Morten G. Søberg

"EPA's New Emissions Trading Mechanism: A Laboratory Evaluation"
– A Comment

Abstract:
In the US tradable SO_2 permit scheme 97.2 per cent of the permits are grandfathered annually to electricity utilities. The remaining 2.8 per cent are withheld and offered for sale at the Environmental Protection Agency (EPA) auction. Also, the electricity utilities may tender permits for sale both at this auction as well as on a complementary permit market. Cason and Plott [3] recommend that the EPA seriously consider reforming the present auction procedure for SO_2 permit trading. They provide experimental evidence of downward biased auction prices that understate the marginal cost of emissions control. Our comparison with available empirical data shows that the complementary market for SO_2 permits disciplines the auction inasmuch as the auction and market prices are not significantly dissimilar. This fact and the extent of conducted permit trade render improbable the assertion that the EPA auction price differs from the true marginal abatement cost. Hence, the policy relevance of the EPA auction's alleged faults may be negligible.

Address: Morten G. Søberg, Statistics Norway, Research Department. E-mail: mgs@ssb.no

Discussion Papers comprises research papers intended for international journals or books. As a preprint a Discussion Paper can be longer and more elaborated than a usual article by including intermediate calculation and background material etc.

1. Background and purpose

The purpose of this note is to discuss the practical relevance of an experiment (Cason and Plott [3]) that tested the auction component of the US tradable SO_2 permit scheme. Permit trading commenced in 1993 and data are now available that facilitate an empirical evaluation of the reported experimental design and predictions (also see Cason [2] and Franciosi *et al.* [5])[1].

The 1990 Clean Air Act Amendments created a market-based approach to reduce US SO_2 emissions by 10 million tons per annum (mta) to 8.9 mta by the year 2000. This is to be achieved by means of tradable permits: given an overall cap on emissions, the individual emissions sources are granted complete flexibility as to how they choose to adhere to the legislation. The binding constraint is for the individual utility to possess permits that cover its annual SO_2 emissions. Permits can be bought both at the US Environmental Protection Agency's (EPA) annual auction and on the complementary continuos permit market.

Since 1993 the Chicago Board of Trade has conducted annual auctions on behalf of the EPA. These enable electricity utilities that do not qualify for grandfathered permits the possibility to purchase rights to emit SO_2. Also, the auction generates price signals that are believed by the EPA to encourage trading[2]. To supply the auction with permits, the EPA withholds 2.8 per cent of the total annual permit allotment. Eighty percent of these are available for auction purposes (the rest being offered for direct sales to power producers at an arbitrarily fixed cost of US$ 1500). Utilities may also tender permits for the sale at the EPA auction.

The EPA auction is a sealed bid, discriminative two-sided auction, *i.e.*, consisting of bids to buy and offers to sell. Submitted bids are ranked from highest to lowest based on price and matched with the submitted offers which have been ordered in an ascending manner[3]. The auction then sells permits on basis of bid price starting with the highest priced bid and continuing until all permits have been sold or the number of bids is exhausted. The EPA offers privately tendered permits upon going short on their own stocks. The auction is revenue neutral insofar as proceeds from permits sales and unsold

---

[1] The empirical data on US trading in SO_2 permits referred to and utilised in this note have been downloaded from the US Environmental Protection Agency's homepage http://www.epa.gov/acidrain/ardhome.html.

[2] An accurate price signal is defined as being indicative of the optimal marginal abatement cost in the industry affected by the tradable permits scheme legislation. Such price signals may contribute to rational planning of abatement by firms and hence a cost-effective distribution of emissions control (Muller and Mestelman [6]).

[3] The EPA may not set a minimum price for the withheld permits mandatorily offered at the EPA auction. Thus, these permits have a zero ask price.

private permits are returned on a *pro rata* basis to those units from which they were originally withheld[4].

2. Experimental design

Cason and Plott [3] evaluated the EPA auction institution relative to the more commonly observed uniform price call auction[5]. In total, 12 sessions were conducted using economics students from the University of Southern California. Eight of the sessions tested the EPA auction rules while four investigated the uniform price call auction. In the EPA auction sessions the successful bids determined the transaction prices, and in the uniform price call auction sessions the midpoint of the market-clearing price interval determined the (uniform) price at which trades occurred.

The EPA auction experiments did not include any mandatory units and focused on SO_2 permits voluntarily offered for sale at the auction. However, as can be observed in table 1, the volume of privately tendered permits is small and has declined steadily. Moreover, sales of privately offered permits represent on average 0.24 per cent of the total number of permits sold at EPA auctions. By confining their focus to privately tendered permits, Cason and Plott appear to analyse but a minuscule part of EPA auction activity.

Table 1. Permits offered and sold at EPA auctions

Year	Number of privately offered permits	Privately offered permits that were sold	Total number of permits sold at the EPA auction	Sales of privately offered permits as per cent of total sales
1993	125,510	10	150,010	0.01
1994	155,001	1,200	176,200	0.68
1995	22,306	1,400	176,400	0.79
1996	22,000	0	275,000	0.00
1997	0	0	300,000	0.00
Total:	324,817	2,610	1,077,610	0.24

Active trading in the permit market commenced spring 1994. Through June 1997 nearly 2.700 transfers moving 10.8 million permits between utilities have taken place in the complementary permit market, ten times the aggregate auction trading volume. This hints at a diminished role for the EPA auction as a price discovery process. Permit market prices convey relatively more information in part

---

[4] Proceeds from the direct sales are returned to the private permit holders in a similar fashion.

