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Research article

Decentralisation and waste flows: A welfare approach

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ABSTRACT

We analyse incentives, equilibria and implications of the governance framework for the disposal of municipal solid waste in an *N*-Region model where waste mobility is allowed. The key decisions revolve around the flow of waste between regions and the externalities associated with its final disposal. Two different institutional settings are considered: a centralised framework where a central planner takes all the decisions and a decentralised model where each region decides on its waste flows. When the regions are characterised by different levels of efficiency in the final treatment of waste, a certain degree of mobility might allow to reap the benefits of higher efficiency. However, when coupled with decentralisation, waste flows may produce sub-optimal outcomes that undermine environmental protection. In the light of these results, we show how the regulator can use the transfer price and the proximity principle as welfare-improving tools.

1. Introduction

The management of municipal waste has a very high political profile because of its complex economic and environmental implications. In particular, waste generation, its mobility and disposal are key areas of public and research interest. According to the European Environmental Agency, waste volumes in the European Union are shifting (EEA, 2009, 2013), driven by changing production and consumption patterns (Andersen et al., 2007), whereas the distribution of the environmental costs associated with waste disposal essentially depends on regulation.

Although there is some evidence of a Kuznets effect for the GDP-waste volumes relationship (Mazzanti and Zoboli, 2009; Mazzanti et al., 2012), there is little evidence of a permanent decoupling, i.e. waste volumes may ultimately increase with GDP. On the other hand, the deployment of large and efficient waste-to-energy technologies affects the public attitude towards the location of waste disposal sites (Fredriksson, 2000) and the flows of waste across regions and borders, which are on the rise across Europe.

Since Oates's seminal work in 1972 on fiscal federalism, a central question of public finance has been which level of a federation should be assigned the provision of public goods. Local jurisdictions, either municipalities or regions, are more likely to internalise local conditions and costs, but overlook inter-jurisdictional spillovers. On the other hand, central governments may internalise those spillovers, but are likely to neglect local conditions.[3] The negative externalities produced by waste mobility are quite relevant because the flows between any two regions affect their environmental quality and that of the neighbouring regions. The regulation of waste disposal is increasingly debated, for its economic as well as environmental implications, even at supranational level (Kellenberg, 2012).

In spite of this lively debate, there is almost no agreement on which level of centralisation is more efficient. Moreover, only few contributions in the waste management literature exploit the standard assumptions of the theory of fiscal federalism to explain

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[3] For reviews see Banzhaf and Chupp (2011) and Buchholz et al. (2011).

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the prevalence of decentralised decisions. Ogawa and Wildasin (2009) argue that decentralisation might allow to reach a more efficient allocation than centralisation, while other studies claim that such a framework might spur undesirable and distortionary effects, such as fiscal competition and "race to the bottom" (Oates and Schwab, 1988; Oates, 1999; Fell and Kaffine, 2014). The focus of most of this literature is on waste generation and disposal, while the incentives to waste mobility are almost neglected.

The aim of our paper is to fill this gap by developing a multi-region model to investigate key policy questions, such as the effects of decentralisation on waste flows, on the investment in the mitigation of environmental damages and, ultimately, on welfare. Our theoretical interest into the key governance features of the problem stems from the fact that across countries municipal waste is managed through a variety of decentralised solutions and regulations. In our model the key decisions revolve around the cross-regional mobility of waste and the externalities (pollution) associated with its disposal, be it via incineration or landfill dumping. When the regions are characterised by different levels of efficiency in the processes they apply to final treatment, a certain degree of mobility across regions develops. This might allow to reap the benefits of higher efficiency. On the other hand, when transportation and environmental costs caused by waste mobility, and the concentration of its disposal become significant, a trade-off emerges.

