Behavioural attitudes towards waste prevention and recycling

Marianna Gilli*, Francesco Nicolli†, Paola Farinelli‡

Abstract

This paper investigates empirically the relationship between individual motivations and recycling and minimisation behaviours. Exploiting an original survey of 618 Italian households, we conducted a cluster analysis on individual motivations to identify the main motivation groups among respondents. In a second step, we used these clusters as independent variables in a simple regression framework to test their correlation with recycling and minimisation variables. Overall, the results show that recycling behaviour does not correlate with individual motivations, while waste minimisation seems to be associated with intrinsic motivation only.

Keywords: Intrinsic motivations; Recycling; Green preferences; Waste policies

JEL: Q53; R11; K42

* University of Ferrara, Department of Economics and Management

† University of Ferrara, Department of Economics and Management & European University Institute, Florence.

‡ University of Ferrara, Department of Economics and Management

1. Introduction

In the last decade, the three words "Reduce, Reuse and Recycle" have become increasingly popular in the agenda of policy makers in OECD[1] Countries. In Europe, for instance, landfill diversion and the promotion of recycling and waste minimisation were pillars of the 1999 Landfill Directive and became even more important in the Waste Framework Directive (2008/98/CE), which can be considered the cornerstone of the European waste management strategy. The most recent strategy in the waste management realm is the adoption of the EU action plan for the Circular Economy, a legislative proposal aimed at bolstering the transition towards a circular economy society. The main idea of this new legislative package was to rethink product lifecycles and place more attention on re-using and recycling. Contextually, the circular economy action plan proposed a set of ambitious targets, which included, among others, a 65% target for municipal solid waste, a 75% target for packaging waste, and a target to reduce landfill use to a maximum of 10% of total waste disposal by 2030[2].

In the last two decades, commitment towards the improvement of waste management systems were reflected in the profound reorganization of entire waste management systems, in which landfilling is always less prominent and recycling is becoming increasingly important: in Europe, it increased from approximately 20% in 1995 to 36% in 2013.

The economic literature (e.g., Nicolli, Mazzanti, & Iafolla, 2012) highlights that income per capita, population density and environmental policies, as well as the rise in alternative disposal choices, such as recycling and incineration, have been the main factors behind the process of landfill diversion.

However, to date, less attention has been given to trying to comprehend how household

---

[1]Organisation for Economic Co-operation and Development
[2]See the dedicated section on the European Commission web site for further reference. http://ec.europa.eu/environment/circular-economy/index_en.htm

behaviour has influenced and can influence this process. In recent decades, following the line already travelled by psychologists and sociologists, economists have started to recognise the importance of non-monetary motivations as determinants of human behaviour (Titmuss, 1970; Andreoni, 1989; Frey & Oberholzer-Gee, 1997; Bénabou & Tirole, 2006). From these seminal studies began the search for new models for interpreting individual actions, including models of motivations other than the pursuit of self-interest, which allows us to draw a more complex and realistic picture of the economic agent than does the traditional *homo economicus*.

This field of research has many implications for waste management studies for several reasons. For example, complicated separate collection schemes require a good amount of effort and time from participating households. This obviously implies that individual motivation, such as altruistic values concerning the environment, play a relevant role in determining the success of collection systems and, consequently, recycling at the country level (Berglund, 2006). Moreover, as shown in several recent contributions (D'Amato, Mancinelli, & Zoli, 2016), the interaction between different types of motivations is nontrivial and can demonstrate different configurations of complementarity/substitutability between external rewards (like unit price systems) and internal motivation (like pro-environmental behaviour).

The present work tries to enrich this growing field of literature by studying the motivations driving recycling and minimisation behaviours at the individual level by exploiting an original survey of 618 Italian households. We test the correlations between household waste minimisation and recycling[3] outcomes with three different types of motivations, namely, intrinsic motivation, extrinsic motivation and a mixed motivation defined as reciprocity.

Overall, our research framework builds upon the previous work of Cecere, Mancinelli, & Mazzanti (2014), which we expand in several directions. First, the survey used in this analysis allows extending their line of research, focussing on a broader spectrum of waste streams other than food

[3]In line with the literature on this topic, we generally use the term "recycling" in the text. We note here, however, that we generally refer to separate collection.

waste. This is a relevant point since, as outlined in the literature, motivations behind food waste minimisation might comprise motives beyond environmental care. For example, Quested, Marsh, Stunell, & Parry (2013) and Halloran, Clement, Kornum, Bucatariu, & Magid (2014) assert that household motivations to reduce waste can be related primarily to money, food consumption patterns and emotions. Clement, Kristensen, & Grønhaug (2013) notice that also grocery store habits matters: most consumers enter the store without a clear idea of what to buy and usually make a purchase based on the front of the package and without assessing relevant alternatives. On the contrary, the wider plethora of waste streams analysed in this paper reflect more closely the complexity of modern waste management systems, in which families are asked to manage different waste streams with different physical characteristics. We believe our contribution more precisely reflects this complexity.

Second, the information collected in the survey allows considering more facets of intrinsic motivation. Indeed, we were able to create a factor variable which exploits the common variability related to intrinsic motivation of a set of different variables, as explained in Section 3. Third, the survey provided us with data on individuals' tendency to react to peers' behaviour, allowing us to include reciprocity in the range of motivation. This is an important aspect because as highlighted in the literature (see for example Abbott, Nandeibam, & O'Shea, 2013) social norms and peer pressure are often more relevant for recycling behaviours than an economic incentive. This aspect of our analysis is discussed in Section 2. Fourth, unlike previous contributions, which focused their empirical analyses on the impacts of waste policies and motivations taken as separate drivers of individual recycling behaviours, we also investigate whether motivations can be a necessary condition for the effectiveness of waste policies when household recycling is at stake. Finally, this paper exploits recent information on waste management in Italy, which represent an interesting case study, because of the complexities and the well-known difficulties related to the local waste management system in different areas of the country. Moreover, this is to our knowledge the first paper that considers waste minimization behaviour in Italy, while for what concern recycling, the literature consists of only one contribution based upon data dating back to the beginning of the 2000s and that do not considers specifically the role of motivation (Fiorillo, 2013). For this reasons, we do believe that our paper is a valuable contribution to the existing literature.

The paper is structured as follows: Section 2 introduces the theoretical background, Section 3 presents the data and methodology, Section 4 illustrates the main empirical results and Section 5 presents our conclusions.

2. Background

The aim of this paper is to show how groups of individuals moved by different sets of motivation behave in relation to household waste management. Therefore, the interest in motivation is central to our analysis because it can be considered as the lever behind human behaviour.

In economics, the literature on the role of motivations towards pro-social and pro-environmental behaviour focuses on two types, namely intrinsic and extrinsic motivations. According to Ryan & Deci, 2000, individuals may begin an activity because they evaluate it positively or because of an external imposition. Intrinsic motivation comes from an inner need to perform an action or to adopt a certain behaviour. For intrinsically motivated people, the reward comes from the action itself, while extrinsically motivated people are moved by the perspective of receiving an external reward in exchange for their behaviour.

Intrinsic motivation can be related to several factors. According to various authors, (see Andreoni, 1989, 1990; Bénabou & Tirole, 2006; Fehr & Schmidt, 1999) people care for others' wellbeing and, consequently, behave pro-socially to maximize their utility. In this case, people are said to be altruistic when utility increases and as they see others increasing wellbeing, independent from the source of the improvement. However, according to De Young, (1996) altruism can also derive from the pursuit of self-interest: the individual may simply be personally satisfied by being engaged in a certain activity, regardless of the positive spillovers that may arise to other individuals. Andreoni (1990), who considers motivations behind charity donations, refers to these latter type of individuals as impure altruists, because they increase their private utility through the act of donating. This utility is enjoyed by the individual as a positive feeling of warm glow. Differently from the case of pure altruism, the performing of an altruistic action is more related to the perception of a warm glow that to the care of others wellbeing.

Reasons that are ascribable to ‘perceived external pressure’ may instead be included in the category of extrinsic motivations. Motivations related to the individual’s need to gain external rewards, either economic or in term of social appraisal enter this category. Behaviours that are instrumental in obtaining an external material reward, such as tax breaks are surely triggered by extrinsic motivations. However, actions related to reciprocity, social norms and reputational concerns instead necessitate further examination, since they do not appear to be related only to external pressure. For what especially concerns social norms, a straight and clear distinction is difficult to operate. In fact, people keen to conform to a socially shared perception of an ideal form of pro-social behaviour are moved both by the desire to achieve a good self-image (essentially intrinsic) and to gain the respect and approval of others (essentially extrinsic). In this case, people behave pro-socially in order to signal their good traits to both themselves and others.

A relevant strand of economic literature has recognized the importance of individual motivations, as alternative to monetary incentives, when the behaviour is pro-environmental. We believe that waste related issues are particularly intriguing in this framework for the specific characteristics of the two main waste related behaviours: waste reduction and recycling.

For what concerns waste reduction, the main associated individual action should consist of reduced consumption of materials that are subsequently thrown away. This is particularly evident when dealing with food waste: what is discarded is usually what has been purchased in excess and not consumed. In this situation the monetary incentive should already come from saving due to “not to buy in excess”. Hence, something more than merely pecuniary drivers must be explored to incentive people to undertake this pro-environmental behaviour. A key element is related to the degree of visibility of the behaviour: waste reduction is a private action which is unlikely to be observable by others (Barr, 2007; Cecere et al., 2014). In fact, it typically involves private decisions as to not buy or purchasing items that result in less waste, or reuse and repair something (Bortoleto, 2015). The hidden nature of minimization actions can be related to theories on informational dependence (Fazio, 1990). First, the lack of information about others performing prevention might prevent "waste minimization" to settle as a prevailing descriptive norm, and therefore to become an action which is undertaken by the most of the population. Second, since individuals looks to a reference group to know about the prevailing norms, they can also decide to opt out from a behaviour if they perceive that their actions cannot be observed by others (Lapinski & Rimal, 2005)

On the basis of these considerations it is more likely that hidden waste reduction behaviour is mainly related to intrinsic motivations. The literature, which seldom analysed this subject, confirm this insight. Barr (2007), for instance, among the several factors that influence waste management behaviour finds that waste reduction is due to personal environmental values. The fundamental role of intrinsic motivations as drivers of waste minimization is shown also in Cecere et al. (2014) for the specific case of food waste. In their study, moreover, extrinsic motivations do not play a significant role to incentivize waste reduction behaviour. Also empirical outcomes in D'Amato et al., (2016) show that warm-glow positively affects waste reduction and has no direct effect on recycling.

Based on this premises we formulated the following hypothesis:

H1: intrinsically motivated individuals are more likely to minimize their waste.

The literature on the role of motivations in realtion to recycling behaviour is on the contrary quite rich. The individual action of recycling, typically require high effort and opportunity cost in terms of time and yields only a low individual environmental benefit. In this situation monetary incentives alone may result too low to guarantee increased efforts by people. A study by Ewing, (2001)show that in the decision to be a better recycler altruism plays a minor role, while what matters the most are the perceptions of the behaviour by the other members of the household as well as other characteristics related to one's egoistic nature. Therefore, recycling can be related to both a narrow definition of extrinsic motivation, intended as an economic incentive and to a broader definition of extrinsic motivation which encompasses also social norms and reciprocity. This hypothesis found support in the literature. For example, Abbott et al., (2013), show that peer pressure is positively correlated with recycling activities, while warm-glow is not; D'Amato et al. (2016), show that recycling is directly influenced by extrinsic motivation intended as social norms. Also Barr et al., (2007), find that recycling is fundamentally a normative behaviour. Notwithstanding this results, other authors found that also intrinsic motivation matters to some extent. Kinnaman, (2006) shows that recycling activities are more susceptible to warm-glow incentives than to unit-based pricing, while Viscusi, Huber, & Bell, (2011) find that, in the U.S., recycling is more incentivized by pro-environmental behaviour than by economics or social incentives. Berglund, (2006), for instance, shows that people with higher Green Moral Index (the measure for intrinsic motivations) have a lower willingness to pay to let someone else take over the waste recycling activity. The willingness to pay to recycle at home is investigated also in Czajkowski, Hanley, & Nyborg, (2017) and their main finding is that willingness to pay is positively associated with moral or intrinsic norms.

