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Getting Serious About the European Green Deal with a Carbon Border Tax

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Abstract

In December 2019 the incoming European Commission announced the European Green Deal (EGD), which aims to turn the EU into a climate-neutral, circular economy. Although it is as yet not very specific in many areas, the EU's Green Deal sends the right signal and contains several promising elements. One of these is the introduction of a carbon border adjustment (CBA) mechanism mentioned as an option in the EGD. Apart from supporting the ecological objectives of the EGD, a carbon border tax can help to counter carbon leakage in EU industries that results from the EU's internal carbon pricing system. This way, distortions of competition in energy-intensive industries due to asymmetric domestic carbon pricing policies can be partially remedied. Another positive side effect of a carbon border tax is that it would add a new source of income to the EU budget that is independent of Member States' direct contributions. To reap this "triple dividend", the CBA needs to be carefully designed both economically and legally. In particular, a European CBA mechanism needs to be compatible with the EU's WTO obligations under the GATT. While this is challenging, it is perfectly feasible. Therefore the EU should introduce a carbon border tax as soon as possible, even though this is a high-risk strategy that is likely to increase existing tensions in the international trading system and will probably require an adjustment of its current trade policy.

Keywords: Carbon border tax, externalities, ecological transformation, WTO, EU budget

JEL classification: F18, F13, F64, H23

CONTENTS

TABLES AND FIGURES

Getting Serious About the European Green Deal with a Carbon Border Tax

KEY POLICY INSIGHTS

- The introduction of a European carbon border tax as a supplement to the EU's domestic carbon pricing system would support the EU's ecological transformation and contribute towards mitigating unwanted carbon leakage effects.
- A European carbon border tax could provide a significant new source of funds for the EU budget that could be used for projects in support of the EU's ecological transformation.
- To ensure WTO compatibility of the carbon border tax, it should be designed as a *charge equivalent to an internal tax*, and the EU's Emissions Trading Scheme should be transformed into a carbon tax.
- The European carbon border tax reveals an inconsistency between the European Green Deal and the EU's pursuit of deep and comprehensive free-trade agreements within its trade policy.
- On the downside, the introduction of a European carbon border tax may be viewed as a protectionist measure by important trading partners and is therefore likely to increase the tensions in the international trading system.

1. INTRODUCTION

In his Royal Economic Society Annual Lecture in 2007, Sir Nicolas Stern referred to climate change as the result of *"the greatest market failure that the world has seen".*[1] For economists, environmental degradation and man-made climate change are primarily the result of negative external effects (e.g. Weitzman, 2014). A negative external effect arises when producers do not have to pay for the full costs that their production activities impose on society. Air pollution and its negative consequences for the environment and human health are a prime example of such a negative externality on the production side. The result is that in the absence of any efficient carbon pricing firms will produce more than is socially desirable, because they do not take into account the damage that their production-related emissions impose on society. This constitutes a classic case of a market failure at the global level.

Recognising the global dimension of the issue, the ideal solution would be to set a price for CO2 and other greenhouse gas emission at the global level. In a recent report the IMF, for example, calls for a carbon tax in the order of USD 75 per tonne of CO2 (IMF, 2019). Despite efforts to cut emissions within the United Nations Framework Convention on Climate Change (UNFCCC), resulting in the Paris Agreement in 2015, the introduction of a carbon tax at the global level is more than unlikely in the foreseeable future. For this reason the EU decided in 2005 to act unilaterally and installed a European system of emissions pricing, the EU Emissions Trading System (EU ETS). This can be interpreted as a *second-best solution* to remedy the market failure within the European Single Market.

[1] See: https://www.res.org.uk/resources-page/achieving-low-carbon-growth-for-the-world----sir-nicholas-stern-on-the-key-elements-of-a-global-deal-on-climate-change.html.

With its European Green Deal (EDG) the European Commission is sending a clear signal: the EU is determined to get serious about climate change and the ecological transformation. The stated objectives are to make the EU economy climate-neutral by 2050 and to shift from a linear production mode to a circular economy. Despite this clear commitment to a "greening" of the EU economy and appropriate carbon pricing, the introduction of the EU ETS has also caused serious concerns in Member States about the international competitiveness of European firms. In this context, the literature sometimes distinguishes between two issues: the risk of "carbon leakage" on the one hand, and the loss of competitiveness of energy-intensive industries on the other (see e.g. Mattoo et al., 2009). However, the deterioration of competitiveness and carbon leakage effects, i.e. the migration of production from countries with a carbon pricing system to countries without such a system (see e.g. Cosbey et al., 2019), are two sides of the same coin. Therefore, in the following analysis the term carbon leakage is used to include not only the environmental aspect – firms leaving jurisdictions with carbon taxes, thereby undermining efforts to curb emissions – but also the competitive challenges arising from asymmetric carbon pricing efforts across countries.

Hence, although the EU's internal carbon pricing mechanism addresses the environmental market failure within the European Single Market, it creates another distortion of trade with third countries, at least in trade with those countries that do not have a comparable carbon tax in place. This is where the idea of a "border measure" comes into play. The above-mentioned additional distortions triggered discussions about some sort of "adjustment at the border" – or a carbon border adjustment (CBA) mechanism – which was pushed by France in particular. A CBA should be seen as a supplement to the EU's own carbon pricing mechanism and as such was integrated into the EGD, where it is mentioned as an option (European Commission, 2019, p. 5). It has also been included in the EU's new Industrial Policy Strategy of March 2020 (European Commission, 2020a), where it forms part of the industrial policy measures in support of the aspired climate neutrality. By 2021 the Commission is bound to submit a proposal for a CBA mechanism for most-affected industries that aims to reduce carbon leakage in case asymmetric efforts to price emissions persist. All Commission documents also emphasise that the CBA will be fully compatible with WTO rules.

This policy paper discusses the ecological and economic effects of a (unilateral) European CBA and also points to the positive side effects of such a levy, since its implementation could provide a new source of funding for the EU budget. In addition, some legal aspects regarding the WTO compatibility of a CBA and the implications for the EU's current trade policy are discussed.

The remainder of the paper is structured as follows. The subsequent section briefly outlines the current EU ETS. The next two sections discuss the economic effects (Section 3) and the most promising legal design of a CBA with a view to its WTO conformity (Section 4). Based on these analyses, the implications for EU trade policy are discussed (Section 5). Section 6 assesses the potential of a CBA for the EU budget. Finally, Section 7 offers some policy conclusions.

