



# Border carbon adjustments: Addressing emissions embodied in trade



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## HIGHLIGHTS

- We estimate the volume of emissions that could be potentially taxed by BCAs.
- We study the effects of trade provisions and country and sectoral coverage on BCAs.
- Trade provisions can significantly reduce the scope and effectiveness of BCAs.
- Best available technology and exclusion of electricity reduce tariffs considerably.
- BCAs are not optimal policy tools to address carbon leakage concerns.

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## ABSTRACT

Approximately one fourth of global emissions are embodied in international trade and a significant portion flows from non-carbon-priced to carbon-priced economies. Border carbon adjustments (BCAs) figure prominently as instruments to address concerns arising from unilateral climate policy. Estimating the volume of emissions that could be potentially taxed under a BCA scheme has received little attention until now. This paper examines how a number of issues involved in the implementation of BCAs can affect their ability to cover emissions embodied in trade and thus address carbon leakage. These issues range from ensuring compliance with trade provisions and assumptions on the carbon intensity of imports, to determining which countries are included and whether intermediate and final demand are considered. Here we show that the volume of CO<sub>2</sub> captured by a scheme that involved all Annex B countries could be significantly reduced due to these issues, particularly by trade provisions, such as the principle of 'best available technology' (BAT). As a consequence, the tariff burdens faced by non-Annex B parties could dwindle considerably. These findings have important policy implications, as they question the effectiveness and practicalities of BCAs to reduce carbon leakage and alleviate competitiveness concerns, adding further arguments against their implementation.

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## 1. Introduction

Previous studies have focused on estimating the amount of greenhouse gas (GHG) emissions that are generated during the production of goods and services destined to be traded internationally (Davis and Caldeira, 2010; Kainuma et al., 2000; Peters and Hertwich, 2008; Peters et al., 2011). One consistent finding in this literature is that industrialised nations (i.e. Annex B) tend to import more emissions embodied in the foreign-made products that they consume than those they export, consequently becoming net-importers (Peters and Hertwich, 2008). Net emissions transfers from non-carbon-priced to carbon-priced economies via

international trade have increased by a factor of 4 during the last two decades, from 0.4 Gt in 1990 to 1.6 Gt of CO<sub>2</sub> in 2008 (Peters et al., 2011). Some authors consider that these growing transfers undermine mitigation commitments, since it can be argued from this perspective that emissions reductions in Annex B countries are in fact lower than what is specified in their national emissions inventories (Kanemoto et al., 2014; Peters et al., 2011).

Net emissions transfers constitute a phenomenon that has been labelled as 'demand-driven' carbon leakage, in order to differentiate it from its other variant, better known as 'policy-induced' leakage (Peters, 2010). The latter can be defined as the increase of emissions in countries with no abatement obligations due to climate policy implemented in nations subject to binding targets (Felder and Rutherford, 1993; Paltsev, 2001). The Intergovernmental Panel on Climate Change (IPCC) provides a more general definition, stating that carbon leakage relates to "phenomena

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whereby the reduction in emissions (relative to a baseline) in a jurisdiction/sector associated with the implementation of mitigation policy is offset to some degree by an increase outside the jurisdiction/sector through induced changes in consumption, production, prices, land use and/or trade across the jurisdictions/sectors" (Allwood et al., 2014; p. 1265). Existing studies have been unable to reveal meaningful empirical evidence of 'policy-induced' carbon leakage (Reinaud, 2008; Sartor, 2012), whereas the existence of 'demand-driven' leakage is clearly reflected on the significant rise of net emissions transfers and constitutes an important matter.

It is believed that carbon leakage is associated with the loss of competitiveness of trade-exposed and carbon-intensive industries located in nations subject to costly carbon restrictions with respect to similar foreign industries situated in countries not constrained by climate policy (Kuik and Hofkes, 2010; van Asselt and Brewer, 2010). In order to alleviate carbon leakage and competitiveness concerns, it has been argued that emission pricing should be extended unilaterally to cover imported goods and services by applying border carbon adjustments (BCAs) (Helm et al., 2012; Ismer and Neuhoff, 2007; Lockwood and Whalley, 2010; Stiglitz, 2006). Applying a price on the carbon content of imported goods at the border, in this manner, could contribute to levelling the playing field between carbon-priced and non-carbon-priced economies.