In the studies above considered, recycling may be driven by both intrinsic and extrinsic motivations: therefore, social norms may well be effective for increasing recycling insofar as recycling entails more reciprocity and visibility related to individual actions.

Based on these consideration, we state the following hypothesis:

H2: individuals who are sensitive to incentives, reciprocity and peer pressure tends to show higher probability of increasing recycling with respect to individuals who are predominantly intrinsically motivated towards the environment

The role of households' behaviours with respect to separate collection is a fundamental precondition to the success of the evolution towards a "recycling society". Besides individual motivations, it is commonly acknowledged in the economic literature (see for example: Abbott et al., 2013; Beatty, Berck, & Shimshack, 2007; Guagnano, Dietz, & Stern, 1994) that better recycling policies that increased provisions of appropriate services and/or implementation of waste disposal fees positively influence household participation in waste sorting, because it decreases the opportunity cost of recycling. As a consequence, any policy that makes recycling more convenient should increase the participation of households in a correct waste management system (Sidique, Lupi, & Joshi, 2010). In this perspective, two kinds of policies may be considered as affecting costs: unit pricing programmes (*economic incentives*) and improvements to convenience such as the proximity of drop-off centres (*technical policies*).

In the first case, the relative price of recycling with respect to residual waste is influenced. Unfortunately, even though we acknowledge the importance of these policies, we are not able to consider them in our analysis because of a lack of relevant information. In the case of technical policies, the opportunity costs of recycling in terms of time spent by households is of concern. Some studies (Ando & Gosselin, 2005; Dahlén, Vukicevic, Meijer, & Lagerkvist, 2007; Folz, 1999; Saphores, Nixon, Ogunseitan, & Shapiro, 2006; Sidique et al., 2010; Abbot et al., 2013; D'Amato et al., 2016) have emphasized how nearness to a recycling centre can positively influence waste sorting behaviours. In this case, we refer to the concept of convenience, which relates to the opportunity cost of performing recycling (in terms of time and effort) of the household. Regarding this aspect, two recycling programmes deserve consideration: bring sites and curbside. The implementation of a local drop-off scheme for collecting specific recycling materials reduces the time and effort spent by individuals to store and transport those materials (i.e., it increases convenience) and, as a consequence, should increase their sorting behaviour. In that perspective, introducing a curbside recycling programme makes recycling even more convenient for the household. The idea here is that an increase in convenience of recycling behaviour through policies, can increase intrinsic motivation to recycle by allowing separate collection to become a household habit. The literature refers to this phenomenon as crowding-in of intrinsic motivation. A large part of studies supports this assumption. Among the earliest works in this field, Jenkins, Martinez, Palmer, & Podolsky, (2003), for instance, using survey data demonstrate that the presence of curbside collection increases significantly the probability that a given material is recycled. In a similar work, Reschovsky & Stone, (1994) find that curbside programs can significantly increase recycling rates, especially if implemented in conjunction with compulsory recycling targets and unit-based pricing. Drop-off recycling programmes are less costly policies (Sidique et al. 2010) because the transportation costs are relocated to the recyclers. Regarding bring sites, some details are worth noting. These are recycling centres that are often located in strategic places across neighbourhoods such as small squares or large streets. Their efficacies can be high, even in those municipalities with curbside systems, especially when collections do not occur too often. In several European cities, for example, curbside systems operate once a week, and large families living in small flats face the problem of storing waste before collection. A nearby bring site collection point can operate in that way. The role of Civic Amenity sites is very different. They are collection points for a whole set of recyclable materials and are located often at one or a few points just outside city centres. The efforts devoted by households to waste sorting may be influenced by other kinds of policies such as specific knowledge and frequency of recyclables collection. Information policies about how and where to separately collect recyclable materials implies time savings by people and has been already recognized as a relevant factor in their involvement with recycling (see for example: Barr, 2007).

Based on the existing literature, we aim to test a third and final hypothesis:

H3: policies aimed to increase convenience related to recycling, may crowd in individual motivation to increase separate collection.

3. Data and empirical framework

3.1 Data

The data we use to test our hypothesis are from a national level survey in Italy[4]. The survey was undertaken through the integration of the computer assisted web interview (CAWI) method and the computer assisted telephone interview (CATI) method. The final sample includes 618 individuals. Interviews occurred in 2014 and were directed to any adult responsible for domestic waste management. The survey includes 63 questions aimed to detect different information, including the collection and disposal methods used by the respondent's municipality of residence; household behaviour regarding waste generation and collection; individual attitudes towards recycling, "green" products and packaging; intrinsic and extrinsic motivations; and socio-economic and demographic characteristics of the respondent.

The variable accounting for intrinsic motivation is a factor variable including several questions that could be related to a greater individual sensitivity towards waste reduction (e.g., questions related to food waste and to reduced packaging of goods) and to a keen interest in environmental protection issues (e.g., membership in an environmental association and willingness to be informed on environmental problems). Our choice is motivated by the fact that it is more difficult to disentangle intrinsic motivation from other factors than doing so with extrinsic motivation or reciprocity, because intrinsic motivation is usually less explicitly manifested by the individual. We therefore extrapolated information on internal motives from several variables that we believe to share common variance. Intuitively, a higher attention towards products packaging and the willingness to be informed about environmental problems, as well as the willingness to participate in a pro-environment organization, involves some degree of intrinsic motivation. Thanks to the factor analysis, we are able to extrapolate from the original set of questions only that part of variance that these

---

[4]The survey has been administered by SWG, a company that devises and produces market surveys, opinion and institutional polls, sector studies and monitoring centres and analyses trends and dynamics of the market, politics and society.

variables share, which we expect to be correlated to intrinsic motivation. The variance not related to the latent variable 'intrinsic motivation' is not considered in the resulting factor, and will not influence our analysis. On the contrary, using the questions separately will allow influences related to other features to influence the result of the cluster analysis. As a proxy for reciprocity, we choose a question reflecting the willingness to pay a waste tariff based on the average waste produced in the households' municipality. The authors are aware that this might seem counterintuitive since according to the traditional economic theory, the household has an incentive to generate more waste than the neighbours, since taxes are based on the average municipality waste production. However, as shown in Fehr & Gätcher (1998) and Bowles & Gintis (2000), reciprocity is a positive (negative) behaviour enacted as a response to a positive (negative) behaviour of an individual and reasons that move a person towards a reciprocal behaviour can be different and not necessarily related to altruistic motivations. In fact, as outlined by in Fehr & Gätcher (1998, p.848), "[…] the existence of positive reciprocity may induce selfish types to behave 'nicely' for purely selfish reasons, because they can expect a reward by the reciprocal types. Likewise, the existence of negative reciprocity may prevent opportunistic behaviour of selfish subjects because they are afraid of being punished by the reciprocal types." It follows that, in our case, positive reciprocity induces household to keep their waste in line with the average of the municipality, because by pursuing the social welfare (i.e. do not increase waste generation) she is actually pursuing her own interest of not increasing her waste-related tax (the punishment for non-compliance with a certain behaviour).

Finally, concerning the extrinsic motivation variable, we select a question that asks a respondent to declare whether he/she would prefer to receive an economic incentive for minimisation practices and/or separate collection practices. In this case, the respondent herself declares to be extrinsically motivated if she prefers to receive an incentive. Thus while reciprocity is, here, an indicator of peer pressure and group social norms, extrinsic motivation is mainly related to the sensitivity to economic incentives. As stated in the proposition H2 and H3 in the previous section, we do expect a positive correlation between reciprocity and incentives in relation to recycling.

To investigate minimisation behaviour, we select as dependent variables questions related to food waste generation and to the minimisation of glass, plastic and paper waste generation. All of these variables take a value of 1 if the household declares to minimise and a value of 0 otherwise[5]. Similarly, to analyse recycling behaviour, we explicitly ask individuals if they systematically separately collect seven different types of waste (glass, plastic, paper, medicines, batteries, aluminium, and organic). If the household declares to collect waste separately, the dummy variable takes a value of 1; if not, the dummy variable takes a value of 0. In a second step, we asked respondents how regularly they were recycling that specific waste stream. This allow us to construct an alternative set of variables, which take a value of 0 if the household was not recycling that type of waste separately, 1 if they were recycling that waste only "sometimes", and 2 if collecting "always".

Second, we assessed the role of collection policies by including two dichotomous choice variables that reflected the presence of *Curbside* and *Bring site* in the municipality. It is worth noting that the variable *Bring site* is specific to each waste stream. Interestingly, *Bring site* systems were well spread across the sample for all seven materials (approximately 80% of households lived close to bring site systems). Also curbside collection systems were well spread across the sample (59%).

Socio-demographic characteristics has also been proven to be important for minimization and recycling behaviours, since it relates to the contextual factors which can explain differences between performances across the country (see for example Abbott et al., 2013 and Cecere at al 2014). Therefore, we include the available information as control variable in our analysis, to rule out variability of these factor that could bias our results. *Area* denotes the household region of residence, namely North, Centre or South of Italy. We believe this variable is relevant since it captures the disparities in terms of standard of living and municipal waste management schemes in the various parts of the country. A second relevant sociodemographic factor is *education*: we believe that highly educated individuals tend to show higher level of environmental awareness which in turn leads to

[5] Relative to food waste minimisation, the dummy variable takes a value of 1 if the respondent declares to waste only a small percentage of unconsumed food, i.e., 0-15%.

better waste management behaviours (this result is supported by the literature; see for example: Callan & Thomas (1993); Rechovsky & Stone (1994)). We include also the source of income (*Income)*, because it influences the opportunity cost of both minimization and recycling: for example, a person whose income derives primarily from the supports of other family members is expected to have more time to dedicate to waste management practises in the household than a person who is employee and spends a big part of the day outside the household. Finally, we considered the *house dimension* in terms of number of rooms of the house. We do believe that the available space to store sorted waste before the collection can affect both recycling and minimization behaviours.

Table 1 - Description and summary statistics of the variables.

