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Emission taxes and the market for abatement goods and services☆

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ABSTRACT

This paper examines the effect of emission taxes on pollution abatement and social welfare, when abatement goods and services are provided by a Cournot oligopoly with free-entry. We point out initially that a higher tax not only increases demand for abatement; it also makes polluters less sensitive to price. This attracts a larger number of abatement suppliers while possibly inducing each one of them to produce less. Total abatement always goes up, however, when the delivery of abatement goods and services exhibits decreasing returns to scale. We then calculate the welfare-maximizing emission tax and compare it to the Pigouvian tax.

1. Introduction

Over the past decades, polluters have come to largely rely on a growing number of specialized firms for the delivery of abatement goods and services. In France, for example, of the 1200 firms forming the

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so called "eco-industry" in 2002, about half did not exist ten years earlier (Alary-Grall and Pijaudier-Cabot, 2002). In Canada, the number of these environment firms reached 7474 in 2000, an increase of 30% since 1996 (Industry Canada, 2002). The size of the eco-industry is now substantial in many developed countries such as the United States (USD 211 billion), the European Union (USD 210 billion) or Japan (USD 93 billion) (Selwyn and Leverett, 2006).

There is a broad consensus that demand for abatement goods and services and the size of the eco-industry are mainly driven by environmental regulation. However, only lately have economists begun to analyze the precise relationship between environmental policies and the market for abatement goods and services.[1] Baumol (1995) and Feess and Muehlheusser (1999, 2002) were the first to acknowledge the existence of an eco-industrial sector, but they did not explicitly address the consequences of imperfect competition between environment firms. This issue was taken up in a recent article by David and Sinclair-Desgagné (2005), who consider how different policy instruments – emission taxes, design standards and voluntary agreements – can affect the market power of an oligopolistic eco-industry (so the price of abatement goods and services and the consequent abatement efforts by polluters). An important conclusion is that the optimal emission tax in this context must depart from the Pigouvian rule (see also Requate, 2005; Nimubona and Sinclair-Desgagné, 2005; Canton et al., 2008; Canton, 2008; David and Sinclair-Desgagné, 2010). This emerging literature has so far assumed that environment firms were symmetric and fixed in number. As the above examples suggest, however, environmental regulation is likely to also have an impact on the entry and exit of abatement suppliers. Our objective is now to examine this impact and its ramifications for environmental policy.[2]

This paper's main upshot is that a benevolent regulator should explicitly take into account the impact of environmental policy on the market for abatement goods and services. More specifically, a regulator seeking to set an optimal emission tax should foresee the ensuing structure (number of firms, elasticity of demand, etc.) of the eco-industry in order to keep the average production cost of abatement goods and services at a minimum. Conditions under which such a tax should be higher than, lower than or equal to the marginal damage of pollution, are spelled out below, in circumstances where the eco-industry forms a Cournot oligopoly with free-entry.[3] If each environment firm's output decreases with the tax, for instance (which is the case when abatement suppliers have more market power as environmental policy becomes more stringent), then the best policy is to set the emission tax below the Pigouvian level.

This analysis builds on, and extends (in a non-trivial way), the industrial organization literature dealing with the effects of demand changes on oligopolistic firms (see Quirmbach, 1988; Hamilton, 1999; Cowan, 2004; Okuguchi and Szidarovszky, 2005). In a paper closely related to ours, Hamilton (1999) finds that, if the inverse demand function exhibits a parallel upward shift (i.e., more can be sold at a given price), then the oligopoly's output always expands; when the inverse demand curve experiences a clockwise rotation (so consumers become less price-sensitive), on the other hand, the oligopoly's output will shrink. While Hamilton considers these two cases separately, we show here (according to David and Sinclair-Desgagné, 2005) that a new emission tax causes *both* changes in demand to occur *simultaneously*.[4] We thus extend Hamilton's work to take into account both effects simultaneously.

[1] For a survey of historical issues, stylized facts and the existing economic literature on this topic, see Sinclair-Desgagné (2008).

[2] Katsoulacos and Xepapadeas (1995), Requate (1997), Lee (1999) and Fujiwara (2009), among others, have already derived second-best emission taxes under an oligopolistic and endogenous market structure. Their focus was on the polluting sector, however, while we deal with the upstream sector providing abatement goods and services.

[3] The assumption of an oligopolistic market structure is realistic for most eco-industrial segments. According to Powers and Wright (2005) for instance, the five largest firms in the air pollution control segment in the United States account for more than 70% of total revenue. The two largest, Bechtel and URS Corp., account for almost half the sector's total income. For water and wastewater utilities, the global market is dominated by five multinational firms – Suez Environnement, Veolia Environnement, Sociedad General de Aguas de Barcelona, Thames Water and Benpres Holdings – which account for more than 45% of private projects in the sector (World Bank, 2003).

[4] The demand rotation considered by Hamilton (1999), moreover, happens through the equilibrium point, while an emission tax rather brings on a rotation of the abatement demand curve around its horizontal intercept.