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# Endogenous market power in an emissions trading scheme with auctioning<sup>☆</sup>

Corina Haita<sup>\*</sup>

Economics Department, University of Hamburg, Von-Melle-Park 5, D-20146 Hamburg, Germany

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## ABSTRACT

This paper contributes to the literature on market power in emissions permits markets, modeling an emissions trading scheme in which polluters differ with respect to their marginal abatement costs at the business-as-usual emissions. The polluters play a two-stage static complete information game in which their market power arises endogenously from their characteristics. In the first stage all polluters bid in an auction for the distribution of the fixed supply of permits issued by the regulator, and in the second stage they trade these permits in a secondary market. For compliance, they can also engage in abatement activity at a quadratic cost. Under the assumptions of the model, in equilibrium all polluters are successful in the auction. In the secondary market the low-cost emitters are net sellers and the high-cost emitters are net buyers. Moreover, the high-cost emitters are worse off as a result of the strategic behavior. In addition, the secondary market price is unambiguously above the auction clearing price. I find that the aggregate compliance cost when polluters act strategically increases in the heterogeneity of their marginal abatement costs at the business-as-usual emissions, but there exists a threshold of the fixed supply of permits above which strategic behavior is compliance cost-saving for the polluters. Finally, for a low enough variance of the marginal abatement cost at the business-as-usual emissions, strategic behavior is compliance cost-saving for the polluters, regardless of the level of the available supply of permits.

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<sup>\*</sup> Tel.: +49 (0)40 42838 8049.

E-mail address: [corina.haita@wiso.uni-hamburg.de](mailto:corina.haita@wiso.uni-hamburg.de)

## 1. Introduction

During the last decades emissions trading schemes (ETS) have increased in popularity as policy tools for emissions reductions. Moreover, large ETSs like the European ETS (EU ETS) or the California ETS have commenced to implement auctioning as the method of initial allocation of permits. The main argument for implementing an ETS is the minimization of the social total cost of meeting the constraint on the total emissions target. Therefore, it is important to understand the nature of these markets, in particular when their functioning deviates from delivering the efficient outcome due to, for example, the exercise of market power. Such concerns have been raised in the literature both with regard to the trading of the permits in the secondary market and to the auction for the initial allocation of these permits. For example, in a paper assessing the effectiveness of the UK ETS, [Smith and Swierzbinski \(2007\)](#) put forth the possibility of the exercise of market power as an explanation for the substantial difference between the auction clearing price and the market price of the emissions permits when these are traded in a secondary market. Indeed, using a stylized model of a monopoly (a group of firms which coordinate their actions in the auction) with a competitive fringe, they are able to reproduce the market price of a permit in the first year of the scheme following the auction.

In addition, in relation to the EU ETS, [Ellerman et al. \(2010\)](#) pointed out that, although the scheme covers more than 11,000 installations, many of them are owned by the same firm. Hence, it is conceivable that they act as one firm in the emissions markets. This thesis is also supported by the empirical analysis conducted by [Trotignon and Delbosc \(2008\)](#) using CITL data and information on installation ownership. They found that, during Phase 1 of the EU ETS, 50% of the potential supply of permits was concentrated in the hands of 30 companies, while 50% of the potential demand was represented by 10 companies. Moreover, using CITL data, [Schleicher \(2012\)](#) shows the uneven distribution of the emissions across the EU ETS entities: 84% of the installations in the EU ETS accounted for only 10% of the emissions generated within the scheme in 2011, which indicates a relatively concentrated market. Evidence of thin markets has also been observed at the initial allocation stage. During the first half of 2013, the number of bidders for the spot auction of the EU ETS was never larger than 20.<sup>1</sup> This is surprisingly low participation in the primary auction compared to the total number of the installations regulated by the EU. Similarly, in the first four advanced auctions of California ETS for the sales of 2015 and 2016 vintage allowances, the Herfindahl–Hirschman Index was between 1198 and 3159. This signals conditions for a concentrated primary market.

The above-mentioned anecdotal evidence of price manipulations in emissions markets, as well as the increasing popularity of auctioning as the method of initial allocation, both geographically and within a scheme<sup>2</sup> point to the importance of understanding the effects of market power, particularly when there is an interaction between the primary and the secondary market for permits. Furthermore, since the latter interaction has not been thus far addressed in the theoretical literature on market power in emissions markets, this paper aims at the theoretical understanding of the consequences of the exercise of market power in an ETS in which polluters<sup>3</sup> act strategically both in the auction, where permits are initially distributed, and in the secondary market, where the polluters trade the permits among themselves. Precisely, I model the initial allocation stage as a sealed-bid uniform price auction in which the participants simultaneously and independently submit bidding schedules to the regulatory agency who issues the permits. The latter clears the auction by equating the aggregate demand with the fixed supply of permits and distributes the permits to the polluters according to their bids and the market clearing price. Subsequently, the emitters trade their permit endowments in a secondary market. Hence, in this two-stage static complete information model of emissions trading the initial allocation is endogenous. Therefore, putting together the auction with the secondary market,

<sup>1</sup> The results of the auctions are published on the European Energy Exchange platform ([www.eex.com](http://www.eex.com)), which is the common auction platform chosen by the European Commission for auctioning the EU ETS allowances.

<sup>2</sup> For example, the EU ETS has implemented auctioning as the main allocation method from 2013 and the percent of permits allocated via an auction should reach 100% by 2020.

<sup>3</sup> The term “polluters” will be used interchangeably with the term “emitters” to denote the members of the ETS as players of the emissions markets.

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