Can unilateral trade measures significantly reduce leakage and competitiveness pressures on EU-ETS-constrained industries?

The case of China export taxes and VAT rebates

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1. Introduction

Trade measures designed to offset competitiveness losses and carbon leakages have taken a high profile in European climate policy debates during the two first phases of the EU-ETS. The perspective of a failure of the Copenhagen COP 15 to reach a global deal for the Post 2012 period, jointly with unilateral efforts proclaimed by the EU to reach the 20-20-20 objective unconditionally, have reinforced the momentum over a border adjustment or compensation mechanism throughout the ultimate months of negotiation of the EU Climate and Energy package. Even though the original BTA was discarded while less aggressive forms preferred – such as free quota allocation and, albeit less clearly, offsetting import mechanisms - the final C&E package adopted during the Dec 08 EU Summit was clearly sealed from the perspective of a significant cost premium imposed by the carbon price on a wide spectrum of energy consuming industries. Event of carbon leakage is defined in Article 10(a), while measures to support energy-intensive industries are listed in Article 10(b) of the package. They include free allowances and the inclusion in the Community scheme of importers of products produced by the sectors or sub-sectors where leakages have been ascertained.

Among the criteria for a sector to qualify for leakage-support, Article 10(a)§17 of the package specifies that "*The list of sectors or sub-sectors exposed to a significant risk of carbon leakage shall be determined after taking into account, where the relevant data are available, the extent to which third countries, representing a decisive share of world production of products in sectors deemed to be at risk of carbon leakage, firmly commit to reducing greenhouse gas emissions in the relevant sectors and within the same time frame to an extent comparable to that of the EU (…)*".What is a "firm" and "comparable" commitment is not defined by the EU. Still, pursuant to Article 10(a)§17, risk of carbon leakage might be discarded as long as large partner countries commit to significantly reduce their greenhouse gas emissions in the sectors considered.

Against this background, the unilateral use of export restricting measures such as export taxes and VAT refund by China on energy-intensive sectors raises both hopes and concerns. From a European perspective, export restricting measures on products where China represents "a decisive share of world production" are likely to ease the competitive pressure faced by European import-competing industries, through both a quantity (import volumes decline) and price (world price rise) effect. Mirroring the BTA originally contemplated in the EU, trade restrictions on Chinese exports might hence have an effect on trade "comparable" to any border adjustment mechanism set in a large importing country. Concerns regard the exact amount to which these trade effects actually avoid leakages outside the EU, and as long as they are part of national commitment to reduce national emissions, can be deemed comparable to that of the EU. To what extent EU import and China export adjustment mechanisms are "comparable" from a climate change perspective is the question raised in this paper.

Focusing on steel, aluminium and cement where risks of leakage are deemed plausible and export restricting measures have been raised in China during the last couple of years, we

assess the comparability of China and EU "commitment" through a proxy given by the EU-ETS quota price equivalent of China's export restrictions set on energy intensive products. Our estimates of the EU-ETS quota price equivalent of Chinese exports restrictions provide figures of similar magnitude as the envisaged range of EU-ETS CO2 price, except for cement.

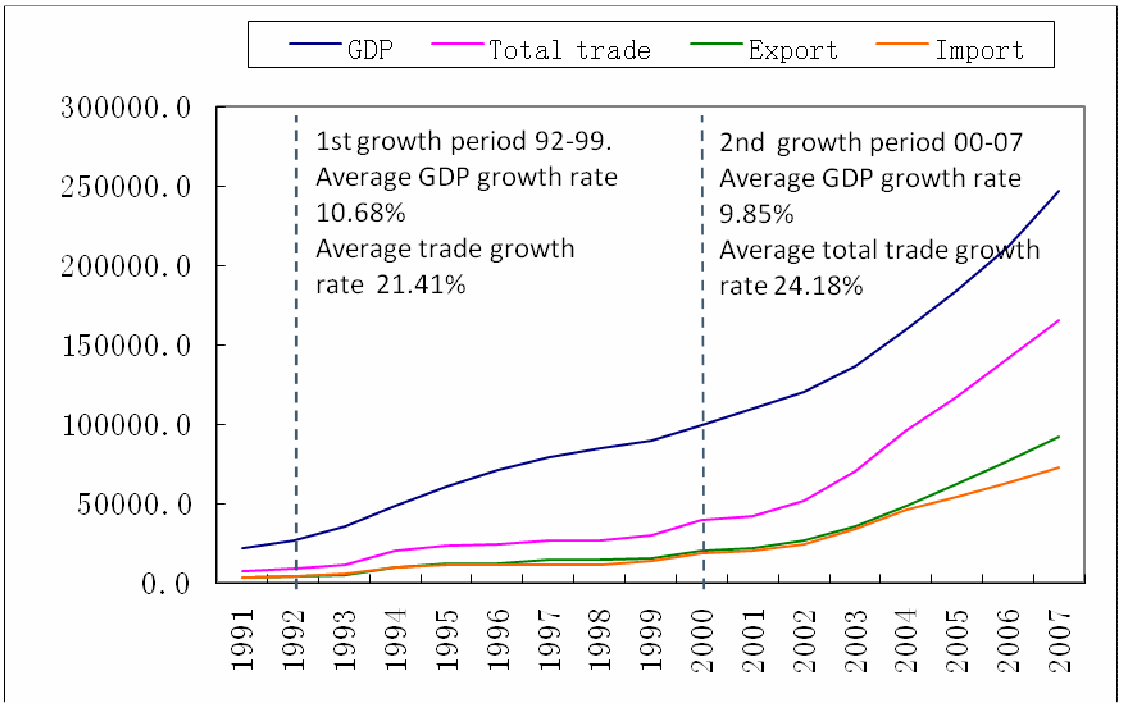
The paper is organised as follows. Section 2 recalls the basic figures of China's trade and growth, as well as the definition and roles of export taxes and VAT rebates in the past. Section 3 digs into current export taxes and VAT rebates on steel, aluminium and cement, providing updated figures of their level and a qualitative assessment of their effect on world prices and export volumes. We present in section 4 the basic formula of EU-ETS quota price equivalent of China's export restricting measures, and its application to steel, aluminium and cement. We discuss the results in section 5 before conclusion.

2 China's "decisive" production, trade and growth

2.1 GDP and trade: a brief overview

China's GDP has expanded at an average 8-9% growth rate during the last two decades, experiencing a two-digit performance from 1992 to 1999, and almost 10% growth thereafter (figure 1). China's trade performance shows a slightly different picture. The first trade boost occurred in 1994, when the annual growth rate skyrocketed at the historical level of 80.83%, while GDP was growing at 26.21% and 23.59% over the precedent years. Chinese trade then stagnated in 1996 and 1998 with an annual growth rate of 2.70% and -0.44%. Chinese imports and exports kept balanced on average until China joined the WTO (11 Dec 2001) after which China's exports grew much faster than its imports. China's trade surplus is now acknowledged as a determining factor of China's buoyant GDP (with a contribution to GDP growth up to 4 percentage points according to World Bank's estimates) even though some controversies remain over the cause-effect relationship between export and GDP growth. The trade/GDP ratio expanded from 20% in the early 1980s to almost 50% in the early 1990s and after a slight decrease from 1993 to 1999, to more than 70% after 2005. In 2007, China's exports almost account for 40% of its GDP.

Figure 1: China's GDP and trade 1991-2007

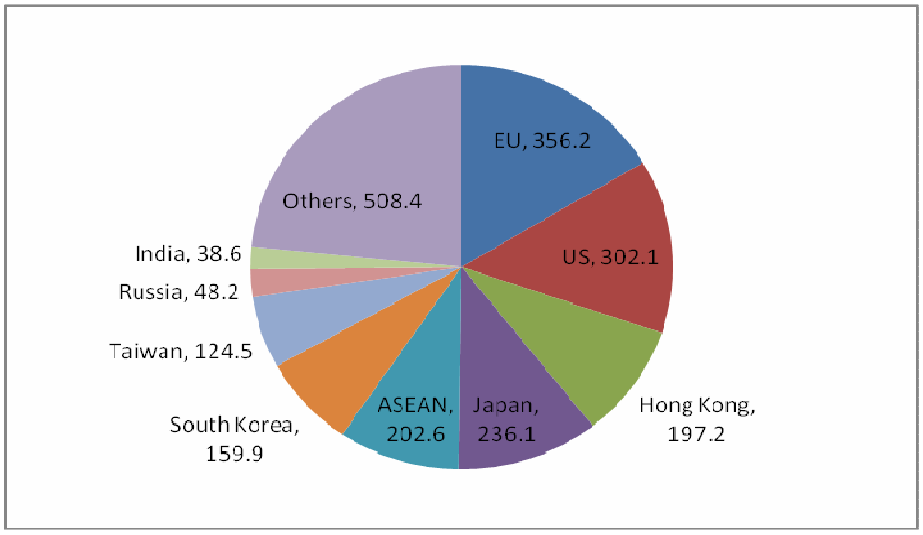


Note: Trade value in yuan in 2007 with an annual average exchange rate of 7.6 yuan/dollar.
Source: National Bureau of Statistics of China, Custom House. Unit: 100 million dollars.

2.2 Trade partners

China's major trade partners are concentrated. Its nine major trade partners were responsible for 76% of its 2.17 trillion dollar total trade value in 2007. The European Union (EU) ranks first, its bilateral trade with China accounting for 16% in China's total trade (figure 2).

