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Pro-environmental behavior: Social norms, intrinsic motivation and external conditions

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Abstract

Pro-environmental behaviors (PEBs) have been linked in the literature to social norms, intrinsic motivation and external conditions. However, no study has jointly analyzed these factors on a cross-country dataset and given a holistic explanation of the variance observed in the adoption rates of PEBs across countries. Using a dataset measuring individual adoption of eight PEBs in the European Union's 28 member states (in 2018), we econometrically test these three groups of factors on a wider scale. We assess the importance of intrinsic motivation as a dominant factor and show how differing levels of intrinsic motivation influence the effectiveness of external conditions, such as monetary incentives and green infrastructures. 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 policy is discussed.

KEYWORDS

economic incentives, environmental attitudes, green infrastructure, intrinsic motivation, pro-environmental behavior

1 | INTRODUCTION

Understanding the determinants of pro-environmental behavior (PEB) in different contexts is important to designing policies that can promote more sustainable lifestyles across the European Union's (EU) socio-economic and culturally varied nations. Data show that environmentally friendly behaviors differ widely among the population of the EU member states. As an example, in 2014 the actual rate of municipal recycled and composted waste ranged between Germany's 64% and Slovakia's 10% (European Environment Agency, 2017); while 60% of Swedes reported buying green label products as opposed to 9% of Portuguese citizens (European Commission, 2015). This article explores such heterogeneity by empirically investigating the contribution of different determinants of PEB in the EU. To this purpose we

run a microeconomic analysis using a database counting 28,000 individual observations evenly distributed across EU's 28 members,¹ and covering 8 PEBs.

The literature on the determinants of PEBs is vast, yet the near entirety of contributions focuses on local contexts, which limits the potential applicability of findings to other areas. Additionally, while the literature has already reached robust conclusions regarding the contribution of either intrinsic motivation or external conditions taken singularly, studies which account for both are rare. They reached contrasting findings and mostly focused on interaction effects—that is, whether providing extrinsic incentives can crowd out intrinsic motivation to act pro-environmentally—, while disregarding that heterogeneity across individuals can lead them to react differently to the same policy. Consequently, the existing literature cannot entirely explain

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the variety of results in the EU, as socio-cultural differences, intrinsic motivation and external conditions—such as the green infrastructures available—have a role in jointly determining different outcomes in the EU.

This article addresses this gap in the literature by:

1. Using a cross-country dataset to offer generalizable conclusions applicable to different European geographical areas.
2. Simultaneously including multiple factors affecting PEB—such as social and individual values, and the green infrastructures locally available—to identify the most impactful ones.
3. Defining whether the effectiveness of external conditions and green infrastructures are subject to individual heterogeneity—assessing whether individuals with differing intrinsic motivation respond differently to the same green infrastructure.

The remainder of this article is organized as follows: Section 2 synthesizes the most relevant existing empirical studies; Section 3 introduces our analytical outline; Section 4 describes our data sources and includes a qualitative data analysis. Section 5 reports and discusses results and Section 6 concludes with key messages and policy implications.

2 | LITERATURE REVIEW

Like most human behaviors, PEB is jointly determined by cognitive processes that are internal to the individual and by the external context that surrounds her/him. However, PEB has traditionally 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/his external context (Bamberg & Möser, 2007; Black et al., 1985; Grodzińska-Jurczak, 2003; Heberlein, 1981; Hopper & Nielsen, 1991; Liobikienė et al., 2016; Sidique et al., 2010); or (ii) the consequence of an external stimulus to which the individual responds as an automaton regardless of her/his own convictions (Ferrara & Missios, 2005; Jacobs & Bailey, 1983; Linderhof et al., 2001; Palmer & Walls, 1997).² 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 et al., 1995; Turaga et al., 2010). 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).

Previous research accounting for both intrinsic motivation and the external context have focused on case studies and field experiments (De Young, 1985; Derksen & Gartrell, 1993; Guagnano et al., 1995; Heller & Vatn, 2017; Humphrey et al., 1977; Katzev & Pardini, 1987)—restricting the potential applicability of the findings to the particular socio-cultural context involved. Extending the analysis to several countries offers two advantages: it highlights national

