Original Articles

Waste management performance in Italian provinces: Efficiency and spatial effects of local governments and citizen action[☆]

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ABSTRACT

This paper investigates the waste management performance of Italian provinces in the period 2004–2011. An efficiency analysis through DEA is first implemented in order to assign efficiency scores both to local administrations and citizens. The presence of spatial interdependencies in the waste management performance of governments and citizens together with the persistence of good/bad performance in waste management distribution is then tested. Our results highlight the presence of two clusters showing better performance in northeastern and southern Italy. The provinces in central Italy performed poorly. A positive spatial correlation for efficiency scores is then found. An interesting result, also for policy makers, is that the joint action of local institutions and citizens reduces the differences between "good" and "bad" provinces, stimulating a convergence process towards better waste management performance. The waste management process is optimised when both citizens and local government behave appropriately.

1. Introduction

In recent years international policy has often focused on environmental protection and especially on sustainable waste management. In 1992 the United Nations Conference on Environment and Development already recommended more conscientious waste management and recycling habits. The first step is to define "waste". The Legislative Decree 152/2006 gives the following definition "any substance or object that owner discards or has the intention or the obligation to discard". Moreover, there is a difference between by-product and the secondary raw materials (or end-of-waste). The first relates to those products that are created by industrial production and that can be used in the same/ different production process by the same/different company. The second are waste that, after some processing operation such as recycling, acquire market value and can be reused. These two definitions are instrumental to the priority of the recent Directives, at national and EU level, which have the objective to create a recycling society and favour a real circular economy. In a real circular economy the aim is to decrease and avoid the production of waste (De Leonardis, 2011). The creation of a circular economy means that it is necessary to take the maximum advantages from the resources, not placing them in a landfill, but introducing them again in the productive process (European Commission, 2014).

In order to achieve such objectives, local policy makers sought to commit citizens to responsible waste management and recycling behaviour. In this perspective economists have also focused on waste management issues in order to evaluate the effectiveness of the implemented policies and/or study the relationships between policy makers' guidelines and citizen action.

Much of the literature analyses the determinants of waste collection and recycling behaviour (Barr et al., 2001a,b; Barr et al., 2005; Coggins, 1994; Tucker et al., 1997, 1998, McDonald and Oates, 2003). Households are the most widely used units of empirical analysis. Some explore the social factors that prevent/bring about sustainable recycling behaviour (Timlett and Williams, 2009; Fiorillo, 2013). Tonglet et al. (2004a,b), used the Theory of Planned Behaviour (TPB, Ajzen, 1991) as a theoretical framework. According to the TPB, individual behaviour depends on three factors: attitude, subjective norms and perceived behavioural control. On the basis of the literature on recycling decisions (Boldero, 1995; Davies et al., 2002) the authors added further variables: moral norms, past experience, situational factors and recycling consequences (Ajzen and Fishbein, 1980; Ajzen, 1991). Moral norms concern the moral obligation to recycle, it is the personal judgement on its moral correctness/incorrectness. Past experience is the individual's