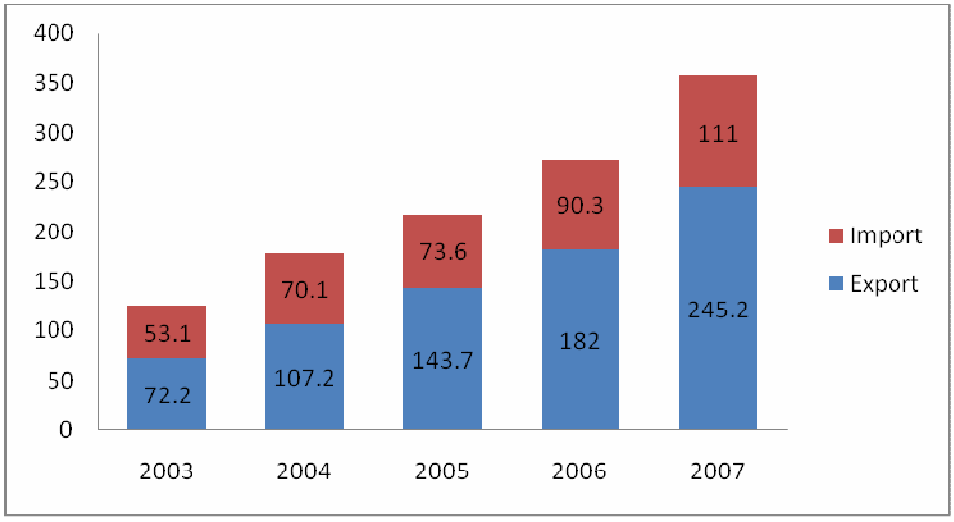
Figure 2. China's total trade by major partner countries in 2007



Unit: billion dollars. Source: China Custom House.
Note: ASEAN, Association of South East Asian Nations.

The total bilateral trade between China and the European Union almost tripled (2.8 times) in five years between 2003 and 2007. In a similar fashion as China's overall trade development over last years, China's export to the EU grows much faster than its import from the EU during the 2003-2007 period (exports more than tripled while imports doubled). As a result, China registered a net trade surplus of 134.2 billion dollars in 2007, seven times higher than the 19.1 billion dollars trade surplus experienced in 2003 (Figure 3).

Figure 3. China's trade with the EU 2003-2007



Unit: billion dollars. Source: China Custom House

2.3 China's exports restricting policies

2.3.1 Export VAT refund

The VAT export refund system, disallowing full recovery of the 17% input VAT, was adopted for the first time in 1985. The domestic VAT and export VAT refund rates were used for three categories: on coal and agriculture products (5-7%; 3%) industrial products (13%; 10%) and other products (17%; 14%). Five major modifications were added to the export VAT refund rate during the last two decades. The first reduction happened in 1996 when export refunding began to create a heavy burden on central budget. As a result, the export VAT refund rate was reduced by 5% for industrial products and 8% for other products. The second adjustment occurred right after the Asian financial crisis when the Chinese products were facing possible competitiveness losses after poor performance in 1998. The export VAT refund rate was augmented gradually as a solution of getting out of the crisis: by July 1999, the export VAT refund rate of China's major exporting products (clothing, electronic equipment, transport equipment and machineries, etc.) were up to 17%, a total reimbursement. Other products' export VAT refund rates were augmented to 13-15%. Overall, the general average Chinese export VAT refund rate was fixed at 15% at the end of last century. The third modification was set up pursuant to a notice (Cai Shui (2003) No.222) modifying the export VAT refund rate and proclaimed jointly by the Ministry of Finance and State Administration of Taxation on October the 13th 2003. This notice defined five categories of export VAT refund categories (17%, 13%, 11%, 8% and 5%). It became effective in January 2004 and reduced the average export VAT refund rate from 15.11% to 12.11%. The fourth adjustment on export VAT refund, which was initiated by a circular issued jointly by five ministries in September 2006, classified three modifications. The circular suppressed the export VAT refund for several natural resources and primary products. It reduced the export VAT refund rate on high polluting and energy consuming products. It also augmented the export VAT refund rate for commodities with high value added and technological content.

After WTO accession, China's boosting trade surplus has continuously fueled disputes with its trade partners. In an attempt to demonstrate China's good faith in attempting to keep trade surplus under control, the Ministry of Finance (MOF) and the State Administration of Taxation (SAT) jointly issued Circular No. 90 on 19 June 2007 (which became effective since July the 1st, 2007) which profoundly modified the VAT export refund scheme. It indeed reduced VAT refund rates for 2,831 commodities accounting for 37% of China's tariff codes. As a result, the export VAT refund rates of 2 268 commodities deemed likely to trigger trade disputes were reduced by 2-8 percentage points (See Table 1 below).

Strikingly, the 2007 VAT refund rate reduction concentrated on energy consuming and high polluting goods in China. As a matter of fact, the idea of controlling the export of such products by the means of trade policy was frequently debated during China's tenth Five Year Plan (2001-2005), when energy and environmental problems were given high profile for the first time and became "official issues" at the end of 2005, pursuant to a circular published by

seven ministries[1]: [Fa Gai Jing Mao (2005) No. 2595]. The circular provided only guidelines and fell short of defining any implementation principles or rules.

Export VAT refund rate reduction or complete withdrawal had been practiced only on a limited range of selected commodities since then. The government willingness to curb excess export on selected commodities was reasserted by the above-mentioned 2007 State Finance Circular [Cai Shui (2007) No. 90] which included a withdrawal or reduction of export VAT refund of 553 highly polluting and energy intensive commodities[2]. Previously, the export VAT refund rate applied on these commodities ranged between 5% and 13%, to be compared with the 17% domestic VAT rate.

Table 1. Export VAT refund rate modification in 2007

Mode of modification	Types of commodities	Commodity number	Major contents
withdrawal	High polluting and high energy consuming.	553	Distinguishing animals and their products, cement and mineral products, fertilizers and other chemical products, several activated carbon products, non-ferrous metal primary manufactures, etc.
Reduction	Commodities easily triggering trade disputes	2268	Clothing, shoes, toys, plastic and its products, furniture, several steel products, low value-added electronic machineries, etc.
Tax free		10	Stamps, nuts, canvas, etc.

Source: Cai Shui (2007) No. 90.

2.3.2 Export taxes

Comparing to the export VAT refund policy implemented continuously – even though unevenly - by China over the last decade, export taxes are set on much more temporary basis. Usually, the Customs Tariff Commission of the State Council jointly with the Ministry of Finance and State Administration of Taxation publishes next year's export tariffs at the end of each year. Possible modifications may occur in the course of the year, with respect to unexpected development in domestic and/or international demand and supply balances.

Extensively used by newly-independent countries in the 1960s and 1970s in Africa, Asia and Latin America (Devarajan, Go, Schiff and Suthiwart-Narueput, 1986), export taxes are a means to reach several potential goals. In her review of the role of export taxes in the field of primary commodities, Roberta Piermartini (2004) recalled that the rationale for an export tax

[1] National Development and Reform Commission (NDRC), Ministry of Finance (MOF), Ministry of Commerce (MOFCOM), Ministry of Land and Resources (MLR), China Custom House, State Administration of Taxation and State Administration of Environmental Protection (former name of Ministry of Environmental Protection).

[2] These include leather, chlorine, dyes and other chemical products, certain industrial chemicals (refined chemical products excluded), some fertilisers, metal carbide and activated carbon products, certain lumber and one-time-use wooden products, unalloyed aluminium poles and other non-ferrous metal processed goods, segmented ships and non-mechanical boats, etc. Consult "Notice Regarding the Reduction of VAT Refund Rates for Certain Commodities" State Finance Circular [Cai Shui (2007) No. 90] for further information.

applies to large countries: the cost of an export tax will be borne more by foreign consumers the more domestic producers manage to reduce exports and raise the world price of the exported commodity. To what extent a country is a large country – ie, a price maker – is given by the elasticity of the world demand facing the exporting country. A small – or price taker – country faces perfectly elastic world demand, while a large country does not. We'll see below that on the products selected, China faces almost rigid demand, which confirms it as a large country. Roberta Piermartini further reviews the arguments for setting export tariffs in the large country case, and confronts them with a limited number of case studies (box 1).

Box 1. Why should a country use export taxes?

Piermartini (2004) enlists 7 arguments for a large country to use export taxes:

The terms-of-trade argument

Stabilisation of domestic prices, export earnings and income

Controlling inflationary pressures

The infant-industry argument

Retaliating to tariff escalation in export markets

Easing the challenges of government revenue collection

Increase the income of the poor

Piermartini further reviews the evidence on the basis of case studies, namely the case of copra in the Philippines, the Indonesian palm oil industry, the cotton and yarn markets in Pakistan, and the rice in Thailand. Environmental goals – or effects – only appear once, as negatives outcomes of export taxes in the case of forestry products in Indonesia.

Source : Piermartini (2004)

Interestingly enough, environmental concerns rarely appear explicitly among the different justifications for an export tax in the economic literature reviewed. Müller and Sharma (2005) pointed out that the use of export duty on carbon-intensive products may be key element settling the deadlock of developing countries' participation in new climate negotiation. Such incentive was proved in China: the Circular Fa Gai Jing Mao (2005) No.2595 clearly states that one major use of such taxes was to further curb the export of highly polluting and energy-intensive products, should the withdrawal of the export VAT refund fail to achieve its purpose. Sectors and sub-sectors of iron/steel, aluminium, copper and several other non-ferrous metals were hit by an export tax rate set between 5 and 25%. The export tax was also used to increase domestic supply on sectors facing protracted deficit. For example, the export tax rate of coal and coke increased from 25% in 2008 to 40% in 2009 and the export rate of fertilizers ranged, across products, between 100 and 150% in 2008.

