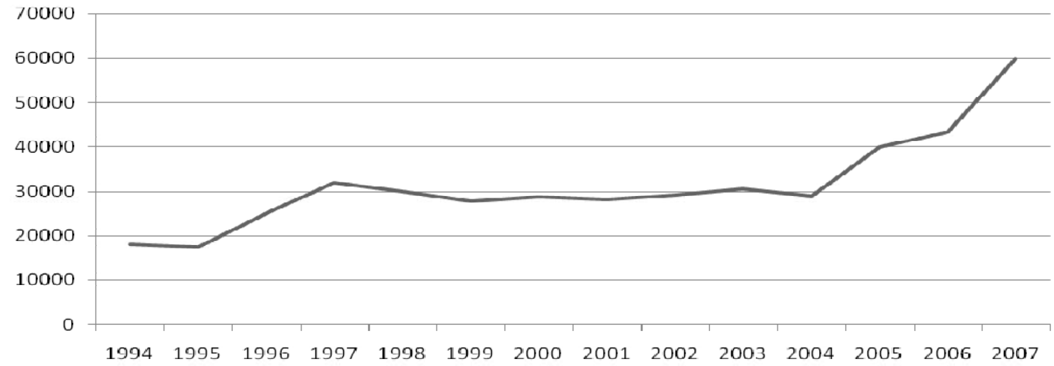


4. Molybdenum articles



32. There is no evidence either that the export restrictions implemented in 2007 had the desired effect on production. In order to fulfil the stated policy objectives of environmental stability and preservation of natural resources, the export restrictions would have had to have resulted in a decrease in the production of molybdenum in China. This has not been the case as the production of molybdenum has risen continually since 2004 by approximately 30% per year (Figure 5). It is clear, therefore, that the measures that were introduced did not achieve their *stated* objectives.

Figure 5. Molybdenum Production, China



Chromium

33. The main producing countries of chromite ore and chromite concentrates are South Africa, India and Kazakhstan, representing 70% of 2008 world production as a whole (Table 4). According to USGS Mineral Commodity Summaries (2009), about 95% of the world's chromite reserves are in Kazakhstan and South Africa.

Table 4. Chromite production and reserves

Country	Mine production		Reserves	Reserve base[1]
	2007	2008		
South Africa	8 720 330	9 267 848	77 000 000	150 000 000
India	3 320 000	3 900 000	21 000 000	44 000 000
Kazakhstan	3 687 200	3 629 000	6 100 000	180 000 000
World total	22 154 309	24 003 004	NA	NA

1. Reserve base means that part of an identified resource that meets specified minimum physical and chemical criteria related to current mining and production practices. The reserve base includes those resources that are currently economic (reserves), marginally economic (marginal reserves), and some of those that are currently subeconomic (subeconomic resources). USGS Mineral Commodity Summaries (2009) Appendix C: A Resource/Reserve Classification for Minerals.

Source: ICDA Statistical Bulletin 2009 edition (2009), USGS Mineral Commodity Summaries (2009)

34. Over 90% of the world's chromite production is converted into ferrochrome for metallurgical applications (Table 5). Most ferrochrome is used to produce stainless steel. Reflecting this industrial structure, chromite ore mines tend to be owned and operated by ferrochromium producers[5].

5. See USGS 2006 Minerals Yearbook: Chromium

Table 5. Chromite ore and concentrates production by end use sectors (metric tonnes)

End Uses	2006	2007	2008
Metallurgical	17 722 856	20 755 861	22 684 810
Refractory	189 423	179 729	166 050
Chemical	671 856	530 642	485 577
Foundry sands	657 036	688 077	666 567
Total	19 241 171	22 154 309	24 003 004

Source: ICDA Statistical Bulletin 2009 edition (2009)

35. Around 30% of the chromite produced is consumed outside the producing countries, and China is by far the biggest importer. In 2008, it imported more than 6.8 million metric tonnes of chromite, or 70% of world imports that totalled around 9.6 million metric tonnes (Table 6). This is partially due to the fact that compared with its minor production of chromite, China is a major producer of ferrochromium. Although China's share of world chromite production was around 1% (220 000 tonnes) in 2008, that same year its ferrochromium production share was 19%, or 1 505 800 tons (Table 7).

