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The efficiency cost of protective measures in climate policy☆

Christoph Böhringer[a,*], Xaquin Garcia-Muros[b], Ignacio Cazcarro[b], Iñaki Arto[b]

[a] Department of Economics, University of Oldenburg, Germany
[b] Basque Centre for Climate Change (BC3), Bilbao, Spain

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ABSTRACT

Despite recent achievements towards a global climate agreement, climate action to reduce greenhouse gas emissions remains quite heterogeneous across countries. Energy-intensive and trade-exposed (EITE) industries in industrialized countries are concerned on stringent domestic emission pricing that puts them at a competitive disadvantage against producers of similar goods in other countries with more lenient emission regulation. This paper focuses on climate policy design in the United States of America (US) and compares the economic implications of four alternative protective measures for US EITE industries: (i) output-based rebates, (ii) exemptions from emission pricing, (iii) energy intensity standards, and (iv) carbon intensity standards. Using a large-scale computable general equilibrium model we quantify how these protective measures affect competitiveness of US EITE industries. We find that protective measures can improve common trade-related competitiveness indicators such as revealed comparative advantage or relative world trade shares but at the same time may lead to a decline in the output value for EITE industries because of negative income effects. The economy-wide cost of emission abatement under protective measures increase as compared to uniform emission pricing stand-alone such that the gains of protective measures for EITE exports may be more than compensated through losses in domestic EITE demand.

1. Introduction

The 21st Conference of Parties (COP21) to the United Nations Framework Convention on Climate Change in Paris in December 2015 set an important milestone in international climate policy. The so-called Paris Agreement (UNFCCC, 2015) achieved global consensus on keeping the global mean surface temperature increase below 2 °C compared to pre-industrial levels. In line with this temperature target not only industrialized countries but also developing countries signalled their willingness to reduce greenhouse gas (GHG) emissions. According to the Paris Agreement, future climate negotiations and emission reduction efforts should be planned in global coordination; however, opposite to the Kyoto Protocol with its legally binding reduction targets for signatory industrialized countries, the Paris Agreement builds only on voluntary pledges of individual countries - so-called intended nationally determined contributions (INDCs) - to reduce GHG emissions.

Under the Paris Agreement, the United States of America (US) has committed itself to cut domestic emissions by 26% −28% by 2025 as compared to 2005 emission levels. One contentious issue in domestic US climate policy is the threat of competitiveness losses for US emission-intensive and trade-exposed (EITE) industries if facing more stringent regulation than competitors abroad.

Reflecting such competitiveness concerns, this paper investigates the economic impacts of four alternative protective measures for US EITE industries: (i) output-based rebates, (ii) exemptions from emission pricing, (iii) energy intensity standards (instead of explicit emission pricing), and (iv) carbon intensity standards (instead of explicit emission pricing). Based on simulations with a large-scale computable general equilibrium model (CGE) for the global economy we quantify how these protective measures affect competitiveness of US EITE industries for alternative degrees of climate policy stringency in other OECD countries. We find that while protective measures can substantially attenuate adverse competitiveness impacts, they run the risk of making US climate policy much more costly than uniform emission pricing stand-alone. In fact, the excess cost imply negative income effects such that the gains of protective measures for EITE exports may be more than compensated through losses in domestic EITE demand.

The remainder of this paper is organised as follows. Section 2 briefly summarizes the literature on climate policy design in the context of competitiveness concerns. Section 3 adopts a simple analytical

☆ A Computable General Equilibrium Analysis for the United States.

* Corresponding author.
E-mail address: boehringer@uni-oldenburg.de (C. Böhringer).

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framework to investigate the competitiveness impacts of alternative protective measures. Section 4 provides a description of the CGE model and data underlying our quantitative analysis, presents the policy scenarios, and discusses the simulation results. Section 5 concludes.

2. Literature review

Concerns on adverse competitiveness effects of asymmetric emission pricing are at the fore of the climate policy debate in many industrialized countries. EITE industries in countries with more stringent emission regulation fear cost disadvantages against their international competitors. Cost disadvantages would incentivize the relocation of EITE production from domestic sites to abroad thereby amplifying adverse domestic production effects for these industries. Opponents to unilateral emission pricing also point to the risk of counterproductive emission leakage – i.e. the partial offsetting of domestic emission reduction through increases of emissions abroad.