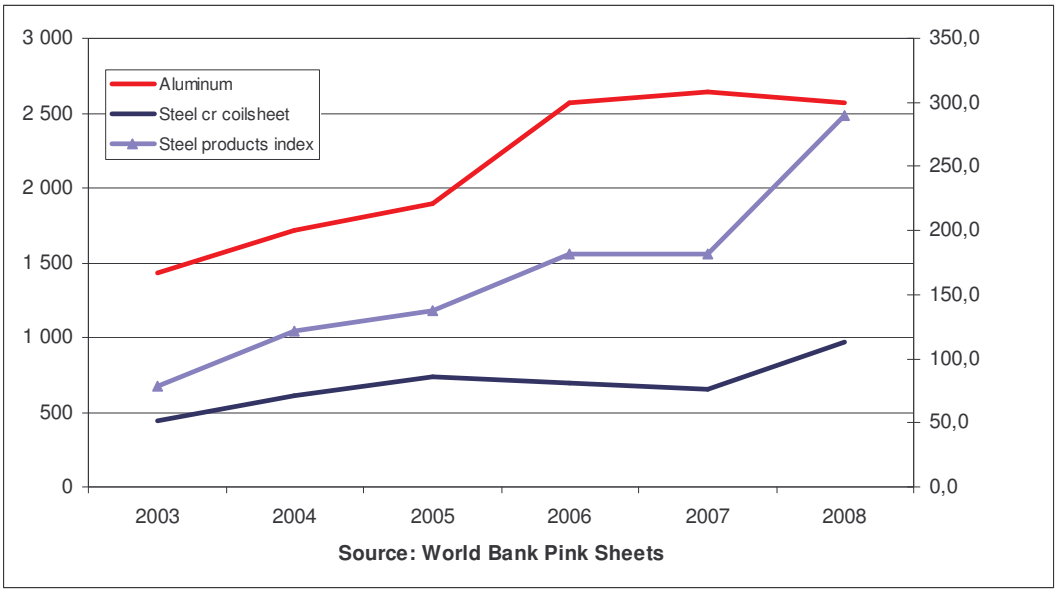
3. The use of export taxes and export VAT refund in EU-ETS leakage sectors

We select three sectors highly where leakages under EU-ETS scheme are deemed plausible, namely steel, aluminium and cement. Not only have these sectors been deprived from VAT export refunding but they have also been imposed relatively high export tax (15% on average).

World market conditions at the time when export taxes were set or raised and VAT rebates were cut were characterised by a widening of world supply/demand gap. Excess demand over supply boosted prices from 2006 on. Prices peaked in 2008 before retreating at the end of the year (figure 4). Without investigating the relationships between China export restraints and market upsurge at this stage, let us simply recall that a key determinant of China's integration in world market on steel, aluminium and cement lies in available supply capacities China provided to match a rising and, as we will see, a rigid world demand – at least until it raised export taxes and cut VAT rebates. To quote the World Bank market outlook webpage, the "outlook for aluminium [and to a lesser extent, steel] prices depends critically on the pace of investment in new capacity (especially in China and the Middle East), as well as on the level of energy costs and deregulation of power markets"[3]. Aluminium—the one major metal whose price has not surged during the current cycle because of the growth of capacity in China, the World Bank adds— "became more expensive recently because of still-strong global demand and increasing costs of electricity, a major input to the production of aluminium. Even if new capacity is concentrated in areas with stranded, low-cost energy sources, such as the Middle East, there is limited downside potential for prices, because aluminium has been fluctuating near the upper portion of the cost curve"[4]. We'll see that limited supply response to export taxes by Chinese competitors in world markets strengthens the overall impact of Chinese export taxes both on prices and indirectly on competitiveness and leakages outside the EU. But let's examine first the steel, aluminium and cement trade and trade policies of China.

[3] http://siteresources.worldbank.org/INTGEP2009/Resources/10363_WebPDF-01Chapter1-w47.pdf
[4] idem

Figure 4. Annual averages of Steel prices, Steel products index and Aluminium prices



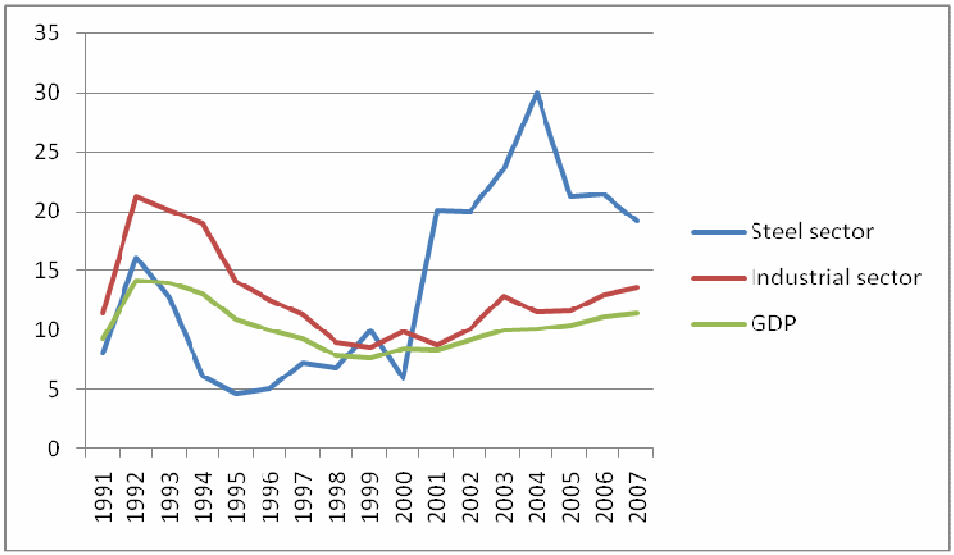
Left axis : price of Aluminium and Steel coilsheet in US$/mt

Right axis : Steel products index (2000=100)

3.1 Steel

China is the world largest producer of steel (and iron). The annual growth rate of steel production is now much higher than the average growth of the overall industry sector (figure 4). Half of Chinese steel is made of raw steel, whose production process is more polluting and energy consuming than other steels.

Figure 5. China's annual growth rate of GDP, industrial sector and steel sector

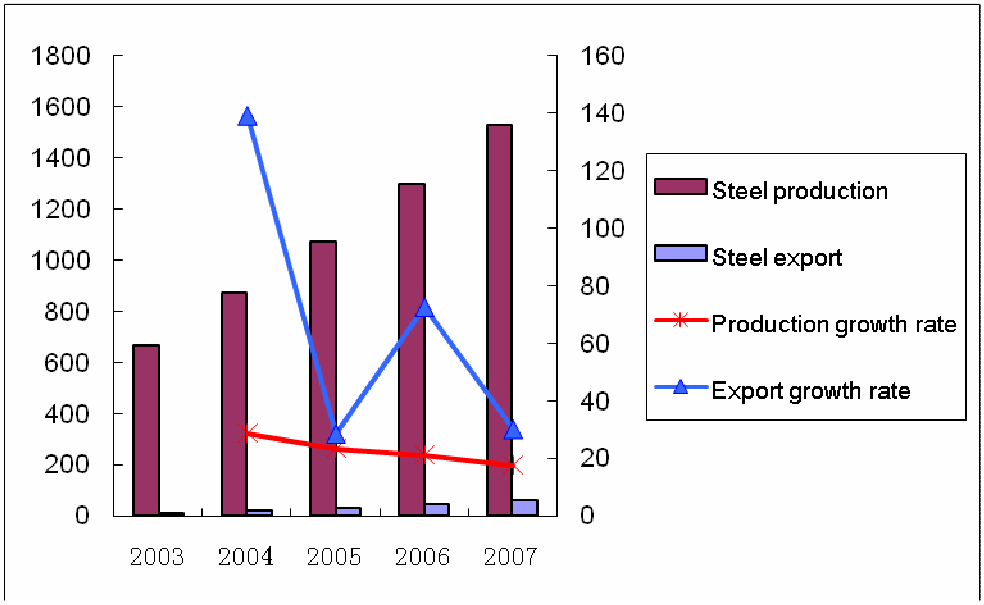


Unit: %. Source: Bureau of Statistics of China.

Note: Steel sector includes steel and raw steel.

Though the first world producer, China export less than 5% of its total production. However, steel (and iron) export has grown much faster than output over recent years: Chinese steel (and iron) export achieved a tremendous annual growth rate of 139% in 2004 and 72.5% in 2006 (figure 5).

