



Analysis

Complementarity vs substitutability in waste management behaviors[☆]Alessio D'Amato^{a,c}, Susanna Mancinelli^{b,c,*}, Mariangela Zoli^{a,c}^a DEF and CEIS, Università degli Studi di Roma Tor Vergata, Italy^b Università degli Studi di Ferrara, Italy^c SEEDS (Sustainability, Environmental Economics and Dynamics Studies) Interuniversity Research Centre, Italy

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ABSTRACT

Both the economic and psychological literature suggest that household waste reduction and recycling behaviors are driven by different motivators. In this article, we investigate whether any relationship exists between waste reduction and recycling efforts and, in this case, if they turn out to be complements or substitutes in individuals' preferences. Our theoretical results, supported by empirical evidence for England, suggest that waste policies and environmental motivations may affect recycling and waste reduction both directly and indirectly, through their reciprocal interactions.

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1. Introduction

Municipal solid waste is the most visible and pernicious by-product of the consumer-based lifestyle which characterizes many of the world's economies (Hoorweg and Bhada-Tata, 2012). Despite the increasing awareness of the external effects of waste production/disposal and the multiplicity of policy initiatives undertaken by governments and international organizations, waste volumes are increasing as a result of higher incomes and urbanization rates, increased consumption of goods and services, and more intensive use of packaging materials.

In response to the challenges posed by growing waste levels, minimization of waste production has been identified as a key policy option towards a sustainable waste management strategy.¹ Focusing attention on the European Union, whilst significant improvements in recycling performance have been realized in recent years,² the same does not hold for reduction of municipal waste. According to the European Environmental Agency, though waste prevention is at the top of the waste hierarchy (EU 2008 Waste Framework Directive), between 2001 and 2010 only

eleven countries cut their generation of municipal waste per capita, whilst twenty-one countries increased their production (EEA, 2013).³ These results suggest that policy efforts at EU and national level have provided stronger incentives towards increasing recycling than towards waste reduction (Mazzanti and Zoboli, 2009; Cecere et al., 2014).

In particular, given larger costs and difficulties of implementing waste prevention interventions and the observed sluggishness of waste reduction policies, an interesting question arises concerning the potential impact of existing recycling policies in driving waste reduction. Intuitively, two opposite situations may arise. On the one hand, incentives to encourage recycling may have positive effects on waste reduction, by affecting people's cultural learning of new preferences about a pro-environmental lifestyle (Bowles and Polania-Reyes, 2012). On the other hand, they may have negative effects due to a sort of multi-tasking effect (*à la* Holmstrom and Milgrom, 1991), so that the individual devotes less effort to waste reduction in response to incentives aimed at increasing recycling efforts. In the first case a relationship of complementarity between the two waste management behaviors may be expected; at the opposite, in the second case a relationship of substitutability is more likely to exist.

In this paper we aim at analyzing these potential interrelationships by explicitly considering, theoretically and empirically, the possibility that recycling decisions interact with reduction decisions, reinforcing

[☆] Analysis

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E-mail address: susanna.mancinelli@unife.it (S. Mancinelli).¹ Waste minimization is defined as "measures or techniques... that reduce the amount of wastes generated. Examples of waste minimization are environmentally-sound recycling and source reduction practices". (Source: <http://www.eionet.europa.eu/gemet/en/concept/5022/> accessed 3 December 2014).² Between 2001 and 2011, recycling and composting of municipal waste decreased from 27% to 40% in the EU-27, while landfilling decreased from 56% to 37% (Eurostat, 2013).³ In the UK, for instance, waste arising from households fell by 2% between 2010 and 2012. Nevertheless, this could be the result of a fall in average household expenditure over the same period, which dropped by nearly 4% in 2012 compared to 2010 (DEFRA, 2015), suggesting that no decoupling is taking place.

or weakening each other. By admitting the possibility that recycling and reduction efforts may be complements or substitutes in individuals' preferences, we introduce additional, and to our knowledge not investigated yet, potential channels through which policies and behavioral drivers can affect the different dimensions characterizing waste related behaviors.

A relevant strand of economic literature has already investigated potential effects of waste policies on recycling and reduction decisions. In several works, the analysis is devoted to assessing whether the provision of convenient recycling options and/or the introduction of waste disposal fees have positive effects in terms of increased households' recycling effort.⁴ For example, user fees or pay-as-you-throw (PAYT) schemes, which charge residents for the quantity of waste thrown away for collection, are suggested to have a direct, negative effect on the amount of waste production, although this effect is not confirmed by all studies (Bel and Gradus, 2014). By increasing households' costs of discarding additional waste relative to the cost of recycling, PAYT instruments can generate also positive incentives on recycling efforts (as shown, for instance, by Hong et al., 1993, and Hong, 1999 for households in Oregon and Korea, respectively, Ferrara and Missios, 2005 for Canada and Kipperberg, 2007 for Norway), even though this evidence is not supported by other studies (Fullerton and Kinnaman, 1996, Kinnaman and Fullerton, 2000 for the US). This can be justified by considering that unit pricing provides only an indirect incentive to recycling (Jenkins et al., 2003).⁵

Previous contributions, however, have focused on the impact of waste policies on waste related efforts taken as separate behaviors, without considering the existence of potential interrelationships between them. We innovate with respect to the literature above, since we aim at investigating not only the direct impact of (both recycling and waste reduction) policies, but also their indirect impact passing through the potential complementarity/substitutability relationship between the two waste efforts.

