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Trade and Climate: Towards Reconciliation

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To limit greenhouse-gas emissions, is it necessary to restrict international trade, as advocated for by promoters of "short circuits"? By buying locally, we would save on transport costs and CO2 emissions, whilst encouraging local jobs and improving the quality of products. These arguments are central: by dissociating where products are produced from where they are consumed, international trade contributes significantly to greenhouse-gas (GHG) emissions worldwide, especially when goods are transported. It also displaces the location of emissions: the consumption-induced carbon footprint of OECD countries is higher than their level of emissions. Large emerging countries find themselves in the opposite case.

However, halting international trade would be particularly ineffective to reduce GHG emissions. According to the simulations presented in this Note, raising average customs duties to 17% (as opposed to current 5%, except for agricultural products) and accepting a fall in aggregate production of 1.8% would only lead to 3.5% GHG emission reduction by 2030.

How then reconcile international trade with the fight against global warming? Economists would suggest using first-best instruments making polluters pay for the social cost of their emissions, using an appropriate and widely-applied pricing scheme that covers international transport. However, such a policy is difficult to implement, as has been shown by the experience of air transport in Europe: in order not to distort competition, pricing must be applied to all operating businesses, regardless of their nationality. However, this leads to effective international retaliation threats. In order to make progress in that area, the authors recommend, at least on a temporary basis, to redistribute the income levied on environmental taxes to the polluters themselves, in a way that does not annihilate the incentive effects of the tax (for example, based on their traffic).

To fight against the outsourcing of polluting activities outside the borders of Europe, some propositions have been made to levy a carbon "content" based tax on imports. Though such a principle makes sense, the technicality of such a border taxation mechanism would be too complex, and too risky in terms of trade retaliation. Instead, this *Note* recommends considering a uniform tax set at a low level. It would be applied by a "club" of countries adopting ambitious and binding policies to fight climate change, against all imports from countries outside of the club. The tax would therefore act as an incentive to join the club, so as not to be subject to its payment. Simulations presented by the Note show that such policy would be effective at shielding ambitious and binding climate policies against competition from less committed countries, thus consolidating the efforts against global warming.

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Introduction

At times where global trade is slowing down,[1] the temptation of protectionism is resurgent in advanced countries, driven by two distinct forces: jobs and the environmental issue.

The impact of international trade on the job market has been proven. The comparative advantage of advanced countries has shifted towards the service industry, specialisation is strengthening deindustrialisation and thus destroying industrial jobs (whilst creating jobs in other sectors). However, trade is far from being the sole accountable for the decline in industrial jobs.[2] Inequalities increase in all sectors, including the service sector, affecting employees who carry out repetitive and codifiable tasks.[3]

For its part, the environmental issue, supposedly justifying a certain level of protectionism, calls forth the idea of short circuits, or "buy local":[4] why bring from faraway lands what can be produced at home, thus saving on transport costs and the associated CO_2 emissions, additionally encouraging local jobs as well as the quality of products, and eliminating several redundant intermediaries? These arguments often applied to agri-food products are not without foundation. Agricultural specialisation leads to increased use of phytosanitary products that damage the environment, whereas geographical distance and the increase in intermediaries weaken the information availability relating to products.[5] However, the distance between production and consumption sites is not an accurate measure of CO_2 emissions associated with the consumed goods. The mode of production often prevails over transport in terms of emissions: even more crucially than the mode of transport and the mileage covered, the environmental impact of goods transport depends to a large extent on the performance of the logistics system.[6] In particular, the environmental performance of the last few miles before reaching consumers is heavily mediocre, regardless of where the goods are produced. Thus, concentrating production in the most efficient locations can also be a source of environmental efficiency.

This *Note* re-examines the environmental argument in the current context, combining the challenge of free trade and the need of reducing global greenhouse-gas emissions. Several questions are examined: how does trade affect climate? Should international trade be restricted to meet the commitments taken in the Paris Agreement? Is it desirable to have a border tax on carbon?[7] And, finally, how can we reconcile trade and climate?[8]

We conclude that it is not free trade that destroys the climate, but the fact that free trade is developing in the absence of generally-applicable carbon pricing of an appropriate level. The fundamental issue is not so much the commitments taken at the WTO as the global lack of environmental policies. In this regard, regulating emissions should give preference to first-best instruments, i.e. effective environmental policies on carbon pricing.

Restricting international trade to reduce emissions would be an excessively costly solution in terms of economic activity and jobs. A more promising approach would be to rely on trade policy to draw large greenhouse-gas emitting countries into a front-line co-operative solution that consists of letting international trade unfold given that it is subject to an adequate carbon pricing. To support the implementation of co-operative policies, environmental protectionism could be envisaged as a temporary measure taken against countries that are inclined to free-ride, in order to encourage them to join climate agreements designed to make a maximum number of countries agree to binding objectives.

Does trade destroy the climate?

What is the impact of trade on CO_2 emissions?

International trade enables production sites to be dissociated from consumption sites through the shipping of goods; thus, it contributes to greenhouse gas (GHG) emissions. This effect can be measured by the gap between emissions from the production of goods and services on the territory (the

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[1] See, for example, International Monetary Fund (2016): "Global Trade: What's Behind the Slowdown?", Chapter 2 in *World Economic Outlook*, IMF, October and Jean S. (2015): "Le ralentissement du commerce mondial annonce un changement de tendance", *La Lettre du CEPII*, no 356.

[2] About 13% of the fall in industrial employment in France between 2001 and 2007, according to Malgouyres C. (2016): "The Impact of Chinese Import Competition on the Local Structure of Employment and Wages: Evidence from France", *Banque de France Working Paper*, no 603. The figure is higher for the USA, according to Autor D.H., D. Dorn and G.H. Hanson (2013): "The China Syndrome: Local Labor Market Effects of Import Competition in the United States" *American Economic Review*, vol. 103, no 6, pp. 2121-2168.

[3] Ebenstein A., A. Harrison, M. McMillan and S. Phillips (2014): "Estimating the Impact of Trade and offshoring on American Workers Using the Current Population Surveys", *Review of Economics and Statistics*, vol. 96, no 4, pp. 581-595.