Figure 6. China's steel production and exportation 2003-2007

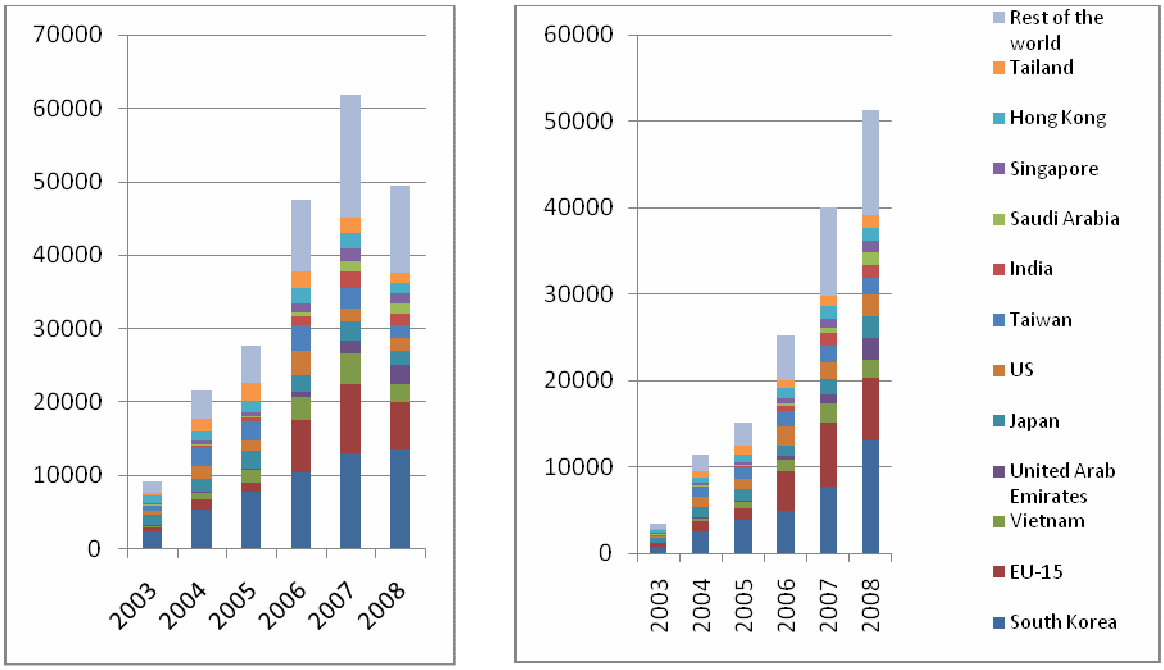


Unit: million tons for left axis and percentage for right axis.

Source: National Bureau of Statistics of China, China Custom House.

China's steel exports to its 12 major purchasers account for more than three quarters of China's overall steel exports in recent years. South Korea is the biggest importer of Chinese steel, followed by EU-15, with one third of China's steel export share (Figure 6).

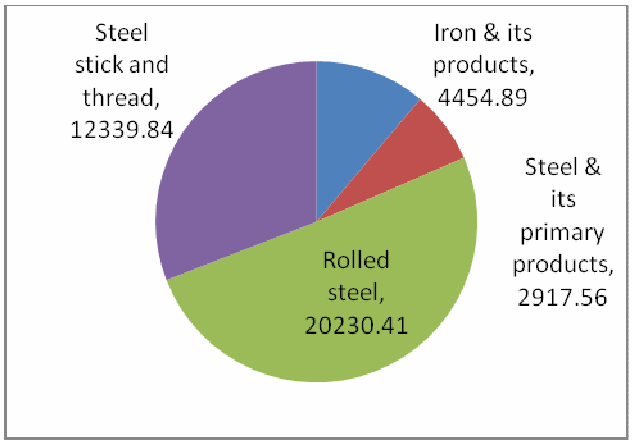
Figure 7. China steel export and export partners, 2003-2008.



Unit: thousand tons (left) million dollars (right).
Source: China Custom House.

The major exported commodities are final steel products. In 2007, these commodities accounted for more than 80% of total steel exports (Figure 7).

Figure 8. Steel export by types of commodities in 2007[5]



Unit: million dollars. Source: China Custom House.

3.1.1 Export VAT refund and export tax

The export VAT refund rate on steel (and iron) underwent little modifications in the 1990s. The refund rate was initially fixed at 17% which equals to the domestic VAT after the general tax system reform in 1994. The rate was cut to 9% from 1995 to 1998, and then raised to

[5] Iron & its products include in HS four-digit 7201-7205, Steel & its primary products include 7206, 7207 and 7218, Rolled steel includes 7208-7212, 7219, 7220, 7225 and 7226, Steel sticks and threads include 7213-7217, 7221-7224, 7227-7229.

15%. This first phase of reduction in export VAT refund was not motivated by environmental concerns. Major reforms of steel export VAT refund really started after 2004, when steel officially appeared in the category of highly polluting, energy and resource consuming products – China committing to reduce their exports from the beginning of the new century. As a result, the export VAT refund rate was reduced to 13% for all types of iron and steel[6]. A circular published jointly by the Ministry of Finance and the State Administration of Taxation at the end of the same year (Cai Shui (2004) No.214) seems to have triggered a number of large export VAT refund rate reductions. The circular suppresses export VAT refund on 16 categories of (crude) iron (HS code 7202) and two categories of aluminium which we will describe later[7]. Shortly after the circular came into force, China abolished the export VAT refund of nearly all crude irons and steels[8] (Cai Shui (2005) No.57).

In the beginning of the 11th Five Year Plan (2006-2010), China strengthened its willingness to limit exports of high polluting and energy and resource consuming products. This resulted firstly in the reduction of export VAT refund rate from 11% to 5% for 142 types (HS codes at 8 digit level) of steel and iron from September 9th, 2006 (Cai Shui (2006) No. 139). This ample reduction was followed in November 1st, 2006 by the implementation of an export tax of 10% on 30 types of steel which are mainly primary products like crude iron, iron alloy and billet steel (cf. China Custom House Circular (2006) No. 63). A more vivid policy was announced less than half a year later, which became effective in April 15th, 2007 (cf. Cai Shui (2007) No. 64), whereby China reduced its export VAT refund rate for 76 types (HS codes at 8 digits) of steel (which are relatively high value added products like cold rolled steel, certain special steel, etc.) from 11% to 5% and abolished this refund for 83 other types (HS codes at 8 digits) of steel. Continuously from June 1st, 2007 on, the promulgation of China's Custom House (2007) No.22 has covered a larger range of export steels whose tax rate increased: 53 types of steel were imposed a 5% export tax rate (coiled steel, plate steel, steel wire, etc.), 30 types of steel a 10% tax rate (normal steel bar, angular steel, etc.), the export tax rate reaching finally 15% for crude products (crude iron, certain iron alloy, billet steel and steel ingot etc.). The overall export tax rate on iron and steel increased by 10% at the beginning of 2008 and was maintained at this new level until the publication of a circular issued at the end of November 2008 by the Customs Tariff Commission of the State Council. It authorized the 2009 tariff policy entering into force from December 1st, 2008 on, to set to zero export taxes on 59 types of steel and iron (8 digit HS codes) whose export tax rate ranged between 5% and 15% before modification. Most of such 'released' products are relatively more value added and less polluting products than those still eligible to the export tax regime. Raw and basic steel and iron products continue to face export tax rates between 15 and 25%.

Changes in the export tariffs of China's steel export is illustrated by figure 8. The low and high lines define the sum of export refund rate (which is positive) and export tax rate (which is negative) as a cost (or net export tax) to the export sector. The lower line (blue) displays the lowest benefit a Chinese steel exporter can obtain from the export regime and the upper

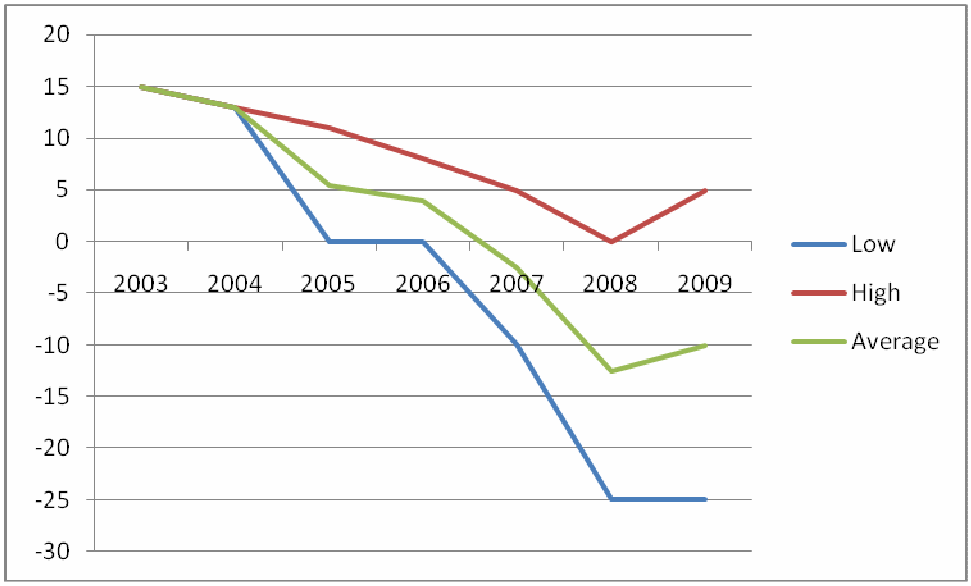
[6] All codes starting with 72 in HS system.

[7] HS codes of the iron include precisely 72021100, 72021900, 72022100, 72022900, 72023000, 72024100, 72024900, 72025000, 72026000, 72027000, 72028010, 72028020, 72029100, 72029200, 72029300 and 72029900.

[8] HS codes include 7203, 7205, 7206, 7207, 7218 and 7224.

(red) line the highest one. The (green) line in between is the simple average of the high and low values. It shows a slowdown of tariff benefits from 2003 to 2008 and a slight rebound in 2009 as a result of the cancellation of about sixty steel products export taxes (8 digit HS code).

