European Economic Review 99 (2017) 77–92

Contents lists available at ScienceDirect

European Economic Review

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

Buy coal and act strategically on the fuel market☆

Thomas Eichner[a,*], Rüdiger Pethig[b]

[a] Department of Economics, University of Hagen, Universittsstr. 41, 58097 Hagen, Germany
[b] Department of Economics, University of Siegen, Unteres Schloss 3, 57072 Siegen, Germany

ARTICLE INFO

Article history:
Received 1 June 2016
Accepted 4 April 2017
Available online 21 April 2017

JEL Classification:
Q31
Q38
Q55

Keywords:
Climate coalition
Fossil fuel
Deposits
Extraction
Fuel caps

ABSTRACT

A coalition of given size fights climate change by a policy of purchasing fossil fuel deposits, and it seeks to manipulate the fuel price in its favor. Assuming that non-signatories are price takers in the fuel market, Harstad (2012) designs a policy of trading deposits that attains efficiency despite the coalition's option to act strategically in the fuel market. The deposit transactions constituting that policy include the trade of deposits which the non-signatories would have exploited and the coalition will exploit. The present paper shows that in a proper subset of economies a simpler policy is (also) efficient that consists of deposit purchases for preservation only. In these economies the coalition is unable to raise its welfare above the level in the benchmark case of fuel price taking. In the economies, where the efficient policy requires deposit transactions for exploitation, the coalition is better off and the non-signatories are worse off than in case of price taking.

1. Introduction

During the last decades, scientific evidence has accumulated on severe negative climate externalities generated by greenhouse gas emissions, notably carbon emissions. Since the Rio de Janeiro summit of 1992, little progress has been made in international climate negotiations towards an effective international climate agreement. That gives rise to the questions of what the chances are of a sub-global climate coalition to reduce carbon emissions efficiently and which policy instruments are most effective. Climate policies in practice as well as the bulk of extant theoretical mitigation literature focus on demand-side instruments. If they are unilateral, such policies cause carbon leakage that curbs the net effectiveness of emissions reductions and leads to excessive global emissions. The inefficiency aggravates, if countries set their climate policies strategically by manipulating the terms of trade (e.g. Copeland, 1996; Hoel, 1994; Markusen, 1975).[1] Supply-side mitigation policies are much less analyzed. This paper aims to contribute to the small literature on sub-global supply-side climate policies.

☆ Financial support from the German Science foundation (DFG grant numbers EI 847/1-2 and PE 212/9-2) is gratefully acknowledged. Thanks also to three anonymous referees for helpful comments. Remaining errors are the authors' sole responsibility.

* Corresponding author.
E-mail address: thomas.eichner@fernuni-hagen.de (T. Eichner).

[1] Environmental demand-side policy is inefficient not only if implemented by a sub-global coalition, but also if implemented by non-cooperative individual countries (Copeland and Taylor, 1995; Kiyono and Ishikawa, 2013; Ludema and Wooton, 1994) or by signatories of a self-enforcing environmental agreement (Barrett, 1994; Eichner and Pethig, 2013; Rubio and Ulph, 2006).

http://dx.doi.org/10.1016/j.euroecorev.2017.04.001
0014-2921/

Specifically, we consider a coalition suffering from climate damage caused by burning fossil energy, denoted fuel for short. There is an international market for trading (the right to exploit or preserve) fuel deposits and an international market for fuel. The coalition seeks to internalize the climate damage by purchasing some of the non-signatories' deposits for the purpose to prevent their exploitation. This kind of climate policy follows the pollutee-pays principle. It is efficient, if all market participants refrain from exerting market power. However, the efficiency implications are less straightforward under Harstad's (2012) assumptions that the deposit prices are subject to bilateral bargaining, that the deposit market clears prior to the fuel market, and that the coalition has the option to manipulate the fuel price via the choice of its fuel demand and supply. Our paper adopts this framework and complements Harstad's investigation of trade in deposits as an efficient instrument of unilateral climate policy. We focus on the pattern of deposit transactions required by such a policy and on its impact on the distribution of welfare among the coalition and the non-signatories.