Variable	Description	Obs.	Mean	Std. dev	Min	Max
Motivation Variables						
Factor variable for intrinsic motivation	A factor variable collecting common variance from questions related to intrinsic motivation:	588	11.632	11.634	0.294	47.41
	- *How much are you bothered by wasting unconsumed food?*	604	3.546	2.016	0	5
	- *Do you usually prefer goods with lower packaging at the grocery store?*	602	1.596	0.491	1	2
	- *Are you informed about environmental problems caused by waste and other environmental issues?*	618	0.838	0.368	0	1
	- *Do you usually buy products made with recycled raw materials?*	618	0.725	0.447	0	1
	- *Are you a member of non-profit/environmental associations?*	618	0.113	0.317	0	1
Reciprocity	Takes a value of 1 if the household declares to prefer	618	0.971	0.296	0	1

	a waste management tariff based on the average waste production of the municipality.					
Extrinsic motivation (economic incentive)	Takes a value of 1 if the household declares that it is fair to provide economic incentive for waste minimisation and separate collection.	587	0.899	0.301	0	1
Waste policies						
Curbside	Is your municipality covered by a curbside collection scheme? (1 "Yes"; 0 "No")	562	0.58	0.49	0	572
Bring Site (Paper)	Is there a Bring Site facility for Paper waste close to your house? (1 "Yes"; 0 "No")	618	0.92	0	1	618
Bring Site (Glass)	Is there a Bring Site facility for Glass waste close to your house? (1 "Yes"; 0 "No")	618	0.92	0	1	618
Bring Site (Organic)	Is there a Bring Site facility for Organic waste close to your house? (1 "Yes"; 0 "No")	618	0.81	0	1	618
Bring Site (Plastic)	Is there a Bring Site facility for Plastic waste close to your house? (1 "Yes"; 0 "No")	618	0.80	0	1	618
Bring Site (Aluminium)	Is there a Bring Site facility for Aluminium waste close to your house? (1 "Yes"; 0 "No")	618	0.84	0	1	618
Bring Site (Batteries)	Is there a Bring Site facility for Batteries waste close to your house? (1 "Yes"; 0 "No")	618	0.80	0	1	618
Bring Site (Medicines)	Is there a Bring Site facility for Medicines waste close to your house? (1 "Yes"; 0 "No")	618	0.83	0	1	618
Minimisation behaviour variables						
Min_food	Takes a value of 1 if a household declares to waste between 0 and 15% of unconsumed food. It takes a	618	0.819	0.386	0	1

	value of 0 if an individual declares to waste more than 15% of unconsumed food.					
Min_glass	Takes a value of 1 if the household increased her glass waste minimisation with respect to the two previous years leading up to the interview. It takes a value of 0 otherwise.	618	0.85	0.358	0	1
Min_plastic	Takes a value of 1 if the household increased her plastic waste minimisation with respect to the two previous years leading up to the interview. It takes a value of 0 otherwise.	618	0.663	0.473	0	1
Min_paper	Takes a value of 1 if the household increased her paper waste minimisation with respect to the two previous years leading up to the interview. It takes a value of 0 otherwise.	618	0.696	0.460	0	1
Recycling behaviour variables						
Rec_glass	Takes a value of 1 if the household usually collects glass.	618	0.955	0.215	0	1
Rec_plastic	Takes a value of 1 if the household usually collects plastic.	618	0.89	0.313	0	1
Rec_paper	Takes a value of 1 if the household usually collects paper and cardboard.	618	0.951	0.215	0	1
Rec_medicines	Takes a value of 1 if the household usually collects medicines.	618	0.86	0.346	0	1
Rec_batteries	Takes a value of 1 if the household usually collects batteries.	618	0.883	0.321	0	1
Rec_aluminium	Takes a value of 1 if the household usually collects aluminium.	618	0.896	0.305	0	1
Rec_organic	Takes a value of 1 if the household usually collects organic waste.	618	0.843	0.364	0	1
Rec_glass_ordinal	Never = 0; Sometimes= 1; Always = 2.	618	1.81	0.48	0	2
Rec_plastic_ordinal	Never = 0; Sometimes= 1;	618	1.67	0.66	0	2

	Always = 2.					
Rec_paper_ordinal	Never = 0; Sometimes= 1; Always = 2.	618	1.79	0.51	0	2
Rec_medicines_ordinal	Never = 0; Sometimes= 1; Always = 2.	618	1.49	0.72	0	2
Rec_batteries_ordinal	Never = 0; Sometimes= 1; Always = 2.	618	1.54	0.69	0	2
Rec_aluminium_ordinal	Never = 0; Sometimes= 1; Always = 2.	618	1.65	0.65	0	2
Rec_organic_ordinal	Never = 0; Sometimes= 1; Always = 2.	618	1.57	0.74	0	2
Demographic variables						
Area	Takes a value of 1 according to different areas: 1= the household lives in Northern Italy (Piemonte, Valle d'Aosta, Trentino-Alto Adige, Lombardia, Veneto, Friuli Venezia Giulia, Liguria, Emilia Romagna); 2= the household lives in Central Italy (Toscana, Umbria, Marche, Lazio, Abruzzo, Molise); 3= the household lives in Southern Italy (Campania, Puglia, Basilicata, Calabria, Sicilia, Sardegna).	618	2.018	0.847	1	3
Education	Takes values according to different education attainments: 1= Ph.D. 2= Master of Science 3= Bachelor 4= University Diploma 5= High School 6= Professional Diploma 7= Medium High School 8= Primary School 9= No Education	618	4.269	1.783	1	9
Income	Takes values according to different income sources: 1= employment 2= self-employment 3= retirement 4= compensations 5= inheritance; investments; estate	618	2.214	1.948	1	8

	6= other family members 7= other source 8= n.a. (prefer not to declare)					
House dimension (m^2)		486	105.502	47.324	30	500

3.2 Empirical framework: cluster analysis

Our analysis comprises two steps: in the first one we carry a cluster analysis in order to identify different *ideal types* of individuals according to their main motivation (intrinsic, extrinsic or reciprocal). Even though we are aware that individuals are not subject to only one type of motivation, we aim to identify what are the characteristics of an average individual who is moved mainly by intrinsic or extrinsic or reciprocal motivation respectively. As a consequence, the cluster should be seen as an approximation of the mix of motivations behind the individual behaviour. Specifically, cluster results will show which type of motivation is prevailing with respect to the others. We reckon that this approach provides, at best, an approximation of human behaviour, and this is one of the limits of our work. However, this approach can help us to identify average tendencies and behavioural differences across households.

The second step is to use the clusters as main independent variables in a regression analysis where we estimate the effect of being driven by a different mix of motivations on waste management performances. The advantage of this setting is that we not only test empirically how motivations affects recycling and minimization behaviours but are also able to identify a set of characteristics that individuals with similar motivations may have in common (e.g., level of education or main income source) allowing to define different target group for policy making. The disadvantage is that while some of the results can be generalised to other contexts, the majority are necessarily restricted to the Italian context. For example, individual moved by reciprocity can present different social and economic characteristics in the UK with respect to Italy, and therefore their impact on household waste management is different.

To group the different households according to their motivations, we carry out a cluster analysis using the variables related to intrinsic and extrinsic motivation and reciprocity. From an empirical perspective, we follow the two-step procedure suggested in Hair & Black (2010): we first run a hierarchical cluster analysis, but instead of proceeding to the direct cluster interpretation, we usd the cluster centroid as the starting seeds for following a non-hierarchical cluster procedure. The advantages of this approach, with respect to running a single cluster analysis, are manifold. First, non-hierarchical techniques tend to be preferred with respect to hierarchical alternatives because they allow researchers to assign observations once an observation in one cluster becomes closer to another[6]. Second, this approach allows to overcome the main arbitrary elements of non-hierarchical cluster analysis, i.e., the starting seeds and the correct number of clusters[7]. Finally, this approach enables an internal robustness test. In our case, for instance, the two cluster analyses produced similar results, confirming the robustness of our method.

From a technical viewpoint, cluster analysis has two important elements to consider: the first is the similarity (or dissimilarity) measure, which influences the shape of the cluster; the second is the linkage, which determines the distance between a set of observations as a function of the pairwise distances between observations. In the first step, for the hierarchical procedure, we apply a Euclidean distance as the similarity measure, while the linkage algorithm is the average linkage. The Euclidean distance summarizes a collection of points by their centroids[8], i.e., the mean and the average linkage algorithm, which combines two clusters into a higher-level cluster using the average among the distances of the object of each of the two clusters. To determine the appropriate number of clusters, we use the Calinski & Harabasz (1974) stopping rule[9], which computes an F-statistic for each number

[6]Not the cluster to which it was originally assigned.

[7]When researchers run a non-hierarchical cluster analysis, they need to choose a priori both the number of clusters to be included in the final solution and the starting seeds of the cluster process. Using the result of a previous hierarchical procedure allows us to reduce this level of arbitrary elements.

[8]The cluster analysis has also been performed using both different linkage algorithms (single linkage, ward linkage) and different dissimilarity measures (Jaccard index, matching coefficient). This robustness check did not lead to substantially different results with respect to those presented in the main text.

[9]For consistency, the appropriate number of clusters was also checked using the Duda-Hart (2001) index.

of possible clusters. As the F-statistic increases, the clustering becomes more distinct. The stopping rule suggested that the appropriate number of clusters was four.

The second step involves the non-hierarchical cluster analysis. As suggested from the hierarchical process, we include four clusters. A k-means algorithm is used to partition the observations into clusters with a similar mean, and the squared Euclidean distance is applied as the similarity measure[10].

3.3 Empirical framework: regression analysis

Beside the contribution of the cluster analysis in identifying how motivations are distributed across the sample, we employ an inferential analysis with the aim of deepening the description offered by the clusters.

Given that our dependent variable are dichotomous, we implement the following logit model (Equation 1):

$$y_i = \alpha + \beta_{ci} cluster_c + \beta_{ca} area_a + \beta_{ce} education_e + \beta_{si} income_s + \beta_1 house\ dimension + \varepsilon_i$$

Here, y_i reflects the different set of waste behaviours made available by the survey (food, glass, plastic and paper minimisation; glass, plastic, paper, medicines, batteries, aluminium and organic recycling). The coefficients $\beta_{ci}, \beta_{ca}, \beta_{ce}\ and\ \beta_{si}$ indicate the coefficient of each i-th level of the corresponding categorical variable, as explained in Section 3.1.

Cluster is a categorical variable that takes a value equal to 1 if the household belongs to the first cluster, 2 if it belongs to the second cluster, and so on. We notice that individuals belonging to a cluster are showing a prominent type of motivation: for example, individuals in cluster 2, as will be

[10]As for the hierarchical procedure, we performed a robustness check of the cluster results by applying a k-median algorithm and different similarity measure (Jaccard index, matching coefficient). Results did not present significant differences.

discussed in section 4, are maily extrinsically motivated and are not moved by intrinsic motivation or reciprocity to a lesser extent. Thus, our cluster basically proxies the effect of one type of motivation on a certain behaviour. *Area*, *Education*, *Income* and *House dimension*, are the covariates that we believe to have a relevant role in our analysis, as discussed in section 3.1.

The coefficients provided by the statistical software are expressed as the log of the odds ratio and measure the strength of the correlation/association between two factors. Since we aim to simplify the interpretation of the outcomes, for each log odds ratio, we compute the marginal effect, i.e., how the probability of a positive outcome in the dependent variable changes when a factor changes from 0 to 1 (Tables 3 and 4). Specifically, marginal effects are computed for the cluster variables to assess how the probability of having waste minimisation and separate collection is affected if respondents are in one cluster or the other.

We also estimate a second model for recycling, in which we use an alternative variable for recycling, which is an ordered categorical variable. In this case, an ordered logit regression is appropriate. We will be estimating the following baseline equation (Equation 2):

$$Rec\_w_i\_ord = \alpha + \beta_{ci} cluster_c + \beta_{ca} area_a + \beta_{ce} education_e + \beta_{si} income_s + \beta_1 house\ dimension + \varepsilon_i$$

Where *Rec_w$_i$_ord* represent the recycling behaviour variables for different items (namely glass, plastic, paper, medicines, batteries, aluminium, organic). *Rec_w$_i$_ord*, is an ordinal categorical variable that can take the following three values: 0 if the respondents declare that he or she do not recycle the item; 1 if the respondents declare to recycle only sometimes; 2 if the respondents declares to always perform the recycling of the item. The coefficients were estimated through a maximum likelihood function, and the main regression table presents simple ordered log odds (In the appendix, Tables A5 to A8). In Tables 5, 6 and 7, on the contrary, we computed marginal effect of the relevant results.

The regression coefficients are interpreted as follow: for a unit increase in the regressors, we expect a β increase in the log odds of being in a higher group of separate collection behaviours (which are 0 = “never”, 1 = “sometimes”, and 2 = “always”), given that all of the other variables in the model are held constant. Moreover, this estimation technique also estimates two cut points (or thresholds), which correspond to the points on the latent variable that result in the different observed values on the dependent variable. It is worth noting that the interpretation of the ordered logit parameters does not depend on the cut points.