[4] See, for example, in the USA: Why Buying Green Means Buying Local http://www.amiba.net/resources/local-business-environment/

[5] An example of the lack of information: does your sandwich loaf contain palm oil from deforestation?

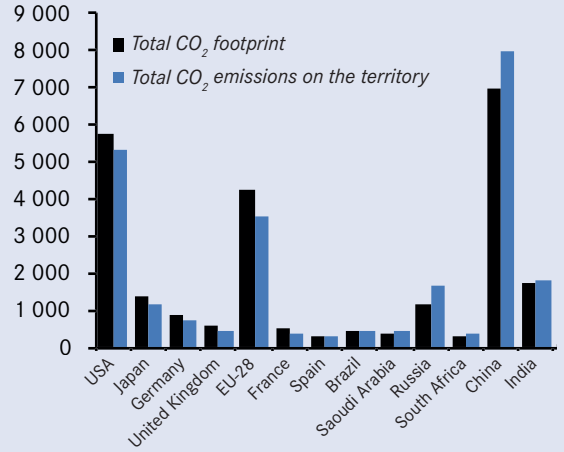
[6] Commissariat général au développement durable (CGDD) (2013): "Consommer local, les avantages ne sont pas toujours ce que l'on croit", *Économie et Évaluation*, no 158, March.

[7] In December 2016, the European Parliament passed a draft directive providing for the need for a "WTO-rule-compliant" carbon inclusion mechanism at the borders of Europe for the cement and clinker sectors (clinker is a component of cement).

[8] The title of this Note echoes the report of the working group of the Global Economic Governance Initiative of Boston University, Gallagher K.P. and M. Porterfield (co-psdt) (2016): *Trade in the Balance: Reconciling Trade and Climate Policy, Report of the Working Group on Trade, Investment, and Climate Policy*, November, available on https://www.bu.edu/pardeeschool/files/2016/11/Pardee_TradeClimate_110316final.pdf. Unlike that report, which focuses largely on regional agreements and on the draft Transatlantic Treaty, we take a wider point of view that is not limited to the impact of trade on pollutant emissions, but which examines how trade rules can impede- or contribute to- compliance with worldwide objectives on emissions reduction, whether or not related to international trade.

"national inventory") and emissions from the consumption of goods and services, including when the latter have been produced outside national territory (the consumption "carbon footprint").

1. International comparison of the CO_2 footprint of final internal demand and of CO2 emitted on the territory, 2011, in millions of tonnes



Lecture: *Reading:* At the global level, total emissions are equal to the footprint. OECD data cover CO_2 from the combustion of fossil fuels (except CO_2 from the decarbonisation of limestone in manufacturing products like cement and glass).

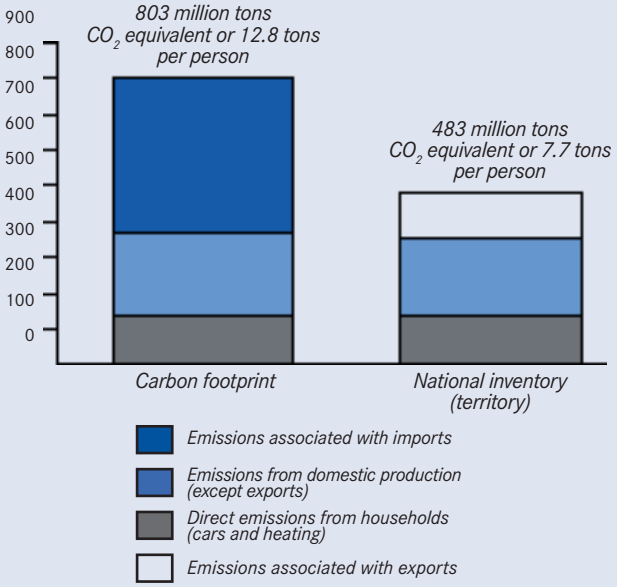
Source: OECD, 2015.

As shown by graph 1, OECD countries have a carbon footprint exceeding the level of emissions released on their territory, whereas large emerging countries are in the opposite situation: they produce emission-intensive goods that are then transported to and consumed in advanced economies.

In the case of France, the carbon footprint of consumption exceeds by 50% emissions released on the national territory (graph 2): 12.8 tonnes of CO_2 per inhabitant, as against 7.7 tonnes in 2010 (the reference year for that type of assessment). Emissions associated with imports have risen by about 60% since 1990, which has offset to a large extent the emission reduction recorded in national inventories. However, the change since 2010 is more favourable: the carbon footprint has been reduced to 11.9 tonnes per inhabitant, of which 6.8 tonnes are linked to production on national territory.

Observation 1. The carbon footprint of OECD countries is higher than the level of emissions released on their territories, whereas large emerging countries are in the opposite situation. Accounting for international trade reduces the performance of advanced countries in terms of emissions reduction.

2. Emissions associated with international trade in France



Source: SOeS, MEEM (2016).

The direct impact of trade on climate comes from goods being transported internationally, and it is clearly positive: more trade leads to more CO_2 emissions. However, the indirect impact is ambiguous. It depends on the combination of a scale, a composition, and a technical effect. The theoretical mechanisms are well documented,[9] although empirical evidence is still only partial.[10]

The *scale effect* is due to the fact that trade leads to an overall increase in economic activity, thus leading to an increase in the worldwide volume of GHG emissions. The *composition effect* is the result, for each country, of specialisation based on its comparative advantages. Finally, the *technical effect* comes from easier access to "cleaner" goods and technologies through trade openness.

The rise in the standard of living resulting from economic growth leads to increase the awareness of environmental issues and to an endogenous intensification of environmental policies, which contribute to reduce emissions per inhabitant. Depending on the country and production sector, emissions can finally rise or fall. The shift to the service sector in advanced economies leads to a mechanical reduction in their emissions, whereas the composition effect goes the other way for emerging and less advanced countries.

Thus, trade affects the spread of emissions around the world by modifying production sites and technologies. It increases total emissions if the scale effect prevails, i.e. if trade

[9] Grossman G.M. and A.B. Krueger (1993): "Environmental Impacts of a North American Free Trade Agreement" in *The US-Mexico Free Trade Agreement*, Garber (ed.), MIT Press, Cambridge MA.