Table 6. Chromite imports by country (metric tonnes)

Country	**2006**	**2007**	**2008**
China	4 324 746	6 090 840	6 848 668
Russia	898 230	989 405	1 112 028
Sweden	315 000	350 000	337 933
World Total	6 437 106	8 561 252	9 673 335

Source: ICDA Statistical Bulletin 2009 edition (2009).

Table 7. Production by country: Chromite and Ferrochromium (2008, metric tonnes)

Country	Chromite ore and concentrates	Ferrochromium
South Africa	9 267 848	3 300 985
India	3 900 000	750 000
Kazakhstan	3 629 000	1 027 387
Turkey	1 885 712	75.840
China	220 000	1 505 800
Total	24 003 004	7 906 553

Source: ICDA Statistical Bulletin 2009 edition (2009).

36. In March 2007, India imposed an export tax of INR 2 000/tonne on chromite in order to provide a greater supply of this mineral to the domestic market. Although demand for chromite has increased in India, higher demand from foreign countries, especially China, made it more attractive to export the products than to supply the domestic market. The downstream industry in India producing ferrochrome had difficulty paying the high price of chromite. The export tax was raised to INR 3 000/tonne in April 2008.

India is a major country regarding production and export of chromite. In 2006, India was the second largest exporter and represented 22.5% of world export of chromite ore with exports of 1 432 740 tonnes.

37. Table 8 shows how this measure actually reduced the amount of exports from India. Inferred from import data of the International Chromium Development Association (ICDA) *Statistical Bulletin* 2009, India's export of chromite decreased from 1 432 740 tonnes in 2006 to 550 532 tonnes in 2008. Most of it was exported to China.

Table 8. India's exports of Chromite (metric tonnes)

Destination	2006	2007	2008
China	1 339 597	984 159	550 532
World	1 432 740	1 104 756	630 413

Source: ICDA Statistical Bulletin 2009 edition (2009)

38. Reduced exports to China combined with increased demand of chromite for ferrochrome production led to an increase in import prices in China. The unit value of Chinese imports of chromite increased from 171.10 USD/ton in 2006 to 396.84 USD/ton in 2008 (Table 9).

Table 9. China's import of Chromite

	Quantity (1 000 tonnes)	Change (%)	Value (million USD)	Change (%)	Unit price (USD/tonne)	Change (%)
2004	2 170	21.8	381 310	152.8	175.71	
2005	3 020	39.6	595 569	56.2	197.21	12
2006	4 320	42.9	739 174	24.2	171.10	-13.9
2007	6 090	41.0	1 549 656	109.6	254.46	48.7
2008	6 840	12.3	2 714.382	75.4	396.84	55.9

Source: Chinese General Administration of Customs

39. Reduced exports to China had the effect of diverting its source of imports from India to other countries. Imports from India decreased by 59% from 1 339 597 tonnes in 2006 to 550 532 tonnes in 2008. To make up for this decrease in imports, China increased imports from other countries. The most striking example is South Africa, with imports from that country increasing by 200% from 868 427 tonnes in 2006 to 2 603 517 tonnes in 2008. (Table 10).

Table 10. China's source of imports of Chromite (metric tonnes)

	2006	2007	2008
India	1 339 597	984 159	550 532
South Africa	868 427	1 964 284	2 603 517
Kazakhstan	144 214	198 083	203 934
Turkey	740 875	1 082 913	1 179 782
World	4 324 746	6 090 840	6 848 668

Source: ICDA Statistical Bulletin 2009 edition (2009).

