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Pollution, foreign direct investment, and welfare

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ABSTRACT

We characterize the optimal environmental policy in an oligopolistic model of production and production-generated pollution. A number of foreign firms are located in the host country which is assumed to be small in the market for foreign direct investment so that entry of foreign firms is endogenous. We derive closed-form solutions for the optimal entry tax and the optimal emission standards for foreign and domestic firms. Inter alia, we find that the optimal tax must be positive to control FDI, the number of domestic firms does not affect optimal policy and the emission standards depend on the relative efficiency of the domestic and foreign firms.

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1. Introduction

The volume of Foreign Direct Investment (FDI) has increased rapidly in the last two decades or so. According to the United Nations Conference on Trade and Development, the ratio of inward plus outward FDI flows to global GDP is over 21% (see UNCTAD, 1998). The two big emerging countries, China and India, which together account for nearly a third of the world population, have been wooing FDI ever since they decided to open up their economies. Initially both countries allowed FDI only in the form of joint ventures with domestic firms. But, over the years, in order to encourage more FDI those restrictions have been and are being removed and 100% foreign ownership is also allowed in many industries. In China, for example, international joint venture as a mode for foreign entry has gone down from 70% of total FDI in 1995 to 35% in 2003 (see Lu, 1998; Folta, 2005). In this endeavor, India lags substantially behind China. In 1990–1991, total net FDI inflow into China and India was $ 2.7 billion and $ 0.1 billion respectively; these figures rose steadily to $ 55.02 billion and $ 5.50 billion respectively in 2004–2005 (Panagariya, 2006). In order to compete with China more effectively, the new Indian government, for example, has started an initiative named 'Make in India'.

There are push and pull factors for the outflow/inflow of FDI. Stricter environmental regulations and higher labor costs in the countries of origin of FDI constitute important push factors. Similarly, lower environmental standards, lower labor costs, proximity to big markets and attractive subsidy packages in the host countries work as pull factors. Low and Yeats (1992) find that during the 1970s and 1980s many polluting industries migrated through FDI flows towards lower-income countries with less strict environmental restrictions. Lucas et al. (1992) show that the stricter regulation of pollution-intensive production in the OECD countries has led to significant displacement of polluting activities. Thus, investment liberalization has alleged to have created pollution havens by developing channels through which polluting industries shift to less developed countries. The empirical evidence in this respect is however mixed.[1]

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[1] Jeppesen et al. (2002) provide an excellent survey on this subject.

What is the optimal environmental policy in such an open economy context?[2] Does a host country have to compromise on environmental standards in order to control FDI? Can it use other instruments to attract FDI and at the same time employ environmental standards which one would normally employ?[3] These are some of the research questions that this theoretical paper addresses. In fact, the use of domestic environmental policies to attract foreign capital seems to be at variance with the Bhagwati–Ramaswami principle on the use of instruments to deal with distortions (see, Bhagwati and Ramaswami, 1963).

To analyze this issue we consider a Cournot oligopolistic market for a non-tradeable commodity. A number of foreign firms serve the market, and, following Lahiri and Ono (1998a, 1998b, 2004) and other studies in the field, we assume that the host country is small in the market for FDI: foreign firms enter (exit) the host country if profits made there are higher (lower) than given reservation profits that they can earn elsewhere. Thus, in the equilibrium the number of foreign firms is endogenous. In addition, we also allow for the possible presence of a fixed number of domestic firms.[4] All firms emit pollution when producing commodities and have access to an abatement technology (or outsourcing) when the pollution emission is restricted. Under the above specification, we consider two sets of instruments: lump-sum entry taxes on foreign firms and emission standards for foreign firms as well as for domestic firms (when they are considered).[5] We then characterize the optimal mix of these policies and examine their properties.