2. THE EUROPEAN EMISSIONS TRADING SYSTEM

The EU ETS is a cap-and-trade system which "internalises" the CO2 externality. Under the system a predefined amount of emission certificates – so-called "allowances" – are issued. One such European Union Allowance (EUA) entitles the owner to emit one tonne of CO2. The total amount of allowances, which is gradually reduced over time, determines the maximum amount of CO2 to be emitted (within the sectors covered by the EU ETS). This is the "cap" on which the system works. The "trade" part of the EU ETS stems from the fact that allowances can be bought and sold at various energy exchanges, such as the European Energy Exchange (EEX).

The advantage of cap-and-trade systems such as the EU ETS is that there is no need to set a price for CO2 emissions. Rather, the price is determined by demand and supply within a market mechanism, which reduces the risk of distortions due to "inadequate" prices. In principle, this market-based mechanism should lead to efficient outcomes, because firms which can reduce emissions at a comparatively low cost will do so and sell their emission allowances, while firms for which the installation of emission-mitigating measures would come at a high cost can buy such allowances. This ensures that emissions are cut where it is least costly to do so.

However, the EU ETS is not without its own problems, such as higher uncertainty for firms' investment decisions due to volatile CO2 prices or too low prices resulting from an oversupply of (free) allowances or from a lack of demand in times of crisis. In both cases, low CO2 prices undermine the steering effect of the entire carbon pricing system. The COVID-19-related shut-down of EU economies is a case in point. Until March 2020 the spot price of an EUA hovered around (an already low level of) EUR 25, but by mid-April it had fallen sharply to less than EUR 16.

The alternative to a cap-and-trade system is an outright carbon tax set directly by policymakers. A carbon tax is less efficient from an allocative perspective, but it has its own merits, as will become clear in Section 4.[2]

The necessity of an effective carbon pricing system is – at least for the moment – undisputed in the EU, even though some Member States are more enthusiastic than others about it, given that the EU has committed to reducing greenhouse gas emissions by 40% until 2030 compared with 1990 levels under the Paris Agreement.[3] In December 2019 the incoming Commission heralded the EGD as the new growth strategy of the EU, which sets even more ambitious emission reduction goals[4] (European Commission, 2019).

Concerns about the loss of competitiveness vis-à-vis third countries also explain why highly energy-intensive industries and those that are exposed to international competition receive free allowances under the EU ETS.[5] However, in the presence of a general carbon tax, such free allowances actually constitute a de facto production subsidy (see also Mattoo et al., 2009). The ultimate objective, therefore, is to eliminate the free allowances in the EU ETS altogether. The fading-out of free allowances calls for a substitute instrument and explains the growing interest in, discussions about, and pressure for a European carbon border adjustment (CBA) mechanism.

2 For a more comprehensive comparison of the advantages and disadvantages of cap-and-trade systems, carbon taxes and direct regulation, see for example Parry and Pizer (2007) or Porrini (2019).

3 See: https://ec.europa.eu/clima/policies/international/negotiations/paris_en.

4 The EGD urges Member States to agree on a reduction of emissions of at least 50%, and ideally 55%, by 2030 (with the year 1990 as benchmark).

5 In order to limit carbon leakage, the EU assigns a higher share of the free allowances to particularly exposed industries. These are industries that suffer from an increase of (direct and indirect) production costs of 5% or more and whose trade intensity with third countries exceeds 10%. Alternatively, industries may experience an increase of production costs by at least 30% *or* a trade intensity with third countries of at least 30%. These criteria result in an extensive list of industries. See: https://ec.europa.eu/clima/policies/ets/allowances/leakage_de.

3. FIGHTING CARBON LEAKAGE: THE ECONOMIC EFFECTS OF A CARBON BORDER TAX

CO2 and other greenhouse gas emissions cause environmental damage and entail several risks for human health. These environmental and health costs, which are a direct result of production-related emissions, are not taken into account by firms in their cost calculations and hence their production decisions. For carbon-intensive products and services, such as steel production or airline services,[6] this leads to an allocative distortion. As a consequence, the market does not deliver a socially optimal outcome.

External effects result from incomplete regulation. In the context of CO2 emissions, the problem arises from an insufficiently clear definition of the property rights on the "use of air", which includes air pollution. To correct this market distortion, it is necessary to specify the condition under which firms are permitted to pollute the air. Usually this condition is the payment of a price, which can take the form of a tax or the need to obtain an emission allowance. Obviously, if the emission of CO2 is no longer cost-free and polluters have to pay for their emissions, overexploitation of the air is halted or at least reduced.[7] That is the rationale behind carbon taxes and also cap-and-trade systems, such as the EU ETS.

This section analyses in greater detail the existing distortions caused by the environmental externality in a specific energy-intensive industry, which is assumed to be an EU export industry.[8] The scenario of an export industry is chosen because it is best suited to illustrate the phenomenon of carbon leakage, one of the most sensitive issues in the context of taxing CO2 emissions. Moreover, the analysis is more complex than the situation of an import-competing industry, and it better illustrates the limits of what can be achieved with a carbon border tax.

Having identified the existing distortions in the industry, the analysis proceeds with investigating the effects of, first, an EU carbon tax that is levied on EU producers, and then the effects of a supplementary carbon border tax on imports into the EU. In both cases the partial equilibrium effects are studied with a focus on the results for the EU. For this purpose the EU is assumed to be a large open economy, i.e. an economy that is able to influence world prices and that is trading with the rest of the world, which is also a large economy. The negative external effect is assumed to be global, that is, production in the industry is causing environmental harm in the EU as well as in the rest of the world, and in both cases to the same extent. More generally, the EU and the rest of the world are "symmetric", i.e. demand conditions are identical, so that the only difference between the two economies is that the marginal costs of EU producers are lower than the corresponding costs of foreign producers (which is identical with the assumption that the industry is an export industry in an open economy setting).[9]

Even with these assumptions, the results of the combined policy measures are rarely unambiguous. The next two sections therefore focus on the "usual" outcome resulting in an EU export industry under the above symmetry assumptions. This analysis is followed by a discussion of the same policy measures in an import-competing industry and some potential outcomes that may become relevant in cases of asymmetric external effects or demand elasticities.

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6 Currently, only emissions from flights within the European Economic Area (EEA) are covered by the EU ETS, whereas connections to extra-EU destinations are not covered. See: https://ec.europa.eu/clima/policies/transport/aviation_en.