40. This increase in cromite exports to China created concern in South Africa on the long-term profitability of its own downstream industry, which is in part a result of the fact that South Africa and China are competing in the downstream industry of ferrochromium (Table 11). This concern led South Africa to consider introducing export restrictions on chromite. In 2007, the Deputy President Phumzile Mlambo-Ngcuka indicated the government was planning new legislation to prevent South African chromite producers from exporting chromite. This reflected the fact that the processed product was more valuable than chromite, and the concern that South Africa was losing the value-added benefits as well as employment opportunities in the downstream industry by exporting raw chromite.

Table 11. Production of downstream products: South Africa and China (metric tonnes)

	South Africa		China	
	Ferrochromium	Stainless Steel	Ferrochromium	Stainless Steel
2005	2 581 578	564 900	854 000	3 350 000
2006	2 893 400	689 700	1 042 500	5 363 000
2007	3 626 871	657 100	1 296 000	7 610 000
2008	3 300 985	528 500	1 505 800	7 344 000

Source: ICDA Statistical Bulletin 2009 edition (2009)

41. Application of the export tax did not significantly change the level of production of chromite in India. Regarding both chromite and ferrochromium, production data does not show a consistent decrease between 2006 and 2008. This, combined with reduced exports as shown in Table 8, indicates that the export tax in this case only raised the share of domestic consumption at the expense of exports while not significantly changing total production in India.

Table 12. Production of relevant products in India (metric tonnes)

	2005	2006	2007	2008
Chromite	3 255 162	3 600 400	3 200 000	3 900 000
Ferrochromium	611 373	634 200	820 000	750 000

Source: ICDA Statistical Bulletin 2009 edition (2009).

42. Export restrictions resulted in diverting China's imports from India to other countries, especially South Africa. This increase of imports from South Africa almost led to the application of similar export restrictions by the government of South Africa. This example indicates that export restrictions in one country can induce similar measures in other exporting countries. The intended effect of the Indian export tax may have been to reduce exports of chromite by raising its export price compared with other countries. However, if South Africa had applied an export tax, it would have offset the impact of the Indian measure by reducing the price gap between products of India and South Africa. Furthermore, such measure, by further reducing international supply, would have led to an even higher international price of chromite. In that case, India would have had to raise the export tax rates further to achieve the policy objective as originally intended. In this sense, the effectiveness of export restrictions depends on how other exporting countries respond to such measures.

Rare Earths[6]

43. Despite their name, rare earths are neither rare nor earths. The term "rare earths" refers to a series of 17 chemically similar metals, consisting of the 15 elements known as the lanthanides, plus yttrium and scandium. These rare earth metals and oxides are of particular interest here due to their unique chemical, magnetic and fluorescent properties.[7]

44. Rare earths are a critical constituent of many high technology goods that are essential inputs to the manufacture of items such as hybrid vehicles, mobile telephones, computers, televisions and energy efficient lights. Although rare earths have a relatively high unit value, the impact of their cost has little, if any, impact on the selling price of the final item because they are present in minute concentrations.

45. The rare earths market represented approximately USD 1.25 billion in 2008. Over the past decade, market growth has been in the range of 8-11% per year, with the exception of the correction in 2001/02 due to the fall in technology markets and the current global economic crisis. While the current global financial and economic crisis is expected to reduce consumption in 2009, it is anticipated that industry growth will return to 8-11% in late 2010 (Kingsnorth, 2009).

46. There are limited commercially viable rare earth resources and reserves. The largest proportion of these reserves lie in China (27 million tonnes) and are equivalent to about 30% of the world's reserves, while the US accounts for another 13 million tonnes, Australia 5 million tonnes and India 2.3 million tonnes. China supplies approximately 95% of global demand and consumes about 60% of the global

6. This section is taken from material graciously provided by Dudley Kingsnorth of Industrial Minerals Company of Australia Pty Ltd (IMCOA).

7. Rare earths are normally expressed in terms of rare earth oxides (REO) and often classified into three groups: light, medium and heavy. The light or 'ceric' elements are: lanthanum, cerium, praseodymium and neodymium; medium elements are promethium, samarium, europium and gadolinium and the heavy or "yttric" elements are: terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium and yttrium. Scandium is also part of the rare earths group.

supply, but its reserves of rare earths are finite. The Chinese government has indicated that if the exploitation of these resources is not controlled, they could be exhausted in 20-30 years.