Our work is related to a large literature on the optimal environmental policy in models with imperfect competition (for surveys see Carraro et al., 1996; Requate, 2007). Levin (1985) and Simpson (1995) have characterized the optimal emission tax in the case of a fixed number of firms. Katsoulacos and Xepapadeas (1995) have shown that the optimal emission tax can over-internalize the externality in the case of endogenous market structures. Similarly, Spulber (1985) has proved that an emission standard leads to excessive industry pollution under free entry and exit, but not with a fixed number of firms. Ulph (1992, 1996) has compared different environmental policies under different types of oligopolistic competitions. Ebert (1992, 1998) has analyzed relative emission standards under symmetric Cournot oligopoly and the effects of different types of oligopolies and abatement technologies on the optimal emission tax.[6]

In a more recent line of research, Conrad (1993) and Barrett (1994) show that governments may adopt weak environmental standards for the domestic firms competing in imperfectly competitive international markets with Cournot competition and a fixed number of firms: the purpose is to give a strategic advantage to the domestic firms ("environmental dumping"). The opposite result emerges in the case of Bertrand competition (Requate, 2007), leaving the implications ambiguous. However, in the case of endogenous entry of international firms, general principles of the theory of commitments (Etro, 2006, 2011) suggest that there should be an incentive for governments to adopt weak environmental standards to expand domestic production. Things are more complex, of course, when competition (and pollution) takes place at home, which is the case considered in the present work. Lahiri and Symeonidis (2007) consider welfare and pollution implications for multilateral piecemeal reforms of environmental policies in an international oligopolistic model with and without free entry and exit of firms.

We should finally mention a related literature on the interface between FDI and environment. Markusen et al. (1993, 1995) analyze the location decisions of two firms in a two-country model and analyze competition between the two countries for FDI. Lahiri and Ono (2007) develop a one-country model in which they analyze the different effects of a tax and a quantity restriction on pollution control in the presence of an endogenous number of foreign firms.

To our knowledge, we are the first to consider a mixture of environmental and non-environmental policies simultaneously. Whereas the lump-sum tax targets the number of firms, the emission standards for domestic and foreign firms target environmental externalities. This way, we are able to adhere to the Bhagwati–Ramaswami principle in policymaking. The government does not have to boost domestic production by setting weak environmental standards. Instead, the government boosts domestic production more effectively by choosing appropriately the lump-sum tax on the foreign firms. Because of the simultaneous consideration of the two different instruments, one of the results we obtain is that the optimal lump-sum tax is always positive, and that its value does not depend on the presence or absence of domestic firms or on the number of domestic firms. However, the emission standards depend on the relative efficiency of the domestic and foreign firms. We also carry out a number of comparative static exercises on the optimal mix of the policies showing how the market size, costs of production and emission abatement, and the marginal social cost of pollution affect the optimal environmental policy.

The paper is organized as follows. Section 2 spells out the basic model in which there are no domestic firms and examines the properties of the optimal mix of the policies. Domestic firms are introduced in Section 3. We also extend the model to general demand functions discussing how some of the results do generalize. Concluding remarks are in Section 4.

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[2] The traditional theory of the optimal environmental policy under imperfect competition (Buchanan, 1969; Lee, 1975; Barnett, 1980; Maloney and McCormick, 1982) abstracts from international economics aspects, trying only to characterize the optimal emission tax and to verify how this differs from the Pigouvian tax that leads to efficiency under perfect competition (this is equal to the marginal value of the environmental damage). For surveys see Baumol and Oates (1988) and Requate (2007).

[3] The theory of the strategic use of environmental policy in an international context goes back to Markusen (1975). More related works are those of Barrett (1994) and, more recently, Ulph (1996) and Duval and Hamilton (2002).

[4] This is the same assumption made in related models of trade policy, such as Lahiri and Ono (2011) or Etro (2014). In the long run, one may consider also endogenous entry of domestic firms, as in Bagwell and Staiger (2015).

[5] An alternative tool is a tax on emissions. In our linear environment, its consideration would lead to similar results (Lahiri and Ono, 2007).

[6] Spulber (1985), Conrad and Wang (1993), Katsoulacos and Xepapadeas (1995), and Farzin (2003) examine the effects of various environmental policies on the market structure in the presence and absence of free entry.