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Analyzing the characteristics of plants choosing to opt-out of the Large Combustion Plant Directive

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ABSTRACT

The EU Large Combustion Plant Directive (LCPD) is a major but largely unstudied environmental regulation. Most of the 1585 large combustion plants in this analysis are electricity supply plants or combined heat and power plants. We find that, controlling for country characteristics and plant size, plants in the electricity supply, combined heat and power, district heating, and paper industries have a higher probability of being opted-out of the emission limit values (ELVs), which necessitates eventual plant closure. Controlling for plant size and industry, increasing the amount of solid fuel or natural gas utilized at a plant is associated with a decreased likelihood of being opted-out of the ELVs.

1. Introduction

In January 2008, the European Union (EU) implemented the Large Combustion Plant Directive (LCPD) regulation, which requires large plants to limit emissions in all member countries in order to protect the environment and improve the economic welfare of EU citizens. Starting January 1, 2008, the LCPD mandates that large combustion plants, with rated thermal inputs of 50 MWth or higher, limit emissions of sulfur dioxide, nitrogen oxide, and particulate matter (dust). The benefits of reducing these emissions include lower human exposure to pollutants that cause adverse health effects and less damage to ecosystems. However, there are compliance costs to this environmental policy, which can vary significantly by plant. Moreover, not every plant is required to respond to the LCPD in the same way. Specifically, the “limited life derogation clause” allows a plant to be “opted-out” of the LCPD emission limit values (ELVs) prescribed by the legislation provided that it will shut down after 20,000 h of operation. In this paper we take the first step toward quantifying the costs of the LCPD by identifying plant characteristics that associate positively with an increased probability of being opted-out of the ELVs.

Anecdotal evidence suggests that firms are choosing to shut down plants because of the LCPD. For example, E.ON UK stated that its power plants without flue gas desulphurization (FGD) would be opted-out of the directive and shut down by 2015.[1] This includes the company's Ironbridge, Kingsnorth, and Grain power stations. It is unclear whether there might be an asymmetric response to the LCPD based upon the fuel mix or the size of the plant since the emission limits vary based upon these characteristics. It may be that plants of a certain type are impacted more than others. Furthermore, differences in industry structure can affect the likelihood of plants being opted-out of the LCPD.

The primary goal of this research is to examine how different industries and fuel mixes are associated with the election of the limited life derogation clause of the LCPD. The majority of plants subject to the LCPD are electricity supply plants and combined heat and power plants; it is important for policy-makers to understand whether plants in these two industries are more likely to be opted-out of the ELVs.Solid fuels such as coal have earned a reputation for causing more adverse health effects than natural gas. Yet some EU countries, such as Poland, have a robust coal mining industry that employs many people and generates much income (Suwala, 2010; Uliasz-Bochenczyk and Mokrzycki, 2007). Hence, although it may be economically efficient to avoid health-care costs by reducing emissions from burning coal, there may also be political costs from

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[1] Please see E.ON UK website: “http://www.eon-uk.com/1421.aspx”.

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adversely affecting the coal industry.[2]

We construct a dataset spanning 17 EU countries with a total of 1585 large combustion plants including all plants that were or were not opted-out of the LCPD.[3] Starting in 2004, each member country was required by the LCPD to report information on their large combustion plants. Using probit regression, we find that plants in the paper, energy supply, combined heat and power, and district heating industries have a higher probability of being opted-out of the LCPD limits. Plant characteristics are also important; larger plants have a higher probability of being opted-out while plants that use more solid fuel (such coal and lignite) and more natural gas have a lower probability of being opted-out. We also find that plants operating in less competitive markets have a lower probability of being opted-out.

Command-and-control regulations are generally considered less efficient than incentive based policies, such as a tax or tradable permits.[4] An interesting aspect of the LCPD is that countries can either choose to entirely follow the command-and-control ELVs or design their own national plan that would achieve the same overall level of emission reductions. A country that designs its own incentive based policy plan should be able to achieve the emission reductions at a lower overall cost. Also, a country that incorporates an emissions tax or a tradable emissions permit system into its plan would give individual plants more flexibility to comply with regulations. Therefore, we investigate whether or not plants in countries with national emission reduction plans have lower opt-out probabilities. Six (6) of the 17 EU countries we examine (Estonia, Finland, France, Greece, Portugal, and UK) designed their own national emission plans to reduce emissions as set by the LCPD. Confirming our theoretical expectations, we find that plants in these countries are opted out at lower probabilities.

