Resource and Energy Economics 34 (2012) 624–646

Contents lists available at SciVerse ScienceDirect

Resource and Energy Economics

journal homepage: www.elsevier.com/locate/ree

Do technology externalities justify restrictions on emission permit trading?☆

Enrica De Cian*, Massimo Tavoni

Fondazione Eni Enrico Mattei and Centro Euro-Mediterraneo per i Cambiamenti Climatici (CMCC), Italy

A R T I C L E I N F O

Article history:
Received 27 February 2010
Received in revised form 29 May 2012
Accepted 31 May 2012
Available online 15 June 2012

JEL classification:
Q54
Q55
Q43
H23

Keywords:
Energy-economy modelling
Emission trading
Technology spillovers

A B S T R A C T

International emission trading is an important flexibility mechanism, but its use has been often restricted on the ground that access to international carbon credits can undermine the domestic abatement effort reducing the incentive to innovate and, eventually, lowering the pace of climate policy-induced technological change. This paper examines the economics that is behind these concerns by studying how a cap to the trade of carbon offsets influences innovation, technological change, and welfare. By using a standard game of abatement and R&D, we investigate the main mechanisms that shape these relationships. We also use a numerical integrated assessment model that features environmental and technology externalities to quantify how limits to the volume, the timing, and the regional allocation of carbon offsets affect climate policy costs and the incentive to invest in innovation and low-carbon technologies.

Results indicate that, for moderate caps on the amount tradable emissions permits and sufficiently high technology spillovers, global innovation and technical change would increase and that this additional innovative effort could lead to economic efficiency gains. The numerical analysis confirms that when constraints are close

☆ This paper is part of the research carried out by the Sustainable Development Programme of Fondazione Enrico Mattei. Financial contribution from the PLANETS project funded by the European Commission under the 7th framework programme is gratefully acknowledged. The usual disclaimer applies.
We would like to especially thank Prof. Sjak Smulders for the many comments and suggestions which have helped to considerably improve this manuscript.

* Corresponding author at: Fondazione Eni Enrico Mattei, Isola di San Giorgio Maggiore, 30124 Venice, Italy. Tel.: +39 041 2700450; fax: +39 041 2700413.
E-mail address: enrica.decian@feem.it (E. De Cian).

http://dx.doi.org/10.1016/j.reseneeco.2012.05.009

to 15% of domestic abatement, efficiency losses are small because they are partly compensated by more technological spillovers and lower energy prices. Under a broad range of parameters, restrictions are costly for the constrained countries, but always beneficial for unconstrained ones.

1. Introduction

Since the Kyoto Protocol, the international trade of carbon allowances and credits has been a fundamental element to ensure flexibility and cost efficiency of climate change policies. International emission trading has the potential to reduce compliance costs because it allows exploiting low cost emission reduction options no matter where they are located. Regional and sub-regional carbon market initiatives, either regulated or voluntary, have emerged, especially in developed countries.[1] The exchange of carbon allowances and credits, especially at the international level, has also raised some concerns. If not well-designed, cap-and-trade schemes might undermine the environmental effectiveness of climate policies, reduce innovation incentives, and ultimately hinder the deployment of clean technologies. As a matter of fact, the lack of agreement on the implementation procedures of the Kyoto flexible mechanisms was the cause of the failure of the negotiations in the Hague in 2000. In 2004, the EU linking directive established the possibility to use the Kyoto credits in the EU-ETS without any limit. During the second Phase of emission trading, the EU Commissions introduced quantitative and qualitative restrictions on the use of these offsets[2] (de Sépibus, 2008). This revision was meant to avoid a price collapse, as observed during the first Phase. Another argument was that emission trading could reduce the incentive to innovate (Hourcade et al., 1999).

When facing the choice between innovate or purchase carbon credits, a polluting country would select the cheapest option (Driesen, 2003). If permits are cheaper compared to the cost of investing in mitigation options at Home, the possibility of trading creates an incentive to shift abatement abroad, reducing total compliance costs, but also lowering the incentive to carry out innovation. Considering these arguments, most cap-and-trade schemes include ceilings on the use of international carbon offsets. If limits to purchase credits are not large, economic losses might be modest and therefore it may be worthwhile on economic grounds to use them (Karp and Zhao, 2009). These limits could avoid huge financial transfers, make the agreement more appealing for industrialised countries, and stimulate innovation.

The argument in favour of ceilings might be reinforced in a second-best world. Unrestricted emission trading always generates efficiency gains in a first-best world when the only distortion is global pollution (see for example Weyant and Hill, 1999; Bohm, 1999; Chander et al., 2002; Richels et al., 2007). However, in a second-best world addressing only one of the various market distortions will not necessarily improve welfare (Lipsey and Lancaster, 1956). Environmental economics suggests that multiple policy instruments should be employed (Jaffe et al., 2003, 2005; Bennear and Stavins, 2007). In practice, however, designing several instruments can be complicated, and despite the various forms of regulation used today, a market-based solution aimed at pricing CO_2 is widely regarded (at least among economists) as the most efficient solution for the case of global warming.

The economic efficiency of emission trading in the presence of various externalities has been analysed mostly using simple analytical models. However, hardly any numerical evaluation has considered second-best interactions with technology externalities. Most second-best quantitative assessments have explore the role of pre-existing distortionary taxes (Babiker et al., 2004; Paltsev et al., 2007; McKibbin et al., 1999). Only Buonanno et al. (2000) assess the pros and cons of introducing ceilings to emission trading in a model with endogenous technical change (ETC-RICE). They find little support for

[1] For a review of cap-and-trade schemes around the world see Capoor and Ambrosi (2009).

[2] In the paper we do not distinguish between trade in carbon credits and allowances, which for the purpose of our analysis are equivalent. When using the term offsets, we refer to both of them.