7 In a sense, a carbon pricing mechanism transforms "unpolluted air", previously a common-resource good, into a private good – at least for firms. The excludability (with regard to firms polluting the air) is established through a laborious monitoring, reporting and verification system of enterprises and their emissions.

8 An "export industry" is defined as an industry in which the domestic price under autarky is lower than the autarky price abroad.

9 In order to ensure "symmetric" demand conditions, it is useful to think of the two trading partners not only as being of equal size but also that the demand schedules feature constant elasticity.

3.1. Market distortions caused by the global environmental externality

Figure 1 illustrates the market distortions caused by a negative externality on the production side in an energy-intensive industry that is symmetric, i.e. of the same size in both economies. The figure focuses on the EU economy. The distortion becomes obvious by comparing the market outcome (panel a) with the socially optimal outcome in the industry (panel b), which by assumption is an EU export industry.

As shown in panel (a) of Figure 1, the negative external effect in production implies that the supply curve, which reflects private marginal costs ($S^{private\ MC}$)[10], is located below the social marginal cost curve ($S^{social\ MC}$), which reflects the private costs curve plus the costs associated with the negative externality. The latter is depicted in pale blue in panel (a) to indicate that it is not relevant for the resulting free-market equilibrium. The reason for this constellation of the two cost curves is that the production process imposes costs on society (i.e. the CO2 emissions) that (profit-maximising) private firms do not have to pay for.

Assuming free trade, the equilibrium production (Q_S^{market}) is found where marginal costs equal the world market price (P^W). Parts of EU production are sold to domestic consumers (up to the point Q_C^{market}), with the remaining quantity being exported. Obviously, the market equilibrium is far beyond the socially optimal output (Q_S^*) produced in the EU.

The same is true for EU consumption which also exceeds the socially optimal level (Q_C^*). As shown more explicitly in panel (b) of Figure 1, in this environment EU production exceeds the optimal level because producers base their production decision on their (private) marginal costs, ignoring the cost of the externality. Therefore, producers in the EU as well as in the rest of the world will "oversupply" the market, which will nevertheless be absorbed by consumers as the world market price under free trade (P^W) is too low in comparison with the socially optimal price (P^{W*}).

Importantly, the EU would remain in the position of an exporter in that industry, because in the social optimum producers in the EU *and* in the rest of the world would take the externality into account. The reason is that if the externality as well as demand structures are symmetric in the EU and the rest of the world, the relative marginal cost structures do not change.

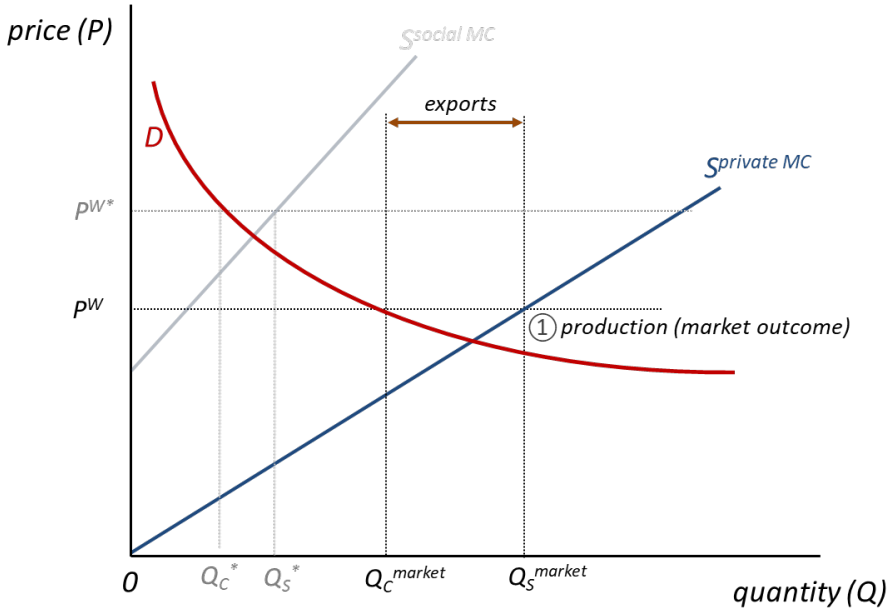
However, the amount of EU exports, as well as EU and global production, are unambiguously reduced by moving from the free trade equilibrium to the social optimum. This is noteworthy as it illustrates that the environmental objective of reducing CO2 emissions is fully in line with the economic objective of maximising welfare.

Since the environmental externality is global in scope, the first-best solution would be a uniform carbon pricing system at the global level. Given the slim chances of such a global measure (e.g. Cosbey et al., 2019), the analysis proceeds with a discussion of unilateral measures by the EU, which should be seen as part and parcel of the EGD. More precisely, two measures are considered: first, an EU-internal carbon tax, which is a tax on domestic producers, and second, a carbon border tax, which is essentially a tariff on imports. As will become clear, any such unilateral measure can only be a second-best option.

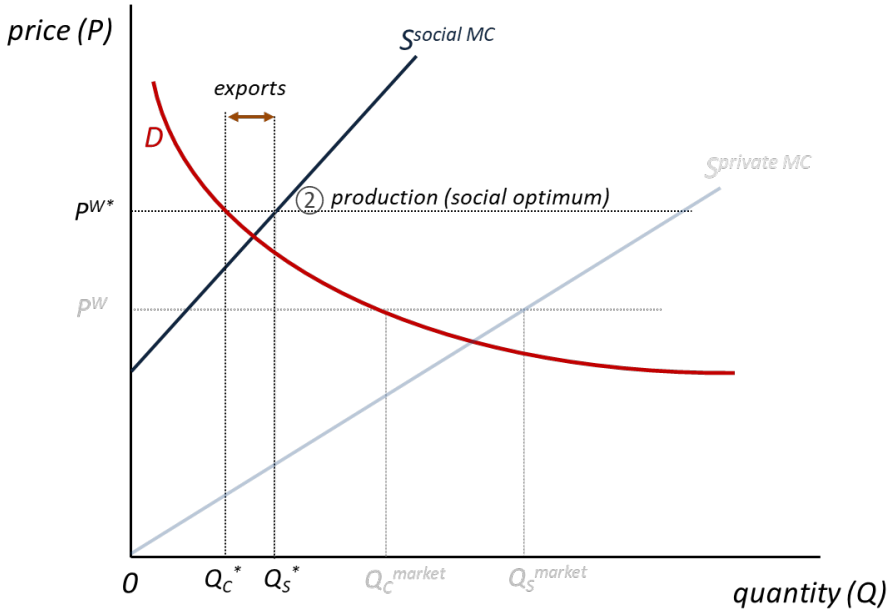
[10] Since the supply schedule reflects marginal costs of production, the supply curve is labelled $S^{private\ MC}$, *where MC stands for marginal cost.*

Figure 1 / Market equilibrium and the social optimum in the presence of a negative external effect

(a) Market equilibrium in an EU export industry with negative external effect



(b) The global social optimum in the EU economy



Note: D = demand; S = supply; C = consumption; Q = output; MC = marginal costs. P^W denotes the world market price under free trade; P^{W*}denotes the socially optimal world market price; Q_S^{market} and Q_C^{market} denote the EU supply and EU consumption under free market conditions; Q_S^* and Q_C^* denote the socially optimal EU production and consumption points taking the negative externality into account.
Source: Author's own representation.

3.2. The effects of a European carbon tax and an EU carbon border tax

In the absence of any carbon pricing at the global level, a feasible option for EU member states to make headway with their environmental objectives is the introduction of an EU-internal carbon tax (Figure 2, panel a). In this case, EU producers have to bear the cost of the tax so that their supply curve shifts up ($S^{private\ MC\ with\ EU\ carbon\ tax}$). As a consequence, domestic production drops (to the level $Q_S^{EU\text{-}CT}$). At this point the marginal cost cum carbon tax of EU producers equals the new world market price. This new price is above the world market price under free trade. If the size of the tax is set such that the EU production equals the socially optimal level, as is assumed in panel (a), the world market price with an EU carbon tax in place will remain below the socially optimal price.[11] Choosing the tax level in this way is a valid option, since the externality-induced distortion – which the measure aims to remedy – is also on the production side.

Compared with the free-trade equilibrium, the output level resulting from the introduction of the carbon tax is much lower, so that the carbon-intensive industry in the EU will contract – which is the intended effect of the carbon tax.

Another, directly related but less fortunate consequence of the carbon tax is that EU exports are lost. In the scenario depicted in panel (b) of Figure 2, the carbon tax will even erode EU producers' international cost competitiveness, defined as a situation where the autarky price[12] in the EU is higher than the autarky price in the rest of the world (where by assumption no carbon tax is introduced). In such a constellation the EU carbon tax will turn the industry into an import-competing industry.[13] This illustrates the much-debated carbon leakage effect. And indeed, carbon leakage is problematic because it results from an exacerbation of the market distortion on the production side due to the asymmetric carbon tax that is levied on EU producers only. In other words, the loss of EU competitiveness is policy-induced and does not reflect the technical productivities, resulting in even greater inefficiencies. Therefore, less productive foreign producers will expand their output,[14] while more productive EU producers will curtail their production (to Q_S^{CT}). Note that not only is foreign production too high compared with the social optimum, but it also expands beyond the level of the free-trade scenario.

A second problem, which is indirectly related to the phenomenon of carbon leakage, is that domestic consumption (Q_C^{CT}) remains too elevated. The reason for this is twofold. First of all, the world market price is too low (compared with the socially optimal price). Second, domestic and foreign consumers can buy the goods free of any carbon tax from foreign producers. This evidences that the EU carbon tax is a sub-optimal policy measure to correct a market imperfection that is global in scope. While such a tax can bring the EU production level down to the desired level, EU and foreign consumption remains too high. The main problem, therefore, is that the EU-internal carbon tax tilts the international competition in the industry in favour of less productive foreign producers.

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11 An alternative would be to set the tax such that EU consumption equals the optimal level. In this case, the resulting price would be equal to the socially optimal price but EU production would be severely curtailed.

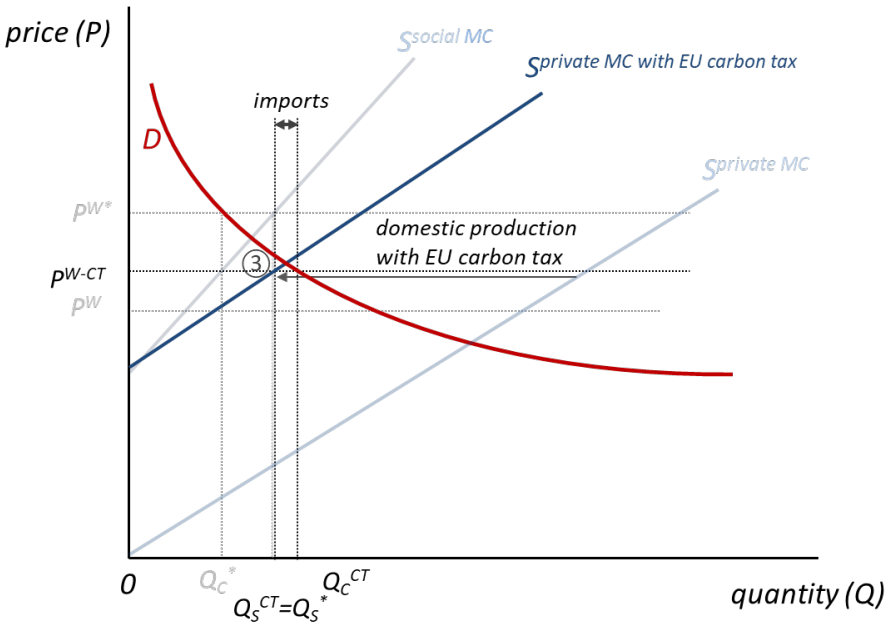
12 The new autarky price in the EU takes into account the carbon tax.

13 The industry will become an import-competing industry if the required carbon tax is relatively large and the marginal cost differential between the EU and the rest of the world is small.

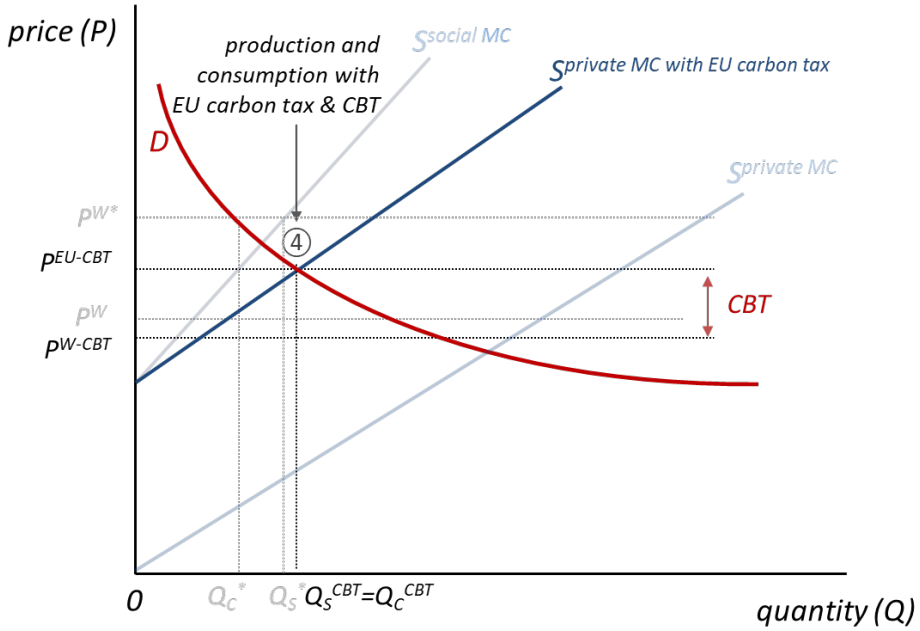
14 Foreign production will expand as long as (i) the size of the carbon tax the EU sets is not extremely high and the induced increase in the world market price is high too or (ii) the price elasticity of demand is not too high. In other words, if the contraction of the industry is sufficiently large, foreign production need not expand, or in fact, may even decline.

Figure 2 / Effects of EU carbon pricing in the presence of a negative external effect

(a) Equilibrium with EU carbon tax (loss of EU competitiveness)



(b) Equilibrium in an EU-carbon-tax-cum-CBT regime



Note: D = demand; S = supply; C = consumption; Q = output; MC = marginal costs; CT = carbon tax; CBT = carbon border tax. P^W denotes the world market price under free trade; P^{W*} denotes the socially optimal world market price; $P^{W\text{-}CT}$ denotes the world market price when the EU sets a carbon tax for EU producers; $P^{W\text{-}CBT}$ denotes the world market price when the EU levies a carbon tax on EU producers and a carbon border tax on imports into the EU; Q_S^{CT} and Q_C^{CT} denote the EU supply and EU consumption when the EU sets a carbon tax for EU producers; Q_S^{CBT} and Q_C^{CBT} denote the EU supply and EU consumption when the EU levies a carbon tax on EU producers and a carbon border tax on imports into the EU. Q_S^* and Q_C^* denote the socially optimal EU production and consumption points taking the negative externality into account.
Source: Author's own representation.

One way to restore the level playing field is the introduction of a carbon border tax (CBT). The effect of the CBT is that of an import tariff: the price in the EU economy increases by the amount of the CBT.[15] This means that the CBT drives a wedge between the resulting world market price ($P^{W\text{-}CBT}$) and the price in the EU ($P^{EU\text{-}CBT}$) (Figure 2, panel b).

The CBT reduces EU demand, thereby bringing it closer to the social optimum. It also remedies the carbon leakage effect, i.e. it is able to stop the imports in the industry. In this sense the CBT is a highly effective tool. At the same time, the potential of the CBT – which remains a second-best option – to restore the EU's international competitiveness is limited.[16] In particular, the CBT is unable to turn the industry back into an export industry without lowering the carbon tax on EU producers or the granting of a rebate of the carbon tax for exports. Such a rebate, while reviving EU exports, would undermine the environmental objective of the carbon tax – and likewise the objectives of the allowances in the context of the European ETS (see also Mehling et al., 2019). Therefore a "pure" CBT without carbon rebates for exporters appears to be the more interesting instrument. Thus, assuming that the EU carbon tax remains in place, the best the CBT can achieve is to push EU production to the level of EU demand (at the resulting world market price). This implies that the combination of the EU carbon tax with a CBT leads to a situation with no international trade.

The reason why the CBT cannot restore EU exports is that the CBT does not hit foreign sales in the rest of the world. Hence, if EU producers are unable to compete against foreign producers abroad with the EU carbon tax in place, they are also unable to do so after the introduction of the CBT. This is all the more the case as the world market price will decline due to the introduction of the CBT (i.e. $P^{W\text{-}CBT}$ is lower than $P^{W\text{-}CT}$). This is the usual effect of an import tariff in the large country case, which is explained by the fact that the import tariff curtails EU demand, thereby bringing down the world market price.

To sum up, even if supplemented with a CBT, the unilateral carbon pricing on the part of the EU remains a second-best option. Still, it remains a useful instrument to eliminate inefficient imports in carbon-intensive industries, i.e. carbon leakage, induced by the EU carbon tax.

The bottom line is that a border adjustment mechanism makes perfect sense environmentally and economically when it is limited to a CBT levied on carbon-intensive imports.

3.3. Further considerations

The previous two sub-sections analysed the case of an export industry under several assumptions. The following is a short discussion of the situation of an import-competing industry and potential differences. Moreover, selected alternative scenarios of potential interest are considered, in particular the case of asymmetric external effects and the special case of perfectly inelastic supply in the rest of the world. Both cases are relevant, especially in the context of the EU's trade relations with developing countries. Asymmetric external effects are in fact likely, as developing countries often do not have access to (or cannot afford) state-of-the art technologies, so that less efficient and more polluting production technologies are employed. With regard to perfectly inelastic foreign supply that the EU may face, this situation can arise in small, undiversified economies which are essentially specialised in one commodity and produce mainly for export. A final

[15] It should be noted that the CBT is only effective if the industry in question is turned into an import-competing industry as a result of the EU carbon tax. If the EU remains in the position of an exporter, the CBT, being essentially an import tariff, has no effect.

[16] The entire analysis assumes a unilateral carbon pricing, i.e. a constellation where the EU trades with third countries without a national carbon pricing system.

alternative scenario is one in which demand between the two countries differs greatly, so that the EU – even though it is an export industry in the market equilibrium – is not in the position of an exporter in the social optimum because of different demand elasticities.

