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Voluntary disclosure and investment in environmental technology



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ABSTRACT

I examine the role of voluntary disclosure programs in creating market incentives for competing firms to invest in environmentally cleaner technology. In an industry subject to environmental regulation (such as emission taxes), such programs may allow firms to credibly disclose their progress in achieving compliance cost reduction through investments in internal R&D, innovation and learning (whose outcomes are uncertain and unlikely to be publicly observable). Specifically, I analyze a duopoly where firms are subject to an emission tax and invest in reducing the emission intensity of their production processes; the outcome of the investment is private information. I show that the ex ante incentive to invest is always higher in the presence of the voluntary disclosure program than without it; in particular, the opportunity to credibly disclose progress in cost reduction allows a successful firm to convey its true position of competitive advantage to the rival firm and realize higher market share and profit. Thus, voluntary disclosure programs increase the efficacy of traditional forms of environmental regulation in creating incentives for green technological change (even when buyers have no preference for greener technology). I show that such programs generally increase social welfare.

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1. Introduction

Information disclosure programs have come to play an increasingly important role in environmental policy and have been characterized as the next wave in environmental regulation, following the more traditional command and control approach as well as market-based instruments (Tietenberg, 1998). In particular, voluntary disclosure mechanisms¹ have become popular quasi-regulatory tools which can take various forms. Eco-labeling, for instance, conveying information about the actual production process or technology of individual firms through a seal or an identifying mark,² has emerged in a wide range of countries. Prominent examples include Green Seal in the United States, the Nordic Swan in Scandinavia, and the Blue Angel in Germany. Another common form of voluntary disclosure is to obtain environmental certification from ISO 14000 or Eco-Management and Audit Scheme (EMAS). In addition, some voluntary disclosure systems ask firms to directly disclose information about emissions such as U.S. Department of Energy's Voluntary Reporting of Greenhouse Gases Program

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¹ The number of mandatory disclosure programs is also growing rapidly. One of the most notable examples is the U.S. Toxic Release Inventory program, which requires firms of certain size within certain industries to publicly disclose their annual releases of over 600 toxic chemicals.

² Dosi and Moretto (2001), Mason (2006), Ibanez and Grolleau (2008) show that some information about production technology and environmental performance can be revealed by eco-labeling.

(or 1605(b) program), while others not only provide emission data but also use this information to rate firms' environmental performances and publish the results, such as India's Green Rating Project.

Considerable empirical evidence has shown that provision of such environmental information to the public results in cleaner technologies and production processes.³ Existing explanations for this empirical observation are largely based on environmental consciousness among consumers; firms develop and disclose the cleaner technology in order to capture consumers' willingness to pay more for products produced by clean technology (Arora and Gangopadhyay, 1995; Amacher et al., 2004; Mason, 2006). This paper provides an alternative explanation of how programs that provide channels for credible voluntary disclosure⁴ can create greater incentives for development of environmentally cleaner technology even if consumers have no preference for such technology.

One important policy objective of environmental regulation is to provide incentives for technological change. Indeed, in industries subject to regulations such as emission taxes, permits, and standards, firms have incentive to invest in cleaner production technology or more efficient abatement technology in order to reduce their compliance costs. Such technological progress often results from internal R&D, innovation and learning whose outcomes are uncertain and unlikely to be publicly observable. In fact, a firm that succeeds in reducing the compliance cost has a natural competitive advantage in the market and can potentially gain market share and profit by making this known to rivals. Voluntary disclosure programs provide credible means of communicating success in reducing compliance cost to rival firms and this, in turn, can increase the incentive for investment in green technological change. This argument is developed in this paper to show that a credible voluntary disclosure program, which reveals firm's private information about the progress in developing cleaner environmental technology, usefully complements traditional environmental regulations in creating incentives to invest in such technology. Market competition plays a critical role in this argument.

The specific model is as follows. I consider a homogeneous good Cournot duopoly where firms are subject to traditional regulation in the form of an emission tax, and may publicly disclose the emission intensity of their production processes through a credible voluntary disclosure program. In the first stage, firms decide whether to invest in the development of an environmentally cleaner technology that reduces their own emission intensity. The outcome of the investment is uncertain and private information of the investing firm. In the next stage, firms decide whether to disclose the realized outcome (emission intensity) voluntarily. Finally, they engage in Cournot competition.

I find that the strategic incentive to invest in the cleaner technology is always higher when the voluntary disclosure program and the tax are combined, as compared to the case in which there is an emission tax but no mechanism for credible voluntary disclosure. A firm invests in the cleaner technology in order to gain a compliance cost advantage over the rivals. This investment incentive is strengthened in the presence of the voluntary disclosure program, because the firm knows that the competitive advantage will be perfectly communicated to the rivals through the disclosure of emission intensity, which will advantageously affect the position of the successful firm in product market competition. This effect always outweighs the negative effect of being revealed to the rival firm in the state where the firm is unsuccessful in reducing emission intensity. The paper also shows that the voluntary disclosure program generally increases social welfare. There is, therefore, a strong case for public policy to encourage and make possible credible voluntary disclosure of production and abatement technology.

There is a growing literature that examines the effects of various environmental policy instruments on incentives for technological change. The performances of permits (free and auctioned), emission taxes, standards (emission and performance), and abatement subsidies have been analyzed (see the survey by Requate, 2005, and also Milliman and Prince, 1989, Jung et al., 1996, and Montero, 2002).

The literature studying the effect of voluntary information disclosure mechanisms on cleaner technology is however small and, as mentioned above, largely relies on preference of buyers for products produced with cleaner technology. For example, Amacher et al. (2004) consider a duopoly model with environmentally conscious consumers who are willing to pay a price premium for the product produced by environmentally cleaner technology. They assume that there exists a voluntary eco-label that allows consumers to become informed about the actual environmental technology used by firms. The authors show that as there is no asymmetric information problem between firms and consumers, the desire to capture the price premium gives firms a strong economic incentive to invest in the cleaner technology. In a similar setup, Ibanez and Grolleau (2008) show that the incentive to adopt the environmentally cleaner technology may also depend on the labeling

³ See among others Hamilton (1995), Konar and Cohen (1997), and Khanna et al. (1998). Maynard and Shortle (2001) show that programs increasing visibility of environmental performance encourage investment in cleaner technologies in the U.S. bleached kraft pulp industry. Pizer et al. (2010) find support for the effectiveness of the 1605(b) program in reducing greenhouse gas emissions. Powers et al. (2011) show that the India's Green Rating Project leads to significant reductions in pollution loadings among pulp and paper plants in India.

⁴ In practice, firms can voluntarily disclose their private environmental information in a credible and verifiable manner through a variety of mechanisms such as third party certification, eco-labeling, and rating by government agencies (or, nongovernmental organizations). In Europe, for instance, EMAS certification is given to firms that are verified to voluntarily operate under EMAS regulations on environmental commitments. The certification is awarded by state or by authorized professionals and overseen by the European Commission. Besides third party certification, a firm which wants to signal its good environmental performance can also seek an eco-label issued by a third party labeling agency if the agency verifies that the environmental fulfillments of the firm to certain well-defined criteria or standard. The labeling agency is often a governmental agency (e.g., the US Department of Agriculture (USDA) Organic program) or a nongovernmental organization (e.g., the Forest Stewardship Council), which are generally viewed as two trustworthy sources of credible and standardized information.

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