differences, and the reasons behind them. To the best of our knowledge there are only two cross-cultural studies in the literature that have included both sets of variables. Cecere et al. (2014) concluded that waste reduction behavior is more strongly driven by intrinsic motives as opposed to extrinsic incentives across the EU-27. However, their paper identified external incentives with the social visibility and desirability of a given behavior, a narrow definition that excludes the material factors that facilitate or hinder a behavior. We instead consider external conditions as the availability of green infrastructures or monetary incentives to facilitate PEB. Ferrara and Missios (2012) assess the relevance of intrinsic motivation and different waste collection policies for ten countries located across the five continents. They find that intrinsic motivation and the availability of recycling facilities are highly relevant in determining behavior, while the presence of monetary incentives to recycle—such as weight and volume based pricing schemes—are not very effective. The authors acknowledge that the validity of the latter result may however be undermined by the scarcity of data available for each pricing scheme. Furthermore, while recognizing differences among countries, the study cannot identify whether such differences are due to divergent socio-cultural values or institutional differences (i.e., regulations and policies). By including indexes of predominant socio-cultural values in our econometric model we can capture whether national differences are due to cultural factors. Following Liobikienė et al. (2016), who proved the relevance of social values in explaining green purchases in different countries, we use five of the six socio-cultural dimensions identified by socio-psychologist Geert Hofstede (Hofstede & Minkov, 2010).

Some of the studies accounting for both intrinsic motivation and external conditions focused on a particular aspect of the relationship between these two groups of variables—analyzing whether providing external incentives crowd out the moral motivation to sort waste (Ferrara & Missios, 2012; Heller & Vatn, 2017; Thøgersen, 1994; Thøgersen, 1996; Thøgersen, 2003). While they analyze an important aspect, the relationship between intrinsic and external conditions extends to other related and unexplored research questions, such as whether the two groups of variables are effective conditionally to each other (Guagnano et al., 1995). 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.

This article contributes to the understanding of the conditions under which internal motivation is conducive of PEB and when providing external incentives—such as the provision of monetary incentives and green infrastructures—can be effective. The literature has observed that individual heterogeneity can result in different responses to external conditions (Beretti et al., 2019; Gneezy et al., 2011). By clustering individual responses based on their level of intrinsic motivation we can record whether the effectiveness of green infrastructures and economic incentives to recycle vary across groups. This approach has the advantage of enriching the debate by highlighting why individuals respond differently to the same external conditions.

3 | THEORETICAL FRAMEWORK

The Norm Activation Model (NAM) is a theory designed to understand how pro-social behavior is affected by internalized norms (Schwartz, 1977). It is one of the most prominent social psychology theories that have been applied to the understanding of PEB (Onwezen et al., 2013). It models altruistic behavior as the result of a cognitive process within the individual. Developed by socio-psychologist Shalom H. Schwartz between 1968 and 1977, the theory analyzes the gap between an intention to act and actual behavior. It identifies those key emotions that, if anticipated, help an intention to translate into actual behavior. While this approach helps explaining individual heterogeneity in altruistic behavior, it cannot account for the effect of external conditions; nor for their interaction with intrinsic motivation. The Attitude–Behavior Context (ABC) model completes the NAM, by incorporating it into a broader framework that also includes external conditions such as physical structures, social institutions and economic incentives (Guagnano et al., 1995). Our theoretical framework applies the ABC model, by maintaining the intrinsic factors specified in the NAM. In the next paragraphs we summarize the two theories and describe how they complement each other.

3.1 | The norm activation model

The NAM aims to explain the cognitive process and the circumstances under which a personal moral norm is activated into behavior. The NAM has proven more fit to explaining PEBs compared to alternative socio-psychological theories of behavior, both conceptually (Thøgersen, 1996) and empirically (Cordano et al., 2011). Numerous papers have corroborated NAM's main hypothesis in its application to PEB (Black, 1978; Cordano et al., 2011; Stern et al., 1985). The PEBs studied in the context of NAM include: recycling, energy conservation, automobile use or travel-mode choice, support for environmental laws and regulations, and willingness to pay for environmental protection or for greener products (see Guagnano et al., 1995, for a review of the literature).

The theory posits that an individual will behave in accordance with a norm if she/he acknowledges the norm (i.e., she/he has internalized a social norm) and if the following two conditions apply simultaneously: (1) the person must have some awareness that her/his potential acts may have consequences for the welfare of others—awareness of consequences; (2) the person must ascribe some responsibility for these acts and their consequences to herself/himself—ascription of responsibility (Schwartz, 1968). We capture these three indicators within our econometric model. The NAM mentions that the external context may have a role in materially facilitating certain behaviors but it does not specify the conditions under which it happens nor the existing relationships between them. The ABC theory was developed 15 years later to enhance the NAM theory by addressing these points.