The case of an EU import industry. Focusing on an import-competing industry, i.e. an industry in which EU autarky prices under free trade are above those in the rest of the world, most results obtained with regard to the effects of the carbon tax and the CBT, respectively, remain intact. In particular, the carbon tax (keeping the assumption of large countries) will lead to a rise in the world market price. Consequently, demand declines both in the EU and abroad, causing the global industry to decline. In view of the negative environmental externality, this decline is as beneficial – both environmentally and economically – as it was in the export industry scenario. Domestic production will unambiguously decline, while foreign production can be expected to expand.[17] Note that in this situation there is no "carbon leakage" in the strict sense, as the EU is not competitive in international markets in the first place. However, also in the case of an import-competing industry, the relative cost structures are changed to the disadvantage of the EU, resulting in a more than proportionate loss of production. An important difference in this scenario is that, if the EU sets the carbon tax and the carbon border tax such that EU production is at the socially optimal level of output, imports will prevail, so that the carbon border tax is effective and the EU generates some revenue from this measure.

Asymmetric external effects. If the negative external effects in the rest of the world (which includes many developing countries) are larger than in the EU, the carbon leakage effect and the negative consequences associated with it are aggravated. Under these circumstances the need for a carbon border tax is all the more warranted. Moreover, in this constellation even the use of rebates for EU exporters as part of a wider carbon border adjustment mechanism may make sense. In the opposite case, where the external effect is smaller in the rest of the world than in the EU – or in the extreme case non-existent – the EU may be better off by abstaining from introducing a carbon border tax. Importantly, though, as will become clear in the next section, WTO rules prevent the EU (or any other member) to apply different carbon border tax rules to different countries on the grounds that the production methods (and hence the environmental damage they cause) differ.

Perfectly inelastic foreign supply. A special case the EU may be confronted with (at least in trade with some specific countries) is perfectly inelastic foreign supply. This implies that foreign supply does not react to the changes in world market prices induced by the European carbon border tax. This scenario may put the EU in a difficult situation, as in this case even the imposition of a CBT may not avert imports (which have been induced by the EU's internal carbon tax). Given that the supply by the rest of the world is fixed, a strong contraction of the industry (induced by a strong increase in the world market price) increases the probability that EU imports will prevail. As was shown above, the effect of imposing a CBT is to reduce the world market price compared with the situation of a carbon tax only. Because of this price effect, the CBT reduces the risk of imports into the EU, but permanent EU imports nevertheless remain a likely scenario in the case of perfectly inelastic foreign supply.

Differences in demand elasticities. Since all economic and environmental effects are ultimately driven by the changes in the world market price induced by the policy measures, the price elasticity of demand plays an important role. With greatly varying price elasticities of demand in the two countries, it may be the case that the industry is an EU export industry at the world market price under free trade but an EU import-competing

[17] Mirroring the situation in an export industry, foreign production will expand as long as the carbon tax is set (i) not extremely high and the induced increase in the world market price is high too, or (ii) the price elasticity of demand is not too high.

industry at the socially optimal world price. In the presence of highly asymmetric demand elasticities, this may arise even if the relative marginal prices (both private and social) are unaltered. In particular, if EU demand hardly reacts to the higher prices prevailing in the social optimum but foreign demand is severely curtailed, foreign social marginal costs will be lower than social marginal costs in the EU at the time that domestic demand in the rest of the world is fully satisfied. This is possible because if the domestic market in the rest of the world is very small (as a result of the high demand elasticity in combination with higher prices), producers from the rest of the world are more likely to serve the international market because they are still at "the lower part of their supply curve" when the domestic market is saturated. While this is a rather unlikely scenario, it is noteworthy because it illustrates that what looks like carbon leakage, i.e. the switch from an EU export industry to an import-competing industry, may in fact be the result of different demand elasticities. This constellation is rather special as the correction of the environmental externality via a carbon tax would, as before, imply a potential loss of exports but unlike in the base scenario described in section 3.2, this loss of exports and the transformation of the EU export industry into an import-competing industry would be in line with the welfare-maximising decision of a global planner. In other words, the outcome would be socially desirable from a global welfare perspective.

4. SOME OBSERVATIONS REGARDING THE WTO COMPATIBILITY OF A CARBON BORDER TAX

Owing primarily to the carbon leakage problem, the EU seems to be strongly inclined to complement the European ETS with a CBT. According to the latest EU industrial policy strategy document (European Commission, 2020a), the Commission is expected to come up with a proposal for a CBT by 2021. Similar initiatives had been contemplated in the United States (see e.g. Hufbauer and Lu, 2017) before the current administration under President Trump took office.

The previous section showed that such a tax makes perfect sense, both economically and environmentally. However, the actual implementation of a CBT in a WTO-consistent manner could be challenging. In this context it is interesting to note that as of today no country has ever implemented a CBT (Mehling et al., 2019). Nevertheless, many observers argue that a transparent, carefully designed CBT has a good chance of being compatible with WTO members' obligations under the General Agreement on Tariffs and Trade (GATT) (e.g. Hillman, 2013; Krenek, 2020). Moreover, the WTO itself has sent positive signals. A (highly publicised) joint report with the UN Environmental Programme (UNEP) states that GATT and WTO *"rules permit, under certain conditions, the use of border tax adjustments on imported and exported products"* (WTO-UNEP, 2009, p. xix).

With respect to the legal WTO compatibility, the suggestion for the design of a European EU CBT by Krenek (2020) seems most convincing. The author suggests that the EU ETS is best transformed into a carbon tax, as this would provide a more stable benchmark for setting the level of the CBT. Such a benchmark is important to ensure that the CBT is non-discriminatory. In GATT terminology, the CBT should be designed as *"a charge equivalent to an internal tax"*[18] according to GATT Article II(2). GATT Article III(2) stipulates that such a charge must not be levied *"in excess of those applied, directly or indirectly, to like domestic products"* (see also WTO-UNEP, 2009), highlighting the need for a transparent benchmark. This also implies that the CBT must not be levied on the specific carbon content of the imported products but solely on the common (e.g. the EU-wide average) carbon content of a specific product – or in WTO jargon, on a specific "tariff line".

[18] The alternative would be to consider the CBT as a customs duty (see also Hillman, 2013).

Otherwise, if the carbon content of imports was higher than that of domestic products, the CBT would exceed the domestic carbon tax,[19] thereby becoming discriminatory.

