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Fair, optimal or detrimental? Environmental vs. strategic use of border carbon adjustment

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ABSTRACT

We carry out a detailed sensitivity analysis of border carbon adjustment (rates) by applying a global computable general equilibrium (CGE) GTAP7-based model. We find different incentives for the regions in the climate coalition to raise carbon-based border tax rates (BTAX) above the standard rate that mimics an equalisation of carbon prices across regions. Herein, the strategic use of BTAX (the manipulation of the terms of trade) is stronger for all coalition regions than the environmental use (the reduction of carbon emissions abroad). Higher BTAX can reduce carbon leakage but with a declining marginal effect. Furthermore, we find different incentives for regions outside the coalition to oppose high BTAX rates: Russia and the other energy exporters would oppose it, while the low-income countries would not because of benefits from the trade diversion effect. Thus, BTAX encourages the former to join the coalition, while compensating transfers are necessary to encourage the other (developing) countries including China and India.

1. Introduction

Economic theory on trade and the environment, in particular the seminal work by Markusen (1975), has derived an optimal tariff that encompasses two terms: a term (a) that influences the terms of trade in Home's favour (given monopolistic power on international markets) and a term (b) that internalises the negative environmental externality caused by Foreign's export production. In the context of climate policy, Hoel (1996) shows that a carbon tax should not be differentiated across sectors if import and export tariffs are available for all traded goods. Such tariffs, also known as border tax adjustment, have recently created a controversy regarding their feasibility for reducing negative competitiveness effects of unilateral climate policy through carbon leakage – that is the relocation of carbon intensive industries to regions without climate policies – and for reducing carbon emissions in general.

Herein, term (a) creates an incentive for policy makers to set a carbon-based tariff higher than the environmentally optimal term (b) in order to influence the terms of trade in their favour. This is especially true in a situation of uncertainty about the true carbon intensities of traded commodities (based on directly created emissions or a full life cycle analysis[3] or the practical assumption that Foreign's emission intensities are equal to Home's emission intensities). Accordingly, there are incentives for policy makers to deviate from the standard carbon tariff rate. This deviation might harm other countries and might be in conflict with WTO legislation (cf. Bhagwati and Mavroidis, 2007). Due to the uncertainty about the true carbon intensities of products imported from different regions, this deviation can easily occur by chance. Therein, small deviations might or might not have significant effects on Home's and Foreign's welfare and global emissions. These considerations complicate the practical implementation of border tax adjustment policies. Therefore, it appears highly policy relevant to assess how important such effects are. A complex multi-region, multi-sector CGE (computable general equilibrium) model using real-world data and capturing relevant intersectoral and international feedback effects is an appropriate instrument to do so. In a related work with a different setting, in which Home aims to minimise the costs of unilaterally reaching a given emission target with sectorally differentiated carbon prices and accounting for leakage, Böhringer et al. (2010b) show that the environmental term (b) is of less importance

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[3] Cf. Peters et al. (2011).

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than the strategic terms of trade effect (a). From a methodological point of view they show that the strategic terms of trade effect can be switched off by compensating Foreign through lump-sum transfers such that its welfare remains at the level without climate policy in Home. Unfortunately, this approach does not carry over to the setting with border carbon adjustment where Foreign's welfare is not only affected by changes in the terms of trade, but also by the border tax Foreign has to pay. Also, in Böhringer et al. overall efficiency of abatement in Home and maximising Home's welfare go hand in hand since emission taxes apply to Home sectors only. This is different in a setting with border carbon adjustment. Overall cost efficiency is nevertheless a relevant issue also under border carbon adjustment. Against this background, our first set of research questions can be formulated as: how sensitive is regional welfare with respect to changes in carbon tariffs? How important is the strategic term (a) relative to the environmental term (b)? Are there different incentives for economies within a climate coalition to impose border tariffs that deviate from the standard rate against certain economies outside the coalition? Which countries or world regions will significantly gain or lose?

Concerning term (b) the problem is that it is difficult to assess climate damages and thus the external costs of carbon. Moreover, the value of term (b) depends on the market power of Home that imposes it: having more market power, Home can induce higher emission reductions in Foreign; thus a higher tariff rate can be optimal from an environmental point of view. In reality, it is overall difficult to determine how high the optimal carbon-based tariff is. Theoretically, it can even be shown in a 2×2 general equilibrium trade model that term (b) can become negative if Foreign's export sector is less carbon intensive than Foreign's non-export sector (Jakob et al., 2011, based on Markusen, 1975) and that an optimal border adjustment is a net import tariff set below the standard Pigouvian rate (Yonezawa et al., 2012). The reason is that border tax adjustment might shift production from exports towards (on average) more carbon intensive non-export production. And in general, in a second best world of existing taxes, tariffs and subsidies, the additional effect of border tax adjustment on top of these is ambiguous. The standard carbon-based tariff rate sets the tariff rate such that the tax bill on imports from Foreign to Home is equal to the tax bill that exporters would have to pay in Foreign if the same carbon price as in Home existed in Foreign. Thus, the standard rate need not reduce global emissions in a (socially) optimal way and the effects of border carbon adjustment on global emissions are not clear-cut. Moreover, policy makers mainly fear that firms will relocate production to regions without a carbon price, which is the "relocation channel" of carbon leakage. Previous model simulations (e.g. Böhringer et al., 2010a), on the contrary, indicate that the reduction in global fossil fuel prices due to climate policy-induced demand reductions, i.e. the "fossil fuel price channel" is clearly the dominant channel. In this sense, our second set of research questions can be phrased as: how sensitive are regional and global emissions with respect to changes in carbon tariffs? How will carbon leakage change when the tariff rate deviates from the standard rate? Is it realistic that very high tariffs can increase carbon leakage? Is the relocation channel or the fossil fuel price channel dominant?

Furthermore, Lessmann et al. (2009) show that under certain conditions, tariffs can encourage non-coalition countries to join a climate coalition as long as the tariff rate is small relative to the Armington elasticity. They show that global welfare rises in the coalition size. In this sense, border carbon adjustment could be a feasible instrument to achieve a large climate coalition. Herein, a third leakage channel occurs, the "free-rider channel". This means a larger climate coalition increases the incentive to leave the coalition and to free-ride on the reduction efforts of the coalition. In the context of carbon-based border measures, a larger coalition can reduce emissions at a lower carbon price, which in turn reduces the carbon-based border measure rates. Thus, the "punishment" for being outside the coalition via border measures decreases and raises free-rider incentives. But again, it is an open question whether these effects are significant. A multi-region, multi-sector CGE model can help assess how this mechanism works, how strong it is and what it implies.[4] Moreover, the linkage of climate policy to trade policy will likely result in trade creation and trade diversion effects (Viner, 1961) between coalition and non-coalition countries. This leads to our third set of research questions: do carbon-based tariffs indeed give incentives for a larger climate coalition? Is such a coalition stable or is the free-rider channel dominant? How high are the tariff rates that are necessary to induce certain countries (such as China) to join the climate coalition or to achieve a global coalition? Is it better for the coalition to use border measures or (financial) transfers to encourage non-coalition members to join? How pronounced are the trade creation and diversion effects?

To address these questions, we apply a version of the CGE model DART and focus our analysis on the year 2020. Our analysis is closely related to the literature that examines border carbon adjustment in numerical models for climate policy analysis such as Babiker and Rutherford (2005) and Böhringer et al. (2010a). This literature often finds a limited potential of border tax adjustment to reduce carbon leakage. It is furthermore related to the original theoretical literature on border tax adjustment regarding value added taxes such as Meade (1974) and Grossman (1980). They show that a uniform sales tax for all goods is non-distorting and trade-neutral under border tax adjustment of imports and exports. However, this does not hold under border carbon adjustment because tax rates differ depending on the carbon content of goods.

Our analysis is also related to the literature on optimal tariffs: Hamilton and Whalley (1983) find that existing tariffs are "some distance from optimal tariffs" and that there is a high potential for trade wars. Herein, they point out that import price elasticities are crucial parameters for such calculations. Summarising the literature, Mayer (1984) concludes that "political decisions on tariff rates are reflections of the selfish economic interests of voters, lobbying groups, politicians, or other decision makers in trade policy matters". Gros (1987) shows (based on Krugman, 1980) that the optimal tariff in form of a uniform ad valorem tax is an increasing function of the economy size and of product differentiation. Kennan and Riezman (1988) build on the common view that particularly large economies can manipulate the terms of trade in their favour, while retaliation would make all countries worse off. The authors show that substantially large economies can win despite retaliation. Kennan and Riezman (1990) examine custom unions[5] that are similar to climate coalitions in our context: custom unions can improve the welfare of their members charging optimal tariffs compared with free trade. According to the authors, the move from Nash equilibrium to free trade improves global resource allocation, while this is not necessarily the case when moving from free trade to a custom union. Yilmaz (1999) shows that results from a CGE analysis of export taxes differ from those in a partial equilibrium analysis. He finds a higher welfare improvement via Nash revenue maximising taxes than via Nash optimum taxes. Finally, Broda et al. (2008) state that "countries set import tariffs nine percentage points higher on inelastically supplied imports relative to those supplied elastically" exploiting their power on international markets. Despite the long history of theoretical work on optimal tariffs accompanied by statistical estimates, the role of optimal tariffs in an applied CGE framework appears to be

[4] Finus (2008) concludes in his overview article focusing on CGE modelling that there are plenty of opportunities for studying the prospects of cooperation "but also a serious need to improve and further develop current models in order to provide policy guidance…"

[5] The theory of custom unions goes back to Viner (1961). He shows that a custom union has a trade creation (replacement of domestic production by imports) and a trade diversion effect (replacement of imports from outside by imports from inside the union).