3.2 | The Attitude–Behavior–Context model

The ABC model postulates that the prevalence of a certain behavior in a given population will depend from both their attitudes towards that behavior (internal factors) and external conditions, intended as “any external source of support or contrast to behavior, whether physical, financial, legal or social” (Guagnano et al., 1995, p. 702). Intrinsic motivation (referred to by the authors as attitudes) can vary on a scale from extremely negative—the person would perform the behavior only if forced to—, or very positive—the person would autonomously apply the behavior. Likewise, external conditions can be very negative—making it difficult to perform the behavior—, or they can facilitate the behavior—making it easy or pleasant. In our article, we define external conditions as the combination of the physical facilities available to facilitate PEB (e.g., biking lanes; recycling bins; public transport lines; etc.), and the economic incentives put in place to promote PEB.

According to this theory, the effectiveness of a policy aimed to either influence attitudes or external conditions will depend on both intrinsic motivation and external conditions, rather than on the magnitude of a single policy intervention. According to these authors, if the external conditions are extremely unfavorable or favorable to PEB, intrinsic motivation will not affect behavior, since regardless of how intrinsically motivated they are; people would be unable to follow the behavior in the first case or would do it anyway in the latter. 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.

In this model, the opposite also applies: a policy focused on changing the external conditions of a behavior will not be particularly effective on individuals that have a very negative attitude towards the behavior, nor it will affect individuals that were already very motivated and would have applied the behavior nonetheless. Empirical studies have supported the idea that the response to policy interventions differs based on user motivation (Abrahamse et al., 2005) and that communication campaigns can be ineffective if targeting those who are already intrinsically motivated (Arkesteijn & Oerlemans, 2005). Previous studies have highlighted that easier, less costly behaviors are more likely to be adopted (Attari et al., 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).

Thus, the ABC model enables to identify boundary conditions that must be met, for a policy to be effective on behavior. It guides the policy maker to adopt a more holistic approach, by helping her/him to anticipate the potential limitations of a single policy intervention. Are citizens of a country, sufficiently motivated to recycle, such that they would respond to a small monetary incentive to do it? Is the public transport network sufficiently developed such that an

educational campaign on its environmental benefits could be enough to shift behavior?

3.3 | Causal model of relationships

Both models refer to social norms as forces that influence behavior. The NAM proposes that internalized norms are derived by the social norms predominant in the society the individual lives in. The ABC model instead, considers social norms as a source of external influence, affecting behavior directly. To account for this component, in our model we include country level social norms, taken from Geert Hofstede's six cultural dimensions theory indicators. The six dimensions were identified between 1963 and 2010 and they register the main socio-cultural differences among countries (Hofstede & Minkov, 2010). Figure 1 summarizes our theoretical framework. We propose that PEB is determined by three classes of factors: (i) social norms, (ii) internalized individual norms and internal factors leading to their activation (awareness of consequences

and ascription of responsibility); and (iii) external conditions facilitating the behavior. The three factors are interrelated among each other. Social norms affect behavior in two ways: indirectly, through internalized norms that are socially derived, but also directly, through peer-pressure to comply with observable social norms. Finally, the level of intrinsic motivation affects the effectiveness of external conditions. The figure reflects the focus of our article although it is clearly not exhaustive, as other factors or relations may also influence PEB.

4 | MATERIALS AND METHODS

4.1 | Data sources

We access data from the Eurobarometer's 2014 survey on "attitudes of Europeans towards environment" (European Commission, 2015), which surveyed 28,000 respondents in the EU'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

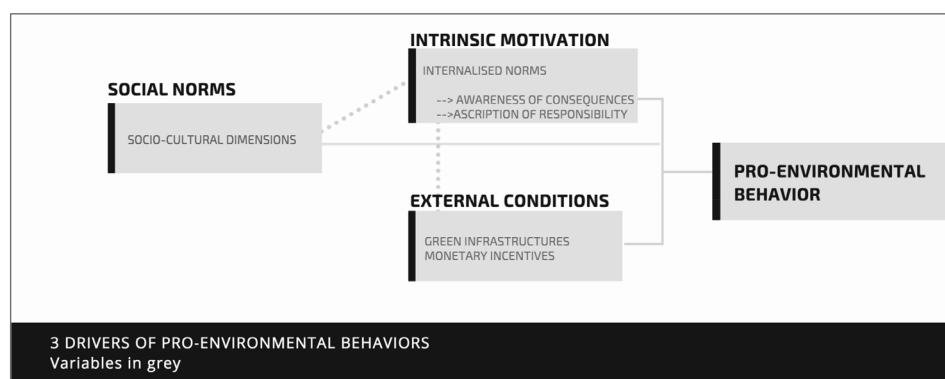


FIGURE 1 Causal model of relationships
Source: Own figure partly based on Schwartz (1968), Hopper and Nielsen (1991), and Guagnano et al. (1995)

