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Pro-environmental behavior: On the interplay of intrinsic motivations and external conditions[*]

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Abstract

A key issue for ecological economics concerns the processes whereby people engage in ecologically responsible behavior and contribute to environmental quality even when they involve a personal cost for a shared benefit.

This paper explores the relative impact of intrinsic motivation versus external conditions and economic incentives on eight pro-environmental behaviors (PEBs). Previous research has mostly focused on one of these two aspects or studied whether external incentives can crowd out moral motivation. More comprehensive accounts of the interplay of these factors are rare and mostly dated or report small-scale experiments and case studies.

Using a data set measuring PEBs and environmental attitudes in the European Union's 28 member states, this paper tests both sets of variables on a wider scale. It assesses the importance of intrinsic motivation as a dominant factor and shows how differing levels of intrinsic motivation influence the effectiveness of external conditions, such as monetary incentives and green infrastructures. External incentives are found to interact positively with intrinsic motivation. The findings also suggest that the influence of external factors varies depending on whether the behavior examined is cost neutral or implies costs or rewards.

We further show that other non-strictly-related factors can affect the salience of an environmental norm and consequently the adoption of the corresponding behavior. Pressing economic preoccupations can distract individuals from behaving pro-environmentally, and PEBs are more likely to arise in individuals who care about the future.

The results suggest that two-pronged policies, which take into account intrinsic motivation and external conditions, are needed to reach a high observance rate in the population in the short and in the long term. The wider significance of these results for environmental policy and policy guidance for each of the eight PEBs is discussed.

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1. Introduction

The transition towards an ecologically sustainable economy implies a radical transformation of people's lifestyles. Consumers' desires drive the demand that is exhausting natural resources and generating unsustainable levels of waste (Jackson, 2005).

It has been estimated that, to maintain global warming below the 2 °C threshold, technological advances will play a minor role, while the majority of the mitigation effort should come from behavior change (van den Bergh, 2013). Thus, individual behavior is not just a relevant driver of emissions but also a "potential agent for change in emissions" (IPCC, 2014, p. 388).

Understanding the determinants of pro-environmental behavior (PEB) is the key to designing policies that can promote more sustainable lifestyles.

Like human behavior in general, PEB is jointly determined by cognitive processes that are internal to the individual and by the external context that surrounds her. In the past most studies, and consequently policy recommendations, have typically focused on one of these two aspects, favoring either educational interventions or alterations of external conditions through incentives or taxes (Fehr & Gintis, 2007; Guagnano, Stern, & Dietz, 1995; Turaga, Howarth, & Borsuk, 2010). However, these one-pronged approaches ignore the insights from the other perspective, any conditional effect that the variables in one approach may have on variables of the other, as well as the interactions between them (Guagnano et al., 1995).

This paper proposes an integrated framework to address these shortcomings in support of two-pronged policies. It contributes to the understanding of the conditions under which internal factors are conducive of PEB and when providing external incentives—such as the provision of monetary incentives and green infrastructures—can be effective.

The framework proposed here adopts a holistic approach, extending beyond directly related factors, such as attitudes towards the environment or incentives to behave pro-environmentally (PE). Studies have suggested that the activation of a norm into behavior also depends on the salience of such a norm in a particular situation (Cialdini et al., 2006). An individual's ability to focus on environmental norms could for example be affected negatively by other more pressing preoccupations, such as financial constraints. Additionally, since PEB implies a cost today for increased environmental quality tomorrow, future environmental quality might be more salient to individuals who do not discount future outcomes too much. Thus, it is expected that more future-oriented individuals should behave more PE. Both possibilities are explored and tested in this paper.

1.1 Objectives

Using a survey data set of self-reported PEBs and environmental attitudes for 28,000 respondents in the European Union's 28 member states, this study analyzes the drivers of eight different PEBs.

The paper aims:

1 To assess the relative strength of intrinsic motivation versus external conditions and to determine whether it varies depending on the PEB observed.
2 To determine whether seemingly unrelated factors, such as an individual's financial constraints and limited future orientedness, can negatively affect PEB, that is by lowering the perceived salience of an environmental norm.
3 To assess whether differing levels of intrinsic motivation influence the effectiveness of external conditions, such as incentives, financial problems and green infrastructures.

The present study represents the first empirical test in which the interaction of intrinsic and external factors is considered across a wide set of countries and behaviors. Previous research has either been limited to case studies and field experiments (De Young, 1985; Derksen & Gartrell, 1993; Guagnano et al., 1995; Humphrey, Bord, Hammond, & Mann, 1977; Katzev & Pardini, 1987)—restricting the potential applicability of the findings to the particular socio-cultural context involved—or focused on just one aspect of the relationship between these two groups of variables (Cecere, Mancinelli, & Mazzanti, 2014; Ferrara & Missios, 2012)—analyzing whether external incentives crowd out the moral motivation to sort waste.

Extending the analysis to several countries offers two kinds of advantages: it highlights national differences, and the reasons behind them, as well as allowing us to determine near "universal" relationships and generalizable lessons. In addition, linking attitudes towards the future and a person's financial preoccupations with PEB is a novel approach in the literature.

1.2 Background

Traditionally, PEB has been studied either as: i) the outcome of an internal process of moral deliberation in which the individual supposedly acts in complete autonomy from her external context (Bamberg & Möser, 2007; Black, Stern, & Elworth, 1985; Grodzińska-Jurczak, 2003; Heberlein, 1981; Hopper & Nielsen, 1991; Sidique, Joshi, & Lupi, 2010); or as ii) the consequence of an external stimulus to which the individual responds as an automaton regardless of her own convictions (Ferrara & Missios, 2005; Jacobs & Bailey, 1983; Linderhof, Kooreman, Allers, & Wiersma, 2001; Palmer & Walls, 1997) (as cited in Guagnano et al., 1995). While both approaches have demonstrated some validity, later evidence that human behavior is determined by both internal and external factors and their interaction has

supported the development of integrated frameworks (Jackson, 2005; Kirakozian, 2016; Turaga et al., 2010; van den Bergh, 2008).

In terms of policy effectiveness, an integrated framework of intrinsic and extrinsic motivation is relevant for three main reasons:

i) Different kinds of individuals are likely to respond to different kinds of incentives.

ii) External incentives may produce quick results that, however, do not extend beyond the duration of the incentive itself, while promoting internal motivation may produce effects in a longer time frame but that may also last longer. Thus, both kinds of stimuli might be needed to achieve both short- and long-term results.

iii) One type of stimulus may work conditionally on the other. For example, external incentives may be ineffective if not supported by a basic level of intrinsic motivation, but strong intrinsic motivation may also be ineffective on its own with a complete lack of green infrastructures. Glaeser (2014) highlights how the interaction between environmentalist campaigns and classic policy interventions can lead to unforeseen effects, thereby reinforcing the need for an integrated approach to monitor and offset possible unwanted consequences.

Thus, to reach out to a wider public, into a longer time frame and more effectively, the two kinds of motivations and how they interact with each other need to be understood and enforced.

The "attitude–behavior context" (ABC) model—initially posited by Guagnano et al. (1995)—represents one of the earliest and most complete attempts to create a model in which behavior and policy effectiveness do not depend on the level of either intrinsic motivation (referred to by the authors as attitudes) or external conditions by themselves but on their relative value to each other. They proposed that PEB can take place when both the intrinsic and the external conditions are positive or when at least one of the two is positive enough to offset the low value of the other. They also suggested that, if the external conditions are extremely unfavorable to PEB or extremely favorable, intrinsic motivation will not affect behavior. For example, an educational program to improve environmental awareness will not have an impact on the population's littering behavior in a context in which there are no trash bins or, on the contrary, if there are already bins everywhere and heavy fines for not using them. Similarly, Derksen and Gartrell (1993) found that intrinsic motivation can enhance recycling rates but cannot overcome the barriers represented by a lack of infrastructures alone.

Another way to think about PEB is as a contrast between individual and social rationality, as it typically involves a personal cost for increased environmental quality, which is a public good, as exemplified in Ostrom (2011). The extent of this

contrast varies, however, depending on an individual's personality and on the cost to comply attached to a specific PEB. Thus, this paper analyzes the determinants of eight PEBs individually; it then focuses on different personality types to determine whether they respond differently to different incentives.

1.2.1 Intrinsic motivation as a personality trait

To act PE, an individual should be motivated either by her own moral call to behave responsibly or by external incentives that make the socially optimal option (i.e. behaving PE) more appealing to her. In other words, an individual may perceive that her best interest is aligned with that of society as a whole and choose to behave in a way that is morally consistent with this belief, while another person may identify personal well-being more strictly with her own individual pay-off. Ceteris paribus, the latter will typically perceive the contrast between individual and social rationality as wider and will need to be compensated with external incentives to behave PE. Based on this distinction, the literature has categorized individuals into either self-regarding actors or reciprocators (Fehr & Gintis, 2007). Moreover, individuals' intrinsic motivation, as measured by their ascription to responsibility and awareness of consequences for their action, has been considered to the extent of a personality trait (Schwartz, 1977). Two studies have supported the idea that the response to policy interventions differs based on user type (Abrahamse, Steg, Vlek, & Rothengatter, 2005) and that communication campaigns can be ineffective if targeting those who are already intrinsically motivated (Arkesteijn & Oerlemans, 2005).