Figure 9. Export tariff benefit changes, Chinese steel 2003-2009



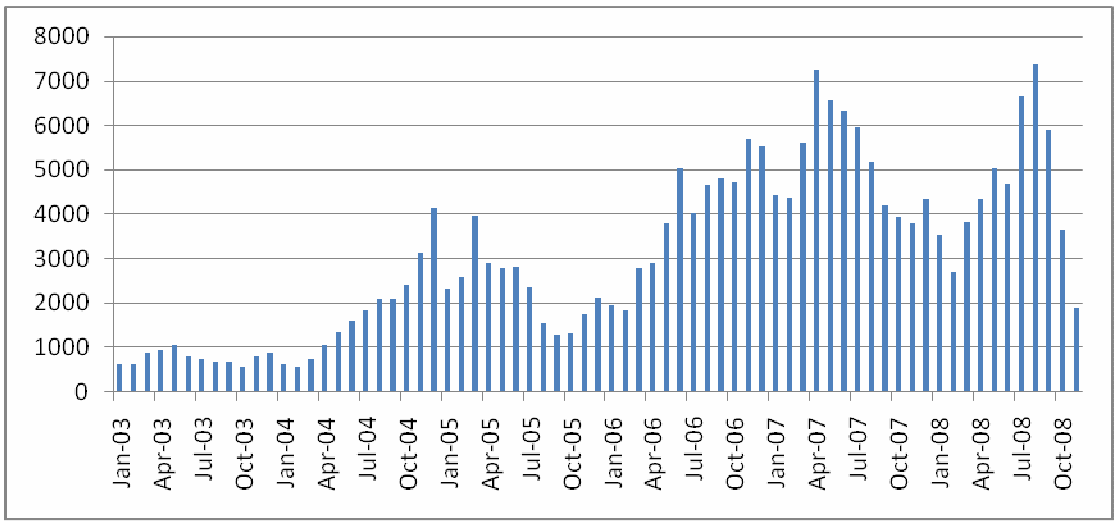
Unit: %.

Source: authors' calculation according to each period's export tax and export VAT refund rate.

3.1.2 Effects

A first dramatic drop of export VAT refund rate in 2005 caused a sharp decrease in export during the second half of 2005 and the first half of 2006. However steel export growth in the beginning of the second semester of 2006 and lasted until the end of 2007 when a more stringent export tax was imposed. This steel export decrease was sustained by a further increase in export tax in the beginning of 2008. As a result, steel export decreased in 2008.

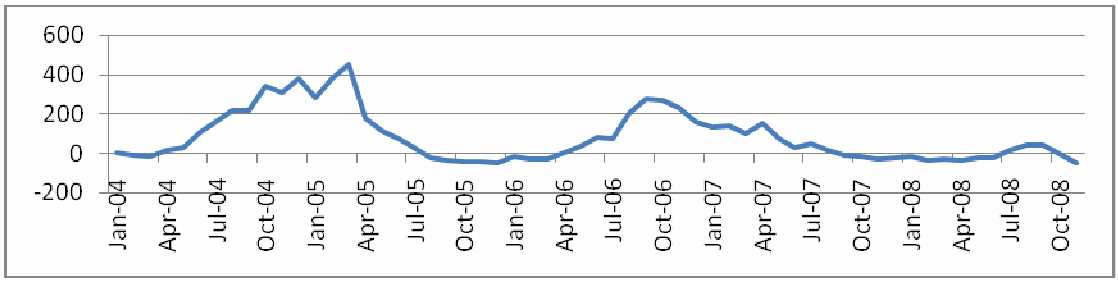
Figure 10. China's monthly steel export volume 2003-2008



Unit: 1000 tons.

Source: China Custom House.

Figure 11. Monthly growth rate of exported steel 2003-2008 (month over the same month of last year)



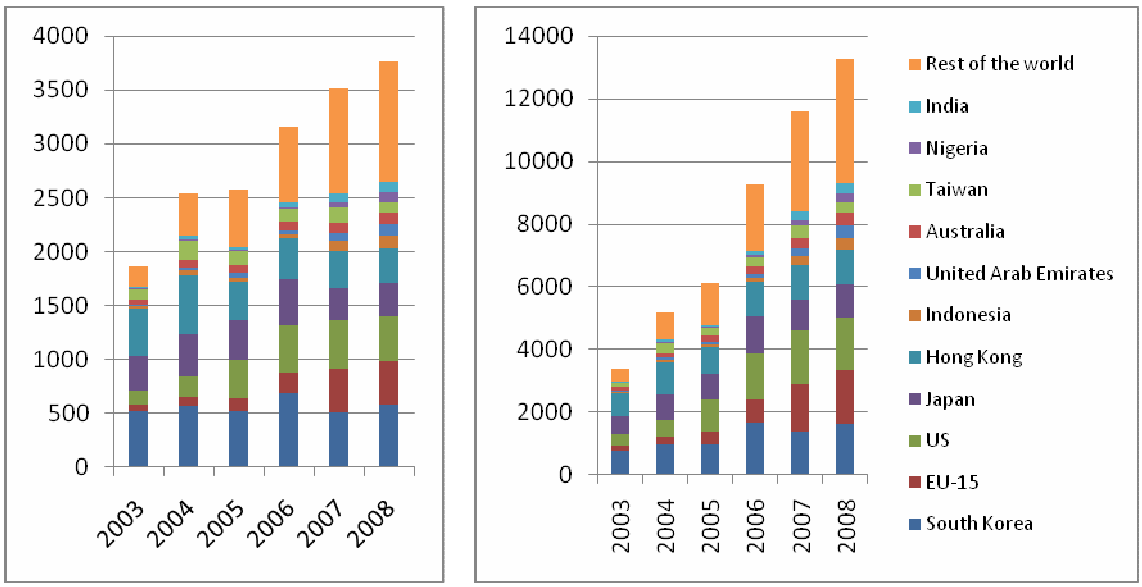
Unit: %.

Source: China Custom House

3.2 Aluminium

China primary aluminium production almost doubled between 2004 and 2008, from 6.6 to an estimated 14 millions tons over the period, accounting now for 53% of world primary aluminium output. Trade in volume followed a slightly less sharp increase, while exports in value skyrocketed in 2008 at the climax of the raw material world market boom. Figures 11 and 12 display the main destinations and components of China aluminium exports.

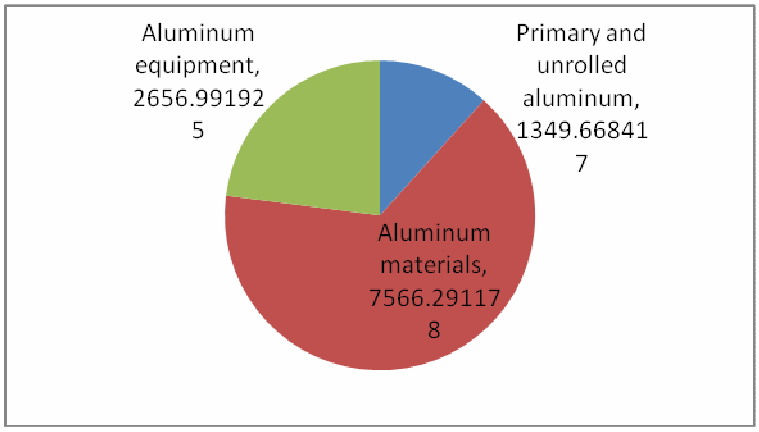
Figure 12. China' Aluminium export (quantity and value) by countries of destination: 2003-2008



Unit: 1000 tons (left) million dollars (right).

Source: China Custom House.

Figure 13. Components of China's aluminium export in 2007[9]



Unit: million dollars. Source: China Custom House

In 2007, only 2 out of the 18 types of aluminium at 8-digit HS codes level eligible to export taxes were effectively imposed an export tax, under HS7601-HS7606 subheadings, which refer mainly to non manufactured aluminium, the most exported goods including HS 7601 non forging rolled aluminium, HS7604 aluminium bars, sticks, and HS7606 aluminium plate thicker than 0.2mm.

[9] Primary and unrolled aluminium includes HS7201-7203, Aluminium materials contains all forms of aluminium-made products, i.e., sticks, threads, foils, etc., with HS codes 7604-7610. Aluminium equipment includes tins, home using products, etc., with HS 7611-7616.

3.2.1 Export vat refund and export tax in aluminium sector

The export VAT refund rate of aluminium was substantially modified both in magnitude and range terms, and reduced from 15% to 8% and 13%[10] in October 2003 by the State Administration of Taxation. A series of small reductions of aluminium export VAT reduction have taken place ever since. The circular Cai Shui (2004) No. 214, denounced by Ministry of Finance and State Administration of Taxation, suppressed the export VAT refund of unrolled aluminium (HS codes 76011000 and 76012000) in January 2005. In September 2006, a reduction from 13% to 8% and 11% was adopted mainly for HS codes 7604, 7605 and 7606 (Circular Cai Shui (2006) No.139). From July 2007, another large modification was introduced: the export VAT refund rates of several aluminium products were suppressed (unalloyed aluminium stick, bar and tube etc.) and other aluminium export VAT refund rates were cut to 5% (Cai Shui (2007) No.90). The export tax refund rate of aluminium since then is maintained at 0%-5% in China. Increase of the export VAT refund rates was conceded at the end of 2008 for a small range of special aluminium products considered as intensive in labor[11].