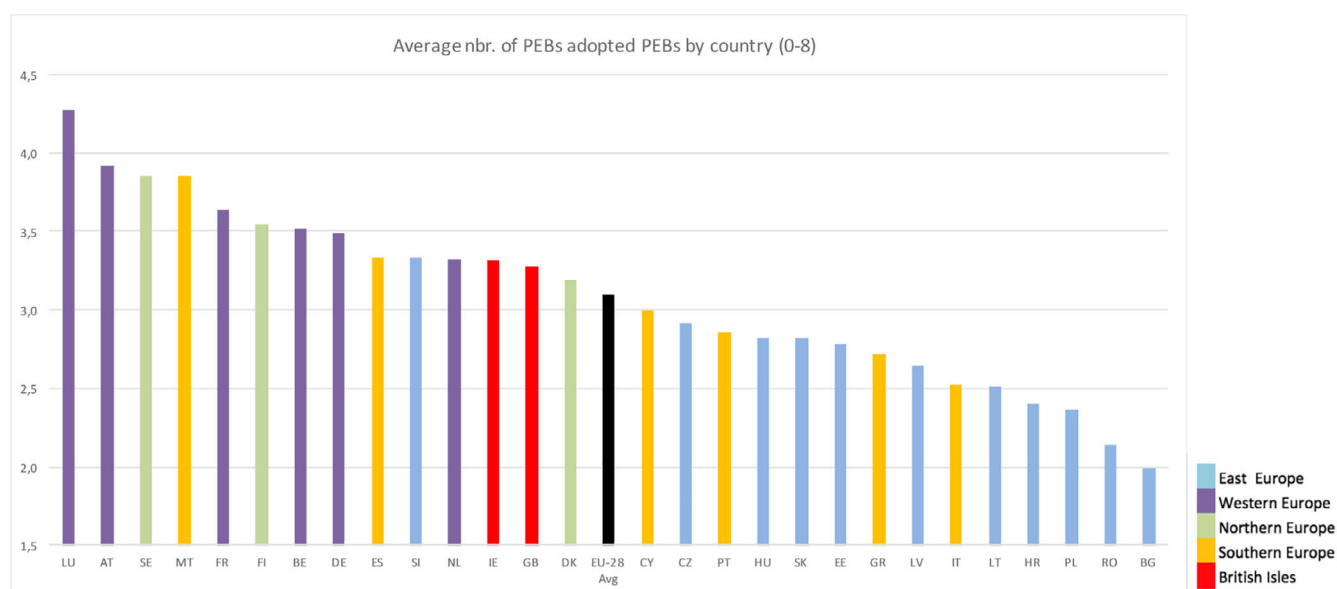


FIGURE 2 Self-reported average number of PEBs in EU-28 by country (2014)

Source: Own computations based on data from the European Commission (2015) [Color figure can be viewed at wileyonlinelibrary.com]