1.2.2 External conditions as a cost of compliance

The external conditions in which a choice takes place are greatly, although not exclusively, defined by the cost of compliance. The perceived cost of adhering to an environmental norm clearly influences whether such a norm will be activated into behavior or not. Previous studies have highlighted that easier, less costly behaviors are more likely to be adopted (Attari, Dekay, Davidson, & Bruin, 2011) and that in these cases intrinsic motivation can be a strong predictor of PEB (Black et al., 1985). Conversely, higher costs of compliance act as a limiting factor that impedes intrinsic motivation from translating into actual behavior (Black et al., 1985). PEBs can imply relatively low costs of compliance, such as a minor habit change or a relatively small economic contribution (e.g. using reusable shopping bags), but they can also require a major lifestyle shift (e.g. such as switching to a vegan diet) or economic investment (e.g. opting for energy-efficient home appliances). Sometimes, behaving PE may involve both a somewhat costly habit change and economic gains (such as taking shorter showers to reduce water consumption as well as the water bill). In consideration of this, the antecedents of each PEB and their relative incidence may be different.

The economic cost of compliance for non-income-neutral PEBs will be perceived differently relative to one's financial situation; that is, the same cost will be

perceived as higher for a poorer individual. The impact of economic constraints on PEB has not been studied thoroughly. One might expect that individuals with financial constraints will engage in those PEBs that entail economic gains or savings (such as reducing energy consumption) and abstain from PEBs that imply an economic loss (such as purchasing green-label products). In line with these predictions, one study has documented a drastic decline in the purchase of green products in Greece since the start of the last economic crisis and reported that energy and water conservation behaviors instead are driven by financial preoccupations rather than environmental concern (Tilikidou & Delistavrou, 2014). However, this does not necessarily imply that financially distressed individuals are less concerned with protecting the environment. A review of the literature on the topic suggests that environmental concern does not vary with income (Kollmuss & Agyeman, 2002). Rather, it might be that environmental preoccupations are less likely to activate into PEB if an individual is distracted by other pressing personal circumstances, such as financial distress. As Cialdini's theory of normative focus conjectures, a norm might be less likely to be activated if the individual's attention is on the self as opposed to the situation and norm (Cialdini, Reno, & Kallgren, 1990). This hypothesis is best tested on an income-neutral PEB, such as recycling, that is, whether economically distressed individuals would still abstain from recycling even in the absence of a financial cost of compliance. The extent of this "economic distraction" may also vary with levels of intrinsic motivation. These tests are undertaken in the next section of this paper.

1.2.3 PEB as future-oriented behavior

Given that PEB represents a personal investment in the future—in which future environmental quality is exchanged for a sacrifice today—, it can be considered as future-oriented behavior, such as quitting smoking, saving for retirement or practicing safe sex. The doubt is whether the individual recognizes when choosing to act PE the stakes that her behavior has in the future and whether she values that future. Considering that PEB often involves small, day-to-day, routine acts, it may be that the future implications of such acts are hidden from sight. Alternatively, it may be that the future is highly discounted, as suggested by the evidence that consumers fail to choose energy-saving appliances that could more than compensate for the higher capital costs (IPCC, 2014; Kollmuss & Agyeman, 2002).

An experimental study showed that individuals cared more about the future and preserved more resources, in an hypothetical game in which resources were distributed among generations, when they could identify those representing future generations (Wolf & Dron, 2015). Similarly, in real life it can reasonably be expected that individuals who are parents are more concerned with preserving the environment, since they can relate to and emotionally connect on a daily basis with the generation next to theirs.

Beliefs about the future could also influence one's PEB. If a person has negative expectations regarding the future in general, she might be less likely to invest

energy in it, as the perceived likelihood of harvesting future results is low. A recent study showed for instance that individuals are less likely to delay gratification and hence invest in the future if they lose faith in the likelihood of future rewards for their efforts (Michaelson, de la Vega, Chatham, & Munakata, 2013).

Chen (2013) proposed that the primary language that an individual speaks correlates with the likelihood that she will engage in future-oriented behavior. The author tested whether individuals who speak futureless languages—that is, languages with a weak future tense[2]—are more future-oriented and less likely to shift costs to the future, because they equate the future, grammatically and conceptually, to the present. He found that speakers of weak future tense languages are remarkably more likely to accumulate savings (39%) and stay physically active (29%) and less likely to smoke (24%) or be medically obese (13%) than speakers of languages with strong future tenses. Similar hypotheses on the relationship between language structure and intertemporal behavior were later confirmed by Chen et al. (2015) and Guin (2015).

This paper tests whether an individual who has i) a personal stake in the future—that is, is a parent; ii) an optimist attitude towards it; or iii) a more long-term-oriented mindset—as proxied by her native language—is more likely to act PE.[3]

2. Material and methods

Similarly to other integrated models of intrinsic and extrinsic motivation, this paper empirically analyzes the joint influence of internal and external factors on the likelihood that an individual *i* will behave PE.

$$(1) \qquad PEB_{(i)} = F(intrinsic\ motivation_{(i)}, external\ conditions_{(i)})$$

Eight PEBs are investigated separately: waste separation for recycling; reduction of waste—by avoiding over-packaged products and buying products with a longer life; reduction of domestic water consumption; reduction of domestic energy consumption; purchase of green-label products; purchase of local products; choice of a greener way to travel; and diminished car use. The response variables capture whether an individual reported having engaged in one of the eight behaviors in the previous month. The causal variables in the model include:

- indicators of intrinsic motivation;

[2] Typically languages that do not require their speakers to mark future events with a future tense. For example, a German or a Mandarin speaker would predict rain using the present tense "It *rains* tomorrow" rather than using the future tense required for example by the English language: "It *will rain* tomorrow" or "It *is going to rain* tomorrow" (M. K. Chen, 2013).

[3] This paper does not test the existence of a causal link between individuals' temporal preferences and their primary language but rather uses the latter as a proxy for a future-oriented mindset. Language is frequently used as a proxy for measuring cultural differences in the literature (V. Ginsburgh & Weber, 2014).

- proxies measuring the availability of green infrastructures and monetary incentives to act PE at the local level;
- self-reported economic problems;
- proxies measuring an individual's general attitude towards the future; and
- a series of demographic and other situational controls spanning from age and gender to internet use and self-assessed placement in society.

Data were obtained from Eurobarometer's 2014 survey on "Attitudes of Europeans towards environment" (European Commission, 2015), which surveyed 28,000 respondents in the European Union's 28 member states. The respondents who did not reply and replied "do not know" to at least one of the questions relevant to this analysis were excluded from the data set; this reduced the sample size to nearly 22,000 observations. The Eurobarometer data set provided all the variables included in the econometric model with two exceptions:

- One of the variables measuring the availability of green infrastructures considers whether a country has adopted a container deposit collection system, for example *BottleBill*, which rewards individuals economically for returning used bottles and vessels. The list of countries that had adopted this legislation by 2004, the year of the Eurobarometer survey, was taken from the website BottleBill.org, maintained by the non-profit organization Container Recycling Institute (Container Recycling Institute, 2016). The list was incremented using evidence from a European Parliament report on refunding schemes for drink containers (Schneider et al., 2011) (Schneider et al., 2011).
- One of the variables measuring attitudes towards the future—specifically *WeakFut*—considers whether a respondent's primary language is a weak future tense language. The variable was constructed by adopting the dichotomic language codification into weak and strong future tense introduced by Chen (2013, Appendix B, Table 1, p. 40).

2.1 Econometric model A

The relationships between the variables presented above are estimated with the following econometric model[4]:

(2)

$$PEB_{(i,b)} = b_b + \alpha Norm_{(i,b)} + \beta EnvWorry_{(i,b)} + \gamma HighResp_{(i)} + \delta NoResp_{(i)} + \zeta EcoInfra_{(i)} + \eta BottleBill_{(c)} + \theta FinProb_{(i)} + \iota(BottleBill_{(c)} * FinProb_{(i)}) + \kappa Parent_{(i)} + \lambda WeakFut_{(i)} + \mu BleakFut_{(i)} + \nu Female_{(i)} + \xi Age_{(i)} + oEdu_{(i)} + \pi NetUse_{(i)} + \varpi LowClass_{(i)} + \rho HighClass_{(i)} + \varrho Rural_{(i)} + \varepsilon$$

[4] A full list of survey questions extracted from the Eurobarometer database and utilized for this model is included in Annex 1.

where:

Individual respondent: i=1 ,2, 3…, 21,954	1=individual 1 2=individual 2 3=individual 3 … 21,954=individual 21,954
PEB: b=1, 2, 3…, 9	1=Sum of the 8 PEBs 2=Waste separation for recycling 3=Reduce household waste 4=Reduce water consumption (domestic) 5=Reduce energy consumption (domestic) 6=Buy green-label products 7=Buy local products 8=Choose green traveling 9=Use car less
Country*:* c=1, 2, 3…, 28	1=Austria 2=Belgium 3=Bulgaria … 28=United Kingdom

2.1.1 The variables

$PEB_{(i,b)}$ is the respondent variable for individual i and behavior b.