The effectiveness of BCAs is a contested issue. Several studies suggest that these instruments can contribute to ameliorate the risk of carbon leakage (Bednar-Friedl et al., 2012; Kuik and Hofkes, 2010). Other examinations, however, have been more critical, highlighting the major drawbacks of these policy tools (Jakob et al., 2014). This paper, in this sense, aims to shed light on the matter by quantifying the volume of emissions that could be actually levied by BCAs, an aspect that has not received the proper attention in the literature. For this purpose, we take into account issues involved in BCA implementation related to trade provisions, carbon intensity of products and sectoral and country coverage. We then examine how these issues influence the tariff burdens faced by non-carbon-priced economies. This allows assessing the ability of BCAs to reduce leakage and their true contribution to climate policy.

The analysis involves the hypothetical case of a BCA scheme implemented by Annex B nations, given that this country grouping is suitable to illustrate the paper's objectives. However, we acknowledge that this particular group constitutes one of many potential scenarios. This is relevant given the introduction of other emissions trading schemes (ETS), apart from the Kyoto Protocol and the European Union ETS, such as the recent launch of South Korea's cap-and-trade programme, the first to be in operation in Asia, as well as the progress made towards setting up a Chinese trading system. The implications for our analysis of considering new abatement schemes in Non-Annex B countries are discussed later in the paper.

This research adds to the literature by showing that some aspects related to BCA implementation, particularly trade provisions, substantially reduce the volume of emissions along the supply chain that could be potentially taxed and contribute to seriously diminish the tariff burdens faced by exporting economies. The results offered in this paper thus confirm other existing studies in the sense that the benefits generated by BCAs would be small, while its implementation could prove to be extremely costly and difficult (Izard et al., 2010; Liu, 2015; McKibbin et al., 2008; Winchester et al., 2011). The findings essentially cast doubts on the practicality and effectiveness of these policy tools. This is relevant, as there has been an increasing discussion about adopting BCAs in some Annex B countries and other industrialised economies. The US represents a particularly pertinent example, since it has explicitly stated that any future climate legislation involving reduction targets would contain a provision for BCAs to protect its

national industries. However, given their ineffectiveness, we argue that other options should be sought. The literature offers examples of alternative measures to address leakage and competitiveness concerns that could be more effective to support major polluting economies to intensify their mitigation actions, rather than to unilaterally penalise them for their inaction (Böhringer et al., 2012; Droege, 2011; Jakob et al., 2014). Some of these examples are presented later in the paper when we address the policy implications.

The paper is structured as follows. Section 2 provides additional background on BCAs and clarifies some conceptual aspects that are adopted in the analysis. Section 3 describes the method and data used. The empirical results are presented in Section 4, which are then discussed in Section 5. Section 6 offers the conclusions derived from the study, as well as the policy implications.

## 2. BCAs: background and conceptual approach

As has been mentioned, this section succinctly covers some key background information about BCAs and clarifies the conceptual approach followed in the analysis. It addresses aspects such as the objectives, implementation, compatibility with trade law, and efficiency of BCAs.

### 2.1. The objectives of BCAs

Advocates of BCAs generally regard them as a trade instrument to internalise a global externality (Markusen, 1975). The literature, however, identifies more specific objectives that can be pursued by implementing BCAs, such as ensuring an effective carbon price domestically, creating incentives to improve carbon efficiency among foreign producers, or from the standpoint of a coercion strategy to penalise free-riders (i.e. non-carbon-abating economies) and persuade them to assume legally binding targets (Neuhoff, 2011).

If carbon prices are asymmetrical among members of a region bound by carbon constraints, applying BCAs to fellow trade partners within the international agreement can ensure an efficient domestic price, given that adequate carbon equalisation measures are in place (e.g. assuming average carbon intensity, best available technology, etc.). BCAs can also encourage emissions reductions abroad by motivating foreign producers outside the scheme to become more carbon efficient, or even to punish non-participation in abatement efforts (Barrett, 1997; Irfanoglu et al., 2015; Lessmann et al., 2009; Li and Zhang, 2012; Winchester et al., 2011). However, it has been suggested that carbon equalisation can hinder the achievement of these two last objectives (Neuhoff, 2011). Depending on the adjustment rate after equalisation, BCAs can contribute to either shift carbon-intensive production to non-exports sectors in the producing country, or even risk blocking future involvement from non-participating nations in climate policy negotiations. In this paper, we argue that carbon equalisation can significantly reduce the tariff rates faced by exporting nations, thus affecting the effectiveness of BCAs. In our analysis, we assume that there is a homogeneous carbon price among the participants of the BCA scheme (and additionally that there is no internal leakage), which seeks not only to improve carbon efficiency outside the region (i.e. reduce net emissions transfers), but also serve as a coercive tool.

When regarded as an instrument of persuasion, BCAs have been often considered as a potential 'game changer' in deadlocked international climate negotiations (Helm et al., 2012). Developing nations, however, have historically experienced border adjustments being imposed against them, with adverse effects on their development efforts. Consequently, they generally oppose to their

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