Order logistic models are based on the assumption that the relationships between pairs of outcome groups are the same, i.e., that the coefficient that describes the relationship between the first two categories (in our case, “never” and “sometimes”) is the same as the one that describes the relationship between the second and third groups (“sometimes” and “always”). If that condition does not hold, it cannot be correctly assumed that a single model can suitably describe the latent response variable. To test that hypothesis, we employed an LR test, which tests the null hypothesis that there are no differences among the coefficients between models (Wolfe, 1997). Alternatively, a Brant test of the parallel regression assumption, which verifies the same hypothesis, could be performed (Long & Freese, 2003).[11] Test results, that are not reported for the sake of brevity, indicate that the proportional odds assumption has not been violated and that the ordered logistic model is suitable for our analysis.

Moreover, equation 2 will be augmented as follows in order to test for hypotheses 3:

$$Rec\_w_i\_ord = \alpha + \beta_{ci} cluster_c + \beta_{pi} waste\ policy_p + \beta_{pi} waste\ policy_p * cluster_c + \beta_{ca} area_a + \beta_{ce} education_e + \beta_{si} income_s + \beta_1 house\ dimension + \varepsilon_i$$

[11] More information is available on the SPost9 web site: http://www.indiana.edu/~jslsoc/web_spost9/sp_install.htm

Where *waste policy* refers either to bring site or curbside, and the interaction term has been included to formally test for research hypothesis 3. A positive and statistically significant coefficient means that policies aimed to increase convenience factors related to recycling, i.e. curbside and bring sites, may crowd in individual motivation to increase separate collection.

4. Results

4.1. Cluster analysis

Table 2 presents the results of the cluster analysis conducted on individual motivations. The cluster procedure produced 4 clusters, three of which were associated with a very clear pattern of motivations, and a fourth one that contained only two households that can be considered as outliers. For this reason, we limit our discussion to explaining the first three groups.

The first group, cluster 1, is the smallest cluster (49 households out of 588) and includes families that are characterized by higher-than-average reciprocity, low intrinsic motivation and very limited extrinsic motivation.

The second group, cluster 2, is, on the contrary, the largest one (385 households) and includes households mainly motivated by extrinsic motivation. Overall, they are less susceptible to reciprocity and show low levels of intrinsic motivation.

Finally, the third group, cluster 3, includes primarily intrinsically motivated individuals who are also susceptible to economic incentives. In contrast, reciprocity is less relevant for this group.

For characterising the clusters, we compared the centroid of our main variable of interest across different clusters. Technically speaking, a centroid is the average value of a given variable for the individual included in a cluster. So, 1.125 is the average intrinsic motivation of the 49 households in Cluster 1, i.e. its centroid. Being the average value of intrinsic motivation in the full sample equal to 11.632, we characterise Cluster 1 as having low intrinsic motivation.

Table 2 also includes some descriptive statistics by cluster for all of the relevant socio-economic variables included in the analysis. Overall, there are no big differences in the socio-economic compositions of the clusters with respect to the sample mean[12]. There are, however, a few exceptions. Individuals in cluster 1 tend to have, on average, a lower level of education[13], with only a 10.20% of graduate individuals, while graduate respondents has a higher share in the other two clusters: 17.92% and 25.98% in cluster 2 and cluster 3 respectively. However, cluster 1 show a higher percentage of postgraduate individuals (10.20%) with respect to cluster 2 (4.68%) and cluster 3 (7.09%). Interestingly, Cluster 2 accounts for the highest proportion of individuals whose education level reaches the primary school (11. 17% with respect to the sample mean of 1.46%) followed by cluster 1 (6.12%) and cluster 3 (4.12%) Moreover, cluster 1 show higher proportions of individual who do not work but whose main source of income are annuities (4.08%) investments (2.04%) or support by family (6.12%). These percentages in cluster 2 are 0.78% for annuities, 1.04% for investments and 4.16% for family support, while in cluster 3 these are 0, 1.57% and 1.57% respectively.

Table 2 - Descriptive summary of the cluster analysis results

		Sample	Cluster 1	Cluster 2	Cluster 3
Description			Mainly motivated by reciprocity, do not present intrinsic or extrinsic motivation	Mainly motivated by incentives, less sensitive to reciprocity and show very low levels of intrinsic motivation	Mainly intrinsically motivated, some sensitivity to incentives but any motivation related to reciprocity
Observations		588	49	385	127
Factor variable for intrinsic	Centroid	11.632	1.125	1.190	47.067

[12]As confirmed by statistical tests, not included in the text for the sake of brevity, but available upon request.

[13] With the term "lower education" the authors refer to individuals whose level of education has reached only primary school or middle-high school or high school degree. The term "higher education" is referred to respondents who declare to have achieved bachelor or postgraduate degree.

motivation					
Reciprocity	Centroid	0.097	0.143	0.099	0.055
Extrinsic motivation (economic incentive)	Centroid	0.899	0	1	0.953
Region	North Centre South	34.95% 28.32% 36.73%	34.69% 38.78% 26.53%	34.03% 29.09% 36.88%	41.73% 25.98% 32.28%
Education	Postgraduate Bachelor High school Middle-high school Primary school No education	5.50% 18.12% 15.37% 49.35% 9.71% 1.46% 0.49%	10.20% 10.20% 18.37% 40.82% 6.12% 6.12% 2.04%	4.68% 17.92% 11.69% 44.94% 5.19% 11.17% 0.52%	7.09% 25.98% 12.60% 44.88% 3.94% 4.72% 0%
Income source	Employed Self-employed Retirement Annuity Investments Support by family Other NA	56.63% 13.43% 17.15% 0.81% 1.13% 3.72% 1.78% 5.34%	51.02% 14.29% 16.33% 4.08% 2.04% 6.12% 2.04% 4.08%	58.44% 14.29% 14.55% 0.78% 1.04% 4.16% 1.04% 5.71%	59.09% 15.75% 15.75% 0% 1.57% 1.57% 2.36% 3.94%
Number of rooms	Average (s.d.)	4.397 (1.812)	4.082 (1.631)	4.440 (1.820)	4.291 (1.696)

The first descriptive evidence of cluster results is presented in Figures 1-3 below. Figure 1 refers to food waste minimisation. The value in the graph represents the proportion of wasted food. For instance, the class 50% and more represents households that throw away more than 50% of their unconsumed food. Interestingly, cluster 3 is the cluster characterized by the lowest rate of food waste, while cluster 1 has the highest rate of food waste.

Similar evidence can be derived from Figure 2, which represents the share of households that increased their waste minimisation performances within the two years prior to the interview. In this case, the performances of cluster 1 and cluster 2 are very similar, while cluster 3 shows a much higher rate of waste minimisation in all the analysed materials.

Finally, Figure 3 focusses on the recycling performances of the three different clusters. In this case, there are no clear differences between the recycling behaviour of the different groups, as the behaviour tends to be stable across groups.

Figure 1: Proportion of unconsumed food thrown away by families.

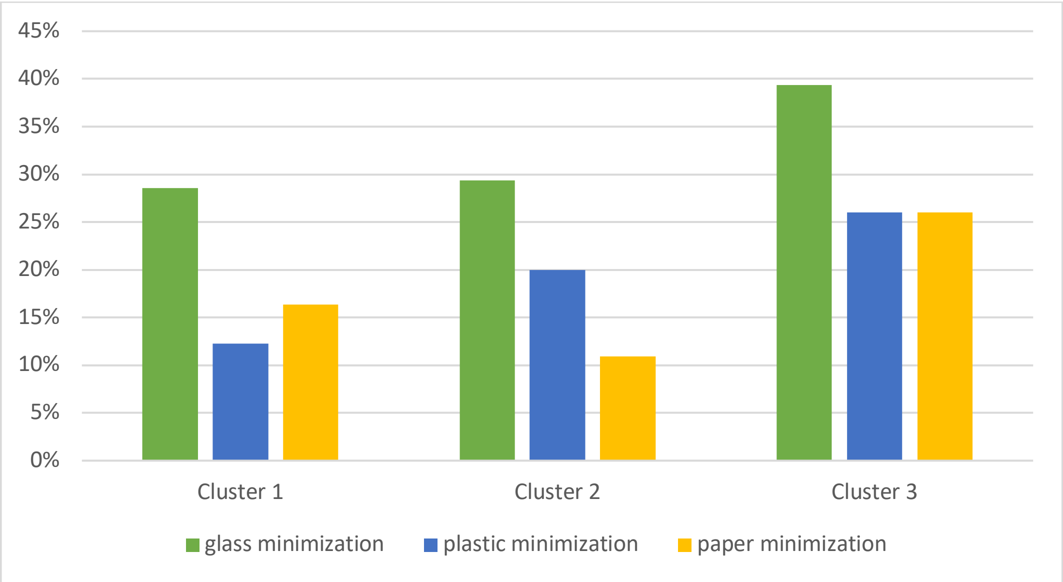

Figure 2: Proportion of households that increased their minimisation of glass, plastic and paper, respectively.

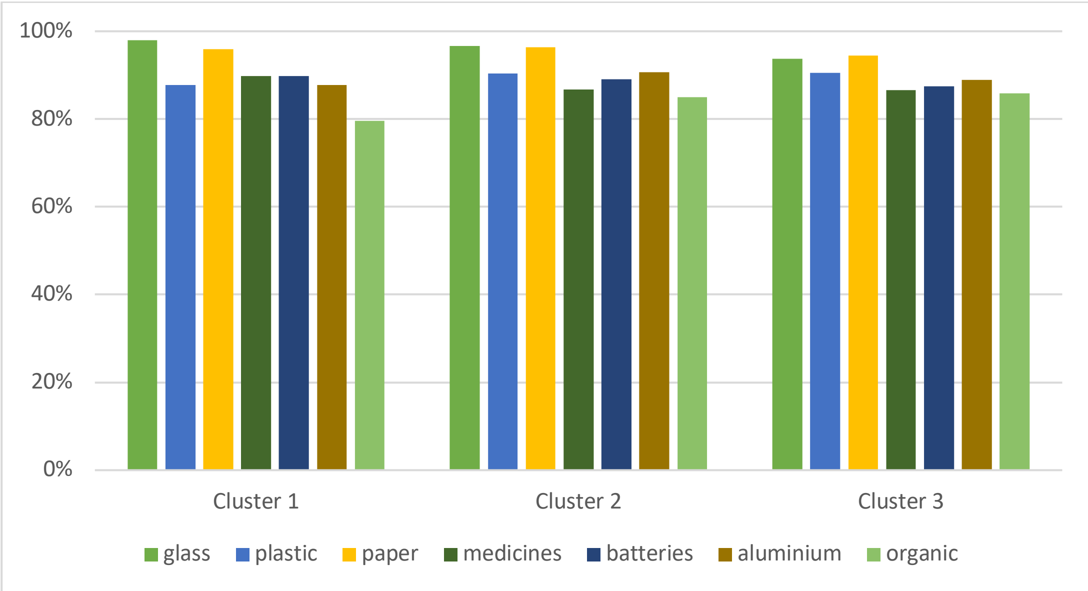

Figure 3. Proportion of households that recycle the seven different waste streams considered.

Summarizing, cluster 1 collects people with a high degree of education and with a high percentage of people not working (12.24% in total). This cluster show the highest rate of food waste as depicted in Figure 1 (more than 30%), while the rates of minimisation are similar to those of cluster 2, (with the exception of plastic) and both are far lower compared to minimization rates of cluster 3. Overall, cluster 2, which includes individuals whose motivation is primarily triggered by economic incentives, collects less educated individuals, the proportion of food waste is however below 20%. The education and income source patterns of this cluster are similar to those of cluster 3 even though cluster 2 has a higher share of people who declares that the primary sources of income are investments. In cluster 3, which comprises intrinsically motivated individuals, people with at least a tertiary education attainment represents a quarter of the group and the proportions of waste minimization (compared to thoise of the other two clusters) provide a solid foundation for the expectation set in the background section. To conclude, this initial descriptive evidence seems to support our research hypothesis that minimisation occurs more often in households where intrinsic motivation is higher, as in cluster 3. In contrast, no significant differences can be found across recycling rates of different cluster groups. A more formal test of these correlations will be presented in the following section.

4.2. Regression analysis

Regression results for Equation 1 are reported in Table A1 and A2 in the Appendix, while the computed marginal effects are presented in Tables 3-6 below. Given the possible collinearity between our control and motivation variables, we also ran a more parsimonious set of regressions in which we excluded all covariates, with the exception of *Cluster.* The results did not vary across these two alternative specifications, and for this reason, in the main text we report only the marginal effect for our preferred one, with the full set of controls. Nevertheless, Tables A3 and A4 in the Appendix present the outcomes of these alternative estimations.

Table 3 presents the marginal effect of being in the four different clusters on minimisation behaviour. In line with the descriptive evidence, the coefficients of *Cluster 3* are statistically significant and associated with the highest magnitude of marginal effect for three out of four dependent variables (note that the stars correspond to statistically significant coefficients in the logistic regression model of Table A1). Similarly, the coefficient of *Cluster 2* is statistically significant, while the effect of *Cluster 1* on the probability of minimising waste is generally low or not significant. In contrast, no statistically significant results can be found for the correlations between the clusters and recycling behaviours, as shown in Table 4.

This empirical evidence corroborates our hypothesis of a correlation between intrinsic motivation (individuals in cluster 3) and minimisation behaviours, while, on the contrary, households driven by economic incentives (individuals in cluster 2) or reciprocity (individuals in cluster 1) are less inclined to practice waste reduction. In other words, as suggested by the theoretical literature, social appraisal and reciprocity do not matter in regard to non-observable pro-environmental behaviour such as waste minimisation. Interestingly, *Cluster 2* is associated with a positive and significant coefficient only in the case of food waste, which is a reasonable result considering that one of the main motivations behind the choice of reducing food waste can be related to the bother of wasting money.

The results for recycling are more surprising (Table 4), but we expect it to be a more empirical issue. Italy has an advanced waste management system, in which recycling (at least up to a certain extent) is already a consolidated behaviour across consumers.

Overall, the only cluster never associated with a significant parameter is Cluster 1, which represent a small group of households moved mainly by reciprocity and only partially by intrinsic or extrinsic motivation. One concern here is that this result can be related to the low number of individual in this Cluster 1, which represent about the 10% of our sample. However, this result is also theoretically grounded as the non-significance of this cluster was somewhat expected. This is in line with the assumption that, at least in this sample, reciprocal individuals are moved by some egoistic motivation (as in Fehr & Gätcher (1998) and Bowles & Gintis (2000)) so that we do not expect particularly significant virtuous behavior

What is more relevant, as shown in Table 5, is the correlation between *Clusters* and the frequency of recycling behaviour. We recall here, that in Table 5 the dependent variable can take three different values: 0 (Never); 1(Sometimes); 3 (Always).[14] Interestingly, in this case individuals moved by economic incentives (*Cluster 2*) are associated with a positive coefficient in the case of glass, plastic and organic waste, a result in line with the predictions of research hypothesis number two. On the contrary, individuals which are mainly intrinsically motivated (*Cluster 3*), do not show a significant correlation between motivation and recycling, with the exception of the case of aluminium. Finally, Tables 6 and 7, report the marginal effect of the different clusters also accounting for the interaction between motivation and waste policies (curbside and bring site), while full regression results are available in Tables A7 and A8 in the appendix. Interestingly, this new specification shows as bring sites and curbside, by increasing the convenience of recycling, are almost always statistically

[14] As before, Tables A5 and A6 in the appendix report full regression results.

significant and positively correlated to the different dependent variables. Interestingly, the results in Tables 6 and 7 show that the interaction between motivation and waste policies are significant and associated with a positive coefficient in several cases, confirming the presence of a crowd-in effect between individual motivations and policies, a result in line with research hypothesis 3. This mean, in other terms, that good and efficient waste facilities crowd-in intrinsic motivations, as motivated households find recycling easier.

In case of the interaction between curbside and intrinsic motivation (*Cluster 3*), this crowd in effect is especially relevant for glass and organic waste. Since organic waste needs to be stored in the household, this behaviour involves some degree of discomfort related to hygiene and bad smell issues. As a consequence, it is reasonable to believe that more intrinsically motivated households are more incline to bear this cost.

Interestingly, the interaction between *Cluster 2* (extrinsic motivated people) and curbside is significant in glass, paper, organic and aluminium recycling. This provide evidence that a curbside scheme can support the increase of recycling rates thanks to the reduction of the opportunity cost related this action. Finally, in this set of regressions the non-interacted bring site variable is not significant, suggesting that advanced collection scheme, like curbside, are effective only when enacted in a context of highly motivated individuals. Finally, policies appear to not represent a lever to improve recycling behaviour for reciprocal individuals.

Turning to the results related to the interaction between bring sites and motivation (Table 7 and Table A8 in the appendix), we find similar evidence. Intrinsically motivated individuals (Cluster 3) tends to recycle more often if bring sites are provided near the household, especially in the case of glass, paper and organic waste. Similarly, extrinsic motivated individuals tend to recycle more glass and paper when living close to a bring site area.

Overall, results offer support for our hypothesis that a crowd in effect on recycling exists between intrinsic and extrinsic motivation, while waste facilities alone appears to not provide enough incentive for frequent recycling. Motivations are thus a preconditions for their success.

Table 3 - Marginal effects of being in one cluster on selected dependent variables. Base model with covariates. Dependent variables: No Minimisation = 0; Minimisation = 1

	Food waste	Glass Minimisation	Plastic Minimisation	Paper Minimisation
Cluster 1	0.627 (0.064)	0.765 (0.057)	0.638 (0.068)	0.648 (0.064)
Cluster 2	0.795*** (0.021)	0.854* (0.018)	0.647 (0.024)	0.675 (0.023)
Cluster 3	0.992*** (0.008)	0.919*** (0.025)	0.745 (0.038)	0.791** 0.036)
Observations	556	544	556	554

Note: Stars correspond to statistically significant coefficients in the logistic regression model (*** p<0.01, ** p<0.05, * p<0.1.). The marginal effects standard error is in parentheses. Covariates included in the model are area of residence, education, income source, and number of rooms in the house.

Table 4 - Marginal effects of being in one cluster on selected dependent variables. Base model with covariates. Dependent variables: No Recycling = 0; Recycling = 1

	Glass Recycling	Plastic Recycling	Paper Recycling	Medicines Recycling	Batteries Recycling	Organic Recycling	Aluminium Recycling
Cluster 1	0.972 (0.033)	0.862 (0.053)	0.949 (0.030)	0.904 (0.043)	0.093 (0.045)	0.76 (0.067)	0.852 (0.056)
Cluster 2	0.964 (0.009)	0.905 (0.015)	0.960 (0.010)	0.865 (0.017)	0.089 (0.015)	0.846 (0.019)	0.903 (0.015)
Cluster 3	0.928 (0.023)	0.899 (0.028)	0.943 (0.021)	0.851 (0.32)	0.861 (0.031)	0.854 (0.031)	0.88 (0.029)
Observations	508	554	519	543	556	540	528

Note: Stars correspond to statistically significant coefficients in the logistic regression model (*** p<0.01, ** p<0.05, * p<0.1.). The marginal effects standard error is in parentheses. Covariates included in the model are area of residence, education, income source, and number of rooms in the house.

Table 5 - Marginal effects of being in one cluster on the probability of high recycling (Recycling=2). Dependent variables: No Recycling = 0; Low Recycling = 1; High Recycling = 2.

	Glass Recycling	Plastic Recycling	Paper Recycling	Medicines Recycling	Batteries Recycling	Organic Recycling	Aluminium Recycling
Cluster 1	0.855 (0.043)	0.737 (0.057)	0.897 (0.035)	0.627 (0.063)	0.674 (0.069)	0.640 (0.063)	0.634 (0.065)
Cluster 2	0.933** (0.011)	0.840** (0.018)	0.939 (0.0091)	0.672 (0.024)	0.670 (0.024)	0.802*** (0.021)	0.755* (0.022)
Cluster 3	0.907 (0.022)	0.848* (0.032)	0.9205 (0.019)	0.645 (0.042)	0.713 (0.043)	0.777* (0.039)	0.790** (0.036)
Observations	508	554	519	543	556	540	528

Note: Stars correspond to statistically significant coefficients in the logistic regression model (*** p<0.01, ** p<0.05, * p<0.1.). The marginal effects standard error is in parentheses. Covariates included in the model are area of residence, education, income source, and number of rooms in the house.

Table 6 - Marginal effects of the interaction between cluster and curbside on the probability of high recycling. Dependent variables: No Recycling = 0; Low Recycling = 1; High Recycling = 2.

	Glass Recycling	Plastic Recycling	Paper Recycling	Medicines Recycling	Batteries Recycling	Organic Recycling	Aluminium Recycling
Cluster 1	0.858 (0.047)	0.731 (0.061)	0.829 (0.056)	0.673 (0.064)	0.708 (0.069)	0.671 (0.064)	0.708 (0.069)
Cluster 2	0.885** (0.016)	0.799 (0.020)	0.865** (0.016)	0.657* (0.024)	0.648 (0.023)	0.780** (0.021)	0.648** (0.023)
Cluster 3	0.841*** (0.031)	0.796 (0.036)	0.825 (0.034)	0.603* (0.040)	0.663 (0.041)	0.728*** (0.034)	0.663 (0.041)
Observations	508	554	519	543	556	540	528

Note: Stars correspond to statistically significant coefficients in the logistic regression model (*** p<0.01, ** p<0.05, * p<0.1.). The marginal effects standard error is in parentheses. Covariates included in the model are curbside, bring site, area of residence, education, income source, and number of rooms in the house.

Table 7 - Marginal effects of the interaction between cluster and bring site on the probability of high recycling. Dependent variables: No Recycling = 0; Low Recycling = 1; High Recycling = 2.

	Glass Recycling	Plastic Recycling	Paper Recycling	Medicines Recycling	Batteries Recycling	Organic Recycling	Aluminium Recycling
Cluster 1	0.854 (0.047)	0.722 (0.064)	0.829 (0.058)	0.663 (0.066)	0.705 (0.067)	0.672 (0.064)	0.695 (0.060)
Cluster 2	0.886*** (0.016)	0.795 (0.020)	0.866*** (0.016)	0.655 (0.023)	0.644 (0.023)	0.774 (0.020)	0.720 (0.019)
Cluster 3	0.833*** (0.030)	0.805 (0.033)	0.824*** (0.033)	0.604 (0.040)	0.674* (0.040)	0.733*** (0.030)	0.759 (0.033)
Observations	508	554	519	543	556	540	528

Note: Stars correspond to statistically significant coefficients in the logistic regression model (*** p<0.01, ** p<0.05, * p<0.1.). The marginal effects standard error is in parentheses. Covariates included in the model are curbside, bring site, area of residence, education, income source, and number of rooms in the house. N.a. means that in two cases the software has not been able to calculate the standard error of the marginal effect due to the low variability in the bring site variable.

5. Discussion and conclusion

This paper builds upon the evidence found in Cecere, Mancinelli, & Mazzanti (2014) and is aimed to show how groups of individuals moved by different sets of motivation behave in relation to household waste management. In line with their results, we found that intrinsic motivations are significantly correlated with minimisation behaviour, while there is not an empirical link between extrinsic motivation and waste reduction. We show here that their result is not specific to food waste, but also applies to other waste streams, especially glass and paper minimisation. This is a relevant result that reinforces and complements previous evidence. Moreover, thanks to our data set, we are able to generate a clearer picture of different types of motivation, thanks to a set of five questions reflecting intrinsic motivation, one question reflecting "reciprocity" and one question capturing "economic incentives". Interestingly, despite the different geographical coverage of our data and the different empirical approach adopted, their main conclusions are reconfirmed.