- For b=1 it is a 0–8 scale measuring how many of the 8 considered PEBs the individual reported having performed in the last month.
- For b=2–9 it is a 0–1 dummy variable measuring whether the individual has performed PEB b in the last month. It is set to 0 if the respondent has not and 1 otherwise.

Intrinsic motivation

Intrinsic motivation is measured by three indicators inspired by Shalom Schwartz's norm activation theory, one of the most prominent social psychology theories that have been applied to the understanding of PEB. The theory posits that an individual will behave in accordance with a norm if she recognizes the norm (e.g. she has internalized a social norm) and if the following two conditions simultaneously apply: (1) the person must have some awareness that her potential acts may have consequences for the welfare of others—awareness of consequences (AC); (2) the person must ascribe some responsibility for these acts and their consequences to herself—ascription of responsibility (AR) (Schwartz, 1968, p. 356).

$Norm_{(i,b)}$ measures the recognition of the environmental norm connected to the PEB examined; for example, the response to the question "Do you think it is a

priority for people to separate waste for recycling?" is used for recycling behavior. It is a 0–1 dummy variable.[5] For b=2–9 it is set to 0 if the respondent did not recognize the norm and 1 otherwise. For b=1 it is set to 0 if the respondent did not recognize any environmental norm and 1 otherwise.

$EnvWorry_{(i,b)}$ measures whether the individual is concerned with the environmental aspect connected to the PEB examined; for example, the response to the question "Are you worried about the growing amount of waste?" is used for recycling behavior.[6] For b=2–9 it is a 0–1 dummy variable, set to 0 if the respondent is not concerned and 1 otherwise. For b=1 it is a 0–5 scale corresponding to the amount of environmental concerns expressed by the respondent (set to a maximum of 5 in accordance with the survey design).

$HighResp_{(i)}$ is a 0–1 dummy variable measuring whether the individual ascribes completely to personal responsibility for caring about the environment. It is set to 0 if the respondent does not and 1 otherwise.

$NoResp_{(i)}$ is a 0–1 dummy variable measuring whether the individual rejects entirely personal responsibility for caring about the environment. It is set to 0 if the respondent does not and 1 otherwise.

External conditions

$EcoInfra_{(i)}$ is a 0–1 dummy variable measuring whether the individual believes that the city is fulfilling its duty in preserving the environment. It can be considered as a proxy for the availability of green infrastructures at the local level, enabling citizens to behave PE (e.g. the presence of recycling bins, public transport and cycling tracks). It is set to 0 if the respondent does not and 1 otherwise.

$BottleBill_{(c)}$ is a 0–1 dummy variable measuring whether the country[7] c where the individual resides has adopted a container deposit law that organizes the collection of cans and bottles and rewards users with a voucher for fuel or groceries. It primarily represents the availability of a green infrastructure tied to an economic incentive to recycle, but it can also be considered as a proxy for the availability of other green infrastructures (e.g. if a country has adopted it, it may be more likely to have adopted other national-level green infrastructures as well). It is set to 0 if the country where the individual resides has not adopted it and 1 otherwise.

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[5] A list of the environmental norms corresponding to each behavior is available in Annex 2.

[6] A list of the environmental concerns corresponding to each behavior is available in Annex 2.

[7] As of 2014, the year of the Eurobarometer survey, only 11 of the 28 surveyed countries had adopted a Bottle Bill system: Austria, Belgium, Croatia, Cyprus, Denmark, Estonia, Finland, Germany, Hungary, the Netherlands and Sweden. Despite their exclusion from the Container Recycling Institute's list (2016), the authors decided to include Hungary and Cyprus in the list following evidence reported by Schneider et al. (2011).

$FinProb_{(i)}$ is a 0–1 dummy variable measuring whether the individual reported problems paying her bills most of the times in the last year. It is set to 0 if the respondent did not and 1 otherwise.

$BottleBill_{(c)} * FinProb_{(i)}$ is the interaction term between the two dummy variables *BottleBill* and *FinProb*. It measures whether the fact of having economic problems and living in a *BottleBill* country has a positive effect on self-reported PEB. If significant, it would imply that economic incentives are effective in increasing PEB for individuals who are more sensitive to small economic rewards.

Attitudes towards the future

$Parent_{(i)}$ is a 0–1 dummy variable measuring whether the individual has at least one child. It is set to 0 if the respondent does not and 1 otherwise.

$WeakFut_{(i)}$ is a 0–1 dummy variable measuring whether the individual is a national of a country where the main language has a weak future tense.[8] It is set to 0 if the respondent is not and 1 otherwise.

$BleakFut_{(i)}$ is a 0–1 dummy variable measuring whether the individual has reported having negative expectations regarding the future of her own country. It is set to 0 if the respondent has not and 1 otherwise.

Demographic controls

$Female_{(i)}$ is a 0–1 dummy variable capturing whether the individual is female. It is set to 0 if the respondent is not and 1 otherwise.

$Age_{(i)}$ is a continuous variable reporting the respondent's age at the time of the interview.

$Edu_{(i)}$ is a 1–10 index reporting the respondent's age when she left full-time education. 1 corresponds to "no full-time education" and 10 to "22 years or more" or "still studying."

$NetUse_{(i)}$ is a 1–7 index reporting how the respondent uses the Internet. 1 corresponds to "no internet access" and 7 to "every day/almost every day."

$LowClass_{(i)}$ and $HighClass_{(i)}$ are two 0–1, mutually exclusive dummy variables

[8] In only 8 of the 28 countries surveyed, a weak future tense language is spoken: Belgium (Dutch and German but not French), Denmark, Sweden, the Netherlands, Estonia (Estonian but not Russian), Finland (both Finnish and Swedish), Germany and Portugal. In the case of multilingual countries, the individual-level dummy reads 1 only if the interview was undertaken in a weak future tense language and 0 otherwise.

capturing whether the individual describes herself as part of the lower and higher class of society, respectively. It is set to 0 if the respondent does not and 1 otherwise. If statistically significant, these coefficients would imply that belonging to a lower or higher social status has an impact on the likelihood of behaving PE compared with being part of the middle class.

$Rural_{(i)}$ is a 0–1 dummy variable capturing whether the individual lives in a rural area or village (as opposed to a small–large town or city). It is set to 0 if the respondent does not and 1 otherwise.

b_p is the intercept.

ε represents the error term.

2.2 Econometric model B

This model represents a simplified version of the previous one. In this case the regression is run on groups clustered depending on their level of ascription to responsibility for caring for the environment. Three levels of responsibility are identified, $HighResp_{(i)}$ and $NoResp_{(i)}$ as above and $MediumResp_{(i)}$, which captures the values in between the two extremes. Given that the cluster group that rejects responsibility in full is rather small, the variables included in the model were reduced for the sake of parsimony.

(3)

$$PEB_{(i,b)} = b_b + \alpha Norm_{(i,b)} + \beta EnvWorry_{(i,b)} + \zeta EcoInfra_{(i)} + \eta BottleBill_{(c)} + \theta FinProb_{(i)} + \kappa Parent_{(i)} + \nu Female_{(i)} + \xi Age_{(i)} + oEdu_{(i)} + \pi NetUse_{(i)} + \varrho Rural_{(i)} + \varepsilon$$

for $HighResp_{(i)} = 1$
$MediumResp_{(i)} = 1$
$NoResp_{(i)} = 1$

where $MediumResp_{(i)}$ is a 0–1 dummy variable measuring whether the individual accepts a medium level of personal responsibility for caring about the environment. It is set to 0 if the respondent does not and 1 otherwise.

Comparing the results across the three equations for a given PEB should give an indication of the interaction and conditional effects that varying degrees of ascription of responsibility have on other indicators of intrinsic motivation and external factors. This analysis contributes to the understanding of whether intrinsic motivation is a precondition for PEB and whether its absence has an impact on the effectiveness of monetary incentives and green infrastructures.

3. Results and discussion

3.1 Model A

The tables below summarize the estimated results of model A for the eight PEBs considered in this analysis. Country dummies, representing the 28 nations in the sample, were added to account for country fixed effects. The results displayed in Table 1 show the estimated parameters when fixed effects are included in the model. However, since the country dummies naturally collided with the variables that are country dependent—such as the presence of green infrastructures in the territory, beliefs regarding the future of one's country and the grammatical features of the main languages spoken in the country (i.e., *EcoInfra*, *BottleBill*, *WeakFut* and *BleakFut*)—the results were also calculated without fixed effects; see Table 2.

The checks for collinearity did not reveal near dependencies among the regressors used. Pearson pairwise correlation showed low correlation in all cases with two exceptions, *BottleBill* and *WeakFut* correlated with 63% and *LowClass* and *FinProb* correlated with 31%. However, all the VIF and Condition Index values were well below the threshold values for multicollinearity of 10 and 30, respectively.[9]

The parameters in the model were successful in explaining 8–26% of the variation in the response variable, as shown by the pseudo-R^2 values in Table 1. In the absence of country fixed effects, the variance explained in the model lowers to 6.5–15%, a level that, given the complexity of human behavior, is considered significant for studies such as this, with individual persons as units of analysis and a heterogeneous sample (Langbein, 2015, p. 141).