[10] Antweiler W., B. Copeland and S. Taylor (2001): "Is Free Trade Good for the Environment?", *American Economic Review*, vol. 91, no 4, pp. 877-908. Frankel J.A. and A.K. Rose (2005): "Is Trade Good or Bad for the Environment? Sorting out the Causality", *Review of Economics and Statistics*, vol. 87, no 1, pp. 85-91.

openness has a strong positive impact on growth, and if international transport brought about by commercial openness is a large source of emissions.

Shapiro (2016) considers that opening up borders causes a rise of about 5% in world CO_2 emissions relative to an autarkic situation with no international trade.[11] That figure is not negligible (it is scarcely less than annual emissions from India, and comparable with those of Russia), yet it is small in relation to the commitments made by advanced countries with regard to reducing emissions.[12] For their part, Cristea *et al.* (2013) estimate at 33% the share of emissions from international trade and transport.[13] That proportion is much higher for manufacturing sectors than for other sectors, and the gaps between countries are more significant: 14% of trade-related emissions from India and China come from the international shipping of goods, whereas that proportion rises to 66% for the USA because of that country's massive use of air transport.

Emissions directly linked to international transport are growing rapidly: + 75% in 2013 with respect to their 1990 level. According to the OECD, emissions linked to the international transport of goods may increase by 290% by 2050, with air and sea transport accounting for over 40% of that increase.[14] The OECD considers that emissions linked to international transport form the main environmental problem caused by international trade. However, the fuel used is not taken into account in countries' climate policies, and approval for international emission-reduction measures takes a lot of time, which undermines confidence in the benefits of trade liberalisation.

> **Observation 2.** International trade contributes significantly to greenhouse-gas emissions worldwide, especially for goods transportation.

To obtain the expected benefits from trade liberalisation without damaging the environment, carbon pricing is needed. It is important that economic actors bear the social costs of their choices, in this case through their GHG emissions. Examining the case of international transport is useful in that regard, especially to identify the constraints encountered in drawing up climate policies when the latter interact strongly with trade.

How to regulate international transport induced GHG emissions ?

The diagnosis of emissions relating to international sea and air transport is not unambiguous. When related to the amount transported and the distances covered, the 'carbon efficiency' of international transport is substantial, due to large volumes and high filling rates. International sea and air cargo holds are excluded from national totals and, thus, from countries' commitments to reduce emissions. However, they significantly contribute to emissions, even if to a lower rate compared to emissions from road transport:[15] each year, sea and air cargo account for at least 1.17 Gt of CO_2, i.e. 3.1% of emissions due to energy combustion around the world. That level is comparable to emissions from countries like Japan or of all Latin American countries. Sea and air transport account for comparable proportions. The share of fossil fuels in the costs of that transport amounting to, respectively, one half and one third, which makes that transport highly carbon-intensive.

Thus, regulating the CO_2 emissions of international transport (goods and passengers) is an essential challenge, but it has proven conflictive. International transport plays a major role in trade globalisation, and finds itself at the core of controversies between anti-globalisation groups and free-trade advocates. For the former, emissions from international transport are the manifestation of waste caused by opening up trade. For the latter, the fall in transport costs is seen as a condition of developing competition for the benefit of consumers. Naturally, export-business lobbies are also opposed to green organisations on that topic.

Beyond these fundamentally divergent positions within countries, interests differ between emerging and advanced countries countries. The former fear an increase in the cost of international transport that may impede their development as they tend to export goods with a high weight-to-value ratio, thus goods requiring a lot of energy to be transported to consumption sites; the latter do not want to make progress alone in the fight against global warming.

In this context, incorporating climate challenges into the regulation of international transport is proving difficult. It is significant that all mention of that sector disappeared from the 2016 Paris Agreement.

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[11] Shapiro J.S. (2016): "Trade Costs, CO2 and the Environment", *American Economic Journal: Economic Policy*, vol. 8, no 4, pp. 220-254.

[12] As part of the COP21, the European Union committed itself to reducing its emissions by 40% by 2030 with respect to the 1990 baseline; the USA committed itself to a reduction of between 26% and 28% by 2025 with respect to the 2005 baseline.

[13] Estimates of the emissions associated with international goods transport arebased on detailed data of the value and volume of bilateral trade and the associated modes of transport, combined to data on greenhouse-gas emissions produced per kg-km by each mode of transport. See Cristea A., D. Hummels, L. Puzzelo and M. Avetisyan (2013): "Trade and the Greenhouse Gas Emissions from International Freight Transport", *Journal of Environmental Economics and Management*, no 65, pp. 153-173.

[14] See OECD/IEA/NEA/ITF (2015): *Aligning Policies for a Low-Carbon Economy*, OECD Publishing, Paris. Available on http://dx.doi.org/10.1787/9789264233294-en

[15] International cargo transport accounts for 13% of total emissions from the transport sector worldwide, *cf.* Commissariat Général au Développement Durable (SOeS, Service de l'observation et des statistiques), Direction générale de l'énergie et du climat (SCEE) and Institute for Climate Economics (I4CE) (2017): *Chiffres clés du climat: France et monde*, available on www.statistiques.developpement-durable.gouv.fr

However, room for manœuvre exists at both technical and operational levels. In the air sector, it is possible to reduce emissions at their source by working on engines, lightening aircraft, developing biofuels, and developing new engines, or by re-optimising the various phases of each flight, including ground phases. In the maritime sector, improving propulsion systems and boilers, reducing excess consumption related to water friction, lowering and optimising sailing speeds, reducing port congestion, increasing the size of vessels, and new fuels (especially liquefied natural gas) offer very substantial routes to improvement. Traditionally, the preferred route to bring about emission reductions has been based on the definition of new technical standards, within the framework defined by the international bodies concerned, the International Maritime Organisation (IMO) and the International Civil Aviation Organisation (ICAO), which ensure the non-discriminatory nature of the standards and the conditions under which they are applied.