As an individual, you can play a role in protecting the environment

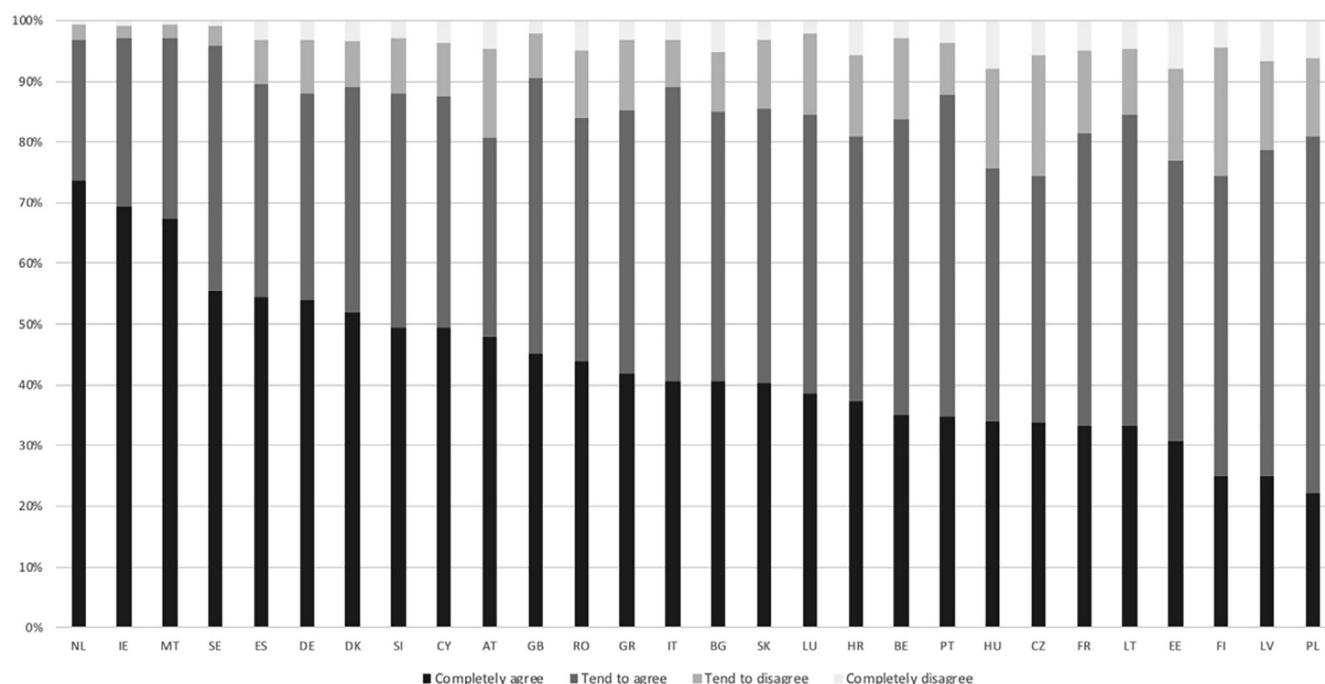


FIGURE 3 Ascription to personal individual responsibility for the environment in the EU-28 by country (2014)

Source: Own computations based on data from the European Commission (2015)