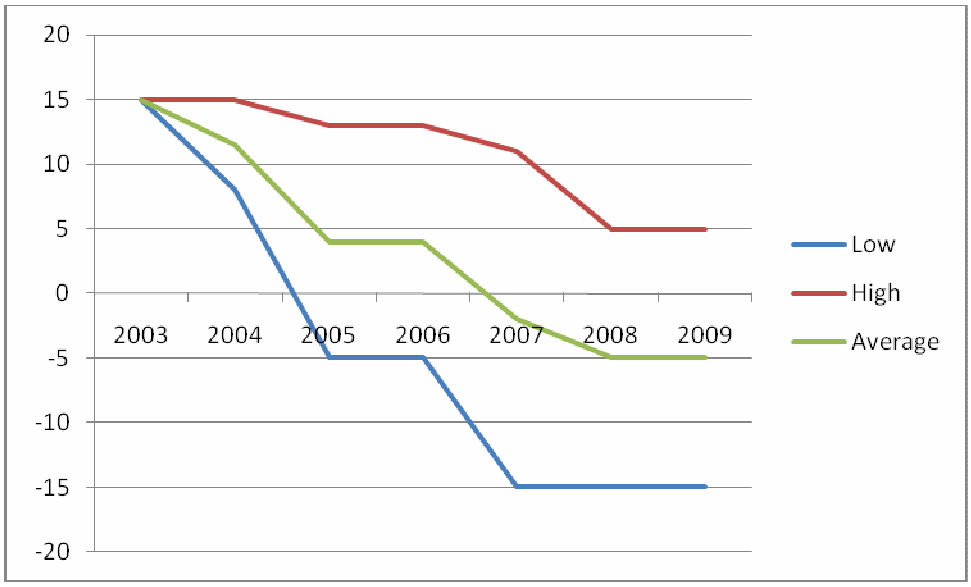
Export tax was first given on electrolytic aluminium at the beginning of 2005 at a tentative rate of 5%. This rate was augmented to 15% in November 2006. In 2007, only three types of aluminium products (HS codes 76011090, 76020000 and 76041000[12]) were imposed an export tax, at 15%. Another aluminium product was hit the 15% export tax in 2008 (HS 76042990). Two other products (76012000 and 76041010 at 15%) were to be taxed as exported good in December 2008 as the new 2009 Chinese tariff was unveiled. A reduction from 15% to 5% was decided in December 2008 for only one aluminium commodity (HS 76042910). Figure 13 encapsulates the changes in China's aluminium export taxes between 2003 and 2009, as figure 8 did for steel.

[10] Among which the export VAT refund rate of commodities under HS codes 7601 and 7602 were 8% and others were fixed at 13%.

[11] The export VAT refund rate on HS codes 7606112000-7606920000 were augmented to 13% (Cai Shui (2008) No.144).

[12] Export tax on HS 76041000 became valid from august 2007, announced by the circular of China Custom House (2007) No.38.

Figure 14 Export tariff benefit changes, China aluminium 2003-2009



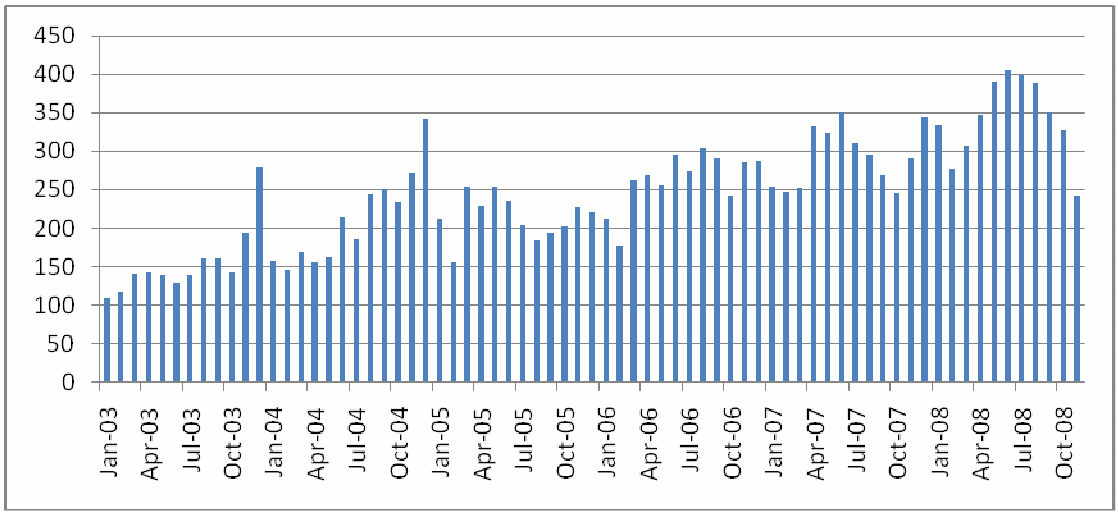
Unit: %.

Source: authors calculation according to China's export tariff changes.

3.2.2 Effects

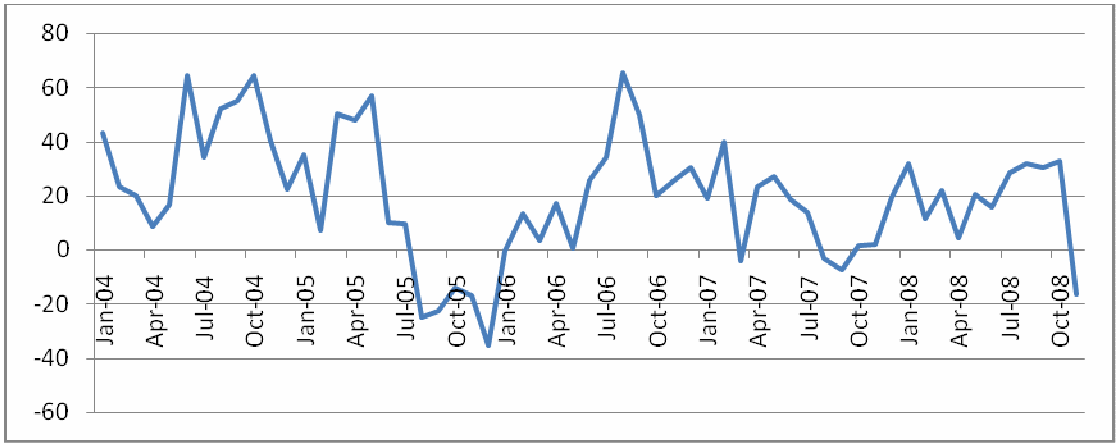
Changes in aluminium export volume after VAT refund and export taxes reductions were passed are visible on figure 14 and 15, especially during the 2005 and 2007 years of plummeting export growth. Yet "visibility" should not be taken as a synonymous of "causality", figures 14 and 15 providing only qualitative information at this stage.

Figure 15 Monthly aluminium exports 2003-2008



Unit: 1000 tons. Source: China Custom House

Figure 16 Monthly growth rate of aluminium export 2003-2008 (month over the same month one year before)



Unit: %. Source: China Custom House

3.3 Cement

China is world largest producer of cement, with more than 1 gigaton produced per year on average since 2005 (figure 16). China's cement production saw a slower growth at 2.8 percent year on year to about 1.3 billion tons in 2008, according to estimates of the Ministry of Industry and Information Technology (figure 17).

Figure 17 World cement production, 2004-2007

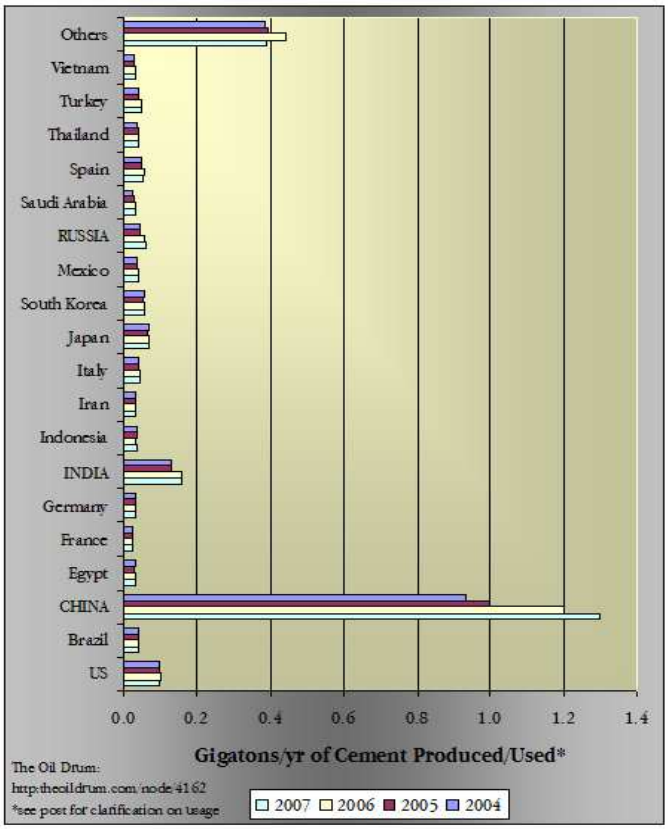
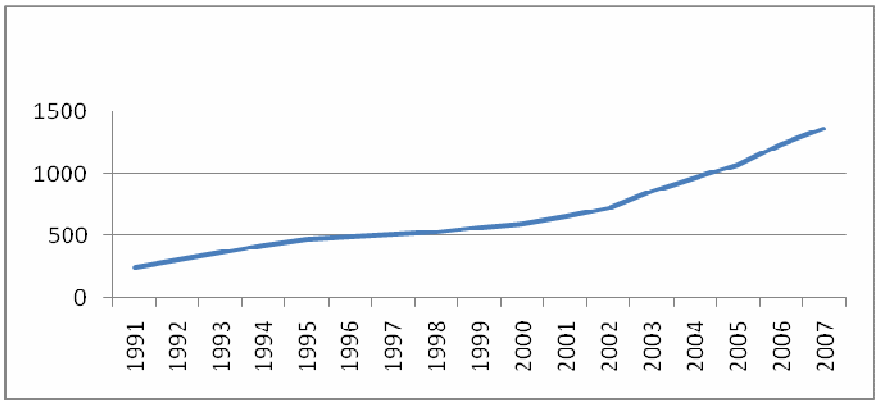