To our knowledge, Bohm (1993) is the first who investigates analytically that kind of deposit preservation policy. He shows that a special policy mix of deposit purchases and a fuel-demand cap implements an emissions cap at lower costs than the stand-alone fuel-demand-cap policy. Asheim (2013) makes the case for deposit purchase policies as a distributional instrument in a growth model. Harstad (2012) follows Hoel (1994) in considering a sub-global climate coalition that sets its fuel demand and fuel supply strategically. He extends Hoel's (1994) setup by a more elaborate international deposit market and a sequential structure of the game and finds that trade in deposits may fully internalize the climate externalities despite the coalition's option to act strategically in the fuel market. Eichner and Pethig (2017) apply Harstad's analytical framework but they replace his deposit market of bilateral deals by a market with uniform per-unit price of deposits. They demonstrate that Harstad's efficiency result depends on the unconventional structure of *his* deposit market by showing that the outcome is inefficient, if the coalition acts strategically in *their* deposit market and in the fuel market.

The present paper relates to Harstad (2012) even closer than Eichner and Pethig (2017), because it takes up his analytical framework including the deposit market concept, and it seeks to assess the potential, implications, and limits of Harstad's policy proposal. His deposit market consists of a set of bilateral trades at prices that may differ between each pair of traders and the "... market clears when there exists no pair of countries that would both strictly benefit from trading some of their deposits at some price" (Harstad, 2012, p. 92).[2] Our focus is on that version of Harstad (2012) Theorem 1, which presupposes that all non-signatories are price takers on the fuel market while the coalition has the option to choose the fuel demand and supply strategically.[3] His theorem states that if the deposit market is in equilibrium, the coalition implements the first best.[4] That theorem is remarkable, because when terms-of-trade manipulations are added to climate externalities, one would expect an inefficient outcome, as is shown, e.g., by Copeland and Taylor (1995) or Kiyono and Ishikawa (2013). One would also expect that the deposit transactions, which constitute Harstad's efficient policy, exclusively relate to deposits the coalition buys to prevent their exploitation. Surprisingly, in all but exceptional cases[5] the deposit transactions constituting Harstad's policy include certain deposits which the seller would have exploited and the buyer will exploit. For convenience, we refer to that policy as *extended deposit policy*. Its puzzling requirement of deposit transactions for exploitation in addition to deposit purchases for preservation calls for closer inspection.

To get insights into that puzzle we will deviate from Harstad (2012) policy design by investigate the outcome of the game under the assumption that the coalition implements what appears to be the natural 'internalization policy', namely the purchase of deposits for preservation only. We refer to that policy as *deposit preservation policy*. Surprisingly, we identify a significant proper subset of economies beyond the set of exceptional cases referred to above, in which the deposit preservation policy is efficient. That is, the extended deposit policy (in Harstad, 2012) is sufficient for attaining efficiency in all economies, but it is not necessary in a non-trivial subset of economies. Harstad (2012) failed to realize that in some non-trivial subset of economies the coalition has at its disposal a policy that is efficient without involving deposit transactions for exploitation. Another significant difference relates to the distribution of welfare among the coalition and the non-signatories. We show that if the deposit preservation policy is efficient, the welfares of all countries are as in the efficient Coaseian benchmark case, in which the coalition and the non-signatories take the fuel price as given. In these economies the coalition is not able to enhance welfare through strategic action in the fuel market. In all other economies, the extended deposit policy makes the coalition better off and the non-signatories worse off than in the benchmark case.

The paper is organized as follows. Section 2 briefly presents the model and characterizes the social optimum with deposit trading. The main Section 3 takes up Harstad's sequential structure of the game, but analyzes the deposit preservation policy and concludes, as indicated above, that this policy is efficient under certain meaningful conditions. Section 4 focuses on the modifications of the analysis of Section 3 that are necessary to replace the deposit preservation policy with the extended deposit policy. We show that in the latter policy the deposit transactions for exploitation serve the role to offset exactly the terms-of-trade effect of the coalition's fuel price manipulation (rather than, as Harstad (2012) argues, to eliminate fuel exports and imports in all countries). Section 4 also investigates the distribution of welfares among the coalition and the non-signatories. Section 5 concludes.

[2] "The absence of mutually advantageous bargains is precisely what one means by efficiency" (Usher, 1998, p. 9).

[3] Harstad (2012) derives efficiency results under different sets of assumptions. Here, we restrict our attention to the case of price-taking non-signatories, which Harstad (2012, p. 103n.) briefly discusses in his section on extensions.

[4] That result crucially hinges on his assumption that the non-signatories do not suffer from climate damage. To secure comparability, we stick to this assumption throughout this paper.

[5] Exceptional cases are those where the fuel market clears without exports and imports.