To avoid excessive structural change against domestic EITE industries, various protective measures for EITE industries which are at risk of carbon leakage are discussed. Principal among these measures are border carbon adjustments, where emissions embodied in imports from non-regulating regions are taxed at the emission price of the regulating region (i.e. "taxing products at the border on their carbon content") and emission payments for exports to non-regulating countries are rebated. From a global efficiency perspective such a combination qualifies as a second-best measure complementing (unilateral) uniform emission pricing (Markusen, 1975; Hoel, 1991; Copeland, 1996). However, border carbon adjustments have always been discussed controversially under WTO rules (Cendra, 2006; Ismer and Neuhoff, 2007); given the Paris Agreement they further lack political feasibility. When border measures are unavailable, differential emission pricing in favour of domestic EITE industries including full exemptions may serve as an alternative protective measure (Hoel, 1996; Böhringer et al., 2014a). Another strategy for protecting EITE industries involves the allocation of free emission allowances conditional on production (i.e. output-based allocation – see Fischer, 2001). Contrary to auctioning of emission allowances or unconditional free allowance allocation, an output-based grandfathering system effectively works as a subsidy to production to recover (part) of losses in competitiveness (Böhringer et al., 1998). A further potential candidate for protection of EITE industries are intensity standards. Instead of being subjected to emission pricing, EITE industries could adopt intensity standards to reduce their emissions as compared to business-as-usual levels. Holland (2012) shows that standards can be viewed as the combination of an input tax and an output subsidy.

As protective measures for EITE industries are predominantly discussed in the context of competitiveness, there is a need for concepts on the definition and measurement of competitiveness at the sector level. The economic literature provides a broad variety of competitiveness concepts (Oberndorfer and Rennings, 2007; Alexeeva-Talebi and Böhringer, 2012). Among indicators to quantify sector-specific competitiveness most common are metrics to measure international trade performance such as relative world trade shares (RWS – see e.g. Balassa, 1962; Ballance et al., 1987; Gorton et al., 2000; Fertö and Hubbard, 2003; Abidin and Loke, 2008) or revealed comparative advantage (RCA – see e.g. Kravis and Lipsey, 1992; Carlin et al., 2001).

The economic impacts of protective measures for EITE industries in unilateral climate policy design have been quantified by numerous simulation studies predominantly based on multi-sectoral multi-regional CGE models. The bulk of these studies investigates border carbon adjustments (e.g., Babiker and Rutherford, 2005; Mattoo et al., 2009; McKibben and Wilcoxen, 2009; Winchester et al., 2010; Böhringer et al., 2010; Dissou and Eyland, 2011) and report impacts on EITE industries mostly in terms of the change in production output. The general finding is that border carbon adjustments attenuate negative output effects for EITE industries in unilaterally regulated countries (see Böhringer et al., 2012a for a meta-analysis), while, providing only limited gains in global cost-effectiveness of unilateral action and enhancing negative terms-of-trade spillover effects to countries without emission regulation. Output-based allocation or preferential emission pricing for EITE sectors can also help to dampen adverse output effects (Fischer and Fox, 2012).

To date, there are only a few studies which cross-compare alternative protective measures: Böhringer et al. (2014b) show that – as the coalition of unilaterally abating countries increases – border carbon adjustments are consistently more effective than output-based rebates in mitigating relocation of EITE output; Böhringer et al. (2012b) extend the comparison to include also tax exemptions for EITE industries; in the case of unilateral action by the EU they find that the negative repercussions on domestic EITE production can be reduced substantially for border carbon adjustments whereas tax exemptions and output-based rebates can only achieve a fraction of this alleviation.

This paper sheds further light on the relative performance of alternative policy measures to protect competitiveness of EITE industries by including standards and focusing on US EITE industries. In our cross-comparison, we deliberately drop border carbon adjustments since their appeal for practical climate policy is limited given international trade law and the consensus agreement of Paris; instead, we include standards on emissions or energy as a potentially attractive measure beyond output-based rebates or tax exemptions. Furthermore, we quantify sector-specific impacts in terms of common competitiveness metrics such as RWS and RCA. Our simulation analysis for US climate policy design provides insights on how protective measures for US EITE industries trade-off with other policy objective such as minimizing economy-wide adjustment cost to national GHG emission targets.

3. Stylized theoretical analysis

We modify a simple partial equilibrium setting (Böhringer et al., 2014b) to show that protective measures improve competitiveness of domestic industries in international trade (as compared to uniform emission pricing stand-alone). While our stylized theoretical analysis illustrates fundamental cause-effect chains, it neglects potentially important market interaction and income effects and thus must be complemented with more comprehensive computable general equilibrium analysis as provided in Section 4 to draw viable policy conclusions.

Consider two countries (regions) which differ only with respect to potential regulatory action: country M with emission regulation and country N without emission regulation. Demand q_{ik} in country i for the good produced in country k exhibits constant elasticities with respect to prices. We measure competitiveness as the ratio of exports over imports in the regulated region M where export demand and import supply can be stated as:

$$ExportsofregionM: q_{NM} = a p_{NM}^{-\eta_0} p_{NN}^{\eta_x}$$
$$ImportsofregionM: q_{MN} = a p_{MN}^{-\eta_0} p_{MM}^{\eta_x}$$

with:

- a denoting benchmark quantities (as initial prices are normalized to unity),
- η_o referring to the own-price elasticity, and
- η_x referring to the cross-price elasticity.

As both economies are symmetric, a competitiveness loss will occur when a policy regulation involves lower exports than imports. We thus measure competitiveness φ as the ratio of exports over imports in the regulated country: