Carbon pricing: is the EU border levy a turning point? Or a flawed attempt to prevent carbon leakage?

The European Commission is preparing a legislative proposal on a carbon border adjustment mechanism (CBAM) to protect domestic industries from competitors in other countries with less stringent and costly greenhouse-gas regulations. The EC also wants to avoid the problem of so-called carbon leakage by deterring firms from relocating production to more lenient foreign jurisdictions.

However, Brussels faces the difficulty of identifying the carbon content of imported manufactured goods. If importers of manufactured goods are initially exempt from the CBAM, the move would increase rather than reduce carbon leakage by encouraging the delocalisation of European materials producers – such as suppliers of steel, cement and chemicals which have heavy carbon footprints. Equally, such a levy would encourage imports of manufactured goods whose carbon content goes untaxed for the moment.

The EU's import levy would fall more heavily on Chinese goods than on imports from any other country for two reasons. First, China is one of the world's biggest producers of materials and finished goods. Secondly, the country is effectively the world's largest exporter of carbon, considering its economy is heavily reliant on fossil fuels for power generation. However, the proposed levy is most punitive on imports of materials, representing a much higher proportion of value added than for manufactured goods such as electronics. Accordingly, we are more likely to see incentives to change current supply chains have an effect in the materials sector than in manufacturing, even if both are taxed.

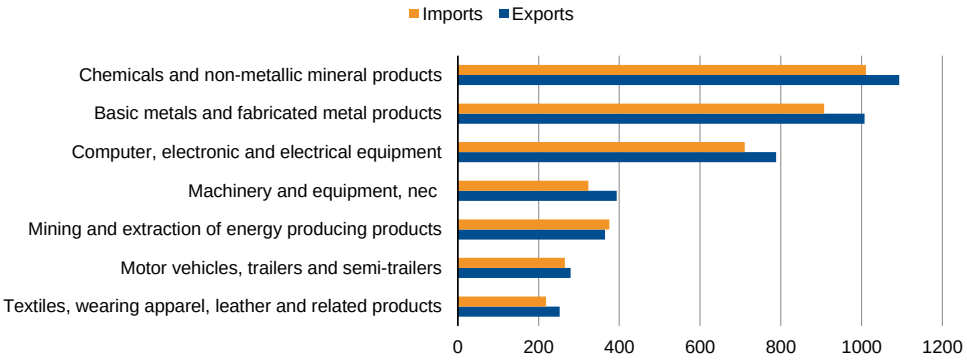
CBAM challenge centres on Green Deal, supply chains, CO2 leakage

The EU's Green Deal and accompanying regulations will affect carbon-dioxide emitting industries in and outside the EU. The overall impact depends on the scope of the regulation across sectors and definitions of the origin of goods for purposes of identifying carbon content.

The identification of original carbon content and its quantity in imported materials such as steel or cement seems manageable, but the task becomes increasingly complex for manufactured products such as computers and electronics. If the EC introduces a levy first on the materials sector and only later for manufactured goods, industries face incentives to move materials production and manufacturing to locations with less stringent environmental regulations while encouraging imports of manufactured products.

To assess the economic impact of the CBAM, we need to know two things: the share of embodied carbon in traded intermediates and final goods per sector; and the distribution of imported carbon across exporting regions and sectors.

Figure 1: Sectors most exposed to carbon-embodied trade (in millions of tonnes of CO2, 2015)



Sources: Scope ESG Analysis, OECD input-output tables

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Chemical, materials are CO2-intensive industries

The chemicals and materials sectors have the highest carbon content, followed by manufactured goods, especially computer, electronic and electrical equipment[1] if we look at the main import sectors in the EU affected by a carbon surcharge based on the embodied carbon in their output (see **Figure 1**).

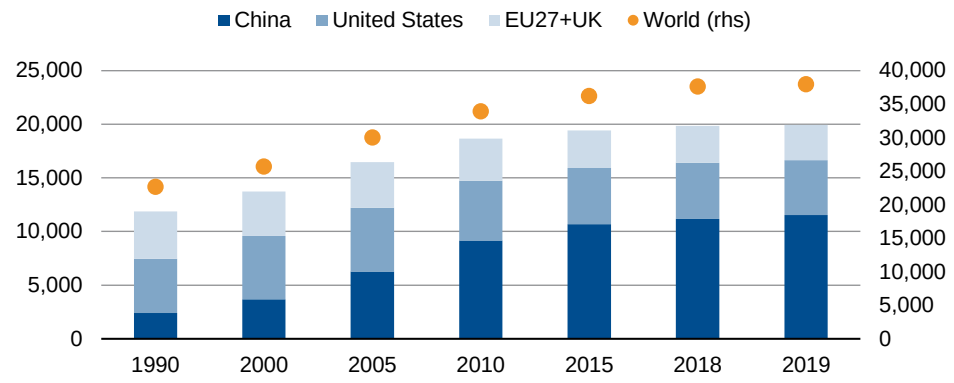
A binding carbon tax on materials imports might reduce volumes but only at the cost, in carbon-content terms, of increased imports of manufactured items which might in turn have higher carbon content if carbon-intensive production has been moved to regions with a greater proportion of fossil fuels in the local energy mix.