47. Current production of rare earths in India and Russia is limited by the low quality and a lack of industry structure that would support their expansion. Currently, there is only one green field rare earths project outside China that has all the necessary environmental and commercial approvals in place and which is under construction: the Mt. Weld Project based in Australia (mining and beneficiation) and Malaysia (processing and separation of the rare earths). The Australian Foreign Investment Review Board placed 'unacceptable conditions' on funding from the China Non Ferrous Metal Corporation, as a result of which required funds were raised through equity issues.

48. There are significant barriers to enter the rare earths market as a new producer:

- Process technology is specific to each ore body.
- High capital cost: typically more than USD30 000 per tonne of annual separated capacity.
- Marketing is customer specific – rare earths are not traded on any recognised exchange.
- Limited operational expertise outside China.
- Industry is dominated by China where input costs are low.

49. A major ongoing issue for the rare earths industry is balance. Due to the incongruity between the supply and demand of individual rare earths, there always exists a situation in which there is a shortfall of some rare earths while others are in surplus. On the basis of known analyses of major resources it is considered that some of the 'heavy' rare earths are more likely to be in short supply in the future.

50. The Chinese government has stated that its reserves of rare earths are finite and, therefore, they will be developed for the prime benefit of China's manufacturing industry. As a result, a series of measures has been implemented to "conserve resources and to maximise the benefits" of its rare earths endowment.[8] To help generate manufacturing jobs and move up the value chain, China has adopted policies that encourage downstream industries that produce goods with higher value added to locate in China.The following measures have been put into place, indicating that China's rare earth resources are a priority for its domestic manufacturing industries:

- Export quotas
- Export taxes
- Withdrawal of the VAT refund on exports
- Production quotas
- Foreign investment in rare earth resources/mines is prohibited.

8. The commitment to developing the rare earths resources in China primarily for the benefit of the domestic manufacturing industries has been reaffirmed recently through a Draft Development Plan (2009-14) for the Rare Earths Industry issued by the Ministry of Industry and Information Technology.

Chinese Rare Earth Export Quotas

51. The rare earth export quotas for the second half of 2009 amount to a 12% annual reduction in the quota compared to 2008. The size of this reduction is greater than in previous years (Table 13). It should be noted however that due to the global economic crisis the total Chinese rare earth export quotas for 2009 are likely to be less than total non-Chinese demand.

Table 13. Chinese Rare Earth Export Quotas

Year	Export quotas	Percent change year on year	Estimated non-Chinese demand
2004	65 609		57 000
2005	65 609	0	46 000
2006	61 821	-6	50 000
2007	59 643	-4	50 000
2008	47 449		50 000
	56 939[1]	*-5.5*[1]	
2009	50 145	-12	35 000

1. Adjusted for 12 month allocation for comparative purposes.
Source: Table 13. Chinese Rare Earth Export Quotas

Export Taxes on Rare Earth Exports from China

52. In late 2006, the Chinese government introduced a tax on rare earth exports of 10%, which was increased to 15% on selected rare earths in 2007. Effective from 1 January 2008, export taxes were raised to the following levels (Appendix Table 1):

- Europium, terbium, dysprosium, yttrium as oxides, carbonates or chlorides – 25%
- All other rare earth oxides, carbonates and chlorides – 15%
- Neodymium metal – 15%
- All other rare earth metals– 25%
- Ferro rare earth alloys – 20%.

Refund of VAT on Rare Earth Exports from China

53. In 2007, China withdrew the refund of VAT (16%) on exports of unimproved rare earths, while the refund on higher value-added exports such as magnets and phosphors remains in place. The effect of this decision, combined with the export tax regime above, is that non-Chinese rare earth processors such as cerium polishing powder producers and rare earth magnet producers pay 31% more for rare earth raw materials (plus transport and storage costs) than their Chinese counterparts.