On the other hand, attempts to set up more general mechanisms for internalising carbon costs have failed. The most striking case is the non-incorporation of the international air sector in the European Emissions Trading System for CO_2. From 2005 onwards, given the size of those emissions, the European Union had envisaged including aviation through an arrangement aimed at all European companies and all foreign companies operating in Europe, for their flights departing from or arriving in European territory. This led to the November 2008 directive (2008/87/EC) requiring incorporation to be completed by 2012. However, applying the directive to intercontinental flights was suspended from the end of 2012 on, due to opposition from the USA, China, India, and Russia, which threatened Europe with commercial litigation and with retaliation, most prominently threatening to drop orders for aircraft. The suspension of the directive illustrates the difficulties involved in taking early action on a unilateral basis when significant commercial effects are at stake. Either the arrangement is rejected because it would affect the competitiveness of national operators, or it preserves that competitiveness but is challenged for setting up barriers to trade, with credible threats of retaliation if it is applied.

In the case of aviation, suspending European regulations was linked to the prospect of a wider agreement within the ICAO. In September 2013, the organisation's Assembly adopted a work programme that set neutral carbon growth in the sector from 2020 onwards as its main objective. The negotiation process resulted in a planned global CO_2 emissions offsetting mechanism for international aviation (the "Global Market-Based Measure"), presented in October 2016. The mechanism requires businesses in the aviation sector to compensate for their excess emissions by buying offsetting units in a market fed by activity sectors that are reducing their emissions (like offsetting mechanisms that were developed on a voluntary basis). In that context, carbon offsetting consists of repairing the damage caused to the planet by purchasing (from NGOs or from specialised agencies) carbon credits that finance projects that enable CO_2 savings to be made, e.g. planting trees. That plan was strongly supported by airlines, which highlighted its incentivising nature and which showcased its effectiveness relative to the alternative, which consisted of subjecting the sector to taxes aimed rather at raising funds than at reducing CO_2 emissions. However, China, India, and Russia still feared that the arrangement envisaged would be an excessive burden for developing countries with aviation markets that have not yet reached maturity.

The CORSIA agreement was finally adopted in 2016 by the 191 members of the ICAO, and plans a first stage over the 2021-2026 period based on voluntary compliance. The compulsory regime will be set up for the 2027-2035 phase (except for less developed countries, small island states, and developing countries with no coastline). Over 65 countries, accounting for most of the international aviation activity volunteered for the first phase, including China, which previously held back.

One may suspect that implementing a voluntary agreement process would in practice serve only to escape the threat of binding regulation, resulting in a final arrangement lacking ambition and reach. Indeed, the implicit price of carbon underlying that type of offsetting-credit mechanism is generally low (less than 10 euros/tCO_2), which limits the desired incentivising impact.

The example shows that a front-line solution requiring all sectors to pay the same price for GHG emissions is only acceptable if three minimum conditions are met:

- Transparency regarding impacts, to remove all suspicion over the purpose of the measure, and to identify possible support measures to be put in place to rule out the objection of an impediment against economic development. Specifically, it suggests carrying out "commercial assessments" of the measures that are envisaged, the equivalent of the environmental assessments carried out as part of trade agreements;
- A pricing that is strictly linked to reference prices for carbon, the only possible balance between concerns over the commercial manipulation of environmental policies and concerns over "greenwashing";
- Using receipts to ensure the acceptability of the measure, which excludes any sector-based yield taxation. The starting point, which is certainly imperfect but the simplest to counter the objections of airlines and emerging countries, could be a redistribution of taxation income at the *prorata* of the traffic generated. This measure for instance was adopted by Sweden when putting in place a tax on nitrogen oxides at an incentivising economic level that did not harm the competitiveness of the industries concerned.[16]

These three conditions apply to sea and air transport alike.

[16] During phase III of the European market on EU-ETS allowances, the allocation of free allowances based on activity to installations exposed to a significant risk of carbon leakage followed the same approach.

Recommendation 1. Promote a genuine carbon pricing scheme for the international transport sector, accompanied by a transparent economic impact assessment. At least in the first instance, plan for a redistribution of receipts to secure the acceptance of the scheme by the concerned sectors and exporting countries.

How to articulate climate and free-trade policies?

How can an ambitious GHG emissions reduction policy be implemented in an international context characterised by the free-riding issue? It is not free trade *per se* that destroys the climate, but the fact that the latter is developing in the absence of a carbon price set at an appropriate level and with a sufficiently wide field of application. However, setting up such a climate policy comes up against national imperatives of competitiveness and development. In this context, the priority for climate policies is to build effective co-operation, especially in matters of carbon pricing, with the necessary transfers to ensure its acceptability for developing countries. Trade policy could then be envisaged as a means of building that co-operation. However, there is no consensus on such vision.

"Environmentalists" highlight the difficulties that they encounter to ensure that ambitious policies for fighting climate change flourish. Compliance with the rules of trade and the constraints on its liberalisation are amongst the most frequent complaints received. In its most categoric version, the debate is part of a general controversy that opposes trade and the environment in a radical fashion. For example, emerging countries mount a fundamental defence of the "development first" principle, while on the side of the most "anti-globalisation" wing, putting in place a world carbon price would not be enough, since international trade is intrinsically a problem.

Curbing trade to reduce emissions is excessively costly

Can the world do without international trade? Let us take the example of agriculture. OECD projections suggest that by 2025, the five leading exporters of agricultural goods will represent at least 70% of total exports. For some goods, just two or three countries will play a leading role. On the contrary, regions which are poor in resources, especially North Africa and the Middle East, will be increasingly relying on food imports, such situation being worsened by climate change. Strictly looking at food safety, and even if local productions must be encouraged, it is not possible to seriously consider a cessation of international trade.

More generally, considering that international trade should be limited in order to reduce emissions goes against the economic principle that the most direct tools are to be used to reach established goals. A first-best instrument (a climate policy based on the carbon price) is always preferable, because it enhances the search for all substitution options to go for less polluting products or factors and favour the most efficient ones.[17] To have orders of magnitude, Fontagné and Fouré (2017)[18] used the calculable general-equilibrium model of the CEPII (*Centre d'études prospectives et informations internationales,* Centre for Prospective Studies and International Information, France) to assess the effects of a second-best policy (a custom duty) aiming at reaching a reduction of carbon emissions.