The global allocation of produced carbon emissions

Global carbon production on the rise before 2019

Global carbon emissions have rapidly increased over the past 20 years, from 22.7 Gt in 1990 to 38 Gt in 2019 (see **Figure 2**). China is the main contributor to the sharp rise with produced emissions of 11.5 Gt (30% of global emissions) while Europe has reduced its produced emissions by around 1 Gt (25%) to an overall 3.3 Gt. US emissions have stabilised around 5.1 Gt. The significant reduction in emission growth since 2010 is mainly driven by China, which has added around 1 Gt to its production in the past 10 years, compared with an average increase of around 4 Gt per decade in preceding decades.

Figure 2: Production of carbon emissions by major regions (million tonnes of CO2)



Sources: Global Emissions Database (EDGAR), Scope ESG Analysis

CO2 production, consumption spread across sectors, countries

The focus on produced emissions is however inconclusive because emission producers are not consumers at the same time. For instance, utilities produce a large share of emissions when generating energy from coal or gas, but their energy is used by other industries as an input for production. Along the supply chain, additional emissions are added to production before the final good is sold for consumption. Accordingly, it is often difficult to identify the source of carbon content and underlying energy mix in a final product.

EU needs to define carbon content of manufactured goods

The main difficulty of a carbon border tax regime is the determination of the carbon-intensity of an imported product. While direct (scope 1) and indirect emissions from production (scope 2) are relatively easy to identify, processed and manufactured products contain less-easy-to-identify carbon content. At the same time, manufactured goods are the most traded items globally in terms of traded value added. The administrative cost of defining and identifying the carbon content of these goods is complex. It depends on underlying production technologies and the energy mix, both of which are hard to identify if the supply chain involves multiple countries of origin. This study shows that the highest share of carbon-embodied trade stems from Chinese production.

[1] Norihiko Yamano et al: CO2 emissions embodied in international trade and domestic final demand: Methodology and results using the OECD Inter- Country Input-Output Database, OECD Working Paper, 11/2020.

China's dominant position in carbon-embodied exports

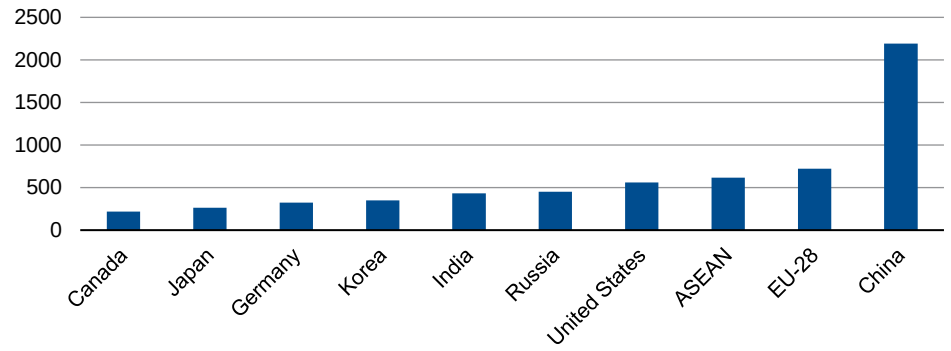
Per capita emissions highest in advanced economies…

While China dominates carbon emissions in absolute terms, the economy ranks far behind other industrialised regions in terms of per capita production with around 8 tonnes per capita in 2019, which compares to 15.5 tonnes in the United States or 17 tonnes in Australia. The country still relies heavily on electricity production from fossil fuels, the most important driver of its carbon account. The energy mix in production remains dominated by coal consumption (67.7%), followed by oil (23.1%) and gas (9.2%)2. China also exports a notable share of its domestic carbon emissions to the world in the form of materials and manufactured goods.

…while China dominates carbon-embodied trade

In 2015, China accounted for 53% of global carbon-embodied exports with a global share in exported value added of 12% (see **Figure 3**)[3]. The country is the largest net exporter of carbon (1,31bn tonnes) while the EU (502m tonnes) is the second-largest net importer after the US (785m tonnes). Assuming a relatively unchanged global allocation of emissions and consumption since 2015, we can use the trade allocation as a proxy for today's emission distribution.

Figure 3: Gross exports of carbon emissions (million tonnes of CO2, 2015)



Source: Scope ESG, OECD Input Output Database

Carbon border levy: metal importers face highest tax burden

Input-output tables inform about carbon content in exports

The introduction of a levy on carbon-embodied products makes foreign-produced carbon emissions more relevant for the domestic economy. In 2015, the EU imported 1.2 gigatonnes (Gt) of CO2 from abroad, equal to a share of 31.6% of total consumed emissions.