Impact of Export Restrictions

54. Rare earths export taxes and withdrawal of the VAT refund may have an effect on world prices of some rare earths. However, these materials are used in such small quantities that such policies are expected to have a limited impact on the prices of final goods. Quotas on exports from China have not had a visible effect on the volume of export of most rare earths as they have been higher than the estimated non-Chinese demand through 2009. As demand grows, however, and if quotas are made more restrictive in the way they have been in the last few years, supply constraints will exist among non-Chinese downstream producers of high technology goods using rare earths as one of their components. It is suspected that supply constraints will be greatest in heavy or "yttric" rare earths.

55. For the owners and financiers of non-Chinese rare earths projects, the major risk is that China will reduce its export taxes and abolish its export quotas that impact the rare earth prices outside China. World prices are now typically 20-40% higher than Chinese domestic prices. A sharp fall in world prices due to changes in Chinese policies may make investments in the rare earths industry outside China non-competitive. The profitability of these investments is already threatened due to high capital costs, strong competition from China where environmental controls are less onerous, specialized processing techniques, and the necessity for customer-specific marketing.

Conclusion

56. Several policy objectives motivate export restrictions of strategic raw materials. Conservation of natural resources is one of them. Export restrictions are also applied to achieve social objectives, such as protection of the environment. Unlike promotion of downstream industries, these objectives can be understood as a response to market imperfections. The question remains, however, whether export restrictions are the most effective tool to achieve these objectives. Since export restrictions have a direct impact on export volumes, in principle, the effectiveness of such measures depends on whether a reduction in exports actually leads to a decrease in production. In this regard, regulation on production itself rather than on trade is one alternative option to achieve these social objectives.[9] Possible future work in this area could include establishing a hierarchy of policy measures with a view to better understanding which ones most efficiently achieve the policy objectives.

57. Specific characteristics of strategic raw materials provide cases with interesting impacts of export restrictions. The concentration of production in a few countries, combined with the fact that there are few substitutes for several materials, result in a higher dependence on imports of these materials for non-producing countries.

58. To be effective in achieving objectives such as the conservation of natural resources and protection of the environment, export restrictions should affect production levels. The government applying the restrictions expects that, by reducing export volume, they will reduce the volume of production. However, this connection is not guaranteed, as shown in the molybdenum case where more production was sold domestically.

59. For conservation and environmental protection purposes, regulation on production itself rather than on trade is another option. Pollution emissions from a certain production process are the same whether

9 For example, Chile responded to resource depletion by applying a mining tax on the income of mine operators instead of relying on export restrictions. See summary report of the OECD Raw Materials workshop (TAD/TC/WP(2009)34/FINAL) for some examples of alternative policies to export restrictions to achieve policy objectives.

the products are consumed domestically or in a foreign market. Indeed, many environmental tax schemes applied by several countries focus on taxation at the production level.

60. Export restrictions imposed by one country can produce similar measures from other exporting countries by diverting the source of imports. This is more important for strategic raw materials because a few major producing countries are responsible for most of the world exports. In this sense, the interdependence among these countries impacts the effectiveness of these measures in achieving policy objectives. This was seen in the case of chromium where export restrictions placed by India impacted policies in another producing country, South Africa.

61. The potential imposition of export restrictions creates more risk for end-use producers as well as producers of the raw materials, as seen in the rare earths case. Although the export quotas in place have not significantly limited export or production so far, the possibility that access to these strategic raw materials will be restricted in the future incurs an additional risk factor for downstream producers that import rare earths. Potential producers of rare earths incur the risk that export restrictions will subsequently be lifted, thereby decreasing world prices to levels that make their production facilities unprofitable. Greater uncertainty in future prices due to potential changes in supply caused by export restrictions may therefore contribute to lower investment in production facilities worldwide. This is particularly problematic in mining industries where investments in new production facilities are necessarily long-term.

62. The impact of export restrictions on some strategic metals and minerals are exacerbated because in many cases the producing countries have a quasi-monopoly on supply. Since some of these metals and minerals are essential in the production of some high-technology products, and are not easily replaceable in the medium term, industry participants in some importing countries are concerned about future access at sustainable prices.