The policy depicted here is not extreme: it is a matter of ensuring that international trade is stabilised at its current level. A calculation to establish which uniform customs duty on goods exchanged worldwide would enable international trade to remain at its current level until 2030.[19] The customs duty required to stop the growth of international trade reaches 17% in 2030. It rises over time to counter the pull effects of world growth on trade: 5% in 2020, 11% in 2025, etc. The number of 17% may seem modest, but it is very high in reality. The average world duty on non-agricultural goods is currently at about 5%. The 17% customs duty would only reduce global CO_2 emissions by 3.5% by 2030 (table 1), which is 7 times less than the reduction of emissions coming out of the full implementation of the Paris Agreement based on the same model.

Around the world, the most affected sectors would be industrial, with the highest volume of trade (vehicles, electronics, machinery and equipment, and the chemical industry) and a fall in value added that could reach 6.6% in 2030 for the most exposed amongst them (electronics). All of those sectors are not sources of particularly high emissions. The GDP cost would be considerable, with a world loss of 2,300 billion dollars (at 2011 constant prices) by 2030, which is equivalent to the current GDP of Brazil or 1.8% of world GDP by that date (table 1). Naturally, that high cost must be considered under the light of a fall in emissions, which are not accounted for

[17] This approach is essential as the cost of climate policies is extremely variable, depending on the means used. In an extreme case, by acting only on growth (and not on the structure of the latter), the costs to be borne seem prohibitive, since they may reach $ 3,000/t CO2 avoided, the average GDP carbon content being 344 t CO2/$million. On the other hand, if an attempt is made to modify the composition of factors of production and structures of consumption to decarbonise the economy efficiently, the costs to be considered are, happily, more modest: the price levels needed to reduce our emissions by three-quarters were estimated to be in the magnitude of 100 euros/t CO2 by the "Quinet Report", cf. Quinet A. (2009): "La valeur tutélaire du carbone", Centre d'analyse stratégique, Coll. 'Rapports et documents', no 16, La Documentation française, Paris.

[18] Fontagné L. and J. Fouré (2017): "Changement climatique et commerce: quelques simulations de politique économique", Focus du CAE, no 15, January.

[19] To simplify, exchanges of services are deemed not to emit GHGs. A uniform customs duty enables price distortions –and, thus, the economic cost of the measure– to be minimised.

1. Reducing emissions by stopping trade growth using a uniform customs duty: effects by 2030 as a deviation relative to a scenario with no additional customs duty

	Effect on CO_2 emissions, in %	Effect on GDP in constant dollars, in %
European Union	– 7.9	– 0.8
USA	– 3.0	– 0.6
China	– 2.6	– 2.9
Rest of the world	– 3.5	– 2.3
World	– 3.5	– 1.8

Source: Fontagné L. and J. Fouré J. (2017): "Changement climatique et commerce : quelques simulations de politique économique", *Focus du CAE*, no 15, January.

(as a negative value) in GDP. The positive consequences of slowing down global warming are also not assessed here. However, in what follows, we show that a much more significant reduction in emissions can be obtained with a first-best policy (a climate policy rather than a trade one) at a lesser cost.

Observation 3. An increase in customs tariffs stabilising international trade at its current level would not be effective in terms of emissions (a fall of 3.5% by 2030), but would be extremely costly in terms of global output (–1.8% of GDP).

Which protectionist measures can be justified by climate policies?

Althrough curbing international trade in order to reduce emissions is ineffective, it is important that international trade develops acknowledging climate challenge. In that regard, the question of carbon leakage (*cf.* box 1) remains when a subset of countries intends to reduce its emissions. By implementing carbon taxation, those countries would lose competitiveness, whereas the displacement of production to locations that have not adopted those policies would lead to a straightforward substitution of emission sites, wiping out the expected benefit of their efforts. Moreover, the fall in carbon-energy prices would benefit countries that are not involved in that emission-reduction policy. For them, it would be a disincentive to emission reduction. Consequently, it is valid to question the use of trade-policy instruments to reduce those effects.

Two solutions can be considered: either a compensation at borders –sometimes called a Border Adjustment Tax (or Carbon-Inclusion Mechanism)–, or a uniform customs duty against countries that do not share ambitious emission-reduction objectives adopted by a group of countries. The first method aims at correcting distortions of competitiveness between countries that apply climate policies that are unequal in what they demand. The second tries to promote the emergence of climate clubs of countries that are capable of much efforts and a high level of participation.

1. Carbon leakage

The term "carbon leakage" designates the rise of emissions in countries that have no climate policy, following the setting up of a unilateral climate policy by a country or a group of countries. Two forms exist: first, the rise in emissions may be due to the relocation of high-emission industries from regulated countries to unregulated ones, a phenomenon called "pollution haven"; second, the rise in emissions may be due to the fall in energy prices on world markets following the fall in demand in regulated countries. One can speak of direct and indirect leaks, respectively, or, more accurately, of the competitiveness effect and the transition effect through the energy market.

The economic literature shows that indirect leakage is the most significant, accounting for between one half and two thirds of total effects.[a] Indirect leakage is also a phenomenon that can hardly be fought against, since the world energy market is concerned.

However, low carbon emission technologies developed in the regulated area can be transferred to unregulated countries, where they allow reducing emissions (also, the fall in their costs can make them attractive to unregulated countries).[b]

With regard to the loss of competitiveness due to increased production costs for businesses in regulated countries (because of polluting emissions being taxed), initial research suggested that the loss was low,[c] especially because of the so-called "Porter" effect, linked to the innovation effort made by companies dealing with the taxation of their emissions. More recent research based on more accurate data however is less optimistic, and highlights the reality of pollution havens.[d]

[a] Burniaux J-M. and J. Oliveira Martins (2000): "Carbon Emission Leakages: A General Equilibrium View", *OECD Economics Department Working Papers*, no 242. Also see the work of Böhringer C., E.J. Balistreri and T.F. Rutherford (2012) : "The Role of Border Carbon Adjustment in Unilateral Climate Policy: Overview of an Energy Modeling Forum Study (EMF 29)", *Energy Economics*, vol. 34, supplément 2, December.

