

Incentives and prices in an emissions trading scheme with updating

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Received 9 February 2007

Available online 25 March 2008

Abstract

Emissions trading schemes where allocations are based on updated baseline emissions give firms less incentive to reduce emissions for a given quota (or allowance) price. Nevertheless, according to Böhringer and Lange [On the design of optimal grandfathering schemes for emission allowances, *Europ. Econ. Rev.* 49 (2005) 2041–2055], such allocation schemes are cost-effective if the system is closed and allocation rules are identical across firms. In this paper, we show that the cost-effective solution may be infeasible if marginal abatement costs grow too fast. Moreover, if a price cap or banking/borrowing is introduced, the abatement profile is no longer the same as in the case with an auction (or lump-sum allocation). In addition, we show that with allocation based on updated emissions, the quota price will always exceed marginal abatement costs, possibly misleading policy makers and investors about abatement costs. Numerical simulations indicate that the quota price most likely will be several times higher than marginal abatement costs, unless a significant share of allowances is auctioned.

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JEL classification: H21; Q28

Keywords: Emissions trading; Allocation of quotas; Quota prices

1. Introduction

A competitive emissions trading market is a cost-effective way of reducing emissions, as long as emissions allowances or quotas are either auctioned or distributed in a lump-sum manner.¹ This well-known result dates back to the 1970s [19]. The design of real-world emissions trading schemes shows, however, that few allowances are auctioned. Moreover, it is difficult to allocate allowances in a lump-sum manner over a longer time horizon without creating perverse distributional effects. Thus, other allocation mechanisms are introduced. Within the EU Emissions Trading Scheme (EU ETS) (cf., [10,11,25]) allocation for the first two periods (2005–2007 and 2008–2012) is mostly based on recent historic emissions levels, but special rules apply

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¹One example of lump-sum allocation is (pure) grandfathering, where allocations in all periods are entirely based on historic emissions before the system is initiated, and where allocations are independent of, for example, firms' closure or new entrants.

for, for example, new entrants and firms' closure. The allocation rules for future periods are not determined yet, and are open to speculation. The SO₂ trading program in the US has mostly lump-sum allocation based on grandfathering, but it also includes allocation rules that have created "an additional set of incentives" [8].

The prime motive for avoiding auctioning or lump-sum allocation is to prevent a deterioration of competitiveness relative to polluters outside the trading system. In the very recent economic literature, there has been some analysis (and discussion) of different kinds of allocation rules. Following Sterner and Muller [24] it is useful to distinguish between "current allocation" and allocation based on "updating". With current allocation, allowances are distributed based on a measure of activity in the current period, where the measure of activity may be the level of output (production), input or even emissions. With updating, allowances are distributed based on activity/emissions in a recent base year, which is continually updated. It is evident that, with either current allocation or updating, firms can influence the number of allowances they receive (either today or in the future), and so the conditions for the above-mentioned result on cost-effectiveness are no longer present.²

Nevertheless, a closed emissions trading system with updated allocation based on emissions is actually cost-effective [4]. Even though firms take into account the effect of current emissions upon future allowances, all firms face the same rule. Thus, with a fixed total emissions level and equal expectations about the future allowance or quota price, the current price is bid up and all firms adjust abatement until marginal abatement costs (MAC) equal the current quota price *minus* expected benefits from future allowances. In contrast, in an open system, for example, the EU ETS linked to external allowances like the Clean Development Mechanism (CDM), updating based on emissions is no longer cost-effective. Moreover, an updating system based on output levels cannot be cost-effective in either an open or closed system [4].

Ahman et al. [1] propose a 10-year updating rule, where allowances are proportional to activity levels 10 years ago. They claim that a 10-year lag would significantly weaken the unwanted effects of future allocation on current behavior, because of discounting of the value of future allowances. Keats Martinez and Neuhoff [16] argue that updating based on emissions can distort the allowance price, which would lead to inefficiencies, if different sectors or regions are faced with different allocation rules or discount rates. A simple two-period example is used to demonstrate this claim. They also derive an expression for the quota price in the case with constant emissions target and abatement costs. Burtraw et al. [6,7] present simulation results of different allocation rules for a regional emissions trading market for electricity producers in nine states of the US. They find the quota price to be about twice as high with updating based on production levels (two years ago) compared with auctioning or grandfathering. The social costs of this system (measured as the change in economic surplus in the electricity market) are three times higher than with the two alternative systems (see also [21]). Harstad and Eskeland [14] analyze a model where the government aims to distribute more allowances to high-cost firms, and where firms signal high costs by purchasing large amounts of allowances. They conclude that prohibiting trade in allowances may be preferable under certain conditions.

Few papers have analyzed the dynamic effects on emissions trading markets of implementing allocation rules based on updating.³ This paper provides a deeper examination of the dynamic effects of an allocation scheme based on updated emissions levels, within a closed emissions trading system.⁴ We point to several factors that may alter the conclusion that such a system is cost-effective. First, we show that the quota price may become infinitely large, rendering the cost-effective solution infeasible, if the MAC grow too fast. Second, an overallocation of quotas will increase emissions beyond its business-as-usual level. Third, introducing a (binding) price cap is shown to give less abatement in such a system compared with a system with, for example, auctioning. Fourth, if the system allows banking and borrowing, the system is no longer dynamically cost-effective if allocation is based on updated emissions levels. Too much abatement is delayed until later periods.

²Note that cost-effectiveness in the emissions trading market is a necessary, but not sufficient, condition for cost-effectiveness in the product market, which is a necessary, but not sufficient, condition for overall efficiency in the general equilibrium. In this paper, the product market is modeled in a very simple way, so that cost-effectiveness in the emissions trading market is equivalent to cost-effectiveness in the product market.

³For analyses based on current allocation, typically within a static framework, see [2,5,12,15,17,18].

⁴Although most existing emissions trading systems are open, our focus is on closed systems. The reason is the appealing result on cost-effectiveness in [4], which only applies to closed systems.

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