The rationale for analyzing eight PEBs separately captures the intuition—supported by Oskamp et al. (1991)—that environmental efforts and attitudes are fractioned into specific components that are peculiar to each behavior; that is, the antecedents of a PEB and their relative importance vary with each behavior. Nevertheless, there may also be findings that are generalizable to most PEBs. The latter are captured in equation 0, in which the response variable represents the sum of the PEBs adopted by the individual (Tables 1 and 2).

[9] The results of the collinearity tests are available on request from the authors.

Table 1. Impact of internal motivation and external factors on 8 PEBs (with country fixed effects)

	OLS – sum of all PEBs 0–8	LOGIT – waste separation for recycling	LOGIT – waste separation for recycling	LOGIT – reduce waste	LOGIT – reduce water house consump.	LOGIT – reduce energy house consump.	LOGIT – buy green house prods	LOGIT – buy local prods	LOGIT – choose green traveling	LOGIT – use car less
	0	*1.a*	*1.b*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Constant	-0.956*** (0.180)	-0.993*** (0.185)	0.399*** (0.142)	-2.108*** (0.170)	-1.617*** (0.167)	-1.563*** (0.160)	-3.185*** (0.194)	-2.055*** (0.174)	-1.494*** (0.171)	-2.686*** (0.193)
Norm	1.383*** (0.141)	1.050*** (0.034)	1.040*** (0.034)	0.480*** (0.035)	0.864*** (0.041)	0.802*** (0.030)	0.859*** (0.037)	1.180*** (0.035)	1.029*** (0.031)	0.558*** (.035)
EnvWorry	0.277*** (0.009)	0.158*** (0.034)	0.157*** (0.034)	0.131*** (0.031)	0.194*** (0.033)	0.166*** (0.031)	0.253*** (0.035)	0.144*** (0.043)	0.096*** (0.032)	0.127*** (0.049)
HighResp	0.548*** (0.022)	0.389*** (0.036)	0.416*** (0.035)	0.399*** (0.032)	0.353*** (0.031)	0.327*** (0.030)	0.503*** (0.036)	0.309*** (0.031)	0.388*** (0.031)	0.329*** (0.036)
NoResp	-0.436*** (0.055)	-0.525*** (0.082)	-0.563*** (0.081)	-0.526*** (0.097)	-0.304*** (0.084)	-0.581*** (0.081)	-0.331*** (0.114)	-0.378*** (0.086)	-0.209*** (0.085)	-0.209** (0.107)
EcoInfra	-0.013 (0.021)	0.108*** (0.035)	0.087*** (0.034)	-0.051* (0.031)	0.024 (0.031)	-0.017 (0.030)	-0.152*** (0.036)	-0.024 (0.031)	-0.010 (0.031)	-0.101*** (0.036)
BottleBill	0.240** (0.112)	0.033 (0.184)	-0.034 (0.179)	0.509*** (0.160)	-0.332** (0.160)	-0.077 (0.155)	0.289[a] (0.184)	0.396** (0.163)	0.386** (0.163)	0.468*** (0.182)
FinProb	-0.046 (0.038)	-0.278*** (0.060)	-0.413*** (0.050)	-0.173*** (0.054)	0.187** (0.049)	0.109** (0.048)	-0.111* (0.063)	-0.030 (0.051)	0.103** (0.050)	0.025 (0.060)
BottleBill FinProb*	0.157** (0.078)	0.067 (0.118)								
Parent	0.099*** (0.022)	0.160*** (0.036)		0.065** (0.033)	0.049 (0.032)	0.122*** (0.031)	0.088** (0.037)	0.040 (0.032)	-0.005 (0.032)	0.088** (0.037)
WeakFut	-0.209** (0.086)	-0.561*** (0.147)		-0.340*** (0.118)	-0.271*** (0.120)	-0.342*** (0.119)	-0.186 (0.140)	-0.578*** (0.122)	0.719*** (0.127)	0.424*** (0.141)
BleakFut	-0.020 (0.022)	-0.110*** (0.036)		-0.045 (0.033)	0.025 (0.032)	0.003 (0.030)	0.003 (0.037)	-0.002 (0.032)	0.024 (0.032)	0.052 (0.037)
Female	0.258*** (0.021)	0.145*** (0.034)		0.218*** (0.031)	0.257*** (0.030)	0.204*** (0.029)	0.329*** (0.035)	0.225*** (0.030)	0.192*** (0.030)	-0.195*** (0.035)
Age	0.011*** (0.001)	0.015*** (0.001)		0.007*** (0.001)	0.010*** (0.001)	0.009*** (0.001)	0.005*** (0.001)	0.012*** (0.001)	-0.005*** (0.001)	0.003*** (0.001)
Edu	0.041*** (0.005)	0.045*** (0.007)		0.028*** (0.007)	-0.003 (0.006)	0.025*** (0.006)	0.064*** (0.008)	0.043*** (0.007)	0.034*** (0.007)	0.019*** (0.008)
NetUse	0.049*** (0.006)	0.058*** (0.010)		0.034*** (0.009)	0.017** (0.009)	0.044*** (0.008)	0.071*** (0.011)	0.060*** (0.009)	0.011 (0.009)	0.070*** (0.011)
HighClass	0.048* (0.025)	-0.057 (0.042)		0.061* (0.037)	-0.042 (0.037)	-0.022 (0.035)	0.185*** (0.040)	0.071** (0.037)	0.045 (0.037)	0.015 (0.041)
LowClass	-0.098*** (0.029)	-0.126*** (0.046)		-0.108*** (0.044)	-0.007 (0.041)	-0.099*** (0.040)	-0.174*** (0.053)	-0.083** (0.042)	0.006 (0.042)	-0.104** (0.051)
Rural	-0.027 (0.022)	-0.027 (0.036)		0.024 (0.033)	-0.046 (0.032)	0.021 (0.031)	0.012 (0.037)	0.102*** (0.032)	-0.220*** (0.032)	-0.080** (0.038)
Pseudo R^2	20.5%	26.3%	24.9%	10.8%	11.7%	11.6%	18.3%	17.5%	14.8%	8.1%
F-test/ -2 log likelihood	124.391	22039.391	22286.659	25780.214	27028.843	28423.623	21268.104	26344.485	26449.001	21264.655
No. of observations	21,953	21,954	21,954	21,954	21,954	21,954	21,954	21,954	21,954	21,954

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10, [a] p=0.12, coefficient had near-marginal significance. For equations 1.a–8, the Nagelkerke R^2 and McFadden -2 log likelihood are reported. Equation 0 shows an adjusted R^2 and F-test of overall significance.

Table 2. Impact of internal motivation and external factors on 8 PEBs (without country fixed effects)

	OLS – sum of all PEBs 0–8	LOGIT – waste separation for recycling	LOGIT – waste separation for recycling	LOGIT – reduce waste	LOGIT – reduce water house consump.	LOGIT – reduce energy house consump.	LOGIT – buy green house prods	LOGIT – buy local prods	LOGIT – choose green traveling	LOGIT – use car less
	0	*1.a*	*1.b*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Constant	-1.216*** (0.162)	-1.506*** (0.112)	0.087*** (0.035)	-1.919*** (0.108)	-1.336*** (0.103)	-1.380*** (0.100)	-3.700*** (0.125)	-2.187*** (0.104)	-1.623*** (0.105)	-2.742*** (0.123)
Norm	1.449*** (0.145)	1.022*** (0.032)	0.998*** (0.031)	0.549*** (0.034)	0.935*** (0.040)	0.824*** (0.029)	0.857*** (0.036)	1.231*** (0.034)	1.019*** (0.030)	0.587*** (.034)
EnvWorry	0.300*** (0.009)	0.130*** (0.032)	0.125*** (0.031)	0.120*** (0.030)	0.283*** (0.031)	0.212*** (0.030)	0.267*** (0.034)	0.151*** (0.041)	0.092*** (0.031)	0.169*** (0.048)
HighResp	0.573*** (0.022)	0.446*** (0.033)	0.493*** (0.032)	0.415*** (0.030)	0.350*** (0.030)	0.365*** (0.029)	0.505*** (0.034)	0.259*** (0.030)	0.355*** (0.030)	0.358*** (0.035)
NoResp	-0.460*** (0.057)	-0.558*** (0.077)	-0.631*** (0.076)	-0.558*** (0.096)	-0.315*** (0.082)	-0.575*** (0.080)	-0.362*** (0.113)	-0.341*** (0.084)	-0.184** (0.084)	-0.238** (0.106)
EcoInfra	0.049** (0.022)	0.222*** (0.032)	0.235*** (0.031)	-0.002 (0.030)	0.050* (0.029)	0.000 (0.028)	-0.103*** (0.034)	-0.007 (0.030)	0.036 (0.030)	-0.081** (0.035)
BottleBill	0.101*** (0.030)	-0.191*** (0.044)	0.102*** (0.033)	0.378*** (0.039)	-0.245*** (0.039)	-0.160*** (0.038)	0.291*** (0.046)	0.102*** (0.039)	0.371*** (0.039)	0.352*** (0.045)
FinProb	-0.157*** (0.038)	-0.443*** (0.053)	-0.657*** (0.044)	-0.272*** (0.051)	0.097** (0.046)	0.029 (0.045)	-0.200*** (0.061)	0.007 (0.048)	0.036 (0.048)	0.056 (0.058)
BottleBill FinProb*	0.167** (0.080)	0.174[a] (0.111)								
Parent	0.070*** (0.023)	0.102*** (0.034)		0.044 (0.032)	0.070** (0.031)	0.109*** (0.030)	0.065* (0.036)	0.003 (0.031)	-0.043 (0.032)	0.065* (0.037)
WeakFut	0.088*** (0.031)	0.275*** (0.046)		-0.228*** (0.043)	0.104*** (0.042)	0.328*** (0.040)	0.041 (0.049)	-0.214*** (0.042)	0.050 (0.042)	0.101** (0.048)
BleakFut	-0.038* (0.022)	-0.088*** (0.032)		-0.105*** (0.030)	0.046[a] (0.030)	-0.017 (0.029)	0.030 (0.034)	-0.090*** (0.030)	0.025 (0.030)	0.113*** (0.035)
Female	0.262*** (0.021)	0.149*** (0.032)		0.214*** (0.030)	0.236*** (0.029)	0.190*** (0.028)	0.321*** (0.034)	0.232*** (0.029)	0.202*** (0.030)	-0.201*** (0.034)
Age	0.013*** (0.001)	0.019*** (0.001)		0.007*** (0.001)	0.008*** (0.001)	0.009*** (0.001)	0.010*** (0.001)	0.012*** (0.001)	-0.003*** (0.001)	0.005*** (0.001)
Edu	0.016*** (0.005)	0.003 (0.007)		0.002 (0.006)	-0.032*** (0.006)	-0.005 (0.006)	0.067*** (0.007)	0.042*** (0.006)	0.040*** (0.006)	0.012* (0.007)
NetUse	0.081*** (0.006)	0.115*** (0.009)		0.053*** (0.009)	0.018** (0.008)	0.060*** (0.008)	0.113*** (0.010)	0.065*** (0.008)	0.025*** (0.009)	0.092*** (0.010)
HighClass	0.036 (0.026)	-0.012 (0.039)		0.014 (0.035)	-0.078** (0.035)	-0.041 (0.034)	0.227*** (0.038)	-0.016 (0.035)	0.103*** (0.035)	0.061 (0.040)
LowClass	-0.164*** (0.029)	-0.257*** (0.042)		-0.186*** (0.043)	0.002 (0.040)	-0.132*** (0.039)	-0.232*** (0.052)	-0.098** (0.041)	0.022 (0.041)	-0.144*** (0.050)
Rural	-0.003 (0.022)	0.015 (0.033)		0.037 (0.031)	0.003 (0.030)	0.012 (0.029)	-0.014 (0.035)	0.065** (0.030)	-0.175*** (0.031)	-0.045 (0.036)
Pseudo R^2	14.9%	13.9%	11.2%	6.1%	7.0%	8.4%	13.9%	11.3%	11.8%	6.5%
F-test/ -2 log likelihood	214.758	24246.753	24714.226	26573.580	27853.713	29000.935	21985.003	27465.216	26973.119	21492.483
No. of observations	21,953	21,954	21,954	21,954	21,954	21,954	21,954	21,954	21,954	21,954

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10, [a] p=0.12, coefficient had near-marginal significance. For equations 1.a–8, the Nagelkerke R^2 and McFadden -2 log likelihood are reported. Equation 0 shows an adjusted R^2 and F-test of overall significance.

3.1.1 Internal motivation and green infrastructures

The most notable finding is that, across all the PEBs observed, the estimated parameters for intrinsic motivation—that is, *Norm*, *HighResp* and *NoResp*—dominate the external factors (they have the highest absolute value among the estimated regressors).[10] All the intrinsic motivation indicators are statistically significant and have the expected sign: recognition of the norm (*Norm*), environmental worry (*EnvWorry*) and personal responsibility (*HighResp*) correlate positively with the dependent variable, whereas the *NoResp* coefficient has a negative sign. The biggest impact is represented by the recognition of the norm, followed by the two personal responsibility coefficients.

The availability of green infrastructures, as represented by the *EcoInfra* and *BottleBill* coefficients, is relevant to seven out of the eight PEBs observed, that is one or both coefficients are statistically significant in each equation. The sign of the two coefficients combined is positive in all cases with the exception of "reduce water consumption" (eq. 4), which is unexpectedly negative. Potentially, the presence of a Bottle Bill—and of a deposit charge on bottled liquids—may have induced individuals to consume more tap water at home rather than buying bottled water. The availability of external green infrastructures appears to be irrelevant to household energy-saving behavior. While this is in part obvious, it also shows that the presence of an external apparatus, which facilitates certain PEBs, does not necessarily induce the adoption of other unrelated PEBs. In Table 2 the *BottleBill* coefficient is also negative for "recycling" (eq. 3.a), although this is due to collinearity between the variable and its interaction term. Dropping the interaction term in equation 3.b returns a statistically significant positive coefficient for *BottleBill*.

3.1.2 Financial constraints

Financial constraints affect the purchase of green products, recycling and waste reduction negatively—the coefficient of *FinProb* is statistically significant and negative in these equations. While it is unsurprising that financially distressed individuals are less likely to purchase green products or energy-saving appliances, which are often more expensive, the negative correlation with income-neutral behaviors, such as recycling, was unexpected. However, it is consistent with the hypothesis that, if an individual is distracted by more pressing personal circumstances, she is less likely to act in a norm-consistent way (Cialdini et al., 1990, p. 204). The coefficient is statistically significant and positive for "reduce water consumption," "reduce electricity consumption" and "choose greener ways of traveling," which is also expected considering that these behaviors reflect positively in savings.

[10] Since all the variables are dummies, except the demographic controls for age, education and internet use, the analysis concerning the magnitude of the estimated coefficients is straightforward.

Surprisingly, when country fixed effects are excluded, the *FinProb* coefficient is not statistically significant in the "reduce energy consumption" and "choose greener ways of traveling" equations (Table 2). This indicates the presence of national-level differences: some countries may be better than others at redistributing the economic savings of these behaviors to the end-user, for example by adopting pricing schemes that reward lower energy consumption, and making driving a car more costly than the public transport options available or at least making public transport an option.

Several European countries have adopted pricing schemes whereby energy tariffs are determined by market prices, which vary depending on the time of the day and the source used, and they generally have an important fixed component that leads to decreasing average prices for the consumer. The user has less control over the final bill and is more likely to control it by changing the usage times rather than by reducing the consumption per se. For example, Filippini (2011) found that households are highly responsive to the changes in off-peak and high-peak energy prices and adapt their energy use accordingly. On the other hand, water tariffs in OECD countries tend to follow constant volumetric pricing, with a growing trend to apply increasing block tariff systems, while the relevance of fixed charges has declined significantly (OECD, 2009). Volumetric pricing schemes, and particularly increasing block tariffs, encourage a reduction in water consumption.

In the recycling equations, the *FinProb* coefficient is bigger than the sum of the two coefficients for green infrastructures, thus suggesting that an individual's ability to focus on PEB may be more important than the PEB's enabling conditions. If economic problems distract individuals from acting consistently with environmental norms, the question arises of whether explicitly linking a PEB to an economic incentive can effectively restore the attention to such behavior. The intuition is that the attention of an economically distressed individual may be attracted more easily if a behavior is framed in economic rather than in normative terms and that she will be relatively more sensitive to an economic contribution, however small. The interaction term in eqs 0 and 1.a between *BottleBill* and *FinProb* tests this hypothesis (Table 2). The coefficient is statistically significant with a positive sign. It suggests that economic incentives are effective in limiting the negative impact of economic difficulties on PEB[11] This last point is corroborated by the descriptive statistics from the database (European Commission, 2015) showing that:

i) Overall, individuals with economic problems are much less likely to recycle per se: only 59% of them recycle compared with 73% in the rest of the sample.

[11] The interaction term is included only in eqs 0 and 1.a, as it is not relevant to other behaviors. *BottleBill* works well as a proxy for other green infrastructures across all PEBs; however, when used to represent specifically an economic incentive for a PEB in the interaction term, it obviously refers to recyling only.

ii) However, if an individual with economic problems resides in a Bottle Bill country, she is 2 percentage points more likely to recycle her trash (60%) than if she resides elsewhere (58%).
iii) The effect of residing in a Bottle Bill country is positive but weaker among individuals who do not report economic problems (only a 1 percentage point increase).

3.1.3 Attitudes towards the future

The coefficient for *Parent* is statistically significant and positive for five of the PEBs considered. In general, being a parent is associated with a 0.1 unit increase in the number of PEBs adopted (eq. 0, Table 1). This confirms the hypothesis that individuals who can identify with the generation next to theirs through an emphatic relationship are more likely to consider future outcomes and thus behave PE.

