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Does environmental regulation create merger incentives?

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ABSTRACT

This paper studies merger incentives for polluting Cournot firms under a competitive tradable emission permits market. We find that when firms are symmetric and marginal costs are constant, an horizontal merger is welfare enhancing if efficiency gains are high enough for the merger to take place. The presence of a competitive (or monopolistic) outside market that also trades in the permits market makes profitable a merger that would not happen otherwise. When firms are vertically related in an input-output chain, an horizontal merger in one of the markets increases profits in the other market due to the permits price decrease. Finally we consider an oligopoly-fringe model in which firms differ in their marginal production costs. A merger between the dominant oligopolistic firms decreases the permits price and is always profitable. Such setting is relevant to assess the observed mergers between power generators in several market for permits, like the Regional Greenhouse Gas Initiative (RGGI), allowing us to derive some policy recommendations.

1. Introduction

Many papers have analyzed the welfare consequences of horizontal mergers in the presence of imperfect competition (see Motta (2004) for a complete mapping of the literature). How mergers incentives and welfare properties are modified in the presence of an environmental externality, regulated by tradable emission permits, is a less explored issue to which we contribute. The paper closest to our analysis is Hennessy and Roossen (1999), who show that in a perfectly competitive industry, incentives coming from the permits market may motivate a merger that wouldn't take place otherwise. The last section of Hennessy and Roosen's paper briefly mentions how the previous result could be modified under Cournot competition in the output market, suggesting that it is ambiguous. We study in depth which are the mechanisms behind that ambiguity and its welfare implications. With this purpose, we consider symmetric firms that compete à la Cournot in a polluting industry subject to an environmental regulation based on a perfectly competitive market for permits.

Our main findings are that in a symmetric Cournot a horizontal merger: (i) with constant marginal costs, is welfare neutral since the decrease in the regulator's revenue due to the resulting decrease in permits price is earned by firms; (ii) if it generates efficiency gains for the merged firms, it is welfare enhancing but efficiency gains must be high enough for the merger to take place;[1] (iii) there are some conditions under which a merger becomes profitable in the presence

of a perfectly competitive (or monopolistic) outside output market that also trades pollution permits. This last result is particularly relevant to understand how the occurrence of mergers in some sectors may be affected by tradable allowances.

Some papers are worth mentioning to put the previous results in perspective. In line with our first result, Ehrhartetal (2008) show that loopholes of the EU-ETS law fosters tacit collusion in oligopolistic Cournot markets. Cantonetal (2012) model mergers that generate cost reductions and consequently an increase in production which is welfare enhancing even if it increases pollution. Similarly Lambertini and Tampieri (2014) model cost reducing mergers and find that the negative effect of a merger on consumer surplus is more than offset by both the raise in industry profits and the fall in pollution. The fact that we consider a market for permits in which the pollution level is fixed by the cap explains the difference between their results and ours. Additionally, Cantonetal (2012) find that the stringency of environmental policy increases the minimal size for merger profitability. Such dependence is in fact in line with our second result on efficiency gains.

Regarding the input-output structure where both the input and the output market are subject to the cap-and-trade regulation, we find that a horizontal merger in one of the markets increases profits in that market and in the vertically related one due to the decrease in the permits price resulting from the merger. This input-output structure is particularly relevant to understand merger incentives in the power sector. Finally we consider an oligopoly-fringe model in which firms

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[1] The impact is similar to the impact that ¨synergies¨ have in Farrel and Shapiro (2001).

differ in their marginal costs of production. We find that a merger between the oligopolistic firms decreases permits price and is always profitable as opposed to the symmetric Cournot case in which there is a critical size for profitability as mentioned before.

Our model is a good representation to understand mergers occurred in the power sector who's CO_2 emissions are regulated in the U.S. Several mergers in the power industry have occurred in the RGGI region since then. In the Dealbook of the New York Times[2] an article of June 16th, 2011 cites Todd A. Shipman, a credit analyst of utilities and infrastructure ratings at Standard & Poor's, saying that the number of publicly traded energy companies is dramatically shrinking, being the environmental regulation one of the reasons behind that trend. In particular he says: *"Utilities — facing pending regulation on greenhouse gas emissions and renewed enforcement of older rules on air pollution — must reckon with the rising costs of compliance. The added expense come just as growth in electricity demand is being crimped by efficiency gains."* This phenomenon could also be present in markets for Green and White certificates where few players from related sectors participate and eventually even in the European system for tradable permits (EU-ETS) where several big mergers have occurred in the power sector. These stylized facts and experts' opinion advocate for the relevance of our analysis.

The paper is organized as follows. In Section 2 we present our benchmark model where we account for the impact of a horizontal merger. We develop first the case of symmetric firms with constant marginal costs before and after the merger, and second the case where the merger generates efficiency gains. In Section 3 we analyze the profitability of a horizontal merger in the case where several sectors are subject to the market for permits. In particular, in SubSection 3.1 we consider the case where two different sectors belong to the same permit market and, in Section 3.2, the case in which the two sectors subjects to environmental regulation are vertically related (either downstream or upstream). In Section 4 we relax the assumption of symmetric firms before the merger by analyzing a case with an oligopolistic dominant group of firms and a competitive fringe. Finally, in Section 5 we analyze the extent to which our results could be applied to understand merger incentives in the power sector under the RGGI market and eventually in the EU-ETS market. In Section 6 we conclude and derive some policy implications.

