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Using contests to allocate pollution rights

Ian A. MacKenzie [a,*], Nick Hanley [b], Tatiana Kornienko [c]

[a] Center for Economic Research, ETH Zürich, 8092 Zürich, Switzerland
[b] Department of Economics, University of Stirling, Stirling FK9 4LA, UK
[c] Department of Economics, University of Edinburgh, Edinburgh EH8 9JY, UK

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ABSTRACT

In this paper we advocate a new initial allocation mechanism for a tradable pollution permit market. We outline a Permit Allocation Contest (PAC) that distributes permits to firms based on their rank relative to other firms. This ranking is achieved by ordering firms based on an observable 'external action' where the external action is an activity or characteristic of the firm that is independent of their choice of emissions in the tradable permit market. We argue that this mechanism has a number of benefits over auctioning and grandfathering. Using this mechanism efficiently distributes permits, allows for the attainment of a secondary policy objective and has the potential to be more politically appealing than existing alternatives.

1. Introduction

The key feature of tradable permit markets is that, in theory, they allow society to achieve a given reduction in pollution at the lowest costs to the economy. Under ideal conditions, how permits are initially allocated amongst polluting firms will not alter this cost-efficiency property. This has led many to view decisions over how to initially allocate permits as being mainly decisions about fairness or political expediency, rather than efficiency. Yet the process of initial allocation has been shown to be important for cost efficiency when the assumptions of a competitive market are relaxed (Hahn, 1984; Stavins, 1995). Further, from a public good perspective, Eyckmans et al. (1993) and Chichilnisky and Heal (1994) have shown that Pareto efficiency requires countries' marginal costs, weighted by their marginal utility of income, to be equalised. This suggests that only a certain number of initial permit allocations can produce Pareto efficient outcomes (Chichilnisky et al., 2000). This debate takes on much greater relevance given the current expansion of tradable permit schemes world-wide, such as phase two of the European Union's Emission Trading Scheme (EU-ETS), and the Regional Greenhouse Gas Initiative and Western Climate Initiative schemes in the US.

The two alternatives for the initial allocation of permits that have been most considered in the literature are grandfathering (a free allocation of permits based on historical emissions or outputs), and auctioning (Goulder, 1995; Parry, 1995; Parry et al., 1999; Cramton and Kerr, 2002; Requate, 2005). Grandfathering occurs when the regulator freely allocates allowances to each firm based on their historical emissions (or perhaps output or some other proxy). Although a popular and frequently used mechanism, grandfathering is far from an ideal allocation mechanism as it is often viewed as politically cumbersome and inefficient (Stavins, 1998; Cramton and Kerr, 2002). Firms may have an incentive to lobby the regulator in favour of larger permit allocations that, due to the wasteful use of resources in rent seeking, may reduce social welfare in the economy.

The main alternative to grandfathering is generally considered to be auctioning. In an auction, permits are allocated to each firm based on their monetary bid relative to that of every other firm (Lyon, 1982; Hahn and Noll, 1982; Oehmke, 1987; Franciosi et al., 1993; Cramton and Kerr, 2002). Auctions are often considered to be a 'lump-sum' allocation mechanism as permits are distributed to each firm independent of their historical emissions. Due to this characteristic, auctioning is viewed as a desirable and efficient method of allocating permits. However, the main drawback, and as a result, the main reason for the infrequent use of auctions is the political difficulty in implementing such a mechanism. As the winners in the auction are obliged to pay for their permits, firms' resistance against implementing auctions has been a severe restriction on the implementation of such schemes. The financial burden of pollution control to firms under an auction may be as great as under an emissions tax (Hanley et al., 2007).[1] It is possible to reduce firms' resistance to auctions by redistributing permit auction revenues to the participants (a revenue-neutral auction

[1] Auctioning, however, is slowly becoming an increasingly important and favoured initial allocation mechanism in existing tradeable permit markets, such as the US SO_2 'Acid Rain' Program and the European Union Emissions Trading Scheme (EU-ETS).

* Corresponding author. Tel.: +41 44 632 24 27; fax: +41 44 632 13 62.
E-mail address: imackenzie@ethz.ch (I.A. MacKenzie).

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Hahn and Noll, 1982) or by reducing distortionary taxes elsewhere in the economy (the revenue recycling effect Parry, 1995; Parry et al., 1999). However, such schemes are very rarely implemented in practice, and may therefore attract little credibility with lobbyists when auction schemes are proposed (Goulder, 1995; Pezzy and Park, 1998).

With problems associated with both grandfathering and auctioning it is therefore desirable to try and find alternative mechanisms for the initial allocation of tradable permits. In fact, the literature has rarely considered the use of alternative allocation mechanisms beyond grandfathering and auctions. The aim of this paper is to broaden the discussion by outlining an alternative allocation mechanism that may be preferred to grandfathering and auctions.