previous experience of recycling and contributes to current behaviour. The above authors also introduce situational factors which may facilitate/discourage recycling behaviour, i.e. the difficulty of recycling resulting from perceived waste of time and space in a household. Finally, recycling consequences concern the outcome of recycling habits such as energy and money savings, natural resources conservation, and better environmental protection for present and future generations. Their results show that pro-recycling attitudes, previous recycling habits and recycling consequences are significant determinants of recycling performance. Pro-environmental behaviour (Curlee, 1986; Frey and Jegen, 2001; Jenkins et al., 2003) may also be influenced by monetary rewards and price schemes, such as external incentives (Hornik et al., 1995). When monetary incentives for individuals that adopt pro-environmental waste management habits are arranged by local authorities, it is widely argued that correct behaviour persists only in presence of incentives. When incentives stop, there may be a crowding-out effect (Frey and Jegen, 2001, among others). As regards price schemes, examples are the volume-based waste pricing programmes. Some authors (Reschovsky and Stone, 1994; Fullerton and Kinnaman, 1996; Jenkins et al., 2003) found that unit-based waste pricing schemes had no significant effect on the recycling rate, probably because households shift to easier recycling goods. For Dutch municipalities Dijkgraaf and Gradus (2004), otherwise, show a significant effect of the level of unit price on recyclable waste. Social capital (see Jin, 2013; Pretty, 2003; Liu et al., 2014, among others) is a crucial factor of pro-environmental behaviour, too. Membership of an environmental organisation, social relations and charitable works are positively correlated with good habits in waste management and generally influence the individuals' preferences on environmental problems positively. An important determinant of pro-environmental habits is also the legal framework (Hicks et al., 2005; Viscusi et al., 2013). Local government can, indeed, encourage pro-social behaviour (Bilz and Nadler, 2014). Municipal law, for example, may introduce mandatory recycling and curbside pickup of materials and increase the quantity of recycled solid waste (Kinnaman, 2006). Furthermore, if local legislation were to make recycling less complex, introducing, for example, waste pick-up at the curbside, it could induce citizens to behave virtuously. Government may also prevent/stimulate a particular behaviour without formal law but by social campaigns, for example, in order to induce large numbers of individuals to stop/adopt the habit (Carlson, 2001). Following a social norm people may engage in pro-social behaviour and adopt good habits, i.e. sound waste management practices, because they win the approval of the other citizens and especially their neighbours. The role of socio-spatial transmission in environmental behaviour was highlighted by Crociata et al. (2016) and Agovino et al. (2016e), investigating whether socio-spatial units (namely Italian provinces), with pro-environmental attitudes, i.e. good recycling habits, manage to influence the performance of "neighbours". Why should socio-spatial effects be found in waste management? The pioneering idea can be found in a study by Oskamp et al. (1991) in which 95% of residents, characterized by virtuous recycling behaviour, state that their friends and neighbours adopt the same behaviour. In other words, if householders are surrounded by individuals with good recycling habits, they are more likely to adopt the same behaviour because they feel part of a virtuous circle. The good habit, then, becomes an act of cooperation with neighbouring individuals. In contrast, if neighbours are poor recyclers, householders only perceive recycling costs and do not adopt appropriate moral behaviour. In this strand of the literature, Agovino et al. (2016e) employed the differentiated waste collection rate as representing a pro-environmental attitude and, using the Spatial Markov Chains (SMC) approach (Rey 2001), investigated the positive/negative effect of virtuous/non-virtuous neighbours on Italian provinces and the dynamic of such influence over time in the period 1999–2012. By applying SMC methodology it was possible to verify whether a province with a virtuous/non-virtuous differentiated waste collection rate tends to remain in that state if surrounded by provinces with similar behaviour. In detail, the technique allows us to test whether provinces with good pro-environmental habits influence positively the neighbours' differentiated waste collection rate and, also, whether provinces with a low differentiated waste collection rate affect their neighbouring provinces negatively. The authors also derived the Moran scatter plot (Anselin, 1993) before performing SMC analysis. The results show the presence of significant spatial spillovers among contiguous provinces: provinces with virtuous recycling habits influence their neighbours' behaviour positively. A negative proximity effect is also found for "bad" neighbouring provinces. Furthermore, in the long run these effects are self-reinforced. The probability of maintaining good (bad) status is very strong when neighbours enjoy an above (below) average differentiated waste collection rate. Crociata et al. (2016) investigate the spatial interaction among Italian provinces in the period 1999–2012 using, as a proxy of pro-environmental behaviour, the separate collection of municipal waste. In the first step of the paper they carry out the Theil index (TI) and the Moran index (MI). Following Chasco and Lopez (2007, 2008) they decompose MI into two parts, contemporary and non-contemporary spatial dependence. Then they construct a first-order spatial autoregressive model through the results of the identification process. The results highlight the presence of an imitation-driven and persistent process. Provinces that are located near virtuous provinces show a good environmental attitude and such spatial interactions have a persistent effect.

In the wake of the latter spatial analyses, in this paper we investigate the waste management capability of local administrators and citizens in Italian provinces in the period 2004–2011. Italy is an interesting case-study because circular economy and eco-innovation could be important drivers for the economy also if there are some technological, structural and regulation barriers which are described in detail in what follows (Mazzanti et al., 2015). There are two types of economic barriers: barriers to market entry by new firms and the structure of small and family Italian firms which, having small access to capital, don't manage to invest in R&D. As regards technological barriers, the Italian innovation capacity is less than that of the other European countries (OECD, 2013), also if, during the last years, it has been improved thanks to the setting up of a regulatory system and increased public funds. Also the number of researcher that works in Italy and not abroad is lower than the others OECD countries, together with the knowledge exchange between universities and industries. Italy imports a lot of energy resources from abroad, yet, and green procedures seems not to be completely adopted by the firms (Antonioli et al., 2013). In this framework the regulatory and policy framework may be important for the adoption of waste related innovation (see Cainelli and Mazzanti, 2013 for the manufacturing sector). Different policy measures with the aim to promote new funding schemes for waste and circular economy were adopted during the last years. Incentives and subsidies have been introduced to improve energy efficiency in buildings and support the eco-innovation and organizational innovations (ISO and Ecolabel among others). Law No. 221 of 2015, December 28th deserves a special mention. Article 21 tried to increase the demand for green products, sustaining competitiveness. Through the Article 23, the Ministry of Economic development furnished financial incentives to the business activities that produce goods using recycled materials and dismantled resources. Article 32 introduced measures to increase separated collection and recycling, setting a top-down increase of 20% in the local landfill tax for those municipalities that do not respect the national targets for the separated collection of waste while articles 36–7 announced a decreasing scheme of waste tariffs for households and activities. As regards the small islands, article 33 gave the possibility of charging a maximum 2.5 € fee to tourist. The underlying idea is that tourist flow increases waste and makes necessary environmental recovery projects. In accordance to the OCSE and UE recommendations, article 68 established, within the Ministry of the Environment, a Catalogue of both environmentally harmful subsidies and environmentally favorable subsidies that is frequently updated.