In this study, we make use the OECD's input-output tables (ICIO)[4] to approximate the physical content of carbon in traded goods and volume of traded carbon in imported goods by country and sector of origin based on data from 2015. For the carbon tax, we assume a price of EUR 40 per tonne which reflects the average market price for a tonne of carbon dioxide in the European Emissions Trading System (EU ETS) in 2021.

Materials importers most vulnerable to EU carbon levy

The main losers of the carbon levy are material-importing industries, which face a high cost relative to the imported value added and therefore have the greatest incentive to adjust their supply chains. At the other end of the spectrum, importers of manufactured goods are unlikely to be hard hit by the carbon levy. First, the complexity of calculating the carbon content makes it unlikely that they will be taxed. Secondly, any carbon levy they did fall under would be low if expressed as a share of imported value-added (see **Figure 4**).

[2] Crippa, M. et al.: "Fossil CO2 emissions of all world countries", European Commission Joint Research Centre, 2020
[3] Norihiko Yamano et al.: CO2 emissions embodied in international trade and domestic final demand: Methodology and results using the OECD Inter- Country Input-Output Database, OECD Working Paper, 11/2020.
[4] Input-Output Tables (IOTs): https://www.oecd.org/sti/ind/input-outputtables.htm

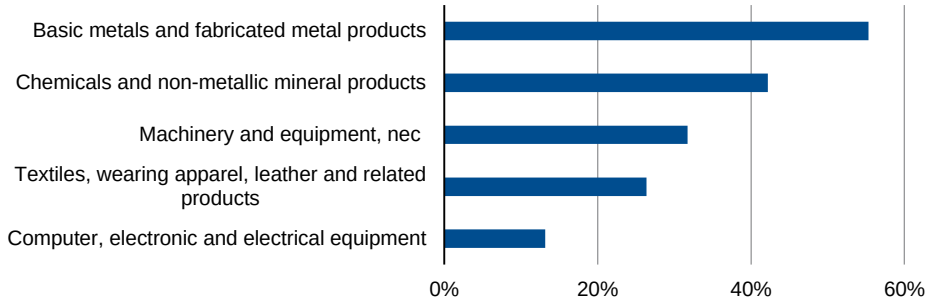
Risk of trade diversion with tax exemptions for manufactured imports

Data for gross value added in 2015 show that the EU's chemical and non-metallic mineral product sector produced around 360g of carbon per dollar of exported value-added. The same sector in China produced around 1.5kg of carbon per dollar of exported value. If a part of the chemicals production were relocated from Europe to China, the world could even experience an increase of carbon emissions rather than a reduction. While some sectors depend on the import of materials for final production such as the construction sector, other value chains could be relocated more easily if technological barriers are low and/or transportation costs for final product shipping remain affordable.

Carbon levy costs on imports from China

We can approximate the cost for importing industries by comparing the proportion of imported value added by sector with the amount of imported carbon by sector, using the ICIO data. According to our calculations, we find that five export sectors from China accounted for around 19% of total imported carbon to the EU in 2015. Assuming a lump-sum annual tax of EUR 40 per ton, importers would be subject to a total surcharge of around EUR 9bn if import volumes and embodied carbon remained unchanged from 2015. Importers of computer, electronic and electrical equipment face the highest absolute costs of a carbon tax equivalent to around EUR 2.86bn (see **Figure 4**), while importers of manufactured items would incur only a small cost relative to the imported value-added.

Figure 4: Carbon levy on major import sectors from China (% of imported gross value)



Sources: Scope ESG Analysis, OECD ICIO-tables

Outlook for CBAM: Brussels faces twin challenges

Ensuring WTO compliance

The EC faces two important challenges in the implementation of the CBAM. First, deciding on the scale and scope of the levy. Secondly, calculating the imported carbon on product level, irrespective of the underlying complexity of identifying carbon content. The first challenge shall be met by introducing a flexible levy instead of a carbon tax, given that the latter presumably violates WTO standards. A flexible levy should mirror the current ETS price of traded carbon certificates and thereby ensure equal conditions for domestic and foreign producers. Importers do not actively engage in the ETS but are subject to the same market price for CO2.

Selective choice of products for carbon levy could intensify carbon leakage

The more complex challenge relates to the calculation of impacts from imported carbon. In many cases, imported goods have made a long journey from the sourced inputs to processing and manufacturing, which involves different countries and emissions intensities by production step. While the origin and quantity of carbon in imported materials such as steel or cement can be identified relatively easily, such identification becomes increasingly complex for manufactured products such as computers and electronics. We therefore expect that the EU Commission is likely introduce a levy first on the materials sector. The question is how such selective carbon border pricing impacts trade flows and production decisions by the industries. For instance, EU-resident companies could move materials production and manufacturing towards locations with less stringent frameworks. The relocated production output would then be imported again in form of manufactured imports.

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