The assessment of discriminatory measures is related to the concept of "likeness" enshrined in the GATT's famous most favoured nation (MFN) principle. The likeness of products is evaluated based on four principles, which are (i) the characteristics of the products; (ii) the end use of the products; (iii) the classification of the products in members' schedule of concessions; and (iv) consumers' tastes and habits. More important than these criteria themselves is the fact that the production method does not feature among them. Therefore it is irrelevant whether a good, for example cold rolled steel bars, is produced using a "dirty" technology that causes a lot of emissions, or whether it applies a sustainable, emission-neutral technology. Within the logic of the GATT the differently produced cold rolled steel bars would still be the same product, with the quintessential consequence that WTO members must not treat them differently. In particular, they must be subject to the same tariff or charge.

Krenek (2020) argues further that even if a European carbon tax did not pass the test of GATT Article II(2), the EU could use GATT Article XX, which opens up the possibility to deviate from the general GATT rules in order to protect human and animal health and life or the preservation of exhaustible resources. But even in this case, the measure must be implemented in a way that does not discriminate between countries.

For these reasons, a CBT designed as a compensatory charge on imports for an EU carbon tax (to be paid by EU producers) has good chances to be WTO-compatible. In contrast, the idea of expanding the existing EU ETS to third countries (as advocated, for example, in Mehling et al., 2019, on the grounds that it does not require new EU legislation), is unlikely to be in line with WTO rules because it would constitute a quantitative restriction.

Obviously, the EU carbon-tax-cum-CBT solution to the carbon leakage problem necessitates transforming the current EU ETS into an outright carbon tax. This change of the EU's carbon pricing system is proposed not for economic reasons but out of legal necessity (i.e. WTO conformity).[20] A positive side effect of the switch to a carbon tax, in combination with the WTO constraints, would be that the free emission allowances would disappear and "carbon exemptions", at least in those industries which are subject to a CBT, would be ruled out.

5. CHALLENGES FOR THE EU'S TRADE POLICY

WTO compatibility is not the only hurdle that an EU CBT has to take. There are two more practical issues that concern the EU's trade policy.

First of all, the plan to introduce a CBT is a high-risk strategy, as trading partners are likely to perceive it as a protectionist measure. This is particularly true for emerging economies (especially those which have become very vocal in the WTO), such as India, Brazil and China,[21] because they would be most strongly affected by an EU CBT. Even more opposition may be expected from the US, which seems to have adopted a

[19] Mattoo et al. (2009) also argue that a CBT ought to be based on the carbon content of domestic production and not the carbon content of imports though not on legal grounds but because of the negative trade effects for developing countries.

[20] Another way forward would be to advocate changes in the likeness criteria of the GATT. But this is even more unlikely to happen (given that it would require the consent of all WTO members) than an agreement among Member States to replace the EU ETS with a carbon tax.

[21] China would potentially not be affected by the EU CBT if it really introduces its own carbon tax, which it announced would happen by the end of 2020.

completely different stance from the EU on the issue of climate change and the necessity of abatement measures. Given the current administration's sceptical view on today's trade rules, it would presumably view the introduction of a CBT by the EU as an act of aggression. This is to be expected, especially given that the US has decided to withdraw from the Paris Agreement on Climate Change and will, in all likelihood, not introduce a federal carbon pricing system, so that it would be affected by an EU CBT. Hence, despite the fact that the US was itself considering a CBT some years ago, such a move by the EU would increase existing tensions in the international trading system further, including various retaliatory measures.

Second, the CBT will lay open the existing policy inconsistency between the EU's current bilateral free-trade policy, enshrined in the "Trade for All" strategy of 2015 (European Commission, 2015) but in its essence already laid down in the "Global Europe" strategy of 2006 (European Commission, 2006). This policy inconsistency stems from the potential conflict between the EU's endeavour to conclude deep and comprehensive free-trade agreements (FTAs) with trading partners in fast-growing regions, on the one hand, and the European Green Deal (European Commission, 2019) which was presented in December 2019 as the EU's new growth strategy, on the other hand. The latter contains a sort of "environmental proofing" clause, which stipulates that all EU policies must be aligned with the objectives of the Green Deal. In particular, the Green Deal mentions the option of carbon border taxes for trade relations with countries that do not have a domestic carbon emissions tax or an emissions trading system comparable to the EU ETS. The Trade for All strategy refers to the EU's commitment to sustainability (in all its dimensions) in its trade policies and the sustainable development goals (SDGs) under the 2030 Agenda for Sustainable Development in an attempt to step up the importance of socioeconomic and environmental aspects in FTAs. This is why the Commission carries out sustainability impact assessments containing in-depth analyses of the potential impacts, including environmental impacts, of an FTA. However, even a comprehensive impact assessment cannot solve the much deeper conflict between potential carbon border adjustment measures, especially a carbon border tax – as envisaged by the Green Deal – and the attempt to eliminate across-the-board tariffs in the context of deep and underlying FTAs. The conflict seems difficult, if not actually impossible, to solve as it results from diametrically opposed policy objectives – dealing effectively with environmental externalities on the one hand, and removing trade barriers to the extent possible on the other hand.

Assuming that the EU takes the EGD seriously, there are essentially only two possible ways to resolve this policy inconsistency. One way forward would be to make the CBT an integral element of future FTAs with partners that do not have a national carbon tax. This, however, would be in conflict with the very idea of a deep and comprehensive FTA[22] (and would also be hard to swallow for trading partners). Alternatively, the EU could adjust its trade policy and conclude FTAs only with countries that already have an appropriate carbon pricing mechanism or commit to introducing one within a clearly specified period of time. Existing FTAs should either be revised to allow for a CBT or, if that is not acceptable to the partner country concerned, suspended.

In a way, carbon border taxes can be seen as a policy instrument that seeks to embed the EU's trade agreements in a reactivated – and ideally mission-oriented – industrial policy to which the EU has committed itself (see Mazzucato, 2018; Pellegrin et al., 2019; Landesmann and Stöllinger, *forthcoming*).

All these considerations make the introduction of an EU CBT a high-risk strategy that is bound to strain the international trading system further. However, it is necessary to ensure the credibility of the EGD and the policy cohesion within the EU.

[22] Currently, the EU strives for an almost full elimination of tariffs in its negotiations on deep and comprehensive FTAs with third countries (with notable exceptions in the agricultural sector).