[b] Gerlagh R. and O. Kuik (2014): "Spill or Leak? Carbon Leakage with International Technology Spillovers: A CGE Analysis", *Energy Economics*, vol. 45, pp. 381-388.

[c] *Cf.* Erdogan A.M. (2014): "Foreign Direct Investment and Environmental Regulations: A Survey", *Journal of Economic Surveys*, no 28, pp. 943-955.

[d] Levinson A. and M.S. Taylor (2008): "Unmasking the Pollution Haven Effect", *International Economic Review*, no 49, pp. 223-254.

Border adjustment

The first method, which can be defended at the WTO and which presents some economic rationality, is implementing compensations at borders. Its aim is to deal with carbon leakage and loss of competitiveness in countries or groups of countries when developing a unilateral climate policy. Taxing imports and subsidising domestic exports based on the emitted carbon during the production of goods (their carbon "content") allows their prices to be adjusted to incorporate the same carbon cost as the one inside the regulated area. The tax paid by importers then equals the domestic carbon-tax rate multiplied by the content of the goods imported. Alternatively, if the system of regulation is a tradeable emission permits scheme, importers must purchase the related permit amount.

This approach drew strong attention in the context of the Kyoto Protocol, which instituted a long-lasting separation between Annexe 1 countries, which are subject to emission ceilings, and emerging countries, which are not subject to a binding arrangement. A full assessment of that arrangement, measured by the yardstick of the Kyoto commitments and done by twelve groups of experts using different models, is now a reference document.[20] Its conclusion is that if a border adjustment tax is applied, it will result in a one-third reduction in carbon leakage (from 12 to 8%). In the European case, a recent study shows that possible commercial retaliation would foremost apply to the agricultural and food exports of the European Union.[21] Implementing that policy raises not only a problem of information regarding the carbon content of imported goods, but also a problem of compliance with international trade law (box 2). The information problem is obviously less acute on the export side; however, an export subsidy could easily be attacked at the WTO, in any case more easily than an offsetting tax on imports justified by dealing with a worldwide environmental problem.

Thus, beyond technical considerations, the major challenge is to set up a "WTO-compatible" arrangement. The question is not a simple one. Until now, the WTO has never ruled directly the question of border adjustment taxes. In addition, when it has done so on related issues, answers were not always consistent across cases. Finally, the WTO doctrine in environmental matters appears to have evolved over time. Under certain conditions, GATT article XX authorises trade limitations for environmental reasons (*cf*. box 3). However, the production process is not a valid restriction criterion. Thus, GATT ruled against the USA in the the tuna/dolphin case against Mexico,[22] whilst the WTO ruled in favour of the USA using article XX in the shrimp/turtle case against India.[23] However, the case of recycled tyres seemed to notify a turning point in WTO article XX jurisprudence. Brazil's prohibition on importing re-treaded tyres, based on the reason that such imports would

2. Technical problems raised by a carbon-inclusion mechanism

The regulated area is facing the following choices.

Should the carbon-inclusion mechanism cover all goods, or just some of them?

Applying the tax to all goods seems far too heavy and complicated. Research on the subject is greatly in favour of restricting the tax to goods that are both highly energy-intensive and tradable, goods for which carbon leakage is the most plausible (steel-making, metallurgy, the chemical industry, and the paper and cardboard industry).

Which tax base?

Given the difficulty of assessing the carbon content of imported goods, and given the fact that for a single item, several production processes –more or less carbon emission intensive- may be used, literature suggests that the regulated area should apply an import tax based on the carbon content of equivalent goods it produces; or on the basis of the carbon content of goods produced with the best technology available (the least carbon emission intensive); or on the basis of the carbon content of goods produced with the worst technology available, except if the business concerned can prove that it uses a better technology. The latter approach would have the advantage of not discriminating *a priori* between import sources, thus complying with the spirit of the WTO's usual rules.

Which exporting countries shall be subjected to the carbon-inclusion mechanism?

All countries outside the regulated area, or only those that do not have an equivalent climate policy? In the latter case, how to define an equivalent climate policy? It could be a policy that results in a close internal carbon value, but it is very difficult to estimate the carbon value that underlies the vast spread of possible regulatory measures. It is therefore difficult to limit the arbitrary from the choice of countries considered to have an equivalent climate policy. Thus it is difficult to avoid countries subjected to the tax not to consider it a political choice and challenge the instrument. Moreover, the decisions may be challenged not only by the countries but also by businesses in the concerned countries, as part of investor-to-state dispute settlement arrangements.

[20] Böhringer C., E.J. Balistreri and T.F. Rutherford (2012): "The Role of Border Carbon Adjustment in Unilateral Climate Policy: Overview of an Energy Modeling Forum Study (EMF 29)", Energy Economics, no 34, S97-S110. In the European case, see Kuik O.J. and M.W. Hofkes(2010): "Border Adjustment for European Emissions Trading: Competitiveness and Carbon Leakage", Energy Policy, vol. 38, no 4, pp. 1741-1748.

[21] Fouré J., H. Guimbard and S. Monjon (2016): "Border Carbon Adjustment and Trade Retaliation: What Would Be the Cost for the European Union?", Energy Economics, vol. 54, no 1, pp. 349-362.

[22] The USA regulatory proposal on labelling called Dolphin Safe, challenged by Mexico, referred to the capture area and to fishing techniques.

[23] The USA required shrimp trawlers to install turtle exclusion devices on their nets, turtles being a protected species.

3. GATT article XX

The article XX of the GATT covers "general exceptions". It sets out various cases in which WTO members can be exempted from GATT rules. Two of the ten provided exceptions concern the environment (paragraphs "b" and "g"). By virtue of these paragraphs, WTO members can adopt measures:

- necessary to protect human, animal or plant life or health (paragraph b);
- relating to the conservation of exhaustible natural resources, if such measures are made effective in conjunction with restrictions on domestic production or consumption (paragraph g).