The coefficient for *WeakFut* (Table 2) is statistically significant for seven equations out of nine: speakers of a weak future tense language 27% more likely to recycle; 33% more likely to reduce energy use in the house; 10% more likely to reduce water consumption; and 10% more likely to reduce car use. They are, however, less likely to purchase local products (-21%) and to reduce household waste (-23%). Overall, speaking a weak future tense language is associated with a 0.09 unit increase in the number of PEBs adopted. As Chen (2013) suggested, individuals who are required by their native language to equate present and future events grammatically when they speak are more prone to engage in future-oriented behavior. Our results suggest that this also holds for PEB, possibly because a language's grammatical features reflect the cultural mindset of its speakers and their future orientedness.

Finally, *BleakFut* (Table 2) is statistically significant for five of the PEBs considered. Future pessimists are less likely to reduce their household waste, recycle and buy local products, whereas they are more likely to reduce their car use and water consumption.[12] Overall, being pessimist about the future of one's own country is associated with a 0.04 unit decrease in the number of PEBs adopted.

Thus, overall the three indicators for future orientedness support the hypothesis that individuals who have a stake in the future, that have a more positive attitude towards it and those who have a more future-oriented mindset are more likely to behave PE. However, there are differences depending on the behavior observed.

[12] The variable measures general beliefs about the future of one's country. The survey question may have been interpreted in economic terms by the respondents. This could explain why future pessimists are more likely to decrease the use of their car or their water use, if they expect the economic outlook to worsen, they may consider at least engaging in PEBs that entail cost savings. A more precise question regarding beliefs about the future of the environment may lead to more accurate estimations.

3.1.4 Other socio-demographic factors

Additionally, the series of socio-demographic controls shows the following:

Being a female correlates positively with all the PEBs with the exception of "use car less," suggesting that women are more likely to adopt any PEBs but not to renounce driving their car. This finding is supported in the literature on altruistic behavior, such as PEBs, which finds that women are more likely to engage in other-regarding behavior (Hunter, Hatch, & Johnson, 2004; Kollmuss & Agyeman, 2002) and hold more PE attitudes (Dietz, Stern, & Guagnano, 1998; Vaske, Donnelly, Williams, & Jonker, 2001).

Age correlates positively with all the PEBs observed except for "choose green traveling," suggesting that older people are in general more observant of environmental norms, except when it comes to considering alternatives to their own car.

Predictably, the level of education also increases engagement in nearly all the PEBs, except water saving. However, there appear to be national-level differences in the efficacy of education on PEB; that is, the effect is weaker when country fixed effects are excluded (Table 2). Cost-saving behaviors, such as water and energy saving, are either affected negatively or not influenced at all by education, a finding that is consistent with Chankrajang and Muttarak (2017).

All the PEBs—except green traveling—increase with the frequency of internet use, suggesting that easy and quick access to a large amount of information benefits environmental engagement.

One's self-assessed position in society correlates positively with nearly all the PEBs. Individuals who identify with the lower classes of society are 10–26% less likely to behave PE than the middle class, depending on the specific behavior considered (with the exception of water saving and the use of green transport). However, a higher social status does not necessarily translate into higher PEB compared with the middle class: a higher social status is only connected to a higher probability of reducing waste and purchasing green and local. Further, the results obtained without country fixed effects show that higher classes are 8% less likely to reduce their water use. As social status is usually a proxy for income, one might expect price, even in a volumetric tariff scheme, to be an ineffective means to induce water-saving behavior among richer individuals.

The likelihood of behaving PE is also influenced by urban settings. People living in rural areas are less likely to reduce their car use or use alternative ways of traveling (eqs 7 and 8), possibly because of the lack of alternatives, but they are more likely to buy local products, perhaps due to easier access to local agricultural produce (eq. 6).

3.2 Model B

Table 3 summarizes the estimated results for model B. Logit split regressions are performed on three groups (a, b, c) clustered by their level of personal ascription to responsibility for preserving the environment. The three regressions are performed on three PEBs that differ in the way in which they affect income: 1) recycling (income neutral); 2) water saving (income positive); and 3) purchase of green-label products (income negative).

Table 3. Impact of external conditions on three PEBs conditional on the degree of internal motivation

	Income-neutral PEB Waste separation for recycling (LOGIT)			**Income-positive PEB** Reduce water consumption (LOGIT)			**Income-negative PEB** Buy green-label products (LOGIT)		
	HighResp	***MedResp***	***NoResp***	***HighResp***	***MedResp***	***NoResp***	***HighResp***	***MedResp***	***NoResp***
	1.a	***1.b***	***1.c***	***2.a***	***2.b***	***2.c***	***3.a***	***3.b***	***3.c***
Constant	-1.191*** (0.171)	-1.856*** (0.141)	-2.103**** (0.482)	-0.974*** (0.146)	-1.305*** (0.135)	-1.285*** (0.503)	-3.433*** (0.167)	-3.714*** (0.172)	-4.292*** (0.764)
Norm	0.891*** (.051)	1.084*** (0.042)	1.315*** (0.155)	0.864*** (0.062)	0.974*** (0.055)	1.162*** (0.202)	0.721*** (0.049)	0.996*** (0.052)	1.365*** (0.232)
EnvWorry	0.097** (0.050)	0.145*** (0.042)	0.008 (0.156)	0.222*** (0.045)	0.354*** (0.044)	0.224 (0.176)	0.294*** (0.046)	0.233*** (0.049)	0.260 (0.227)
EcoInfra	0.312*** (0.051)	0.205*** (0.042)	0.237 (0.155)	0.087** (0.043)	0.011 (0.041)	-0.005 (0.164)	-0.134*** (0.047)	-0.049 (0.050)	-0.288 (0.232)
BottleBill	-0.027 (0.054)	-0.010 (0.045)	-0.038 (0.161)	-0.220*** (0.045)	-0.200*** (0.044)	0.089 (0.169)	0.354*** (0.048)	0.350*** (0.052)	-0.137 (0.235)
FinProb	-0.518*** (0.072)	-0.479*** (.063)	-0.646*** (0.207)	0.104[a] (0.066)	0.123** (.062)	-0.017 (0.212)	-0.262*** (0.079)	-0.324*** (0.091)	-0.533 (.348)
Parent	0.080 (0.053)	0.113*** (0.045)	0.149 (0.167)	0.048 (0.046)	0.088** (0.044)	0.030 (0.178)	0.075 (0.050)	0.052 (0.053)	0.367 (0.241)
Female	0.215*** (0.051)	0.127*** (0.042)	-0.062 (0.157)	0.268*** (0.043)	0.215*** (0.041)	0.247 (0.165)	0.366*** (0.048)	0.248*** (0.050)	0.384* (0.229)
Age	0.020*** (0.002)	0.021*** (0.002)	0.014*** (0.005)	0.009*** (0.002)	0.008*** (0.002)	0.002 (0.006)	0.013*** (0.002)	0.009*** (0.002)	0.012 (0.008)
Edu	0.005 (0.010)	0.009 (0.009)	0.004 (0.031)	-0.038*** (0.009)	-0.032*** (0.008)	-0.044 (0.033)	0.078*** (0.010)	0.080*** (0.011)	0.044 (0.046)
NetUse	0.117*** (0.014)	-0.135*** (0.012)	0.128*** (0.041)	0.022* (0.012)	0.014 (0.011)	-0.007 (0.042)	0.128*** (0.014)	0.120*** (0.015)	0.169*** (0.062)
Rural	0.016 (0.052)	-0.020 (0.044)	0.209 (0.158)	-0.037 (0.044)	0.029 (0.042)	0.088 (0.165)	-0.008 (0.049)	-0.017 (0.052)	-0.065 (0.236)
Pseudo R^2	9.1%	12.7%	18.8%	5.2%	6.7%	7.8%	11.0%	10.8%	13.9%
-2 log likelihood	9826.220	13467.594	1011.184	12625.523	14293.057	930.315	10013.917	10462.214	545.701
No. of observations	9,567	11,568	819	9,567	11,568	819	9,567	11,568	819

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10, [a] p=0.11, coefficient had near-marginal significance. The Nagelkerke R^2 and McFadden -2 log likelihood are reported at the end of the table.

The rationale is to assess whether people with differing levels of ascription to responsibility react differently to external conditions and whether changes apply to different kinds of PEB, as defined by their effect on income.

Recognition of the norm (*Norm*) is the most important factor across groups and behaviors (statistically significant coefficient and greatest in magnitude). In all three behaviors, the coefficient for *EnvWorry* is not statistically significant for the *NoResp* group. This would suggest that, without a minimum level of ascription to responsibility, environmental concern alone is not conducive to adopting PEB.

The availability of "green infrastructures" (captured by *EcoInfra* and *BottleBill*) is relevant only to medium/high levels of ascription of responsibility (the two coefficients are not statistically significant in the three regressions for the *NoResp* group). This implies that, without a minimum level of motivation, green infrastructures and external incentives alone are not effective. The effect of green infrastructures is positive for medium/high levels of ascription of responsibility in the case of income-negative and income-neutral behaviors. Green infrastructures, however, affect income-saving behaviors negatively for medium/high levels of responsibility.