Besides, we found that the effect of extrinsic motivation is more relevant when turning to recycling behaviour: the probability of recycling increases with extrinsic motivation. We further considered if waste policies directed to increase convenience of recycling could crowd-in motivation. The results support our hypothesis: frequent recycler, both intrinsically and extrinsically motivated may benefit from the introduction of curbside and bring sites facilities. Thus, we conclude that motivations are a precondition for the success of recycling policies, which alone do not always show significant results. Surprisingly, we never find significant evidences for batteries and medicines. In our opinion, there are two possible explanations, related to the specificities of the Italian waste management context. First, these type of waste stream are often collected in civic amenities, a type of policy which we do not cover in this paper. Second, and as a consequence, we believe that these two items are more sensitive to reciprocity, because civic amenities and drop-off sites in pharmacies (for medicines) and public institutions and supermarket (for batteries) allows peers to observe the behaviours of others. Summarising, these are the only two type of waste stream in which extrinsic and intrinsic motivated individual do not behave significantly different from individual moved by reciprocity.

Finally, this analysis highlights an important feature of waste management systems. If we want to move from a policy framework based mainly on recycling towards achieving the actual reduction of waste at the source, attention should be paid to the interaction between waste policies and waste behaviour. Policies aimed to increase consumer awareness of their produced waste will increase the efficacy of policies. Our results imply that the reverse is also true: the policy maker, needs to pay attention because a non-efficient technical policy (i.e. bring sites always full of garbage) or the imposition of measures not shared or agreed with the local population (such as the imposition of a *pay as you throw* scheme) may crowd out motivation, letting households decline their responsibilities toward waste. This is, however, a conclusion derived indirectly from our analysis, and not formally tested in the paper, which we leave to further research.

References

Abbott, A., Nandeibam, S., & O'Shea, L. (2013). Recycling: Social norms and warm-glow revisited. *Ecological Economics*, *90*, 10–18. https://doi.org/10.1016/j.ecolecon.2013.02.015

Ando, A. W., & Gosselin, A. Y. (2005). Recycling in multifamily dwellings: Does convenience matter? *Economic Inquiry*. https://doi.org/10.1093/ei/cbi029

Andreoni, J. (1989). Giving with Impure Altruism: Applications to Charity and Ricardian Equivalence. *Journal of Political Economy*, *97*(6), 1447. https://doi.org/10.1086/261662

Andreoni, J. (1990). Impure Altruism and Donations to Public Goods: a Theory of Warm-Glow Giving. *Economic Journal*, *100*(401), 464–477. https://doi.org/10.2307/2234133

Barr, S. (2007). *Factors Influencing Environmental Attitudes and Behaviors*. *Sage Publication, Inc.* (Vol. 39). https://doi.org/10.1177/0013916505283421

Beatty, T. K. M., Berck, P., & Shimshack, J. P. (2007). Curbside recycling in the presence of alternatives. *Economic Inquiry*, *45*(4), 739–755. https://doi.org/10.1111/j.1465-7295.2007.00055.x

Bénabou, R., & Tirole, J. (2006). Incentives and prosocial behavior. *American Economic Review*, *96*(5), 1652–1678. https://doi.org/10.1257/aer.96.5.1652

Berglund, C. (2006). The assessment of households' recycling costs: The role of personal motives. *Ecological Economics*, *56*(4), 560–569. https://doi.org/10.1016/j.ecolecon.2005.03.005

Bortoleto, A. P. (2015). Waste prevention policy and behaviour: New approaches to reducing waste generation and its environmental impacts. *Waste Prevention Policy and Behaviour: New Approaches to Reducing Waste Generation and Its Environmental Impacts.* https://doi.org/10.4324/9781315817941

Calinski, T., & Harabasz, J. (1974). A dendrite method for cluster analysis. *Communications in Statistics - Theory and Methods*, *3*(1), 1–27. https://doi.org/10.1080/03610927408827101

Cecere, G., Mancinelli, S., & Mazzanti, M. (2014). Waste prevention and social preferences: the role of intrinsic and extrinsic motivations. *Ecological Economics*, *107*, 163–176. https://doi.org/10.1016/j.ecolecon.2014.07.007

Clement, J., Kristensen, T., & Gr??nhaug, K. (2013). Understanding consumers' in-store visual perception: The influence of package design features on visual attention. *Journal of Retailing and Consumer Services*, *20*(2), 234–239. https://doi.org/10.1016/j.jretconser.2013.01.003

Czajkowski, M., Hanley, N., & Nyborg, K. (2017). Social Norms, Morals and Self-interest as Determinants of Pro-environment Behaviours: The Case of Household Recycling. *Environmental and Resource Economics*, *66*(4), 647–670. https://doi.org/10.1007/s10640-015-9964-3

D'Amato, A., Mancinelli, S., & Zoli, M. (2016). Complementarity vs substitutability in waste management behaviors. *Ecological Economics*, *123*, 84–94. https://doi.org/10.1016/j.ecolecon.2015.12.005

Dahlén, L., Vukicevic, S., Meijer, J. E., & Lagerkvist, A. (2007). Comparison of different collection systems for sorted household waste in Sweden. *Waste Management*, *27*(10), 1298–1305. https://doi.org/10.1016/j.wasman.2006.06.016

De Young, R. (1996). Some psychological aspects of reduced consumption behavior: The role of intrinsic satisfaction and competence motivation. *Environment and Behavior*, *28*(3), 358–409. https://doi.org/10.1177/0013916596283005

Ewing, G. (2001). Altruistic, egoistic, and normative effects on curbside recycling. *Environment and Behavior*, *33*(6), 733–764. https://doi.org/10.1177/00139160121973223

Fazio, R. H. (1990). Multiple processes by which attitudes guide behavior: The mode model as an integrative framework. *Advances in Experimental Social Psychology*, *23*(C), 75–109. https://doi.org/10.1016/S0065-2601(08)60318-4

Fehr, E., & Schmidt, K. M. (1999). A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics*, *114*(3), 817–868. https://doi.org/10.1162/003355399556151

Fiorillo, D. (2013). Household waste recycling: national survey evidence from Italy. *Journal of Environmental Planning and Management*, *8*(56), 1125–1151.

Folz, D. H. (1999). Municipal recycling performance: A public sector environmental success story. *Public Administration Review*, *59*(4), 336–345. https://doi.org/10.2307/3110116

Frey, B. S., & Oberholzer-Gee, F. (1997). The Cost of Price Incentives: An Empirical Analysis of Motivation Crowding- Out. *The American Economic Review*. American Economic Association. https://doi.org/10.2307/2951373

Guagnano, G. A., Dietz, T., & Stern, P. C. (1994). Willingness to pay for public goods: A Test of the Contribution Model. *Psychological Science*, *5*(6), 411–415. https://doi.org/10.1111/j.1467-9280.1994.tb00295.x

Hair, J. F., & Black, J. (2010). *Multivariate data analysis: A global perspective*.

Halloran, A., Clement, J., Kornum, N., Bucatariu, C., & Magid, J. (2014). Addressing food waste reduction in Denmark. *Food Policy*, *49*(P1), 294–301. https://doi.org/10.1016/j.foodpol.2014.09.005

Jenkins, R. R., Martinez, S. A., Palmer, K., & Podolsky, M. J. (2003). The determinants of household recycling: A material-specific analysis of recycling program features and unit pricing. *Journal of Environmental Economics and Management*, *45*(2), 294–318. https://doi.org/10.1016/S0095-0696(02)00054-2

Kinnaman, T. C. (2006). Policy Watch: Examining the Justification for Residential Recycling. *The Journal of Economic Perspectives*. American Economic Association. https://doi.org/10.2307/30033692

Lapinski, M. K., & Rimal, R. N. (2005). An explication of social norms. *Communication Theory*, *15*(2), 127–147. https://doi.org/10.1093/ct/15.2.127

Nicolli, F., Mazzanti, M., & Iafolla, V. (2012). Waste Dynamics, Country Heterogeneity and European Environmental Policy Effectiveness. *Journal of Environmental Policy & Planning*, *14*(4), 371–393. https://doi.org/10.1080/1523908X.2012.719694

Quested, T. E., Marsh, E., Stunell, D., & Parry, A. D. (2013). Spaghetti soup: The complex world of food waste behaviours. *Resources, Conservation and Recycling*, *79*, 43–51. https://doi.org/10.1016/j.resconrec.2013.04.011

Reschovsky, J. D., & Stone, S. E. (1994). MARKET INCENTIVES TO ENCOURAGE HOUSEHOLD WASTE RECYCLING - PAYING FOR WHAT YOU THROW AWAY. *Journal of Policy Analysis and Management*, *13*(1), 120–139. https://doi.org/10.2307/3325093

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Saphores, J. D. M., Nixon, H., Ogunseitan, O. A., & Shapiro, A. A. (2006). Household willingness to recycle electronic waste: An application to California. *Environment and Behavior*, *38*(2), 183–208. https://doi.org/10.1177/0013916505279045

Sidique, S. F., Lupi, F., & Joshi, S. V. (2010). The effects of behavior and attitudes on drop-off recycling activities. *Resources, Conservation and Recycling*, *54*(3), 163–170. https://doi.org/10.1016/j.resconrec.2009.07.012

Titmuss, R. M. (1970). *The Gift Relationship*. London: Allen and Unwin.

Viscusi, W. K., Huber, J., & Bell, J. (2011). Promoting Recycling: Private Values, Social Norms, and Economic Incentives. *The American Economic Review*. American Economic Association. https://doi.org/10.2307/29783716

Appendix 1 (for on-line Publication only)

Table A1. Estimation results of the full model including covariates. Dependent variables: Minimisation.

	food minimisation	glass minimisation	plastic minimisation	paper minimisation
Cluster 2	0.891***	0.613*	0.0431	0.129
	(0.325)	(0.366)	(0.324)	(0.317)
Cluster 3	4.395***	1.312***	0.520	0.756**
	(1.064)	(0.481)	(0.369)	(0.376)
Area = 1	0.420	-0.0636	0.0891	0.0570
	(0.318)	(0.308)	(0.231)	(0.234)
Area = 2	-0.191	0.218	0.0193	0.322
	(0.286)	(0.316)	(0.223)	(0.237)
Income=2	0.315	0.390	-0.203	0.172
	(0.644)	(0.528)	(0.453)	(0.435)
Income=3	-0.653	0.268	-0.571	-0.169
	(0.629)	(0.542)	(0.471)	(0.452)
Income=4	-0.292	-0.510	-1.038	-0.501
	(0.808)	(0.661)	(0.694)	(0.632)
Income=5	-0.0539	0.931*	-0.180	0.696*
	(0.575)	(0.500)	(0.426)	(0.411)
Income=6	-0.880	0.466	-0.570	-0.0644
	(0.719)	(0.682)	(0.571)	(0.554)
Income=7	-0.617	1.737**	0.292	0.891*
	(0.676)	(0.787)	(0.542)	(0.533)
Income=8	0.214		0.153	
	(1.414)		(1.264)	
Education=2	-0.821**	-0.137	-0.0987	-0.177
	(0.328)	(0.375)	(0.271)	(0.274)
Education=3	-0.254	-0.567	-0.156	-0.263
	(0.392)	(0.387)	(0.290)	(0.298)
Education=4	-0.400	-0.926	0.547	0.197
	(1.003)	(1.012)	(1.094)	(0.969)
Education=5	-0.850	-0.644	-0.939	0.412
	(0.952)	(0.999)	(0.849)	(0.898)
Education=6	0.0765	-0.453	0.228	0.420
	(0.606)	(0.595)	(0.497)	(0.530)
Education=7	-0.549		-1.515**	0.268
	(0.976)		(0.727)	(0.727)
Education=8	-0.465	-0.429	-0.209	-0.224
	(0.476)	(0.497)	(0.413)	(0.429)
House dimens.	0.178**	0.122	-0.0817	0.0298
	(0.0786)	(0.0764)	(0.0505)	(0.0512)
Constant	0.0869	0.127	1.193**	0.0403
	(0.678)	(0.648)	(0.574)	(0.533)
Observations	556	544	556	554

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A2. Estimation results of the full model including covariates. Dependent variables: Recycling.