For an environmental measure to be justified under that article, it must be possible to prove that the measure is covered by one of these exceptions, and that it satisfies the regulations governing its introduction. The latter specifies that: "Subject to the requirement that such measures are not applied in a manner that would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party" of such measures.

limit the country's ability to rid itself of its own used tyres, was accepted by the WTO under article XX.[24] Accordingly, even if the differential carbon footprint of products is recognised as an admissible criterion under article XX, the legal analysis of that type of measure will remain subject to debate.[25]

Above all, the issue of commercial retaliation (e.g. by China)[26] is a central one. In order to reduce that risk, it is important to avoid the pitfall of disguised protectionism. To ensure that developing countries do not consider the policy to be aggressive towards them, compensating factors must be developed. A flat-rate repayment to each country of the total amount paid in tax by its businesses is not a tool providing enough incentives. The transfer of pollution-reducing technologies is preferable, but raises the issue of how to compensate businesses harmed by the ensuing weakening of intellectual-property rights. All these difficulties[27] highlight the limits of the carbon-inclusion mechanism, which is not a truly promising instrument.

Recommendation 2. Relinquish the idea of a carbon-inclusion mechanism, too complex and carrying real risks of commercial retaliation.

A uniform customs tariff levied on countries that do not contribute to emission reduction

A second method consists in applying a uniform customs duty, imposed by a club of countries that commit themselves to a binding, ambitious emission objective, to all product imported (whether or not they intensively emit carbon gases) from countries that are not part of the effort.

Although inspired by economic theory (a coalition is not stable if there is no penalisation of free-riding), such a policy does not necessarily correspond to WTO requirements in the event of commercial litigation. However, if a club of countries with ambitious objectives, for example in terms of carbon pricing, or of setting up a single emission permits market, were to be formed, it would be difficult not to acknowledge the environmental aim of such a tax. All the more so since it would be covered by multilaterally approval objectives as part of the UN sustainable-development objectives, the climate convention, and the COP21.

In particular, the Paris Agreement (2016) sets the objective of keeping the global average rise in temperatures below 2 °C relative to pre-industrial levels, and, by sustaining the efforts done so far, to limit the temperature rise to 1.5 °C relative to pre-industrial levels. It highlights the need to support and promote regional and international co-operation in order to mobilise stronger and more ambitious climatic action by all parties. Thus, such a measure seems to be fundamentally in accordance with the letter of the GATT article XX and potentially acceptable in this regard, given that it is interpreted following its objectives; that its terms and conditions are not creating unjustifiable restrictions on trade; and that the climate club is open to any country that wishes to join it.

That proposal was made prominent by William Nordhaus in his Presidential Address given at the 127th congress of the American Economic Association in January 2015.[28] Nordhaus starts from the finding that, in theory, no stable climate coalition is able to pursue ambitious greenhouse-gas emissions reduction objectives without a sanction mechanism against

[24] Consultations were opened following the request of the European Union in June 2005.

[25] The joint report by the WTO and UNEP (2009) called "Trade and climate change" restates the pre-eminence of the environment over trade under certain conditions: "The WTO's case law confirmed that WTO rules do not outweigh environmental rules. For example, if a border measure linked to climate change were held to be incompatible with one of GATT's fundamental provisions, it could nonetheless be justified under general exceptions set out in GATT article XX, provided that several conditions are met" (p. 4). The report refutes the effectiveness of carbon-inclusion measures: "Discussions that have taken place to date on those measures have shown how difficult it would be to apply a border adjustment mechanism that responds to the concerns of national industries whilst contributing to meeting the wider objective of alleviating worldwide climate change" (p. 3).

[26] Cf. the case of international aviation mentioned above.

[27] And, cf. infra, the fact that it does not create appropriate incentives for building stable, ambitious climate agreements.

[28] Nordhaus W. (2015): "Climate Clubs: Overcoming Free-Riding in International Climate Policy", American Economic Review, vol. 105, no 4, pp. 1339-1370.

non-participants. He then shows how, on the other hand, an international climate treaty that combines carbon pricing and the use of moderate commercial sanctions against free-riding states could work. That incentivising duty, which sanctions free-riders, is uniform in order to limit distortions, whilst minimising the risk that amongst exporting countries the most heavily hurt sectors gather into producer coalitions, thus limiting the risks of retaliation. That solution guarantees great simplicity of implementation, compared with any mechanism involving compensation at borders.

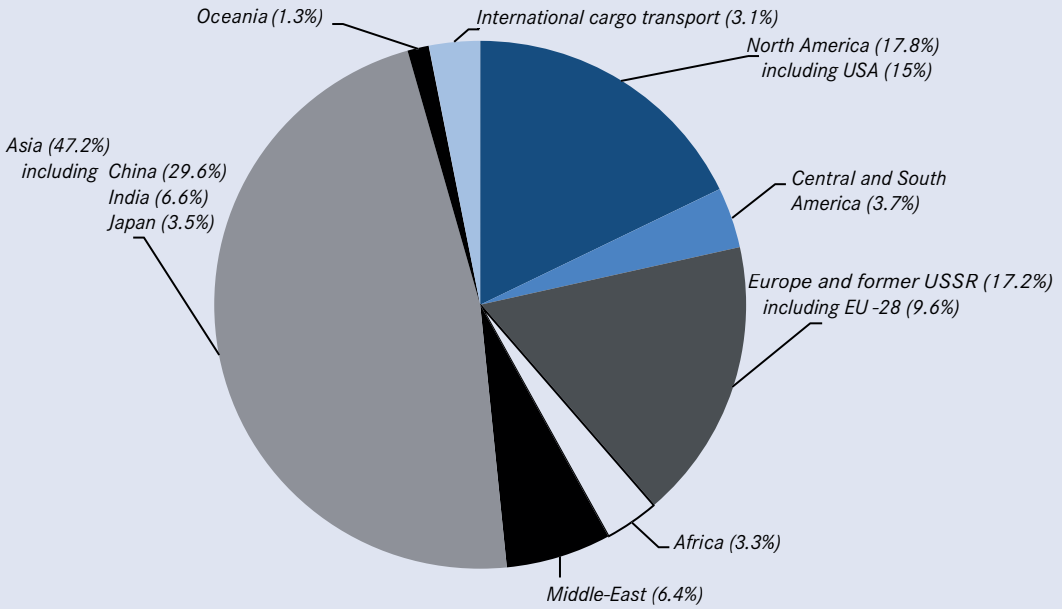
Fontagné and Fouré (*op. cit.*) have simulated the economic effects of such a policy by 2030. Three scenarios are compared to a reference path that involves a "business as usual" (BAU) approach, i.e. the potential trajectory of the economies under consideration, given their demographic changes, factor productivity, energy efficiency, and an oil price based on the projections of the International Energy Agency.