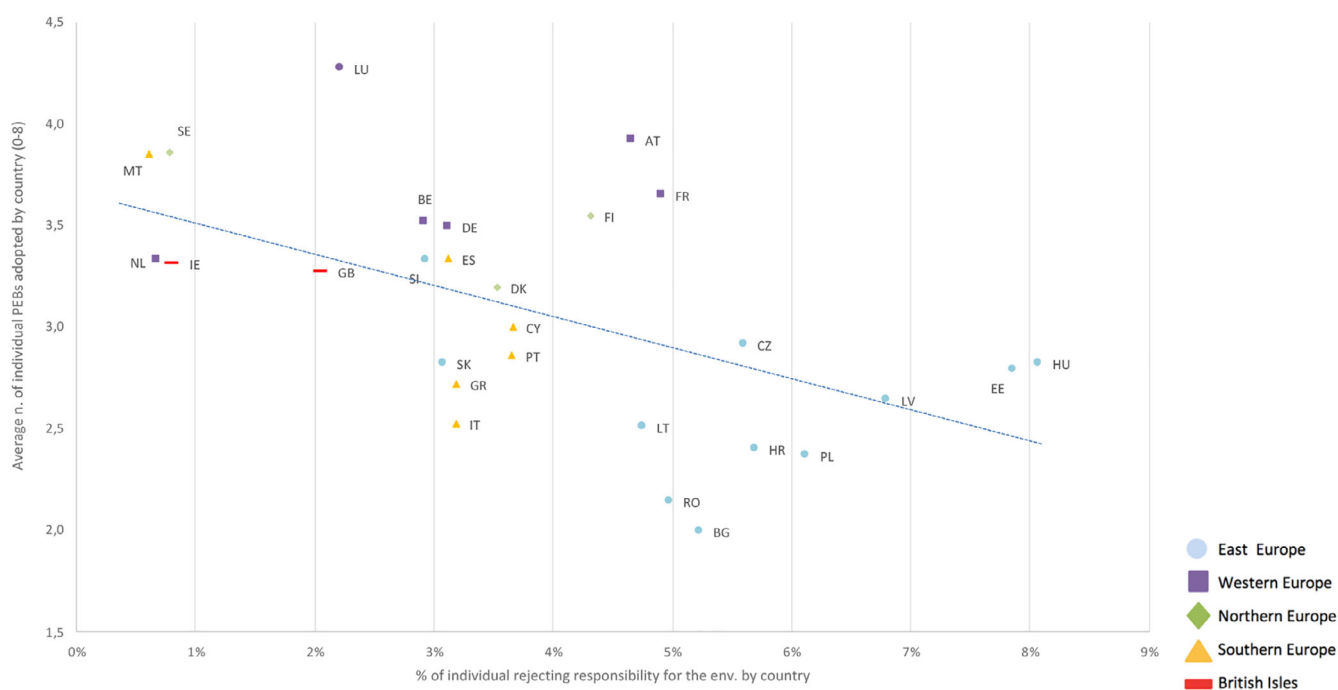


FIGURE 4 Self-reported average number of PEBs in EU-28 by country (2014)

Source: Own computations based on data from the European Commission (2015) [Color figure can be viewed at wileyonlinelibrary.com]

from the data set; this reduced the sample size to nearly 23,000–25,000 observations, depending on the analysis carried out.

The Eurobarometer data set provided our response variables. It registers whether respondents reported having performed eight PEBs

in the previous month: 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;

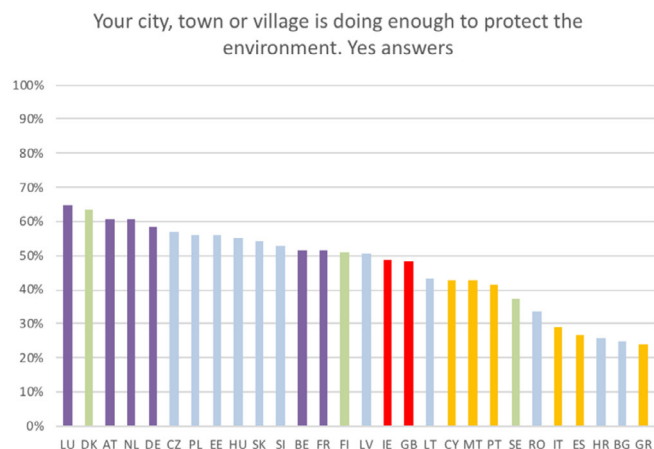


FIGURE 5 Individual assessment of local green infrastructures in EU-28 by country (2014)

Source: Own computations based on data from the European Commission (2015) [Color figure can be viewed at wileyonlinelibrary.com]

purchase of local products; choice of a greener way to travel; and diminished car use. The same dataset also provided the following types of causal variables: indicators of intrinsic motivation; proxies measuring the availability of green infrastructures; self-reported economic problems; demographic controls—age, gender, and years of education.

We integrated the database with two additional sources. First, a variable measuring the availability of green infrastructures that considers whether a country has adopted a container deposit collection system, that is, *BottleBill*, which rewards individuals economically for returning used bottles and vessels. The list of countries that had adopted this legislation by 2014, 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). It represents in our model a monetary incentive to recycle at the national level. Second, the Hofstede cultural dimension country level indicators were taken from Geert Hofstede own website GeertHofstede.com (Hofstede, 2015).

4.2 | Qualitative analysis

In this subsection we first qualitatively analyze the variance of PEBs within EU countries. We then observe the distribution across countries of two classes of determinants, intrinsic motivation and external conditions, with the aim of identifying regional patterns that may explain such variation. We classified and color-coded countries based on their geographical area to highlight possible similarities between countries that share similar geographic and cultural features: Eastern, Western, Northern, Southern Europe and the British Islands.

The average number of PEBs adopted by individuals (on a 0–8 scale) per country varies between 2 in Bulgaria and 4.3 in Luxembourg (Figure 2). With a few exceptions, we identify patterns, with same color countries being close to each other in the figure. On average, Western and Northern Europe countries tend to have a higher number of PEBs adopted compared to Southern and Eastern Europe countries which are concentrated towards the right hand side of the figure.

However, the ranking of countries changes depending on the behavior observed; for example, Southern Europe countries are the most dedicated to saving water whereas Northern Europeans are more likely to shop green label products. These differences could be due to diverging national priorities and environmental worries (i.e., water scarcity is more likely to plague Southern Europe); but also different economic possibilities (green label products are usually pricier and may be more accessible to on average wealthier Northern European nationals).

The level of ascription to personal individual responsibility for the environment also varies widely among countries (Figure 3). The percentage of individuals ascribing to the highest level of personal responsibility to preserve the environment on a 0–4 scale varied between 74% in the Netherlands and 22% in Poland. While the proportion of individuals who reject any responsibility ranged between 1% in Sweden and 8% in Hungary.

By plotting these last percentages against the average number of PEBs adopted by the population we find a negative relationship between these two (Figure 4). This negative correlation may be a sign that national level differences in the adoption rates of PEBs is channeled by differing level of individual responsibility. This negative correlation could signify that countries with lower adoption rates of PEBs may fail to instill a high sense of individual responsibility for caring about the environment. We further notice regional patterns with Eastern Europe countries clearly gathered in the bottom right of the figure; Southern countries mainly clustered in the middle; while Western and Northern Europe countries are distributed within the upper left corner. Regional proximity likely reflects socio-cultural proximity, in the next section we use indexes of predominant socio-cultural values to test whether they influence PEB adoption rates.

With regard to external conditions variables, individual assessments regarding the availability of green infrastructures vary with only 24% of Greek respondents considering that their local government is doing enough for the environment as opposed to 65% of Luxembourgers (Figure 5). Also in this figure, a clear regional pattern emerges with Western Europeans showing more satisfaction with the green infrastructures available to them and Southern Europeans showing a higher discontent.

Moreover, at the time of the Eurobarometer survey (2014), only 11 of the then 28 EU's countries had adopted a Container Deposit system that rewards economically individuals who returned used vessels for reuse or recycling, they are nearly evenly distributed across regions.

4.3 | Econometric approach

In this section we run separate regressions using a logit regression for each of the eight PEBs, to assess how the odds that an individual (*i*) will adopt a certain PEB (*b*) are affected by the joint influence of predominant

TABLE 1 Explanatory variables definition and description

Variable	Description
<i>Intrinsic motivation variables</i>	
$NORM_{(ib)}$	0–1 dummy variable measuring 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. ^a For $b = 2-9$ it is set to 0 if the respondent did not recognize the behavior specific norm and 1 otherwise. For $b = 1$ it is set to 0 if the respondent did not recognize any environmental norm and 1 otherwise. ^b
$ENVWORRY_{(ib)}$	0–1 dummy variable measuring individual concern 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. ^c 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).
$HIGHRESP_{(i)}$	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.
$MEDIUMRESP_{(i)}$	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.
$NORESP_{(i)}$	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.
<i>External conditions variables</i>	
$ECOINFRA_{(i)}$	0–1 dummy variable measuring whether the individual believes that her 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 pro-environmentally (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.
$BOTTLEBILL_{(c)}$	0–1 dummy variable measuring whether the country ^d 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.
<i>Hofstede socio-cultural values variables^e</i>	
$POWERDIST_{(c)}$	0–100 index measuring the extent to which the less powerful members in country c accept an unequal distribution of power. The higher it is, the more important are dependence and subordination.
$INDIVID_{(c)}$	0–100 index measuring how loose ties are among individuals in country c . The higher it is, the most important are independence, competition, personal achievement and self-reliance.
$MASCUL_{(c)}$	0–100 index measuring how strongly emotional gender roles are set in country c . The higher it is, the most important are assertiveness, success and achievement.
$LONGTERM_{(c)}$	0–100 index measuring the extent to which members in country c are oriented towards future rewards as opposite to immediate gains, prioritizing saving, persistence and adaptation to changing circumstances.
$INDULG_{(c)}$	0–100 index measuring the extent to which members in country c feel free to pursue subjective happiness and have a sense of control over their own life.
<i>Socio-demographic controls</i>	
$FEMALE_{(i)}$	0–1 dummy variable capturing whether the individual is female. Set to 0 if the respondent is a male and 1 otherwise.
$AGE_{(i)}$	Continuous variable reporting the respondent's age at the time of the interview.
$EDU_{(i)}$	1–10 index reporting the respondent's age when she/he left full-time education. 1 corresponds to “no full-time education” and 10 to “22 years or more” or “still studying.”
$FINPROB_{(i)}$	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.
$BOTTLEBILL_{(c)} * FINPROB_{(i)}$	Interaction term between the two dummy variables <i>BottleBill</i> and <i>FinProb</i> . It measures whether the fact of having economic problems and living in a <i>BottleBill</i> 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.

Note: A full list of survey questions extracted from the Eurobarometer database and utilized for this model is available in Annex 1.

^aA list of the environmental norms corresponding to each behavior is available in Annex 2.