[5] In the uniform price call auction the auctioneer aggregates and arrays all bids and asks as revealed demand and supply schedules, and all trades occur at a uniform price where these schedules intersect.

due to the emergence of increasingly sophisticated market transactions such as permit swaps, fuel bundling, and options trading. The effects of this interaction between the SO_2 permit market and the EPA auctions are not discussed in Cason and Plott's paper. This low degree of design correspondence[6] prohibits a realistic discussion of how a co-existing permit market affects the EPA auction's behavioural properties.

3. Experimental predictions

The main conclusion in Cason and Plott's 1996 paper is that the EPA auction rules create strong incentives for both buyers and sellers to under-report their true cost of emissions control. This leads to a downward price[7] bias and the extraction of fewer gains from trade compared to the uniform price call auction[8]. The theoretical rationale is that sellers receive the bid price of a specific buyer, and their asking price determines their trading priority. Since sellers with the lowest asking prices receive the highest bids they have an incentive to submit offers that underrepresent their true cost of emissions control. Bid prices tend to be downward-biased because buyers have an incentive to under-reveal demand in discriminative auctions (Vickrey [7]).

Nevertheless, figure 1 indicates that the interaction between the EPA auction and a complementary permit market is consistent with equal market and EPA auction permit prices[9,10]. Also, the clearing (intersection of permit demand and supply) and average winning prices in the EPA spot auction appear to converge[11].

---

[6] Davis and Holt [4] use this term to indicate "closeness" to natural situations. A high degree of design parallelism is said to obtain when the laboratory setting resembles scale models of the target markets/institutions.

[7] Cason and Plott [3] define the market clearing price as the final transaction price at the margin when the auctioneer intersects the revealed supply and demand arrays.
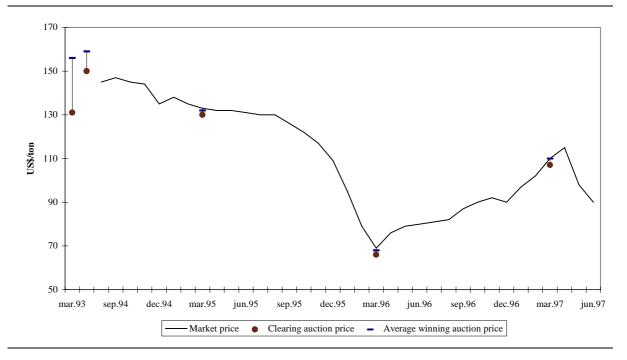
[8] The standard significance levels for the T-statistics reported by Cason and Plott [3] are invalid since the observations are not independent across periods within an experimental session.

[9] A Wilcoxon signed-rank test fails to reject the null hypothesis of no difference between the average winning auction price and the market price recorded the same month as the auction is conducted ($p = 0.25$).

[10] The reported market prices stem from the Cantor Fitzgerald Monthly Price Index (MPI). This index is based in equal parts on the following factors: the average of the highest bids weighted by permit volume (total volume does not exceed 1,500 SO_2 permits), the average of the lowest offers weighted by permit volume (total volume does not exceed 1,500 SO_2 permits), and the weighted average of actual trade prices determined from trades consummated during prior trading period that settle within the following 6 months. The weighted average is based on permit volume, not to exceed a weighting equivalent to 1,500 permits regardless of trade size. Trades below this mark is included on a weighted basis. A trading period, for the purposes of the MPI, is defined as the period beginning the 25th day of the previous month and ending with the 24th day of the month in which the MPI is published.

[11] The range between highest and lowest bid in the EPA auctions decreases over time in a similar fashion.

Figure 1. Auction and market prices[12]

This similarity of prices questions the reliability of Cason and Plott's prediction of a downward biased auction price, that is, the auction price being lower than the market (uniform price call auction) price. However, relatively lower auction prices would create possibilities of arbitrage with traders purchasing permits at the auction and selling them profitably in the permit market. Hence, it seems illogical that a significant price difference could be sustained.

The extent of trading activity in the permit market implies that prices reflect considerable information on marginal costs of emissions control. The observed convergence of auction and market prices consequently renders improbable Cason and Plott's assertion that auction prices systematically understate the industry's true marginal abatement costs.

4. Concluding remarks

Laboratory techniques are frequently used to testbed proposed institutions before implementing them into the field (see, *e.g.*, Bohm [1]). However, a realistic design is critical to obtaining verisimilar predictions. Cason and Plott's experimental evaluation did not include any analysis of the interaction between the SO_2 permit market and the EPA auction. It appears that the complementary market neutralised the auction's alleged objectionable features. The experimental predictions for the EPA

---

[12] All auction prices are spot auction prices. 1993 average winning price is not weighted.

6

auction *per se* consequently failed to be empirically corroborated. Similarly, the policy implication derived from this laboratory test - a recommended reform of the EPA auction procedure - may be of less importance.

References

Bohm, P. (1997): Joint Implementation as Emission Quota Trade. An Experiment Among 4 Nordic Countries, Nord 7:1997, Nordic Council of Ministers, Copenhagen.

Cason, T. N. (1995): An Experimental Investigation of the Seller Incentives in EPA's Emission Trading Auction, *American Economic Review*, September **85**, 905-922.

Cason, T. N. and C. R. Plott, (1996), EPA's New Emissions Trading Mechanism: A Laboratory Evaluation, *J. Environ. Econom. Management* **30**, 133-160.

Davis, Douglas and C. A. Holt (1985), Experimental Economics, Princeton, New Jersey: Princeton University Press.

Franciosi, R., R.M. Isaac, D.E. Pingry, and . S. Reynolds (1994): Experimental Research on the EPA's "Two-Tier" System for Marketable Emissions Permits, Manuscript, University of Arizona.

Muller, R. A. and S. Mestelman (1993): Tradable emission permits: Policy implications from laboratory markets, Working paper, Ontario, McMaster University,.

Vickrey , W. (1961): Counterspeculation, auctions, and competitive sealed tenders, *Journal of Finance* **16**, 8-37.