The first two scenarios simulate the implementation of policies reducing GHG emissions with no offsetting trade policy: in the "Paris" scenario, only the Paris Agreement is implemented; in the "Club" scenario, the three largest CO_2 producers (the USA, the European Union-28, and China, *cf.* graph 3) decide to go one step further in the fight against global warming by forming a "club" with a single market in tradeable emissions permits, and align themselves with the EU objectives, i.e. a 40% reduction in emissions relative to 1990 (2011 for China, to take account of differences in the level of development). The simulation proves most insightful in the third, so-called "Nordhaus" scenario, wherein the EU, the USA, and China apply to their "extra-Club" trading partners a uniform customs duty of 2%.[29] It is important to highlight the fact that behind the notion of a club lies an approach aimed at building a stable coalition with regard to the "selfish" interest of its participants,[30] thus including that of the USA.[31]

The "Club" and "Nordhaus" scenarios bring about a nearly 42% reduction in emissions. This means a change of scale in the climate ambition, putting efforts to a level deemed necessary to avoid a runaway effect on climate change as well as related damages. Their costs in terms of world GDP are higher than the "Paris" scenario (but a little lower for the European Union) but it is recalled that the positive effects on the climate are not assessed here. At world level, the fall in GDP by 2030 is 1.8 times higher than that simulated in the case of stabilisation of world trade (table 2), but the reduction in emissions is 12 times larger.

However, by greatly reducing their emissions, the club member countries trigger a fall in demand for fossil fuels and, thus, a fall in their world price. Countries that are not club mem-

3. Geographical spread of CO_2 emissions in the world in 2014
in %, except LULUCF (Land Use, Land-Use Change, and Forestry)



Source: SOeS, EDGAR, World Bank (2015).

[29] Intra-European trade (and trade with the United Kingdom) is not considered here.

[30] As Nordhaus states it: "An important aspect of the club is that it creates a strategic situation in which countries acting in their self-interest will choose to enter the club and undertake high level emissions reductions because of the structure of the incentives".

[31] Of course, that is based on the assumption that they correctly see the long-term challenges posed by the climate risk, e.g. for the cities and coasts of the USA cf. Bloomberg M.R., H.M. Paulson and T.F. Steyer (co-Pres.) (2014): A Climate Risk Assessment for the United States, Risky Business: The Economic Risks of Climate Change in the United-States, June.

2. Reducing emissions by climate and trade tools: three scenarios

	Effect on CO_2 emissions relative to the reference scenario, in %			Effect on GDP by 2030 relative to the reference scenario, in %		
	Paris	Club	Nordhaus	Paris	Club	Nordhaus
European Union (28)	– 45.2	– 45.2	– 45.3	– 1.8	– 1.6	– 1.6
USA	– 32.6	– 63.8	– 63.8	– 0.1	– 1.4	– 1.4
China	– 38.4	– 75.1	– 75.1	– 1.5	– 10.6	– 10.6
Rest of the coalition[a]	– 33.9	– 33.9	– 33.9	– 1.5	– 1.6	– 1.7
Rest of the world	+ 6.0	+ 15.5	+ 14.8	– 0.8	– 1.0	– 1.3
World	– 27.0	– 41.6	– 41.8	– 1.2	– 3.2	– 3.3
Additional carbon leakage relative to the "Paris" scenario	—	13.1%	12.2%			

Note: [a] Other countries part of the Paris Agreement, for which reduction objectives are common to the three scenarios.

Source : Fontagné L. et J. Fouré J. (2017) : « Changement climatique et commerce : quelques simulations de politique économique », *Focus du CAE*, n° 15, janvier.

bers increase their carbon demand because of that price decrease, which reduces the effectiveness of the policy. The "Nordhaus" scenario limits free-riding behaviour and reduces carbon leakage. The simulation shows that the Nordhaus tax (which is dissuasive and temporary) reduces carbon leakage with the additional "Club" effort in relation to the "Paris" scenario (12.2% versus 13.1%). It should be noted that the tax has no positive effect on the GDP of the countries that are club members, which guarantees its multilateral acceptability.

Recommendation 3. As a priority, explore the implementation conditions of the Nordhaus proposal of a uniform duty that incentivises joining a climate club, following a precise timeline.

An initial stage would involve giving a WTO-UN group a mandate to study means of reconciling trade development with greenhouse-gas emissions reduction efforts, by taking into account, on the one hand, the dumping carried out by countries that do not apply carbon pricing or that set it an excessively low level, and, on the other hand, situations in which trade rules limit progress on climate policies.

Conclusion

International trade and transport contribute to emissions and therefore to global warming mainly because they do not internalise their negative externalities. Indeed, international trade develops in the absence of a carbon pricing that is sufficiently general in application and set at an adequate level. In such a situation, economic theory recommends the use of a first-best instrument: internalising external costs through the generalisation of carbon pricing, rather than trying to reduce emissions by restraining the development of international trade, which would be a very costly measure in terms of GDP for only limited environmental effectiveness

Hence, there appears to be no basis for the manner in which the public debate on protectionism usually refers to the environmental motive: the negative impacts of trade on the environment refer fundamentally to the shortcomings of environmental policies. Protectionist measures would be no more than costly substitutes for building effective environmental regulations. Thus, the environmental challenges of trade deserve better than the rhetoric within which they are often confined. There is a need to regulate trade-related emissions, and to that end, to reach an improved coordination of the various branches of international regulations to ensure a boom in climate co-operation.

Prioritising emission pricing means that trade development is not an end in itself, but that it can contribute to greater effectiveness in the global economy. In the absence of a single international organisation on environmental matters, the WTO case law about article XX allows to develop uniform and moderate customs duties aimed at promoting international co-operation in climate matters. In fine, this would give a concrete body to the idea that "WTO rules do not outweigh environmental regulations".[32]

[32] WTO and UNEP Report "Trade and climate change", 2009, *op. cit*.

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