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Ownership and environmental regulation: Evidence from the European electricity industry

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ABSTRACT

The paper investigates how ownership affects the environmental performance in developed countries where environmental regulation is introduced in the form of market-based instrument. By looking at a cross-country panel dataset of 29 power markets around Europe over the period 1990–2012, we find empirical evidence that an increase of public ownership, as measured by the OECD ETCR index, is associated with a reduction of both greenhouse gas emissions and carbon intensity. We also find that the implementation of the European Emissions Trading Scheme (ETS) had a limited impact on emissions' reduction due to lax allocation of allowances. The positive effect of public ownership on environmental performance has been significant even after the introduction of the ETS, giving additional incentives to mitigate emissions when the ETS cap was not stringent enough. This evidence suggests that government control over power companies in Europe can has created idiosyncratic incentives to improve environmental quality, complementing environmental regulation in the achievement of environmental goals when the latter was absent or sub-optimal.

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1. Introduction

During the last decades, policy-makers have implemented a variety of instruments to address environmental issues such as climate change. Carbon taxes and cap & trade schemes have increasingly become popular tools to foster a cost-effective reduction of greenhouse gas (GHG) emissions. Environmental-friendly governments, directly controlling some public enterprises, can, in principle, address environmental issues by shaping the objective functions of such firms. This calls to analyse whether the ownership of a firm impacts on its environmental performance. We are also interested in investigating whether the relation between ownership and environmental performance changes with the implementation of environmental regulation. Indeed, one could argue that, in the absence of binding environmental regulation, the different goals that managers of state-owned and private enterprises are respectively instructed to maximize by their principals may result into divergent environmental outcomes. Conversely, differences in ownership may change in the presence of an effective environmental regulation that aligns social and private marginal costs, creating optimal incentives for the internalization of environmental externalities.

Existing empirical literature addressed this issue during the '90s, by looking mainly at developing countries where environmental regulation was either absent or implemented via Command & Control. The empirical evidence suggested that environmental performance worsens under public ownership[1] due to the inefficiency of state-owned enterprises (SOEs) and to their lower incentives to comply with environmental regulation. Bureaucratic connections with controlling agencies are likely to result into lower probabilities of inspection and higher chances to evade environmental standards (Hartman et al., 1997; Wang and Jin, 2012). Theoretical literature points out that output – and in turn pollution – is higher under mixed oligopoly than private oligopoly when the social welfare function does not internalize environmental damages. This assumption fits quite well to the case of developing countries where governments may have other political priorities than environmental protection.

This paper extends previous research on the environmental impact of firms' ownership to the case of developed countries, both theoretically and empirically. We first develop a model of mixed oligopoly where a

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[1] In this paper the terms "public" and "public ownership" mean "ownership by the government" and should not be confounded with the financial meaning of a corporation whose ownership is dispersed among the public in many shares of stock (e.g. public company or publicly traded company).

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SOE competes *a la Cournot* with *n* private enterprises in a market where emissions are priced through a cap and trade system. While the private enterprises maximize their own profits, the SOE maximizes a social welfare function which internalizes the environmental externality at a shadow price. The shadow price reflects the social marginal cost of pollution and can deviate from the market carbon price. Both emissions and carbon intensity decrease with the carbon price, which proxies the stringency of environmental regulation. Moreover, the model predicts that emissions decrease under mixed oligopoly more than under private oligopoly when the carbon price is lower than the social marginal cost of pollution. This suggests that the presence of SOEs in the market can work as a corrective device when the carbon price is low and regulation is not stringent enough.

We test empirically the predictions of the theoretical framework by looking over the period 1990–2012 at the power generation sector across 29 European countries (27 EU Member States, plus Norway and Turkey which have agreed with the EU certain environmental regulations). This cross-country sample is suitable to analyse the interplay between ownership and environmental regulation thanks to two major reforms: *i*) in the last decades the process of privatization brought to a progressive dilution of public ownership in the power sector. Nowadays, public ownership is still relevant in the European electricity industry, with remarkable variations among countries both in the timing and intensity of the privatization pattern; *ii*) the issue of climate change mitigation gained an increasing importance in the European political agenda and it has been address through the launching in 2005 of the world widest cap & trade scheme – the European Emissions Trading Scheme (ETS). The EU ETS covers more than 11,000 installations from 31 countries[2] and several industries, the power sector being the most relevant in terms of capped emissions.[3] It has been widely recognized that the implementation of the EU ETS has been affected by some shortcomings. During the first pilot trading period 2005–2007, the ETS cap was not sufficiently stringent due to the lack of reliable information on installation-level historical emissions (Ellerman and Buchner, 2007) and to strategic interaction between member states in a non-cooperative game (D'Amato and Valentini 2011a,b). During the second trading period 2008–2013, the financial crisis resulted in a structural surplus of emissions unit allowances (Clò et al., 2013), which caused the carbon price to dip on several occasions beneath the level required to support investments in low carbon technologies (European Commission, 2010, Helm, 2008).