In a First-Best scenario, benefits and costs are duly taken into account and an optimal solution can be found. The essential features of this solution are: 1) the investment in damage-reducing activities takes into account the spillovers caused by waste disposal (the stronger the spillover, the larger the investment); 2) the indirect effects that cross-regional flows of waste have on the environmental quality of all the regions are considered. These spillovers may not be fully perceived at the local level, and our model shows that they may have an effect on: 1) the investment to mitigate pollution, which is unambiguously suboptimal in the decentralised solution; 2) the size of the flow of waste; 3) its direction. These inefficiencies lead to the conclusion that decentralisation is a second-best solution. However, this does not imply that all the regions are worse off: some of them may favour decentralisation, and their behaviour may create high welfare losses to other regions. The spatial distribution plays an important role: we show that when the distance between regions, or the preferences for environmental protection, are not homogeneous, some of them are likely to prefer decentralisation to the centralised solution. However, since total damage is higher, this means that some regions will suffer a considerable decrease in the quality of their environmental endowment. In this case, upper tiers of government (national or super-national) may wish to mitigate these problems with specific measures to regulate waste mobility. In this respect, the proximity principle (as introduced by the EU) as well as setting tariffs for importing/exporting waste, may reduce the incentives for opportunistic behaviour. The paper is organised as follows. In Section 2 we briefly describe the salient mechanisms of governance for Municipal Waste Management (MWM) across Europe. In Section 3 we present our model, the two regulatory frameworks and derive the optimal flow and investment levels. These results are then analysed, compared and discussed in Sections 4 and 5, where we also derive the main policy implications of our analysis.

2. Waste mobility and its regulatory system

There are various drivers explaining waste flows and trade. Demographics and regulation obviously determine the demand for final treatment, but pricing and environmental aspects also play an important role. The use of landfill sites is increasingly discouraged, while incineration plants (especially those allowing energy recovery) are on the rise. In addition, local political factors often make the cost of the final disposal of waste prohibitively high, so that some waste mobility becomes unavoidable. In general, direct and indirect local cost-saving motives drive the observed increase in the shipment of municipal waste for incineration or landfill dumping, domestically and across national borders (Mazzanti and Zoboli, 2013). Several factors, coupled with the uneven geographical distribution of incineration capacity, determine this trend. This calls for studying the incentives for waste shipment across regions and the ensuing environmental implications.

The sparse available data show that the distribution of treatment facilities for municipal solid waste is very uneven both at regional and country level (Wilts et al., 2017). For instance, in Europe six countries (Germany, France, the Netherlands, Italy, the United Kingdom and Sweden) account for almost three-quarters of Europe's incineration capacity. Many of the remaining countries still depend heavily on landfill for municipal solid waste disposal. Also the distribution of incineration facilities within each country is not uniform and this is likely to cause a key imbalance between available waste production, recycling and incineration capacity, thus triggering significant waste flows.

In the European Union, the MWM regulatory framework typically involves three governance levels, sometimes with overlapping responsibilities:

- the national level, framed by the EU, is mostly in charge of economic, technical and environmental regulation;
- the regional level: focuses on planning of disposal capacity, enforcement of the self-sufficiency principle, authorisation of facilities and overview of MWM practices;
- the local level: organises MWM services within general rules concerning management and finance of local services, competition laws, etc.

The German and Dutch frameworks embed several features adopted by other member states. In Germany, the responsibility for waste management is shared among the national government, the federal states and local authorities. The national Ministry of the Environment sets priorities, participates in the enactment of laws, oversees strategic planning, information and public relations and defines requirements for waste facilities. Each Federal State adopts its own waste management act containing supplementary regulations to the national law, e.g. concerning regional management concepts and rules on requirements for disposal. Each Federal State develops a waste management plan for its area.

In the Netherlands, the Environmental Management Act stipulates that the Ministry for Housing, Spatial Planning and the Environment must draw up a Waste Management Plan every six years. Obligations at the provincial level mostly concern the licensing and monitoring of treatment facilities, as well as the environmental rehabilitation of closed landfills sites. Municipalities are responsible for the collection of household waste in their own area.

Italy broadly implemented the German model for a long while. The main difference was in the allocation of functions: sub-regional authorities (provinces) were in fact responsible for the planning, regulation of access to facilities and overview of MWM services. Access to landfill sites and incinerators was broadly restricted to provincial waste. New national laws have recently introduced cross border mobility for waste incineration, subject to some restrictions.[4] Moreover, regional laws have fostered mobility of waste

[4] The practical application of this principle is still uncertain because of the jurisdictional conflict between regions and the national government as to which kind of waste should be allowed to flow.