As noted in model A, financial difficulties exert a negative impact on income-neutral and income-negative behaviors and a positive impact on income-positive behaviors. However, the impact of financial difficulties differs among groups. Financially distressed individuals are:

- 65% less likely to recycle if they do not ascribe to any responsibility for the environment than if they claim high responsibility (-52%);
- 10% more likely to reduce water consumption if they claim high responsibility for the environment than if they do not—the coefficient is not statistically significant;
- 32% less likely to buy green-label products if they ascribe to a medium level of responsibility for the environment than if they claim a high level of responsibility (-26%).

Thus, financial problems influence more heavily the behavior of individuals who do not ascribe to any environmental responsibility: not only are they less likely to adopt income-neutral or income-negative behaviors but they will also be less likely to consider PEB even if they imply economic savings/gains.

4. Conclusions

This paper supports an integrated framework of intrinsic and extrinsic motivation for PEB. Our empirical model, based on survey data of 28,000 individuals across the European Union's 28 current member states, assessed the relative strength of intrinsic motivation and green infrastructures and the effect of their interaction on eight self-reported PEBs. It further took a holistic approach by extending the

analysis to non-strictly-related factors, such as an individual's economic condition and attitudes towards the future.

Both intrinsic motivation and external conditions contribute positively to the likelihood that an individual will behave PE. However, between the two, intrinsic motivation—as measured by an individual's norm recognition, ascription of responsibility and awareness of consequences proxies—dominates external conditions. This finding was consistent across the eight PEBs examined.

In particular, ascription of responsibility appears to be an essential precondition for an individual to respond positively to external incentives, for example being less prone to negative influences (such as economic constraints) and more receptive to enabling conditions (such as the availability of economic rewards). Guagnano et al. (1995) proposed that intrinsic motivation can predict behavior outside of extreme external conditions (positive or negative); symmetrically, this paper analyzed the limits of external incentives and suggested that they can only be effective in promoting PEB among individuals who have a minimum level of intrinsic motivation.

This identifies a problematic case of "Catch22": just as someone cannot search for her lost glasses since she would need her glasses to find them, non-intrinsically motivated individuals should be dragged towards PEB by external incentives. However, such external incentives will be effective only for individuals who are already intrinsically motivated.

The considerations above led us to conclude that a policy mix combining both intrinsic and extrinsic incentives is needed to secure a high observance rate of PEBs in the population. Raising intrinsic motivation through education and the perception that observance of the norm is dominant should in the long term decrease the number of non-intrinsically motivated individuals (i.e. defectors). Meanwhile, in the short term, improving the external conditions is likely to facilitate norm observance among those who are already motivated above a minimum threshold. This is consistent with Thøgersen and Ölander (2002), who suggested that intrinsic values (and the associated behaviors) can only change in the long term; consequently, the ideal short- and medium-term approach should combine educational efforts with policies aimed at facilitating PEBmaterially.

In addition to these general findings, there are differences in the external factors that are relevant to each behavior. For example, there are behaviors that are more influenced by status (people identifying themselves with a higher social status are less likely to reduce their water consumption) and others that are more dependent on the availability of infrastructures and built-in habits (older people or people who live in rural areas are for instance less likely to renounce the comfort of their cars). In general, the drivers of each PEB will vary depending on the perceived cost—that is, whether it is an income-neutral behavior or whether compliance implies economic rewards or losses. The table below summarizes additional policy

messages specific to each behavior.

Table 4. Additional policy recommendations specific to each PEB

Behavior Type	*PEB*	*Policy Recommendations*
Recycling	**Waste separation for recycling**	Attaching economic remuneration to the act of recycling (e.g. through Bottle Bill legislation) is an effective way of increasing adoption rates (+2%). The evidence collected in this paper does not support the possibility that attaching an economic payoff to PEBs crowds out moral motivation. On the contrary, responses are positive even though the monetary contribution is minimal. Financial problems affect recycling rates negatively even though recycling is a cost-neutral behavior (and potentially a cost-saving behavior where pay-as-you-throw systems with free recycling and composting collection are in place). Presumably this happens because having economically pressing preoccupations can divert people's attention from environmental concern and norms. The presence of a Bottle Bill helps in counteracting this effect. The extension of a deposit container law system to other materials or packaging types and the expansion of Bottle Bill legislation to more countries would benefit recycling rates.
Household waste and resource use reduction	**Reduction of household waste**	The adoption of this behavior increases linearly with status level, possibly through income. Lower-status and financially distressed individuals are less likely to choose less-packaged products or products with a longer life. Presumably this is connected to the lower price of products that are not made to last and to the lower price of often over-packaged bulk purchases. This is consistent with Hausman (1979), according to whom lower-income groups discount more highly the potential future gains from buying more energy-efficient appliances. The provision of bonuses for lower-income groups for the purchase of products with a longer life (such as rechargeable batteries versus standard batteries) and the provision of economic incentives to firms and supermarket chains to limit the packaging of their products may provide effective solutions. The introduction of an environmental fee, which reflects the waste of resources in packaging and non-durable items, could also be effective in discouraging these kinds of purchases. However, the regressive impact of these measures on lower-income groups should be analyzed.
	Reduction of domestic water consumption	The use of volumetric pricing schemes, and in some cases increasing block tariffs, appears to be conducive to water-saving behavior. However, price alone is not an effective way of reducing household water consumption for two reasons. Firstly, the relevance of the utility bill is relative to a person's income level. For higher incomes even a volumetric pricing scheme may not be an effective deterrent from wasting water. Secondly, even a financially distressed individual is unlikely to cut down her water consumption as a way to ease her financial situation, unless she feels at least minimally responsible for the environment. Raising awareness about the consequences of water waste remains an essential precondition for the adoption of water-saving behavior. While price plays an important role in controlling water use, it may be ineffective if not linked to a user's income. A progressive pricing scheme that increases with income could be one of the available options to influence

		behavior on all income levels and take social equity into account.
	Reduction of domestic energy consumption	The most commonly adopted energy-pricing schemes in Europe may have a regressive effect on the amounts consumed: the presence of an important fixed component means decreasing marginal prices for the consumer, which encourage use rather than deterring it. Further, the use of market prices for the marginal component implies that the user is more likely to try to reduce the final bill by using electricity at off-peak times rather than by diminishing its use. The use of a volumetric pricing scheme (and eventually increasing block tariffs) would instead promote price as a mechanism to induce energy-saving behavior. The effect and effectiveness on different income levels should, however, be taken into account.
Purchasing behaviors	**Purchase of green-label products**	The common perception, and often the reality, that green-label products are more expensive dominates the adoption of this behavior. Green purchases increase with social status and are lower among people with financial difficulties. Efforts to expand the offer of green products that are equally priced or cheaper than standard products could increase the adoption of this behavior, as a consumer survey revealed (RetailMeNot Inc, 2015). Additionally, providing lower-income groups with bonuses to purchase green-label products would be effective. Frequent internet users are also more likely to purchase green products. The diffusion of information on the differential environmental impact of green versus standard products in traditional communication channels (radio, television, paper press) could increase the adoption rate by reaching out to a different audience.
	Purchase of local products	Individuals living in rural areas are more likely to purchase local products (+10% ceteris paribus). This might be connected to the proximity of rural areas to the agricultural produce. Increasing the connection between cities and the surrounding countryside's produce may also encourage non-rural residents to purchase locally sourced products.
Travel choices	**Choice of a greener way to travel**	Individuals who live in rural areas are considerably less likely to shift to green means of transport, such as bicycles, walking and public transport. This could be connected to the unavailability of alternatives and to the large distances in rural areas. Age is also negatively associated with choosing greener ways of traveling; this might be due to path-dependent behavior. While parents are more likely to adopt most PEBs, this does not hold for greener traveling, which may be due to the sometimes-intricate logistic necessities of families. The above would suggest offering public transport services tailored to families; actively promoting and organizing car-pooling systems in rural areas; and offering incentives for greener work commutes to help contain private traffic pollution. In general, individuals with economic difficulties are more likely to consider greener means of transport. However, this does not hold for all countries. In certain countries greener means of transport may not be viable or economically more convenient. In such cases ways to redistribute the economic gains from taking public transport to the end-user should be investigated.
	Diminished	Similar to the above, individuals who live in rural areas are less likely to

	car use	diminish their car use. While women are more likely to adopt the other seven PEBs observed (up to 32% more, ceteris paribus), they are less likely to diminish their car use. The reasons should be investigated further, as they might be tied to child-rearing needs or even to gender-based safety concerns.

Whether an environmental norm will activate into behavior or not depends not just on individual motivation or enabling external conditions but also on the salience that the norm has for the individual in the choice context. The empirical evidence gathered in this paper suggests that financial problems can distract the individual from acting PE, even when compliance with the norm is free of costs. In this case reframing the choice context into economic terms—by attaching an economic value to the behavior—can be successful in repairing this "loss of focus."

A distinction should be made between external conditions that are purely aimed at facilitating a behavior (such as conveniently located recycling bins) and others that instead more actively incentivize it through rewards or avoided fees (such as BottleBill legislation or pay-per-bag schemes). While it is uncontroversial that green infrastructures aimed at facilitating behavior positively affect PEB, the role of incentives is highly debated in the literature.