Our proposed alternative mechanism, a Permit Allocation Contest (PAC), distributes permits to firms based on their rank relative to each other. The ranking is achieved by ordering firms based on an observable 'external action' where this external action is an activity or characteristic of the firm that is independent of their choice of emissions in the tradable permit market. Obtaining a higher ranking is costly to firms. This ranking criterion is selected by the regulator who chooses this to meet a secondary policy objective. We argue that this mechanism has a number of additional benefits over traditional allocation schemes. Similar to auctions, a PAC will efficiently allocate permits in the tradable permit market. However, it can simultaneously achieve a secondary policy objective, such as a reduction in noise pollution or improvement in corporate social responsibility targets. Given the wide variety of possible ranking criteria and secondary policy objectives available, the PAC may also be easier to implement in the face of intense interest group pressure than an auction. We also find that a PAC avoids some of the problems with grandfathering.

The remainder of our paper is organised as follows: Section 2 introduces the allocation mechanism and Section 3 discusses the possible benefits of implementing such as scheme. Section 4 discusses the regulator's optimal choice of permit distribution in the PAC, while Section 5 illustrates the potential implementation of the mechanism in the European Emissions Trading Scheme. Section 6 concludes.

2. A permit allocation contest

To understand how a Permit Allocation Contest has the potential to work in a tradable permit market, it is beneficial to consider the different possible types of contest that exist. Two main mechanisms exist: rank-order tournaments and rank-order contests. The distinction between the two rests on the relationship between agents' unobservable effort and observable actions. Rank-order tournaments are incentive schemes used in situations where firms' performance is observed with some exogenous noise. That is, in rank-order tournaments, it is generally assumed that each agent experiences a stochastic relationship between their effort and actions. For example, in the control of non-point source pollution, an agent's effort could be in the form of land management changes. The regulator cannot observe these efforts, but instead measures the effects of this effort on water quality. Stochastic processes determine the relationship between the farmer's effort, and the consequent impacts on water quality, making it difficult for the regulator to infer what the farmer has or has not done. When the observation noise is common to all firms, rank-order tournaments typically outperform absolute, or individualistic, schemes (Lazear and Rosen, 1981; Holmström, 1982; Green and Stokey, 1983; Nalebuff and Stiglitz, 1983; Mookherjee, 1984).

When there is no individual-specific noise involved in the observation of firms' actions, one can implement a rank-order contest, which is, in effect, a multi-prize all-pay auction (Glazer and Hassin, 1988; Barut and Kovenock, 1998; Clark and Riis, 1998; Moldovanu and Sela, 2001, 2006). This differs from tournaments as agents in rank-order contest models are generally assumed to have a deterministic relationship between effort and actions. In a rank-order contest, there are a finite number of prizes to be distributed among the participating agents, with the size of each prize known before the onset of the contest. Firms compete in this contest by submitting costly (monetary or non-monetary) "bids". Firms then are ranked in order of their bids, and the "prizes" are distributed to the firms according to firms' rankings. That is, a firm that submits the highest bid is ranked first, and thus gets the largest permit allocation ("first prize"), the firm that submits the second-highest bid is ranked second, and thus gets second-largest allocation ("second prize"), and so on, up to the firm that submits the lowest bid being ranked last, and thus receiving the smallest allocation (possibly nothing). Rank-order contests, like tournaments, tend to outperform alternative types of individualistic and contract-based regulation.

In this paper we discuss the implementation of a rank-order contest. A similar argument can also be applied to rank-order tournaments. Our rank-order contest, the Permit Allocation Contest, attempts to reach a middle ground between grandfathering and auctioning as an initial allocation mechanism. As our model is a type of multi-unit 'all-pay auction' it has many similarities to a standard permit auction. Yet, as the ranking criterion in the PAC can be non-monetary, it can share certain desirable characteristics with a grandfathering mechanism.

2.1. The allocation mechanism

Consider a competitive tradable permit market with n participating firms.[2] Within this market each firm has the option either to purchase permits from the market or to abate pollution. However, each firm must hold enough permits to cover their emissions. The regulator has responsibility of initially allocating permits to the participating firms. Aside from regulating emissions in a tradable permit market, let us assume the regulator also has a secondary (unrelated) objective where the regulator aims to minimise a social 'bad' produced by all firms in the permit market. This secondary objective could relate to the improvement of health and safety incidents, reductions in noise pollution, cuts in other pollutants not related to the permit market, or encouraging corporate social responsibility. Therefore, in our model, the regulator aims to minimise the aggregate social 'bad' (or maximise some social 'benefit') by using incentives in the form of permit allocations (without the need for standard command and control regulation). This turns out to provide an attractive way of allocating permits.

The regulator is assumed to have two non-competing policy objectives. First, the regulator is motivated to choose a schedule of permit allocations to minimise the aggregate abatement cost in the tradable permit market—the standard permit market regulatory objective. Second, the additional objective of the regulator is to provide incentives for the permit market firms to achieve some predetermined public policy target linked to the external actions of firms which we define as the maximisation of expected aggregate external actions. As such, the regulator is not assumed to adopt economic efficiency as its sole criterion: whilst it wishes a cost-effective solution to the pollution control problem that the

[2] For an analytical exposition of a permit allocation contest see MacKenzie et al. (2008a).