Environmental Pricing in Ports

The Need for Coordination

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Increasing attention is being paid to reducing the environmental impacts of transport activities. In the context of ports, little research has been focusing on the role that environmental pricing can play in reducing environmental costs of port operations. Such pricing can take the form of taxes, fees, or subsidies that reflect the environmental costs of port activities. There are several benefits to implementing environmental pricing in ports, including:

- Encouraging sustainable practices: By reflecting the environmental costs of port activities, environmental pricing can encourage port operators and port users to adopt more sustainable practices, such as using cleaner fuels or reducing emissions.
- Reducing pollution: By increasing the cost of environmentally harmful practices, environmental pricing can help to reduce pollution levels in and around ports. This can improve air and water quality and reduce the impact of port operations on local ecosystems.
- Promoting innovation: By creating financial incentives for innovation in sustainable practices, environmental pricing can encourage the development of new technologies and solutions that can help to reduce the environmental impact of port operations.

- Supporting regulatory compliance: Environmental pricing can also help ports to more cheaply comply with national or regional environmental regulations by providing a financial incentive to reduce pollution and emissions.

Overall, environmental pricing in ports can help to promote sustainability, reduce pollution, encourage innovation, and support regulatory compliance, making it a valuable tool for creating more environmentally sustainable port operations. Following a long tradition of environmental pricing, in this paper we analyse the consequences of uncoordinated environmental pricing practices in independent production units (ports) with a high degree of (geographical) market power.

The paper makes use of game theory in a case where multiple ports, that are modelled as production units, compete on different types of outputs, some of which are produced in a competitive set up will other are produced in monopoly. The outputs jointly result in the production of a negative output (pollution). Game theory has been widely utilized in port management studies, particularly in addressing competition and cooperation among different ports. For instance, Talley and Ng (2013) used game theory to examine port competition and the role of maritime transport chain choices. Additionally, Song et al. (2016) applied a Bertrand oligopoly game theory model to investigate competition among ports and liner shipping companies and obtain general pricing rules for ports and carriers.

While game theory has been used extensively in port studies (see for example Pujats et. al. 2020), it has not been applied in the context of environmental charges, which has been subject of a few papers in the last few years. For example, Martínez-López et al. (2021) explored the impact of specific environmental charges on the adoption of cold Ironing in European Short Sea Shipping. Their study used a simulation-based approach to evaluate the effectiveness of policy measures in promoting environmentally friendly practices. Another study, that built on data collected in an EU project (Geerts et al. 2017) investigated the potential effects of environmental differentiated port pricing in the Hamburg-Le Havre range. They utilized a scenario analysis approach to examine the competitive interactions between ports and the response of shipping lines to various pricing schemes. The study found that the introduction of environmental charges could lead to improved environmental performance and emphasized the importance of coordination and cooperation among ports. Acciaro and Kosmas (2018), analyse the implications of environmental charging for port authorities and recommend that the most inelastic sector should be effectively targeted with environmental charges, and that harmonisation among ports is not necessary.

Game theory was not explicitly been used in the application of environmental charges, but it appears useful for a better understanding of the dynamics between ports and shipping companies in the context of environmental policies (see ongoing work by Acciaro, 2021a; 2021b). In fact, our model shows that in a multi output context, environmental pricing is likely to be suboptimal depending on the substitutability of products. Modelling strategic interactions among production units (ports) we show that welfare can be substantially increased when coordinated action in relation to undesirable outputs is taken.

In addition to outlining the general properties of the problem under analysis we also look at the policy

consequences of coordinated action in the case of European Ports. Following the decision at the European Commission level carry out the implementation of onshore power supply in the ports of the Union, a discussion on how to optimally fund such infrastructure and how to charge accordingly is urgently needed.

The paper shows that in absence of uncoordinated pricing, environmental price setting is likely to result In opportunistic behaviour on part of the port management companies, that will either fall short of the funding needed for reducing some of the environmental costs associated with port activities, or will contribute to consolidate the dominant position of the largest players in the industry with potential negative consequences for trade and society wellbeing.

Keywords: Environmental pricing; ports; European Union; externalities.
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