Given this background, we can formulate our research questions more precisely. We first assess whether a change in the ownership structure affects environmental performance. Environmental performance is measured with the annual level of GHG emissions and carbon intensity of the power sector, while we use the OECD ETCR index of ownership to measure the intensity of government control in the power sector (Koske et al., 2015). We also combine the OECD ownership index with the OECD market structure index, which refers to the market share owned by the main company in the electricity market. In this way, we create an additional explanatory variable which distinguishes the cases of private oligopoly, mixed oligopoly and monopoly, allowing a direct comparison with the theoretical framework. Then, we assess whether the implementation of the ETS affected the trend of emissions and carbon intensity in the power sector. We use the sectoral ETS cap as a measure of environmental policy stringency. Next, we focus on the interaction between ownership and environmental regulation, which represents the core of the paper. We investigate whether the relation between ownership and environmental performance varies after the launching of the ETS in 2005. This allows also to assess whether the government involvement in the provision of carbon-intensive goods can complement environmental regulation in the achievement of environmental goals when the latter is implemented with flaws.

The empirical analysis brings to the main result that, in the European power industry, higher public ownership is associated with lower greenhouse gas emissions and carbon intensity. This is further confirmed by the evidence that both public monopoly and mixed oligopoly are associated with a better environmental performance compared to the private oligopoly case. Moreover, we find that: a) the implementation of the ETS contributed in reducing emissions, though emissions increased under permissive environmental regulation, that is for increasing level of the ETS cap; b) the impact of public ownership remained significant even after the implementation of the ETS, and it gave additional incentives to mitigate emissions when the ETS cap was not stringent enough. We conclude that the presence of SOEs in Europe has complemented environmental regulation when it was sub-optimal.

We finally look at the issue of financial sustainability. Since the abatement of emissions comes at a cost, better environmental performance of SOEs may, however, have been associated with some financial distress. As a result, SOEs deviating from the profit maximization may have faced a problem of financial sustainability. To address this issue, we have considered 1855 enterprises operating in Europe in the power generation sector (Amadeus data),[4] where SOEs represent around 15% of the sample. We find that SOEs show positive financial performance ratios which are, on average, lower than the values of private enterprises. A priori, we cannot assess whether this lower financial performance of the SOE is linked to their environmental strategy, a topic that we leave to further research. Nevertheless, this evidence is consistent with our conceptual framework where the SOE internalizes the environmental damage in its objective function, deviating from the profit maximization goal.

The paper is structured in the following way. After recalling the relevant literature in Section 2, we present our conceptual model in Section 3. The dataset is introduced in Section 4, while Section 5 describes our empirical strategy. Empirical results are discussed in Section 6, while some robustness checks are presented in Section 7. Section 8 addresses the issue of financial sustainability and ownership, while Section 9 concludes.

2. Earlier literature

During the '90s the World Bank promoted several field researches in Asian countries to investigate the impact of ownership on environmental performance. The main finding was that environmental quality deteriorates under public ownership. The reason why state-owned firms pollute more than privates was traced back to the inefficiency of state-owned plants and to the fact that SOEs used their bureaucratic connections to escape pollution regulation (World Bank, 1995). Hettige et al. (1996) focus on several south-east Asian countries and find that private firms control pollution better than SOEs. This partly depends on the fact that SOEs tend to manage older and inefficient plants. Pargal and Wheeler (1996) compare water pollution caused by private and state-owned factories in Indonesia and find that the worse environmental performance of state-owned plants persists also in the case of plants with similar scale, age and efficiency. They argue that SOEs pollute more because they benefit from preferential relation with the environmental controlling agencies and face higher chances to evade pollution regulation than their private counterparts. Hartman et al. (1997) focus on 26 pulp and paper plants in four countries: Bangladesh, India, Indonesia, and Thailand. They find that pollution

[2] The EU ETS applies to all 28 EU Member States plus Iceland, Norway, and Liechtenstein.

[3] The other economic activities included in the ETS are: refining of mineral oil; production of coke; metal ore roasting or sintering; production and processing of pig iron or steel, ferrous and non-ferrous metals, and aluminium; production of cement, clinker or lime; production of glass; production of ceramics; production of pulp, paper and board; production of chemical products; and aviation.

[4] Amadeus is a database managed by Bureay Van Djick which reports balance sheet and corporate governance comprehensive information on around 21 million companies across Europe.

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