2. The importance of efficiency gains

Consider a market for a product where the inverse demand function for a quantity $Q \geq 0$ is given by $P(Q)$. Assume that $P'(Q) < 0$, $P''(.) \leq 0$ or $P''(.) \geq 0$ not too large for all Q. N symmetric firms compete à la Cournot in this market. The production technology exhibits constant returns to scale and c denotes the marginal cost of production.

Production generates pollution: for each unit of the good $\alpha > 0$ units of a pollutant are emitted. Pollution is socially costly and firms are required to buy as many pollution permits as their individual emissions. Assume also that the total number of pollution permits $E > 0$ supplied by the authority, is fixed. Our main assumptions relate to the functioning of tradable pollution permits.

Assumption 1. The market for pollution permits is perfectly competitive.

Assumption 1 implies that firms have no market power on the permits market. Therefore, the equilibrium price for permits σ is such that the total demand for permits, αQ, equals the total supply of permits, E.

$$\alpha Q = E. \tag{1}$$

The previous assumption can be justified by the fact that the environmental regulation covers many states in the case of the RGGI

and also many sectors in the case of the EU-ETS. This assumption is quite usual in environmental literature (see for example the seminal paper of Sartzetakis (1997) and Sartzetakis (2004)).

We focus on the interesting case in which the environmental regulation effectively constrains firms' decisions, *i.e.*, $\sigma > 0$. A sufficient condition for this to be the case is that the total supply of permits is smaller than the total pollution that would be generated by a hypothetical monopolist:

Assumption 2. Define $Q^m = \arg\max_Q[P(Q) - c]Q$. The total supply of permits E is such that $E \leq \alpha Q^m$.

This assumption ensures that the price of permits σ is positive after a merger of any size.

We consider a game in which firms choose their production levels of the final good and the market for permits clears simultaneously.

A horizontal merger. Let us derive the conditions under which a merger is profitable, from a private and a social point of view.

In the absence of merger, firm i solves the following problem:

$$\max_{q_i \geq 0} [P(Q) - c - \alpha\sigma] q_i, \tag{2}$$

where $Q = \sum_{i=1}^N q_i$. Indeed, for each unit of the final good produced, firm i emits αq_i units of pollution that must be covered with permits. Consider an interior solution of the previous optimization problem in which firm i's quantity is characterized by the corresponding first-order condition:

$$P'(Q)q_i + P(Q) - c - \alpha\sigma = 0. \tag{3}$$

Eq. (3) is sufficient provided that the demand is concave or not too convex, which holds under our assumptions.

An equilibrium of the game is a production profile $\{q_i\}_{i=1,\dots,N}$ and a permits price σ such that, for each firm $i=1,\dots,N$, Eq. (3) is satisfied and the permits market clears, *i.e.*:

The crucial feature implied by the market clearing condition (1) on the permits market is that the total quantity of good produced only depends on the exogenous supply of permits E and the pollution factor α. Using Eqs. (3) and (1), the profit of each firm at the symmetric equilibrium is given by (see derivation in Appendix):

$$\pi^*_{pre} = -P'\left(\frac{E}{\alpha}\right)\frac{1}{N^2}\left(\frac{E}{\alpha}\right)^2. \tag{4}$$

Suppose now that M firms, $N \geq M \geq 2$, decide to merge. Such a merger reduces the number of firms from N to $N - M + 1$. The profit of each firm at the symmetric equilibrium is thus given by:

$$\pi^*_{post} = -P'\left(\frac{E}{\alpha}\right)\frac{1}{(N - M + 1)^2}\left(\frac{E}{\alpha}\right)^2. \tag{5}$$

Denote by $\Delta\sigma \equiv \sigma^{post} - \sigma^{pre}$ the difference between the permits price before and after the merger. Using the first-order conditions in Eq. (3), we obtain:

$$\Delta\sigma = P'\left(\frac{E}{\alpha}\right)\frac{E}{\alpha^2}\frac{M - 1}{N(N - M + 1)} < 0. \tag{6}$$

Simple computations show that the variation in the revenue of the regulator associated to the sale of permits exactly corresponds to the change in the industry's profit ($\Delta\Pi \equiv \Pi^{post} - \Pi^{pre}$):

$$\Delta\Pi = -\Delta\sigma \times E > 0. \tag{7}$$

Our results from a welfare perspective can be summarized as follows.

Proposition 1. *In a symmetric Cournot case with constant marginal costs, any merger is welfare neutral and does not affect consumers surplus. The permits price decreases, which implies that the regulator's revenue from permits sales is redistributed to firms.*

Proof. See Appendix.

Since the quantity produced is constant, a merger is welfare neutral.