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Multi-period emissions trading in the electricity sector—winners and losers

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Abstract

In the context of controlling greenhouse gas emissions, the directive on a Europe-wide trading scheme may be perceived as one of the most important milestones in recent years. Prior to its start, however, a number of very specific design features have to be agreed upon. Regarding the allocation of allowances, a distribution (almost) free of charge seems to be the most likely choice. An aspect that has interestingly attracted little attention in the past is the question of how to allocate emission rights over time. The following paper analyses different allocation options in multi-period emissions trading that are currently discussed in the European context. The options are applied for the electricity sector which is simulated over two periods. The paper distinguishes between a market effect of emissions trading and compliance costs for meeting the emission reduction obligation. The market effect results from a price increase which is due to the fact that opportunity costs for using allowances must be considered. It turns out that the electricity sector as a whole gains from the introduction of the instrument due to the increase of the electricity price. With regard to the different allocation options, it is found that utilities have different preferences depending on the fuel used.

Keywords: Allocation of GHG allowances; Electricity sector; Multi-period emission trading

1. Introduction

In the context of environmental regulation emissions trading has gained acceptance and support in the past (Stavins, 2003). With regard to the fight against global warming, tradable greenhouse gas (GHG) emission entitlements have first been introduced on state level in the Kyoto-Protocol in 1997. Subsequently, it was implemented on entity level in the UK and Denmark. The most important example, however, may be the directive on a Europe-wide emissions trading scheme adopted in 2003 (EU, 2003). According this directive certain installations, i.e. major immobile sources of GHGs, are obliged to participate in a cap and trade scheme from January 1, 2005. The allocation of emission Entitlements, in the European context called allowances, is perceived as a very important issue from the companies' point of view. Two main approaches have been focussed on during the discussion between governments and participants, namely an allocation based on emissions in a reference year and the use of an emission benchmark (PWC, 2003). With both options allowances are distributed free of charge. Interestingly, the question on how to design the allocation over time, i.e. in subsequent periods, has only attracted little attention. The impact of different alternative allocation options on the single installations has only rarely been addressed so far (for example, Burtraw et al., 2001, 2002). Apart from that, existing literature, which is briefly reviewed below, generally either concentrates on the sector level or provides a pure analytical discussion. During the negotiations of the national allocation plans within the EU Member States this issue has either been overlooked or has not been discussed in public so far. Nevertheless, this question has to be answered in some way—possibly without knowing the exact implications.

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Against this background this article deals with the analysis of the impact of different allocation options on installations in the electricity sector. Electricity generation has been chosen as it is a major source of GHG emissions in Europe and plays an important role in the planned trading scheme. The focus is on the relative impacts of the allocation on different power generation technologies rather than on absolute effects of the allocation on this sector compared to other sectors covered by a trading scheme. It thus addresses equity issues within the electricity sector and does not discuss efficiency aspects.

The analysis is based on a simulation of an artificial but realistic electricity market. As the focus is on the impacts of the allocation, only a few technical issues are considered. Transmission losses, for example, are fully neglected. The analysis is limited to a short-term perspective only. On the one hand, this is due to the fact that politically a short-term perspective is likely to influence current legislation the most. On the other hand the path for auctioning the allowances is already slightly paved in the European scheme. With a 100% auctioning, however, the problems discussed below, do not exist anymore.[1]

The paper first discusses the impact of emissions trading on firms from a theoretical perspective. Section 3 reviews different options for allocation allowances free of charge. Multi-period emissions trading in the electricity sector is analysed in detail in Section 4. Section 5 concludes.

2. Emission trading and its impact on firms

Emission trading is a market based instrument that allows a cost-efficient achievement of an emission target through the equalisation of marginal abatement cost. Participants in the trading scheme are not prescribed any specific abatement options. The only obligation they face is to surrender as much emission allowances at the end of a period as they released emissions into the atmosphere in this period. Therefore, they can decide whether to abate emissions in-house or to buy allowances[2] on the market. The decision to buy allowances is driven by the question of whether internal marginal abatement costs[3] are lower than the allowance price.

The implementation of an emissions trading schemes requires a number of decisions to be taken with regard to the design, as for example the compliance period, the units traded, monitoring rules, liability etc. (for a more detailed discussion see AGE, 2001; AGO, 1999; Boemare et al., 2002; CCAP, 1999, 2002; WBCSD, 2001, p. 8; UNEP and UNCTAD, 2002). Another important aspect is the allocation of the allowances. Generally, allowances may either be provided free of charge or only be issued to participants for a fee. For trading at the company level, economists have argued in favour of a fee-based allocation or more precisely an auction. Distributing the allowances for free would result in extra revenue for the recipients of the allowances and in reduced efficiency on a macro-economic level (Cramton and Kerr, 2002; FIELD, 2000, p. 31; Speck, 1999; Woerdman, 2000, p. 620). A more detailed analysis follows below. However, it has been argued that this question can only be answered when comparing the concrete design of an auction[4] and a free of charge scheme respectively (for example, Bohm, 2002). Burtraw et al. (2001) compare three different allocation options for the electricity sector in the US and find that the costs to society are about one-half with auctioning compared to the two free of charge options.[5]

On the other hand, emitters ask for an allocation free of charge arguing that the additional financial burden of paying the fees would be too high. They have until now generally succeeded. The directive on GHG trading in the EU prescribes as[6] an allocation almost free of charge [7] and Stavins (2003) reports the same for the relevant non-GHG trading schemes in the US.

The argument of the additional financial costs is, however, only partly true. One also has to look at the other side of the coin. It is reasonable to assume that allowances are scarce, at least at the start of the scheme. Otherwise there would be no reason to introduce the instrument apart from obfuscation of a do-nothing strategy. In this case there will be a price for allowances. Thus, although allowances are allocated for free, their use for production involves an opportunity cost; they could have been sold in the case of non-production. According to cost theory, producers will consequently raise the product prices according to the product's emission intensity and the costs for emitting carbon.

The effect on the market can be studied in comparison to a per unit tax (for general example, see Pashigian,

[1] The price increase and the resulting additional producer rents, which are discussed below, would persist. With a 100% auctioning, no rule for allocating the allowances (and thus the scarce resource) would be required. The scarcity rent would be collected by the government as in the case of a CO_2 tax.

[2] The term emission right and allowance are used interchangeably.

[3] Costs resulting from in-house abatement are referred as abatement costs in this paper. Compliance costs by contrast are the sum of abatement costs and expenses from buying or selling allowances on the market.

[4] For example, "How is the revenue from the auction recycled?".

[5] The authors use the revenue from the auction in the least efficient way discussed in literature, namely the direct redistribution to households.

[6] For their position during the legislation process see, COM (2001, p. 2).

[7] More precisely: at least 95% of allowances have to be allocated free of charge for the initial period 2005–2008 and at least 90% for the subsequent period (EU, 2003).