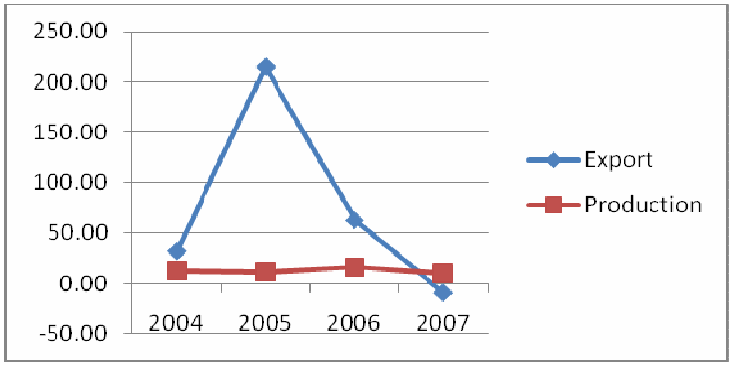
Figure 18 Annual cement production, 1991-2007



Unit: million tons. Source: National Bureau of Statistics of China.

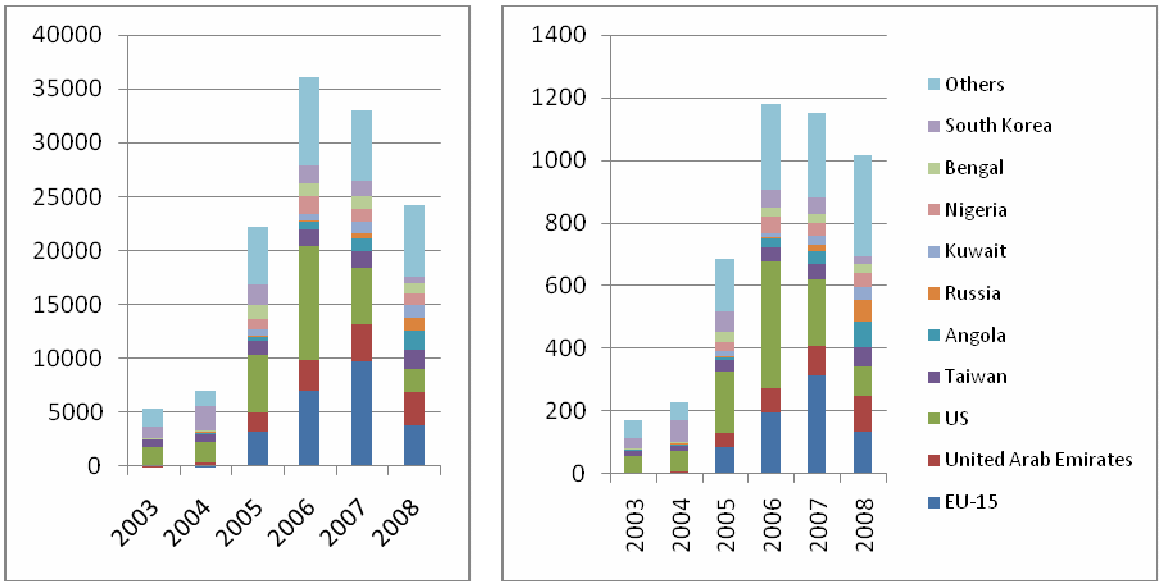
Cement export (HS2523) accounts generally for less than 1% of its production in China, as in most producing countries – trade being a very tiny part of world cement output. Unlike production which expands at a relatively stable pace, China's cement export increased tremendously in 2005 and 2006, before experiencing a slight decrease in 2007 (figure 19). China's cement exports by destination countries are given by figure 20.

Figure 19 China's cement production and export growth rate, 2003-2007



Unit: %. Source: China Custom House and National Bureau of Statistics.

Figure 20 China's cement export by destination countries 2003-2008.

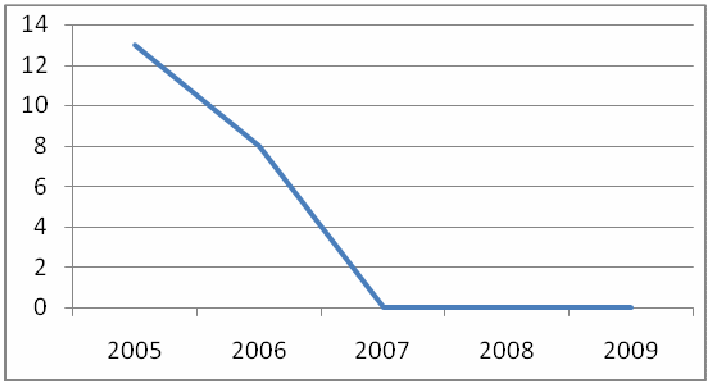


Unit: 1000 tons (left), million dollars (right). Source: China Custom House.

3.3.1 Export VAT refund

The export VAT refund abatement in cement sector was first implemented in September 2006, with a reduction from its former level of 13% to 8% pursuant to the circular Cai Shui (2006) No. 139. The export VAT refund was set to 0 in July 2007 (Cai Shui (2007) No. 90) and remained at the 0% level ever since (figure 21).

Figure 21 Tariff cost in cement sector

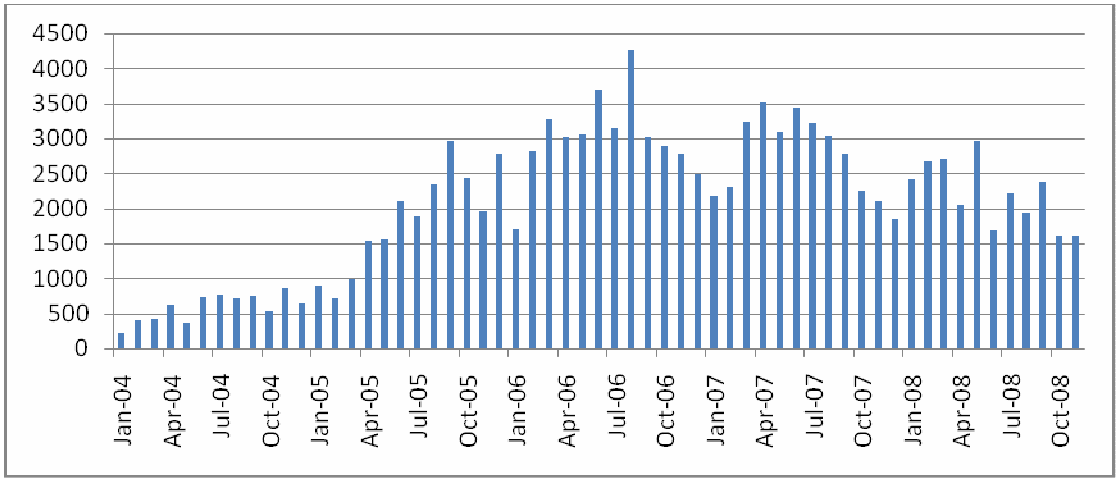


Unit: %. Sources: calculated from each year's tariff.

3.3.2 Effects

China's cement exports being highly volatile both in magnitude and destination over years, the visual information conveyed by export growth monthly changes become even harder to interpret than in the case of steel and aluminium (figure 22).

Figure 22 Monthly cement exports 2004-2008



Unit: 1000 tons.

4. Assessing the cost of export restricting measures with EU-ETS quota price equivalent

We assess in this section the energy consumption-induced CO2 emissions of steel, aluminium and cement exports from China. Though significant CO2 emissions may arise from other (direct) sources than energy consumption in the industrial process, we restrict to energy-consumption related emissions, for at least two reasons. The first one points to the share of direct and indirect (energy consumption) CO2 emissions in steel, aluminium and cement processes. With power generated almost exclusively by coal, electricity consumption-induced CO2 emissions take the lion's share in steel and aluminium production (the case of cement is different, as we'll see below)[13]. The second reason points to relevance. The rationale for curbing exports in the sectors considered is given by the long-term official objective of energy cost effectiveness and energy efficiency increase across energy intensive sectors. How much energy was saved by VAT refund reductions and export taxes is the specific question underlying China's initiative. Its translation from an overall, climate change – and certainly European perspective becomes how much CO2 was avoided thanks to the export-embedded energy consumption saved. A proxy of this figure is given below by the EU-ETS quota price equivalent of the export restriction efforts made by China. Contemplating the scenario European importers have to buy emission permits in the EU-ETS quota market for their imports of steel, aluminium and cement, we calculate the CO2 EU-ETS price equivalent of export taxes, including VAT refund cuts.

We use the following simple equations:

$$C = p \times \frac{a}{1+a}, \qquad [1]$$

where C is the unit tariff cost of export, p is the average price which is obtained by dividing the total export value by the total export quantity for the products considered, a is the average tariff cost (including VAT refund) in percentage terms.