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APPENDIX 1. KNOWN EXPORT RESTRICTIONS ON STRATEGIC METALS AND MINERALS

Mineral	Country	Date	Product	Restriction	
Antimony	China	2008		Export quota: 59 000T	Tax
	China	2008	Ore/concentrate		10%
	China	2008	Unwroght antimony		5%
	Russia	2008	Waste and scrap		6.50%
	Tanzania		scrap	Export ban	
Cobalt	Argentina		Cobalt waste and scrap; semi-processed products; articles of cobalt		5%
	Russia		scrap		30% but not less than 1200EUR/tonne
	Tanzania		scrap	Export ban	
	Ukraine		Cobalt waste and scrap; semi-processed products; articles of cobalt		27%
Copper	Ukraine		Unrefined copper, copper waste and scrap		30% (but not less than 1euro per kg)
	Argentina		copper ore and concentrates		10%
	Russia	2008	copper cathode		10%
	Russia	2008	refined copper and copper alloys		10%
	Russia		unrefined copper		10%
	Russia		copper waster and scrap		50%
	China	2008	ores and concentrate		10%
	Kazakhstan		Refine copper and alloys		30% (but not less than 330euro per ton)
	Tanzania		copper scrap	Export ban	
Chromium	Ukraine	2008			30% (but not less than 0.4euro per kg)
	India	Apr-08	Ore		INR 3 000/t
	China	2005	Ferrochromium		5%
	China	2008	Chrome ores and concentrate		15%
	China	2008	Unwroght chromium		15%
	China	Jun-05	Chromium scrap		15%
	Tanzania		chromium scrap	Export ban	
Gallium	Russia				6.5%

Mineral	Country	Date	Product	Restriction	Tax
Germanium	China	2008	Oxide		5%
	China	2007			
	Russia		Waste and scrap		6.5%
Indium	China	2008 (June 2007?)		Export quota: 240T	
	China				15%
	Russia				6.5%
	Tanzania			Export ban	
Manganese	China	2008			39%
	China	2008	ores and concentrate		15%
	Gabon	since 2001			3%
	Ghana	since 2001			6%
	India	2006	Ore and dioxide		Rs 20 per tonne (ore), 20% (dioxide)
	Russia		Waste and scrap		6.5%
	Tanzania		scrap	Export ban	
Molybdenum	China	2008	Molybdenum	Export quota: 26,300T	
Molybdenum	China	(June?) 2007	Molybdenum	Export quota: 35,700T	
Molybdenum	China	January 1, 2008	ferromolybdenum		20%
Molybdenum	China	January 1, 2007	Molybdenum concentrates and oxides and ferromolybdenum		10%
Molybdenum	China	January 1, 2007	Molybdenum powder, unwrought molybdenum and scrap		15%
Molybdenum	China	July 1, 2007	Molybdenum hydroxides and salts and ammonium molybdates	VAT rebate cancelled	
Molybdenum	China	July 1, 2007	Molybdenum wire and other molybdenum products	VAT rebate reduced to 5%	

Mineral	Country	Date	Product	Restriction	Tax
Molybdenum	China	June, 2007		Export licensing system implemented granting export licenses to selected producers who meet certain criteria.	
Molybdenum	China	8 August 2001- 28 February 2002	ferromolybdenum	Export limit of 8861T to the EU following dumping duties imposed by the EU in 2000.	
Molybdenum	Russia		molybdenum ores and concentrates; waste and scrap		6.50%
Nickel	Russia	2008	Waste and scrap		30%
	Russia	2008	nickel matters and non-alloyed nickel		5%
	Ukraine	2008			30% (but not less than EUR 0.4/kg)
	Ukraine	2008			30% (but not less than EUR 5.5/kg)
	China	2008	ores and concentrate		15%
	Tanzania		scrap	Export ban	
Palladium	Russia				6.5%
Platinum	Russia				6.5%
Rare Earths	China	1999		Rare earth export quotas introduced to increase world prices (rare earths prices increased by USD120 in 2000 as compared to 1999)	
Rare Earths	China	2000		Export quota: 47,000T	