2. Previous literature

Policymakers regularly debate the economic effects of environmental regulation. The LCPD is an example of command-and-control (direct) regulation. Theoretically, command-and-control regulation has limitations, particularly in terms of potential loss of economic efficiency when marginal abatement costs differ across firms. That is, command-and-control regulation may not minimize the cost of achieving a given pollution reduction goal. Yet, “there remains a need for more empirical evidence on the economic efficiency of direct regulation” (Iraldo et al., 2011). The relationships among environmental regulation, firm performance, and economic competitiveness are complex and may vary by context (Haq et al., 2001; Iraldo et al., 2011).

The LCPD is a major step towards reducing pollution in the European Union but the policy has received little academic analysis. Papers providing descriptive historical background on the LCPD include Ramus (1991) and Markusson (2012). Eames (2001) finds that countries comply with the regulation but costs associated with compliance vary at the national level. The paper was written before countries started reporting data required by European Environmental Agency (EEA) on plant emissions. Therefore, there is no analysis conducted on the effects of the directive on plants and industries.

Although we are not directly examining a causal relationship between regulation and plant exit, the limited literature on the survival or exit of polluting plants is informative. Jiang (2012) examines the US refining industry, Chen (2002) studies the decline of industry due to deregulation of crude oil markets, and Becker and Henderson (2000) show that in response to emissions regulations, plants in industries that pollute tend to close and relocate to areas with less strict regulations.

More generally, a literature review by Jeppesen and Folmer (2001) finds that stricter environmental policy is more likely to result in closure as compared to relocation of plants or reduced location of new plants. A recent survey by Millimet et al. (2009) concludes that the theoretical literature shows that increasing absolute environmental standards induces exit. Empirical evidence appears to support this. Henderson (1996) analyzes ground-level ozone regulation and finds that plants exit or relocate from areas that are more heavily regulated. Snyder et al. (2003) find a similar result for chlorine-manufacturing plants. Deily and Gray (1991) and Helland (1998) find that plants that are less profitable or in declining industries are less likely to be inspected and therefore have lower probability of exiting. Kassinis and Vafeas (2009) compare the environmental performance of plants prior to their closure against plants that do not close and find that plants that close are subject to more regulatory pressure and reduce their emissions more compared to plants that do not close. Yin et al. (2007) find that environmental regulation can induce small firms to exit due to economies of scale and liquidity constraints. In a comparative study of power plants in Croatia and in Bosnia and Herzegovina, Višković et al. (2014) find that differential exposure to the EU ETS negatively impacts the more heavily regulated country, Croatia, in terms of economic competitiveness. Thus, most empirical evidence suggests that increased regulation can lead to decreased firm competitiveness. Nonetheless, theories and findings are not uniform concerning the effects of environmental regulation; utilizing a Delphi method survey, Korhonen et al. (2015) find that experts view tightening of environmental regulations in the pulp and paper industry as both a threat and an opportunity to businesses. Environmental regulation as an opportunity is consistent with the “Porter induced innovation hypothesis,” which states that environmental regulations spur firm innovation and hence increase firm competitiveness (Porter and van der Linde, 1995).

3. Description of the LCPD

The EU adopted the LCPD in October 2001, with the regulations taking effect January 2008.[5] An EU directive, the LCPD requires Member States to reduce emissions of sulphur dioxide, nitrogen oxides, and particulate matter from combustion plants with a rated thermal input of 50 MWth or more (Ritchie et al., 2005). Plants with thermal input of this scale include electricity plants, combined heat and power plants (CHP), district heating plants, oil refineries, sugar refineries, chemical manufacturers, and large industrial manufacturers (such as steelworks plants). The regulations are different for existing plants (licensed before 1 July 1987) and for new plants (licensed after July 1, 1987). For existing plants, member States can choose between complying with ELVs and implementing a national emission reduction plan. All new plants must comply, although ELVs vary by the size of the plant and the fuel that is burned; in general, ELVs are more stringent for larger plants. Liquid fuels (such as oil) and solid fuels (such as coal) have

[2] For a recent example of political costs related to proposed changes in the Polish mining industry, see Foy (2015).

[3] The countries include: Belgium, Bulgaria, Cyprus, Denmark, Estonia, Greece, Spain, Finland, France, Latvia, Malta, Poland, Portugal, Romania, Slovenia, Slovak, Republic, and United Kingdom. No firm opted-out of the LCPD in the other 10 countries.

[4] For a standard textbook treatment of the topic, see Tietenberg and Lewis (2012). Harrington et al. (2004) compare the cost effectiveness of various command-and-control and incentive based policies in the United States and Europe.

[5] For more information on the LCPD please also see Meyer and Pac (2013).