	Glass Recycling	Plastic Recycling	Paper Recycling	Medicines Recycling	Batteries Recycling	Organic Recycling	Aluminium Recycling
Cluster 2	-0.262	0.404	0.278	-0.398	-0.128	0.511	0.564
	(1.336)	(0.485)	(0.745)	(0.543)	(0.580)	(0.508)	(0.405)
Cluster 3	-1.094	0.407	-0.142	-0.523	-0.446	0.261	0.627
	(1.414)	(0.564)	(0.803)	(0.597)	(0.614)	(0.573)	(0.457)
Area=1	-0.913	-0.262	-0.728	-0.538*	-0.359	-0.810*	-0.338
	(1.199)	(0.400)	(0.737)	(0.326)	(0.392)	(0.451)	(0.321)
Area=2	-3.111***	-0.537	-1.942***	-0.109	-0.849**	-1.504***	-0.741**
	(1.062)	(0.355)	(0.611)	(0.324)	(0.347)	(0.397)	(0.295)
Income=2	-0.860	-0.498	-0.183	-0.355	0.648	-0.656	-0.383
	(1.135)	(0.790)	(1.386)	(0.791)	(0.663)	(0.846)	(0.591)
Income=3	-0.719	-0.263	-0.760	-1.317*	0.244	-0.583	-0.368
	(1.306)	(0.872)	(1.504)	(0.791)	(0.687)	(0.920)	(0.626)
Income=4		-0.995	-1.765	-0.687	-0.127		0.588
		(1.077)	(1.627)	(1.112)	(0.980)		(1.230)
Income=5	-0.699	-0.515	-1.143	-0.828	0.00821	-0.916	-0.532
	(1.124)	(0.750)	(1.316)	(0.742)	(0.579)	(0.820)	(0.554)
Income=6	-1.201	-0.649	-0.943	0.515	1.147	-1.116	-0.559
	(1.503)	(0.953)	(1.791)	(1.280)	(1.178)	(1.016)	(0.767)
Income=7	-0.825	-0.734	-0.133	-0.983	0.206	-0.938	-0.455
	(1.298)	(0.857)	(1.551)	(0.826)	(0.720)	(0.939)	(0.690)
Income=8	-3.096*			-2.107	-2.852**	-1.322	
	(1.737)			(1.419)	(1.401)	(1.594)	
Education=2	-0.381	0.0439	-1.129*	0.175	0.207	-0.0987	-0.430
	(0.616)	(0.445)	(0.610)	(0.384)	(0.447)	(0.426)	(0.322)
Education=3	0.0117	-0.851**	-1.645***	-0.185	-0.0690	-0.453	-0.00922
	(0.623)	(0.384)	(0.628)	(0.376)	(0.445)	(0.414)	(0.383)
Education=4					0.273		
					(0.921)		
Education=5	-1.629	-0.644	-3.473***	-0.271	-0.473	-1.952**	-0.191
	(1.139)	(1.074)	(1.015)	(1.231)	(1.128)	(0.897)	(1.053)
Education=6		0.715		-0.632	-0.151	-0.270	0.449
		(1.108)		(0.607)	(0.807)	(0.880)	(0.815)
Education=7					-0.525		
					(1.030)		
Education=8	-0.352	0.961	-0.699	-0.740	-1.152**	0.905	-0.255
	(1.169)	(1.053)	(1.108)	(0.494)	(0.487)	(1.047)	(0.540)
House dimens.	-0.249*	-0.0451	-0.157	-0.0250	-0.0609	-0.0533	-0.0242
	(0.142)	(0.0914)	(0.133)	(0.0807)	(0.0716)	(0.102)	(0.0706)
Constant	7.820***	2.924***	6.446***	3.441***	2.909***	3.801***	2.137***
	(2.513)	(0.999)	(1.281)	(0.850)	(0.888)	(1.070)	(0.771)
Observations	508	542	519	543	556	528	540

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A3. Base model without covariates. Dependent variables: Minimisation.

	food minimisation	glass minimisation	plastic minimisation	paper minimisation
Cluster 2	0.913***	0.816**	0.0840	0.237
	(0.320)	(0.356)	(0.315)	(0.316)
Cluster 3	4.380***	1.441***	0.503	0.766**
	(1.047)	(0.462)	(0.359)	(0.368)
Constant	0.457	1.019***	0.544*	0.544*
	(0.293)	(0.324)	(0.297)	(0.297)
Observations	561	561	561	563

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A4. Base model without covariates. Dependent variables: Recycling.

	Glass Recycling	Plastic Recycling	Paper Recycling	Medicines Recycling	Batteries Recycling	Organic Recycling	Aluminium Recycling
Cluster 2	-0.517	0.272	0.120	-0.295	-0.0747	0.302	0.369
	(1.050)	(0.469)	(0.772)	(0.496)	(0.500)	(0.470)	(0.382)
Cluster 3	-1.172	0.291	-0.315	-0.307	-0.238	0.119	0.440
	(1.075)	(0.531)	(0.821)	(0.540)	(0.543)	(0.520)	(0.437)
Constant	3.871***	1.969***	3.157***	2.175***	2.175***	1.969***	1.361***
	(1.011)	(0.436)	(0.723)	(0.472)	(0.472)	(0.436)	(0.355)
Observations	561	563	561	561	561	561	561

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A5. Base model with covariates. Dependent variables: No Recycling = 0; Low Recycling = 1; High Recycling = 2.

	Glass Recycling	Plastic Recycling	Paper Recycling	Medicines Recycling	Batteries Recycling	Organic Recycling	Aluminium Recycling
Cluster 2	0.859**	0.628**	0.562	0.201	-0.0174	0.822***	0.577*
	(0.386)	(0.317)	(0.422)	(0.291)	(0.331)	(0.303)	(0.306)
Cluster 3	0.509	0.695*	0.278	0.0779	0.184	0.672*	0.779**
	(0.441)	(0.392)	(0.468)	(0.329)	(0.376)	(0.362)	(0.363)
Area = 2	-0.450	-0.145	-0.340	-0.286	-0.296	-0.438	-0.116
	(0.372)	(0.289)	(0.352)	(0.228)	(0.233)	(0.271)	(0.259)
Area = 3	-1.123***	-0.426	-0.897***	-0.0817	-0.543**	-0.927***	-0.582**
	(0.340)	(0.259)	(0.318)	(0.212)	(0.223)	(0.250)	(0.231)
Income=2	0.245	-0.717	-0.222	-0.254	0.0884	-0.631	-0.368
	(0.638)	(0.649)	(0.656)	(0.445)	(0.484)	(0.528)	(0.469)
Income=3	-0.243	-1.107*	-0.283	-1.207***	-0.687	-0.272	-0.167
	(0.623)	(0.665)	(0.725)	(0.460)	(0.494)	(0.576)	(0.502)
Income=4	-0.720	-1.561**	-1.176	-0.113	-0.508	-0.794	-0.349
	(0.746)	(0.741)	(0.855)	(0.754)	(0.704)	(0.617)	(0.597)
Income=5	-0.386	-0.877	-1.028*	-0.719*	-0.397	-0.808	-0.508
	(0.554)	(0.614)	(0.605)	(0.415)	(0.454)	(0.503)	(0.438)
Income=6	0.199	-0.504	-0.646	0.309	0.0404	-0.865	-0.407
	(0.942)	(0.825)	(0.895)	(0.640)	(0.616)	(0.658)	(0.614)
Income=7	0.321	-0.829	-0.993	-0.150	-0.463	-0.713	-0.0683
	(0.737)	(0.718)	(0.757)	(0.544)	(0.526)	(0.611)	(0.560)
Income=8	-0.623	14.49***	14.41***	-0.308	-2.915*	-0.0771	0.557
	(1.988)	(0.842)	(0.881)	(1.598)	(1.688)	(1.631)	(1.144)
Income=9	14.52***	14.14***	13.98***	12.84***	13.16***	12.91***	11.94***
	(0.952)	(0.949)	(0.963)	(0.836)	(0.852)	(0.884)	(0.853)
Education=2	-0.127	0.331	-0.470	0.0115	0.0335	-0.133	-0.285
	(0.388)	(0.361)	(0.349)	(0.258)	(0.268)	(0.293)	(0.295)
Education=3	-0.688*	-0.753**	-0.538	-0.252	-0.260	-0.413	-0.330
	(0.380)	(0.314)	(0.426)	(0.265)	(0.277)	(0.314)	(0.299)
Education=4	14.16***	-0.0195	-0.534	0.448	0.0975	-0.334	-0.234
	(0.944)	(0.979)	(1.154)	(1.191)	(0.795)	(0.740)	(0.602)

Education=5	-1.364*	-1.031	-2.379***	-0.742	-0.999	-1.448*	-1.120**
	(0.816)	(0.758)	(0.886)	(0.674)	(0.674)	(0.749)	(0.499)
Education=6	0.721	-0.186	14.05***	0.00112	-0.0859	-0.146	0.605
	(1.090)	(0.522)	(0.348)	(0.545)	(0.478)	(0.568)	(0.696)
Education=7	13.74***	0.519	-1.009	0.0277	-0.758	0.00968	0.803
	(0.494)	(1.077)	(0.847)	(0.684)	(0.681)	(0.734)	(0.987)
Education=8	-0.564	-0.257	-0.629	-0.308	-0.627	-0.169	-0.347
	(0.500)	(0.368)	(0.541)	(0.424)	(0.417)	(0.429)	(0.416)
House dimens.	-0.0471	0.0242	-0.0121	-0.00452	0.0494	0.0398	0.0147
	(0.103)	(0.0768)	(0.0865)	(0.0550)	(0.0552)	(0.0803)	(0.0631)
Constant cut 1	-3.700***	-2.710***	-4.233***	-2.530***	-2.587***	-2.634***	-1.814***
	(0.770)	(0.725)	(0.743)	(0.507)	(0.593)	(0.650)	(0.599)
Constant cut 2	-2.412***	-1.862***	-2.876***	-1.190**	-1.155**	-1.568**	-1.119*
	(0.803)	(0.720)	(0.754)	(0.504)	(0.584)	(0.657)	(0.599)
Observations	560	560	560	560	560	560	560

Ordered Logit Estimates. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A6. Base model without covariates. Dependent variables: No Recycling = 0; Low Recycling = 1; High Recycling = 2.

	Glass Recycling	Plastic Recycling	Paper Recycling	Medicines Recycling	Batteries Recycling	Organic Recycling	Aluminium Recycling
Cluster 2	0.817**	0.651**	0.416	0.266	0.0600	0.738**	0.533*
	(0.359)	(0.308)	(0.392)	(0.274)	(0.297)	(0.290)	(0.295)
Cluster 3	0.535	0.753**	0.215	0.146	0.332	0.650*	0.728**
	(0.415)	(0.367)	(0.440)	(0.309)	(0.348)	(0.339)	(0.348)
Constant cut 1	-2.551***	-1.616***	-2.827***	-1.694***	-1.959***	-1.577***	-1.200***
	(0.326)	(0.284)	(0.389)	(0.259)	(0.292)	(0.269)	(0.276)
Constant cut 2	-1.309***	-0.798***	-1.511***	-0.392	-0.582**	-0.548**	-0.513*
	(0.320)	(0.281)	(0.361)	(0.254)	(0.280)	(0.264)	(0.273)
Observations	563	563	563	563	563	563	563

Ordered Logit Estimates. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A7. Alternative model with covariates and with waste policies and interactions (curbside * Cluster). Dependent variables: No Recycling = 0; Low Recycling = 1; High Recycling = 2).