The quota cost (or price) of one export unit is given by:

$$C' = p' \times b \times e, \qquad [2]$$

[13] The International Aluminium Institute provides world average estimates of 0.6% of global GHG emissions resulting from primary aluminium production excluding electricity and 1.4% including electricity – figures which in China need to be adjusted in favour of electricity consumption-related emissions (electricity is produced mainly from coal-fired power plants). For steel, the structure of emissions mirrors energy use in China, with coal and coke dominating, followed by electricity, then fossil liquids, and a small amount of natural gas (Price, Sinton, Worrell, Phylipsen, Hu and Li, 2001).

where p' is the EU-ETS quota price, b is the average energy consumption for one production unit, and e=2.38 is the CO2 emission per unit of standard coal consumption. Equalizing the two equations, we derive the equivalent quota price as

$$p' = \frac{p \times a}{(1+a) \times b \times e} \qquad [3]$$

For steel, we use 2007 data and take the average euro/dollar exchange rate of 1.3, an estimated energy consumption of 632.12 kgce per ton of steel (China Steel Association) and an average export steel price of 645.7 $/t.

The energy consumption rate of aluminium in 2007 was 14488kwh/t. Each kwh consumes 360 g of standard coal (NDRC). The steel sector's average energy consumed per ton of aluminium rises hence to 5216 kgce. The average export price in 2007 was 3291.5 $/t.

For cement, we use a modified formula so as to account also for the CO2 emitted during the production process, in addition to energy consumption. We use the formula of Li (2008) according to which the production of one ton of clinker emits one ton of CO2. With the average export price of cement in 2007 at 34.86 $/t, the quota cost (or price) takes the following simple form:

$$C' = p'$$

Table 2 provide estimates of the EU-ETS quota price equivalent of a range of 10 average export tariffs (a in equation [1]) .

Table 2 Estimates of EU-ETS quota price equivalent for various levels of export tax

Tariff cost		5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
Equivalen	Steel	15.72	30.01	43.06	55.02	66.03	76.19	85.59	94.33	102.46	110.05
	Aluminum	9.71	18.54	26.6	33.99	40.79	47.07	52.88	58.27	63.3	67.99
	Cement	1.28	2.44	3.5	4.47	5.36	6.19	6.95	7.66	8.32	8.94

Unit: euro/ton.

Applied tariffs in 2006-2008 (a varying between 10% and 15% on average) would be hence equivalent as a EU-ETS quota price ranging between 30 and 43 euros per ton of CO2 for steel, 18 and 26 euros per ton of CO2 for aluminium, and between 2.5 and 3.5 euros per ton of CO2 for cement.

5. Discussion of results

Our estimates provide a proxy of the plausible efforts made by China to reduce its CO2 emissions embedded in steel, aluminium and cement exports. Our figures indicate that the EU-ETS quota price equivalent charged to Chinese exporters amount to 43 euros per ton of CO2 for steel, 26 euros per ton of CO2 for aluminium and a mere 4 euros per ton of CO2 for cement, on the basis of a 15% average export tax (including export tax as such plus VAT refund). Two sets of question arise, the first related to the figures, the second to their meanings.

5.1 Limitations due to calculation methods and data

We calculate the EU-ETS quota price equivalent on the basis of the coal burnt to produce the steel, aluminium and cement exported. Several limitations should be kept in mind.

Firstly, we have used the energy (coal) consumption per unit of product without distinguishing sub-categories by pollution levels or tax rates applied at several HS digits. The quota price equivalent is hence a rough estimate.

Secondly, estimates would need to be revised downward, to account for both (non-energy) direct and indirect effects. Indeed, the more CO2 emissions embedded in the exported products considered, the lower the EU-ETS quota price equivalent for a given level of export tax. Still, correcting for some direct (non-energy consumption related) effect should leave our estimates in the range of 15-25 euros per ton (cement excepted).

Thirdly, we did not correct for the potential world price and EU-ETS CO2 price changes, nor for their possible effect on competitiveness and leakage. Our estimates of EU import demand elasticity suggest that Chinese exporters face a rigid import demand and are hence price makers. Curbing exports should hence lead to a world price increase (in comparison with the case of a small country setting up the same export taxes) and in turn, to a relaxing of the competitiveness pressure faced by EU industry. According to our calculus, the purchase of an average 2 million emission quotas by EU importers would have been needed to offset the CO2 price disadvantage of EU producers of steel, aluminium and cement on Chinese exports. This represents 1% of 2006 EU-ETS allowances, whose addition over years ends up making a significant amount of the overall reduction effort expected from EU firms.

5.2 What do our estimates really mean?

Are export restrictions part of a "firm commitment to reducing" GHG emissions? As already mentioned, export taxes are designed as part of an energy saving package, and not climate change policies as such, at least explicitly. Further, it would seem needed to separate

temporary and long-lasting measures, the former being a weak proof of a "firm commitment". Still, several arguments militate for export taxes to be considered as structural parts of an energy efficiency deal, and hence as a firm commitment to reducing GHG emissions.

Export tax and export VAT refund abating are set up to reduce the use of energy and natural resources whose domestic price is below market prices. The huge amount of exports of such products occurs at the cost of tremendous government energy or input based subsidies. This indeed helps to relax the energy tension in China. But it also helps to reorganize the production structure towards higher value-added and/or energy-efficient products. Higher export taxes or export VAT refund rate reductions are imposed on products with high polluting rate and low value-added. This happens along with the implementation of domestic policies closing small and energy-wasting factories, or at least restricting their number. All these initiatives belong to one of the key development objectives of China, namely energy efficiency. A reduction of 20% of energy consumption per unit of GDP from 2006 to the end of 2010 was officially defined in the 11th Five Year Plan and in the energy (2007) and climate change (2008) white papers. Though pessimism has been prevailing so far for the poor achievement of this plan, more stringent domestic policies are expected to be approved in the immediate future so as to achieve energy efficiency objectives by 2010. We may consider, implicitly, that export tax and VAT refund abating in China incorporate climate change concerns and efforts because of their contribution to higher energy efficiency.

What is the effect of export taxes on domestic production, and in turn, on GHG overall emissions from China? Trade is a minor part of sectoral emissions. The use of tax revenues and the effective implementation of complementary (energy efficiency) domestic measures will be key factors to both climate change mitigation and the more diplomatic demonstration that firm commitment indeed occur to "an extent comparable to that of the EU".

6. Conclusion

Three questions are related to Chinese export taxes on energy-intensive products. The commitment itself from China, the magnitude (comparability) of such commitment, and its stability (firmness) over time.

1. The commitment issue or why and for what does China resort to export taxes? Our findings suggest that China did not set any strategy of export led growth on the products considered. On the contrary, the proof was repeatedly given – through official statements – of its willingness to shutter energy-inefficient factories, in a context of world import demand rising faster than domestic capacity changes (China acting in world market as a "production capacity reservoir" necessary to bridge the world supply-demand gap). Last, export taxes enabled China to manipulate the terms of trade and reap off trade benefits through an export price increase.

All these three factors combine into a win-win-win scenario: energy saving, the modernization of production domestic processes, and export overall value gains were three interlinked objectives that the export tax helped China meet.

As a consequence, no commitment on climate change as such – particularly in EU terms where emissions reduction target should be made explicitly – can be formally associated with Chinese export taxes. This said, it may be worth recalling that that shuttering plants to reach formal emission targets can leave the marginal production cost unchanged (case of clinker in China with excess energy-intensive and energy inefficient capacities) and hence be of limited help to internalize CO2 price. Conversely, taxing exports without emission reduction targets can lead to energy efficiency increase, and in turn climate change mitigation, even though it does not appear as formal commitment to cut GHG emissions. Overall, export taxes (VAT refund cuts included) should be considered as part of a commitment from China toward higher energy efficiency. And in turn, although not explicitly, toward climate change mitigation

2. The comparability issue or does China's commitment fit into the same magnitude range as Europe's?

Our estimates shows that the CO2 price embedded in aluminium and steel (after correcting roughly for CO2 process-related emissions) in China's exports lies in the same range as EU-ETS average expected price (20-30 € per ton). For these two products, the energy saved in China and the emissions avoided in the EU occur at a comparable value of CO2 price.

This is not true for cement. In this case, the energy saving objective of China and the emissions reduction of the EU cannot be compared, unless export taxes (on a low value product such as clinker) reaches levels of several hundred percents. Setting VAT refund to 0 on cement export might suffice to reach domestic objectives (reduce profit margins, propel

modernisation toward energy efficient plants) but according to our estimates, the negative externality associated with exports are far from being priced at their EU CO2 price equivalent level.

Overall, taxing excess-energy embedded in exports (China approach) and taxing negative externality (EU approach) are two different processes, which match in the case of steel and aluminium, but not in the case of cement

3. The firmness issue or is China's commitment stable over time?

Export tax are more temporary devices than VAT refund cuts, the latter pointing to long term objectives of energy efficiency and upgrading of Chinese exports. A subsidiary question can be raised as follows: can Chinese export taxes help build up a climate deal between China and the EU?

Positive answers come from the fact that China is price maker in the three markets considered, with a significant effect of its export policies on world prices and hence on EU competitiveness. Indeed, opportunities for new comers in world market to offset China's export reductions and supply the EU seem rather limited. This confers a particular position to China, whose unwillingness to expand its GDP through exports of energy-intensive products could hence possibly satisfy EU competitiveness concerns and EU demand to limit imports growth on ETS products. Whether or not remaining imports in the EU should still be charged EU-ETS CO2 price depends on the definition of "leakage" chosen. Should we depart from the issues of "commitment", "comparability" and "firmness" addressed in this paper and consider instead leakage as emission reductions not passed onto EU-ETS CO2 price, then the purchase of emission credits by European importers remains a necessary condition for CO2 price to signal the scarcity negotiated inside EU.

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