Mineral	Country	Date	Product	Restriction	Tax
Rare Earths	China	2001		Export quota: 45,000T	
Rare Earths	China	2004		Export quota: 48,040T	
Rare Earths	China	2005		Export quota: 48,040T	
Rare Earths	China	May, 2005		Export VAT rebate cancelled	
Rare Earths	China	Late 2006			10%
Rare Earths	China	2006		Export quota: 45,752T	
Rare Earths	China	2007		Export quota: 43,573T	
Rare Earths	China	2008	Europium, terbium, dysprosium, yttrium as oxides, carbonates or chlorides; rare earth metals (except neodymium)		25%
Rare Earths	China	2008	All other rare earth oxides, carbonates and chlorides; neodymium metal		15%
Rare Earths	China	2008	Ferro rare earth alloys		20%
Rare Earths	China	2008		Export quota: 37,189T	
Rhenium	Russia				6.5%
Silicon	China	2008		Export quota: 216,000T	
	China				5-15%
	China	2008	silicon metal		10%
Silver	China	2008		Export quota: 48,000T	
	China	2008	ores and concentrate		10%
Tantalum	Russia		Waste and scrap		6.5%
	Tanzania		Scrap	Export ban	
Titanium	China	July 2007	Titanium white	VAT rebate increased from 0% to 13%.	
Titanium	Russia		titanium scrap	30% but not less than USD 1091/ton	
	Russia		Unwrought titanium; powders, ingots, slabs and other products		6.5%
Tungsten	China	2008	tungsten and tungsten products (metal content),	Export quota: 14,600T	
Tungsten	China	2007	tungsten and tungsten products (metal content),	Export quota: 15,400T	

Mineral	Country	Date	Product	Restriction	Tax
Tungsten	China	2007	Ammonium paratungstate, tungsten carbide, tungsten trioxide, and unwrought tungsten metal and powder		5%
Tungsten	China	2006	tungsten and tungsten products (metal content),	Export quota: 15,800T	
Tungsten	China	1 November 2006	Ferro-tungsten		10%
Tungsten	China	1 November 2006	Tungsten scrap		15%
Tungsten	China	January 1, 2006	tungsten and tungsten products	VAT rebate reduced to 5%.	
Tungsten	China	May 1, 2005	tungsten and tungsten products	VAT rebate reduced to 8%.	
Tungsten	China	2005	tungsten and tungsten products (metal content),	Export quota: 16,300T	
Tungsten	China	2004	tungsten and tungsten products (metal content),	Export quota: 16,300T	
Tungsten	China	2004	Tungsten products with the exception of tungsten powder and concentrates and scrap	Export VAT rebate reduced to 5%.	
Tungsten	China	2004	tungsten concentrates and scrap	Export VAT rebate cancelled.	
Tungsten	China	2003	tungsten and tungsten products (metal content),	Export quota: 16,300T	
Tungsten	China	2002	tungsten and tungsten products (metal content),	Export quota: 16,300T	
Tungsten	China	2000		Export quotas assigned to approved traders who meet export guidelines.	
Tungsten	Russia	December, 2002			0%
Tungsten	Russia	through end 2002			6.5%
	Tanzania		Scrap	Export ban	
Tungsten	Ukraine	May 16, 2008, date of WTO accession	tungsten waste and scrap		30% but not less than EUR 10/kg
Tungsten	Ukraine	prior to 16 May 2008	tungsten waste and scrap	Export ban	
Vanadium	Russia				6.5%

Sources: Industrial Minerals Company of Australia Pty Ltd. (IMCOA), International Chromium Development Association (ICDA) *Statistical Bulletin* 2009, Metal Pages http://www.metal-pages.com/, Price *et al.* (2008), USGS Minerals Yearbook, and responses from various country questionnaires.