	Glass Recycling	Plastic Recycling	Paper Recycling	Medicines Recycling	Batteries Recycling	Organic Recycling	Aluminium Recycling
Cluster 2	-0.718	0.0922	-0.815	-0.867	-0.955*	-0.284	-0.830
	(0.629)	(0.630)	(0.764)	(0.550)	(0.535)	(0.473)	(0.625)
Cluster 3	-1.530**	-0.113	-0.898	-1.112*	-0.940	-0.922*	-0.253
	(0.673)	(0.698)	(0.820)	(0.587)	(0.591)	(0.514)	(0.683)
Door to door	-0.668	-0.0235	-0.507	-0.522	-0.115	-0.206	0.0455
	(0.857)	(0.736)	(0.940)	(0.679)	(0.761)	(0.690)	(0.732)
Cluster 2 * curbside	1.897**	0.789	2.424**	1.316*	1.171	1.515**	1.844**
	(0.949)	(0.789)	(1.007)	(0.724)	(0.794)	(0.747)	(0.797)
Cluster 3 * curbside	2.988***	1.505	1.593	1.307*	1.416	2.340***	1.181
	(1.118)	(0.929)	(1.125)	(0.771)	(0.886)	(0.870)	(0.935)
Bring site (Material Specific)	1.997***	1.363***	1.906***	1.323***	0.913***	1.879***	2.524***
	(0.547)	(0.325)	(0.492)	(0.301)	(0.269)	(0.334)	(0.338)
Area = 2	-0.534	0.0869	-0.222	-0.200	-0.202	-0.0701	0.0219
	(0.434)	(0.322)	(0.392)	(0.244)	(0.261)	(0.318)	(0.312)
Area = 3	-1.264***	-0.366	-0.751**	-0.0962	-0.480*	-0.619**	-0.336
	(0.414)	(0.291)	(0.359)	(0.235)	(0.255)	(0.307)	(0.295)
Income=2	0.467	-0.730	-0.143	-0.463	0.291	-0.518	-0.495
	(0.689)	(0.698)	(0.711)	(0.521)	(0.523)	(0.625)	(0.555)
Income=3	-0.110	-1.068	-0.197	-1.421***	-0.493	-0.204	-0.139
	(0.669)	(0.735)	(0.762)	(0.529)	(0.534)	(0.648)	(0.596)
Income=4	-0.829	-1.340	-1.398	-0.615	-0.570	-0.618	-0.892
	(0.892)	(0.861)	(0.973)	(0.797)	(0.790)	(0.887)	(0.689)
Income=5	-0.000771	-0.608	-0.797	-0.809	-0.0721	-0.545	-0.375
	(0.594)	(0.659)	(0.655)	(0.493)	(0.499)	(0.597)	(0.514)
Income=6	0.488	-0.590	-1.101	0.175	0.312	-0.346	-0.323
	(1.244)	(0.932)	(0.826)	(0.807)	(0.714)	(0.780)	(0.796)
Income=7	1.200	-0.450	-0.522	-0.0214	-0.0676	-0.461	0.776
	(0.917)	(0.789)	(0.890)	(0.650)	(0.579)	(0.722)	(0.756)

Income=8	0.302	13.45***	15.70***	0.584	-2.519	0.500	1.311
	(2.342)	(0.960)	(1.100)	(1.806)	(1.676)	(1.999)	(1.478)
Income=9	16.47***	13.11***	15.05***	12.21***	14.07***	13.12***	13.23***
	(1.145)	(1.044)	(1.091)	(0.942)	(0.924)	(1.049)	(1.007)
Education=2	-0.312	0.0895	-0.726**	-0.0393	0.0169	-0.422	-0.674**
	(0.401)	(0.388)	(0.365)	(0.278)	(0.305)	(0.330)	(0.339)
Education=3	-0.332	-0.548	-0.121	0.0365	0.0973	0.0135	-0.0256
	(0.457)	(0.359)	(0.470)	(0.298)	(0.311)	(0.374)	(0.374)
Education=4	14.70***	-0.529	-1.103	0.127	-0.371	0.191	-0.330
	(1.851)	(1.131)	(1.210)	(1.474)	(1.057)	(1.420)	(1.171)
Education=5	-1.756**	-1.330	-2.839***	-0.913	-1.203**	-1.933*	-1.740***
	(0.796)	(0.958)	(1.039)	(0.577)	(0.570)	(1.043)	(0.544)
Education=6	0.595	-0.519	14.62***	0.0676	-0.0985	-0.0717	0.396
	(1.095)	(0.526)	(0.377)	(0.551)	(0.481)	(0.624)	(0.755)
Education=7	13.99***	0.700	-1.050	0.0673	-0.530	-0.0776	1.349
	(0.544)	(1.170)	(0.954)	(0.680)	(0.605)	(0.861)	(1.685)
Education=8	-1.071*	-0.340	-0.982	-0.576	-0.936**	-0.201	-0.966*
	(0.647)	(0.524)	(0.679)	(0.432)	(0.471)	(0.559)	(0.577)
House dimens.	-0.148	-0.0173	-0.0779	-0.0261	-0.00857	-0.0355	-0.0991
	(0.0954)	(0.0894)	(0.0968)	(0.0606)	(0.0538)	(0.0901)	(0.0700)
Constant cut 1	-3.176***	-1.777*	-3.158***	-2.283***	-2.209***	-1.613*	-0.812
	(1.180)	(1.010)	(1.118)	(0.722)	(0.706)	(0.886)	(0.890)
Constant cut 2	-1.775	-0.834	-1.657	-0.859	-0.649	-0.307	0.181
	(1.208)	(1.008)	(1.145)	(0.719)	(0.698)	(0.895)	(0.904)
Observations	516	516	516	516	516	516	516

Ordered Logit Estimates. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A8. Alternative model with covariates and with waste policies and interactions (bring site * Cluster). Dependent variables: No Recycling = 0; Low Recycling = 1; High Recycling = 2.

	Glass Recycling	Plastic Recycling	Paper Recycling	Medicines Recycling	Batteries Recycling	Organic Recycling	Aluminium Recycling
Cluster 2	-16.93***	-0.614	-15.19***	-1.175	-1.552*	-0.402	-0.0867
	(1.499)	(1.240)	(0.748)	(0.726)	(0.922)	(0.676)	(0.778)
Cluster 3	-18.38***	-0.810	-16.12***	-1.626*	-1.905*	-2.473***	0.208
	(1.767)	(1.290)	(1.095)	(0.840)	(0.999)	(0.926)	(0.907)
Curbside	1.197***	0.779***	1.384***	0.671***	0.972***	1.280***	1.584***
	(0.327)	(0.270)	(0.315)	(0.208)	(0.217)	(0.258)	(0.255)
Bring site (Material Specific)	-15.36***	0.0244	-13.91***	0.0544	-0.634	0.484	2.138**
	(1.471)	(1.249)	(0.946)	(0.767)	(0.996)	(0.693)	(0.904)
Cluster 2 * Bring site	17.53***	1.397	15.78***	1.330	1.546	1.229	0.327
	(1.577)	(1.305)	(0.909)	(0.846)	(1.047)	(0.796)	(0.937)
Cluster 3 * Bring site	18.52***	1.791	16.35***	1.556	2.182*	3.257***	0.338
	(2.099)	(1.362)	(1.159)	(0.958)	(1.135)	(1.037)	(1.088)
Area = 2	-0.509	0.126	-0.149	-0.175	-0.187	-0.0589	0.0626
	(0.433)	(0.320)	(0.400)	(0.249)	(0.266)	(0.327)	(0.313)
Area = 3	-1.186***	-0.345	-0.709**	-0.0946	-0.511**	-0.584*	-0.324
	(0.408)	(0.287)	(0.359)	(0.236)	(0.256)	(0.303)	(0.295)
Income=2	0.409	-0.780	-0.156	-0.529	0.283	-0.529	-0.603
	(0.708)	(0.720)	(0.720)	(0.528)	(0.515)	(0.640)	(0.566)
Income=3	-0.112	-1.060	-0.141	-1.478***	-0.434	-0.145	-0.179
	(0.690)	(0.750)	(0.777)	(0.537)	(0.528)	(0.667)	(0.606)
Income=4	-1.140	-1.391	-1.512	-0.712	-0.600	-0.808	-1.086
	(0.918)	(0.874)	(0.998)	(0.800)	(0.784)	(0.869)	(0.725)
Income=5	-0.0961	-0.615	-0.880	-0.863*	-0.0443	-0.569	-0.468
	(0.610)	(0.678)	(0.660)	(0.497)	(0.493)	(0.610)	(0.528)
Income=6	0.549	-0.517	-1.116	0.169	0.379	-0.300	-0.365
	(1.251)	(0.946)	(0.853)	(0.806)	(0.711)	(0.784)	(0.797)
Income=7	0.781	-0.533	-0.773	-0.147	-0.0792	-0.591	0.548
	(0.887)	(0.800)	(0.876)	(0.644)	(0.563)	(0.722)	(0.735)
Income=8	-1.446	12.97***	14.73***	0.179	-2.791**	-0.196	1.026

	(1.906)	(1.011)	(1.509)	(1.902)	(1.278)	(1.697)	(1.351)
Income=9	16.36***	13.02***	15.07***	13.15***	12.78***	12.21***	13.93***
	(1.176)	(1.044)	(1.129)	(0.960)	(0.943)	(1.056)	(1.032)
Education=2	-0.304	0.0514	-0.685*	-0.0228	0.0463	-0.462	-0.665*
	(0.410)	(0.388)	(0.370)	(0.279)	(0.307)	(0.330)	(0.341)
Education=3	-0.289	-0.571	-0.129	0.0156	0.0723	-0.00805	-0.0222
	(0.466)	(0.363)	(0.464)	(0.296)	(0.308)	(0.378)	(0.378)
Education=4	15.93***	-0.544	-1.047	0.253	-0.290	0.243	-0.314
	(1.946)	(1.207)	(1.673)	(1.545)	(1.040)	(1.618)	(1.519)
Education=5	-1.752**	-1.397	-2.893**	-0.955	-1.202**	-1.857	-1.900***
	(0.767)	(0.958)	(1.144)	(0.582)	(0.560)	(1.137)	(0.663)
Education=6	0.516	-0.545	14.25***	0.0167	-0.138	-0.148	0.265
	(1.082)	(0.521)	(0.366)	(0.539)	(0.483)	(0.612)	(0.750)
Education=7	13.93***	0.612	-1.030	0.0374	-0.544	-0.299	1.393
	(0.549)	(1.259)	(0.995)	(0.685)	(0.620)	(0.872)	(1.703)
Education=8	-0.868	-0.233	-0.872	-0.568	-0.969**	-0.223	-0.872
	(0.600)	(0.510)	(0.643)	(0.440)	(0.484)	(0.538)	(0.570)
House dimens.	-0.146	-0.0169	-0.0650	-0.0166	-0.00563	-0.0293	-0.0851
	(0.0997)	(0.0890)	(0.0934)	(0.0625)	(0.0532)	(0.0943)	(0.0681)
Constant cut 1	-19.32***	-2.447	-17.70***	-2.618***	-2.835***	-1.898**	-0.244
	(1.712)	(1.586)	(1.047)	(0.827)	(1.012)	(0.968)	(0.904)
Constant cut 2	-17.90***	-1.497	-16.22***	-1.194	-1.266	-0.568	0.736
	(1.571)	(1.576)	(1.155)	(0.823)	(0.999)	(0.973)	(0.923)
Observations	516	516	516	516	516	516	516