6. NEW FUNDS FOR THE EU BUDGET

Another advantage of the CBT (as well as the EU ETS) worth mentioning is that it generates additional (and greatly needed) revenue. The Commission's proposal for the Multiannual Financial Framework (MFF)[23] covering the period 2021-2027 (European Commission, 2018) as well as the proposal by the Council of the European Union from February this year (Council of the European Union, 2020) suggest to allocate parts of the revenue from the issuance of the emission allowances in the ETS directly to the EU budget. This revenue from the ETS would create new "true resources"[24, 25] for the European budget. Although the national contributions will remain the main source of funding for the foreseeable future, a strengthening of the EU's so-called "true" own resources is welcome. Increasing these true own resources is seen as an advantage in a situation where national contributions by member states make up 70% of the EU budget. The problem with this way of funding (which was originally not foreseen in the European treaties) is that national contributions nurture the "juste retour" logic (Richter, 2008; Haug et al. 2011), which detaches the financial funds from the EU's policy objectives (HLGOR, 2016).

While the revenue generated by the ETS is difficult to predict (given changing prices and changing schedules for free allowances), the amounts expected to flow into the EU budget vary between EUR 2.5 billion (European Commission, 2020b) and EUR 3 billion annually,[26] which is a rather modest contribution. These funds are already included in the financing plan for the Green Deal.

To strengthen the EU's true own resources further, it would be advisable to assign the entire revenue from the EU CBT directly to the EU budget. In this respect, a recent study by the French Economic Observatory (OFCE) is highly informative.[27] The study estimates that France alone could collect EUR 3 billion per year via a CBT. This number is derived by assuming a carbon emission price of EUR 25 per tonne of CO2.[28] According to the environmental accounts of the World Input-Output Database (WIOD) developed by the EU's Joint Research Centre (Corsatea et al., 2019), France's share in the EU's total EU CO2 emissions was 7.9% in 2016.[29] While EU Member States differ with regard to trade openness, trading partners and import structures, a rough estimate of the CBT revenue for the EU as a whole – based on the French estimates – would be about EUR 38 billion annually. This amount is equal to 23% of the 2019 budget. Hence, a full assignment of the revenue from the CBT to the EU budget would result in a substantial strengthening of the EU's true own resources and represent a considerable increase in the overall EU budget. These funds should be used predominantly for two purposes: to finance projects in support of the ecological transformation of the EU and its neighbourhood, and to compensate developing countries for any potential negative trade effects resulting from the CBT, with these compensation payments to be used to finance investments in non-carbon industries.

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23 The MFF is the EU's seven-year-budget plan.

24 The EU budget is funded from three sources, which are known as own resources. These own resources are customs duties and sugar levies (from the Common Agricultural Policy), also termed "traditional" own resources; the value-added tax (VAT)-based own resource; and "national contributions", which are calculated on the basis of Member States' gross national income.

25 Another new own-resource suggested is a levy on plastic packaging waste that is not recycled. See: https://www.consilium.europa.eu/en/policies/eu-budgetary-system/eu-revenue-own-resources/2021-2027/.

26 See: https://www.consilium.europa.eu/en/policies/eu-budgetary-system/eu-revenue-own-resources/2021-2027/.

27 See: https://www.euractiv.com/section/energy-environment/news/eu-carbon-border-tax-cheaper-and-fairer-than-french-energy-levy-says-report/

28 See: https://www.euractiv.com/section/energy-environment/news/eu-carbon-border-tax-cheaper-and-fairer-than-french-energy-levy-says-report/.

29 Author's own calculations. Results are available on request.

7. CONCLUSIONS

This policy paper illustrates that carbon pricing is a complex issue. This is all the more true when it comes to the design of a carbon border tax (CBT), which the EU is considering as part of its new (green) growth strategy, the European Green Deal (EGD). The implementation of a CBT will not be easy, inter alia because of the legal issues involved, but it is nevertheless feasible. An appropriately designed CBT would offer the triple advantage of *(i)* supporting the EU's ecological transformation; *(ii)* mitigating carbon leakage, and *(iii)* providing sizeable new funds for the EU budget that are independent of Member States' direct contributions. For these reasons the EU should proceed with the introduction of a carbon border tax as quickly as possible to ensure the credibility of the Green Deal, even though this constitutes a challenging endeavour. This conclusion should be seen in combination with the following considerations:

› A CBT is a necessary supplement to the EU's internal carbon pricing mechanism in order to avoid inefficient and economically harmful EU imports in energy-intensive industries, i.e carbon leakage. Still, it remains a "second-best solution" to remedy a global market failure.

› A CBT levied on imports is an effective tool to support the environmental objectives laid down in the EGD and to fight carbon leakage. In contrast, the idea of rebates for the carbon-related costs of EU exporters should be dropped as it runs counter to the necessary shakeout of emission-intensive industries.

› A *domestic carbon pricing cum CBT system* could be part of a broader green industrial policy mission. The prime objective of such a "green mission" (see also Mazzucato, 2018) should be to make the EU carbon-independent, defined as zero imports of petroleum, natural gas and coal (Stöllinger and Landesmann, 2020).

› A European CBT must be carefully designed in order to ensure WTO compatibility. This could be achieved by designing the EU CBT as a charge equivalent to an internal tax (Krenek, 2020). Such a charge should be permissible under WTO rules, provided it does not exceed the domestic tax so as not to discriminate against imports. Moreover, a transparent, WTO-consistent CBT requires a stable benchmark in order to evaluate the non-discriminatory nature of the CBT, which in turn calls for turning the current EU ETS, which is a cap-and-trade system, into a carbon tax.

› WTO compatibility notwithstanding, the introduction of a CBT by the EU is bound to lead to further tensions in the global trading system and potentially retaliatory measures, as major trading partners without a national carbon tax will perceive the EU CBT as a protectionist measure.

› The CBT also lays open the policy inconsistency between the objectives of the EGD and the EU's (bilateral) trade policy, which is aimed at concluding deep and comprehensive free-trade agreements (FTAs) with fast-growing economies. To resolve this inconsistency, the EU should refrain from concluding FTAs with countries that do not have a domestic carbon pricing system and revise (or suspend) existing FTAs.

› The CBT would be a lucrative new source of funds for the EU budget, which could initially be in the order of magnitude of 20% of the current EU budget. Therefore the CBT would strengthen the EU's true own resources substantially, which would make the bloc less dependent on national contributions from the Member States.

› The additional funds for the EU budget from the CBT should be used to finance the ecological transformation in the Member States and their neighbours that the EGD aims to achieve.

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