We are particularly interested in assessing the indirect effect of recycling policies on waste reduction behaviors, given the persistence of difficulties and delays in the implementation of waste minimization policies. As noted above, in the EU, waste reduction policies are still lacking, and in several Member States waste collection and disposal costs continue to be financed through flat charges or municipal taxes not related to the amount of generated waste.⁶ In this respect, the choice of England as case study for our empirical investigation is particularly relevant, as in this country current legislation forbids local authorities from introducing PAYT schemes,⁷ implying that they have to rely on other instruments to stimulate waste reduction efforts. In this context, recycling policies play an important role in the waste management system; this suggests the opportunity of investigating potential indirect effects due to the presence of complementarity or substitutability between recycling and reduction efforts. On the other hand, given the importance of other drivers behind individual pro-environmental behaviors,

as testified by a wide literature on this subject, it is worthy to explore the impact of different, non monetary motivators of waste disposal decisions.

Our analysis then builds upon the literature that focuses on the potential determinants of different waste behaviors. One of the main conclusions from this literature is that recycling and waste reduction represent different dimensions of waste management behaviors, and then require different strategies and specific incentive mechanisms. According to Ebreo and Vining (2001), for instance, waste reduction is not strongly correlated to recycling behavior: whilst individual concerns for the future are related to recycling behaviors, the same predictors are not effective in stimulating waste-reduction behaviors, which at the opposite are related to internal values and general concerns about the environment. Tonglet et al. (2004) find a significant correlation between reduction behaviors and some recycling factors (i.e. consequences of recycling and outcomes of recycling), even though the correlation with recycling intentions and attitudes does not turn out to be significant. An extensive analysis of different motivators for waste management behaviors is provided also by Barr (2007), that identifies three groups of predictors: environmental values, situational variables and psychological factors. On the basis of this taxonomy, the author investigates the determinants of recycling, reuse and reduction behaviors, concluding that different determinants explain each of them. According to Barr, recycling is mainly a normative behavior, as it is likely to be affected by individual awareness of the social norm, while waste reduction behavior reflects personal environmental values.

Finally, we draw on a second strand of literature that explores the influence of non-monetary incentives on individual waste management decisions (Berglund, 2006; Brekke et al., 2003, 2010; Hage et al., 2009; Halvorsen, 2008). Viscusi et al. (2011), for instance, empirically investigate the role of social norms in affecting recycling of plastic water bottles in US, finding that the social norm variable, reflecting the individual's potential guilt with respect to neighbors' attitudes in case of not recycling, turns out to be not statistically significant. Kinnaman (2006) suggests that recycling is increased by warm-glow incentives more than by unit-based pricing, to the point that households may even be willing to pay for the opportunity to recycle. With respect to waste reduction, Cecere et al. (2014) test how motivations affect food waste reduction, finding that warm-glow decreases the likelihood of producing more waste. Finally, Abbott et al. (2013) examine (theoretically and empirically) how social norms and warm-glow affect the link between the quality of recycling facilities and recycling effort, showing that social norms significantly affect recycling decisions and warm-glow does not.

Our paper adds to these contributions by considering that recycling and reduction efforts may interact in the individual utility function, when we evaluate the impact of policy as well as other behavioral and environmental factors on them. To empirically test the hypothesized interactions between waste behaviors, we adopt structural equation modeling (SEM), which allows us to estimate the magnitude of both direct and indirect effects among the involved variables. In particular, the use of such technique is required in order to verify the existence of a reciprocal causation effect between recycling and waste reduction behaviors.

The paper is organized as follows. Section 2 presents the theoretical model and lays out the main research hypotheses to be tested empirically. Section 3 introduces the data, while Section 4 presents the empirical specifications and estimation results. Section 5 concludes.

2. Theoretical model and testable implications

We model a setting featuring a single agent.⁸ Individual utility increases with the effort exerted by the agent in waste recycling and reduction, labelled, respectively, as e_{REC} and e_{RED} . In other words, we

⁴ Jenkins et al. (2003) provide a thorough review of existing empirical studies exploring the impact of unit pricing and curbside recycling policies on households' recycling effort.

⁵ For the US, however, Reschovsky and Stone (1994) find that recycling rate increases when PAYT schemes are adopted jointly with curbside recycling programs. Morris and Holthausen (1994) simulate the introduction of unit disposal fees without changing the opportunity cost of recycling, and conclude that the percentage of recycled material can even be reduced.

Regarding the different impact of waste disposal fees in different national contexts, Kipperberg (2007, p. 225) concludes that "[...] an emerging insight is that user fees work in several societies, including in Norway, whereas their effectiveness in the United States is yet to be fully established".

⁶ According to Hogg et al. (2012), in the EU, only Austria, Finland and Ireland have PAYT schemes in place in all municipalities. Reschovsky and Stone (1994) have identified some concerns about PAYT schemes, related, for instance, to difficulties in setting rates, potential incentives to illegal dumping, high administrative costs and the regressive impact that variable fees could have on low income residents. All these factors contribute to explain their difficult implementation and scarce popularity.

⁷ Localism Act 2012; see Holmes et al. (2014).

⁸ This is coherent with the unit of analysis of the dataset adopted in the empirical part, that is at individual level.

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