Although a thorough test of the often-cited motivation crowding-out effect[13] is beyond the scope of this paper, it can be noted that providing an economic incentive to recycle (e.g. as implied by a Bottle Bill legislation) does not decrease recycling rates but rather increases them. Additionally, the economic incentive is effective only in individuals with a medium to high level of personal commitment (e.g. ascription to responsibility) to act PE, supposedly because the economic payoff is generally too small even to be noticed by people who do not minimally commit to the environment. Thus, the evidence collected in this paper suggests that monetary incentives do not crowd out moral motivation but interact positively with it. This is in line with Ferrara and Missios (2012), who found that unit pricing of waste does not crowd out the moral motivation to recycle but it rather reinforces it.[14]

[13] The motivation crowding-out theory proposes that the provision of external incentives, such as a monetary payoff, can undermine intrinsic motivation. See Frey (2012, 2008) and Frey and Jergen (2001) for an introduction to the concept.

[14] The crowding-out literature suggests that external incentives deliver information to the individual concerning the attractiveness of the task rewarded and the value of the action incentivized (Bénabou & Tirole, 2003). It also proposes that monetarily rewarding a task may change the narrative of the action, distracting the individual from the moral dimension of the action and gearing it towards an evaluation of whether the economic payoff is worth the effort (Cecere et al., 2014). In the case of the Bottle Bill, the monetary compensation received may not be perceived as a reward but rather as a refund on the additional value of the bottle paid; therefore, the symbolic price associated with each returned vessel may not necessarily be perceived as depreciating the effort involved. Further, under Bottle Bill schemes the user is often given the choice either to keep the credit for herself or to donate its value to a charitable organization, thereby reinforcing the moral dimension associated with the behavior. This choice structure cleverly attracts both types of individuals: it appeals to those who would not otherwise recycle but are economically sensitive to the small sums involved, but it also preserves the moral narrative for those who recycle as a pro-social act.

Since the benefits of PEB mostly materialize in the future, it was expected that individuals would be more likely to behave PE if they had an interest in the future—such as the well-being of their offspring—if they were optimistic about it and if they had a future-oriented mindset—as proxied by their native language's grammatical structure. All three indicators were relevant in explaining PEBand supported the hypothesis above, with the partial exception of pessimism for the future, which had a positive or negative impact depending on the behavior considered. These results suggest that individuals who act PE understand the intertemporal dimension of PEB, meaning that they can frame it correctly as future-oriented behavior, and that they will engage more in it the more valuable future outcomes are to them. Meanwhile, individuals who do not act PE may either place a lower value on the future or be less conscious of the impact that their behavior has on future environmental quality. The latter case would support the use of framing techniques to make the environmental consequences of day-to-day acts more obvious.

The limitations in this study were linked to data availability. The main difficulty was represented by the unavailability of individual-level data in the same survey database on reported PEB, environmental attitudes and intertemporal preferences, which ultimately led to the selection of three relatively unusual indicators of attitudes towards the future. In addition, data regarding the availability of green infrastructures in the respondent's area were not included in the Eurobarometer database, and, given that there is often high variance within locations in the same country, we had to rely on proxies. Data collected through an ad hoc survey would offer a chance to corroborate the findings presented in this paper regarding the relevance of external factors and the impact of future orientedness on PEB.

The findings in this paper validate the importance of an integrated research and policy approach to PEB, which includes both external incentives and intrinsic motivation, not as competing paradigms but as interrelated factors.

PEBs include a wide array of actions with different cost, lifestyle and status implications. While a few findings could be generalized across behaviors, clear differences also emerged. This suggests that policies should also approach each PEB individually in consideration of its specific features and the way in which it affects individuals' perceptions and lives.

This paper supports the idea that the impact of economic difficulties extends beyond affecting the economic ability or relative convenience of behaving PE. It also determines a shift of focus from the environmental norm towards more urgent short-term matters, to the point at which even cost-neutral PEBs are negatively affected. To date, no comprehensive research has been undertaken on the impact of economic problems on PEB. Especially in the context of the recent economic crisis, an overview of how PEBs' observance rates have evolved since the beginning of the last economic crisis and a study on the conditions and extent to which individuals

trade environmental and economic priorities would give a more holistic understanding of the determinants of PEB.

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Annex 1 – List of Eurobarometer's attitudinal survey questions included

Survey question: ***QA2. From the following list, please pick the five main environmental issues that you are worried about.***

Answer options (max. 5 answers, 16 and 17 are exclusive):

1. The depletion of natural resources
2. Our consumption habits
3. The growing amount of waste
4. Loss or extinction of species and their habitats and of natural ecosystems (forests, fertile soils)
5. Shortage of drinking water
6. Water pollution (seas, rivers, lakes and underground sources)
7. Agricultural pollution (use of pesticides, fertilizers, etc.)
8. Soil degradation
9. Land take (i.e. that more land is used to build roads or cities and that cities expand into the surrounding countryside)
10. The impact on our health of chemicals used in everyday products
11. Air pollution
12. Noise pollution
13. Urban problems (traffic jams, pollution, lack of green spaces, etc.)
14. The spread of harmful non-native plants and animals (invasive species)
15. Other
16. None
17. Don't know

Use in the analysis: used to create explanatory variable *EnvWorry*.

Survey question: ***QA11. Have you done any of the following for environmental reasons in the past month?***

Answer options (multiple answers possible, 10 and 11 are exclusive):

1. Chosen a more environmentally friendly way of traveling (by foot, bicycle, public transport)
2. Reduced waste, for example by avoiding over-packaged products and buying products with a longer life
3. Separated most of your waste for recycling
4. Cut down your water consumption
5. Cut down your energy consumption, for example by turning down air conditioning or heating, not leaving appliances on stand-by, buying energy efficient appliances
6. Bought environmentally friendly products marked with an environmental label
7. Chosen local products
8. Used your car less
9. Other
10. None
11. Don't know

Use in the analysis: used to create response variable *PEB*.

Survey question: ***QA12. In your opinion, which of these should be the top-three priorities for people in (OUR COUNTRY) in their daily life to protect the environment?***

Answer options (max. 3 answers, 12 and 13 are exclusive):

1. Use public transport as much as possible instead of using your own car
2. Replace your car with a more energy-efficient one, even if it is smaller or more expensive
3. Purchase environmentally friendly products for your daily needs
4. Reduce food waste through smarter purchasing, storage, preparation and use of leftovers
5. Sort waste so that it can be recycled
6. Reduce waste, for example by avoiding over-packaged products and buying products with a longer life
7. Reduce your home energy consumption (lighting, heating, household appliances)
8. Consider environmental aspects when you make large purchases (e.g. travelling, heating systems, build a house, etc.)
9. Buy more local products and avoid products that come from far away
10. Reduce water consumption at home
11. Other
12. None
13. Don't know

Use in the analysis: used to create explanatory variable *Norm*.

Survey question: ***QA13.1 Please tell me to what extent you agree or disagree with each of the following statements: as an individual, you can play a role in protecting the environment in (OUR COUNTRY)***

Answer options (one answer):

1. Totally agree
2. Tend to agree
3. Tend to disagree
4. Totally disagree
5. Don't know

Use in the analysis: used to create explanatory variable *HighResp (=1), MedResp(=2,3), NoResp (=4)*.

Survey question: ***QA16.3 In your opinion, is each of the following currently doing***

too much, doing about the right amount or not doing enough to protect the environment? Your city, town or village
Answer options (one answer): 1. Doing too much 2. Doing about the right amount 3. Not doing enough 4. Don't know
Use in the analysis: used to create explanatory variable *EcoInfra*.

Annex 2 – Matrix of environmental norms and worries linked to each PEB

The table below summarizes the environmental norms and worries that we considered for each PEB in the econometric analysis. Individual values were obtained from the answers to survey questions QA11, QA12 and QA2.

Table 5. Matrix of environmental norms and worries linked to each PEB

Equation no. in Tables 1 and 2	PEB (question QA11)	Norm (question QA12)	EnvWorry (question QA2)
1	Sum of the 8 PEBs	At least one of the norms listed below.	Sum of all worries, scale 0–5.
2	Waste separation for recycling	Sort waste so that it can be recycled	The growing amount of waste
3	Reduce household waste	Reduce waste, for example by avoiding over-packaged products and buying products with a longer life	The growing amount of waste
4	Reduce water consumption (domestic)	Reduce water consumption at home	Shortage of drinking water
5	Reduce energy consumption (domestic)	Depletion of natural resources	Reduce your home energy consumption (lighting, heating, household appliances)
6	Buy green-label products	Purchase environmentally friendly products for your daily needs	The impact on our health of chemicals used in everyday products
7	Buy local products	Buy more local products and avoid products that come from far away	Land take (i.e. more land is used to build roads or cities and cities expand into the surrounding countryside)
8	Choose green traveling	Use public transport as much as possible instead of using your own car	Depletion of natural resources
9	Use car less	Use public transport as much as possible instead of using your own car	Land take (i.e. more land is used to build roads or cities and cities expand into the surrounding countryside)

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NUM	TÍTOL	AUTOR	DATA
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