^bThe ideal question to measure recognition of a norm would have been “Do you think people should separate waste for recycling?” The question contained in the survey instead, measures whether the individual considers a given behavior a priority. If the individual responds affirmatively, we consider that she/he implicitly acknowledges the behavior as a norm, as something that ought to be done. If the individual responds negatively, it may be that she/he acknowledges the behavior as a norm but does not identify it as ‘urgent’ or that she does not identify the behavior as something that ought to be done at all. Therefore, there is a possibility, depending on how the respondent interpreted the survey question, that our indicator may underestimate the number of individuals that recognize the norm. On the other hand, the opposite error (inclusion error) would have been worse. We are confident that the individuals who responded affirmatively, are individuals who recognized the norm. At best, the risk is that our estimated parameters for this indicator, that are in all cases, statistically significant, may be slightly underestimated.

^cA list of the environmental concerns corresponding to each behavior is available in Annex 2.

^dAs of 2014, the year of the Eurobarometer survey, only 11 of the 28 surveyed countries had implemented 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, 2016), we decided to include Hungary and Cyprus in the list following evidence reported by (European Parliament, 2011) and (BiPRO/CRI, 2015).

^eThe socio-cultural dimensions identified by Hofstede are six, however, for the sake of this analysis we dropped one, namely “uncertainty avoidance,” because of multicollinearity with other variables.

TABLE 2 Impact of internal motivation, external factors and socio-cultural values on eight PEBs

	OLS		LOGIT									
	Sum of all PEBS 0–8 0.a	Sum of all PEBS 0–8 0.b	Sum of all PEBS 0–8 0.c	Recycling 1	Recycling 2	Waste reduction 3	Reduce water use 4	Reduce energy use 5	Buy green products 6	Buy local products 7	Greener way of traveling 8	Use car less 9
Norm	1.442*** (0.133)	1.442*** (0.133)	1.392*** (0.131)	1.007*** (0.031)	1.076*** (0.032)	0.476*** (0.032)	0.879*** (0.040)	0.811*** (0.029)	0.884*** (0.036)	1.177*** (0.034)	1.033*** (0.030)	0.543*** (0.034)
EnvWorry	0.324*** (0.009)	0.320*** (0.009)	0.291*** (0.009)	0.120*** (0.031)	0.198*** (0.032)	0.141*** (0.032)	0.186*** (0.032)	0.157*** (0.030)	0.253*** (0.034)	0.145*** (0.042)	0.091*** (0.031)	0.150*** (0.047)
HIGHRESP	0.602*** (0.021)	0.601*** (0.021)	0.518*** (0.021)	0.391*** (0.019)	0.299*** (0.020)	0.320*** (0.020)	0.264*** (0.019)	0.287*** (0.018)	0.369*** (0.024)	0.251*** (0.020)	0.245*** (0.019)	0.211*** (0.023)
Ecolnfra		0.049** (0.021)	0.012 (0.021)	0.228*** (0.065)	0.182*** (0.032)	−0.070** (0.030)	−0.004 (0.030)	−0.042 (0.029)	−0.183*** (0.034)	−0.046 (0.030)	−0.034 (0.030)	−0.123*** (0.035)
BOTTLEBILL		0.212*** (0.023)	−0.074*** (0.026)	0.065*** (0.032)	−0.353*** (0.041)							
FinProb		−0.288*** (0.036)	−0.283*** (0.036)	−0.608*** (0.044)	−0.566*** (0.052)	−0.209*** (0.051)	0.165*** (0.046)	0.034 (0.045)	−0.188*** (0.060)	−0.104** (0.048)	0.110*** (0.047)	−0.073 (0.057)
FinProb * BOTTLEBILL		0.133* (0.077)	0.281*** (0.077)		0.257** (0.110)							
POWERDIST			−0.005*** (0.001)		0.002** (0.001)	−0.006 (0.004)	0.006 (0.004)	0.000 (0.004)	−0.006 (0.004)	−0.007* (0.004)	0.005 (0.004)	0.001 (0.004)
indivd			0.003* (0.001)		0.005*** (0.001)	−0.020*** (0.005)	−0.003 (0.005)	−0.001 (0.005)	−0.011* (0.006)	−0.007 (0.005)	−0.001 (0.005)	−0.012** (0.006)
MASCUL			0.002** (0.000)		0.004*** (0.001)	0.008*** (0.003)	0.000 (0.003)	−0.006** (0.003)	−0.001 (0.003)	−0.007** (0.003)	−0.012*** (0.003)	−0.004 (0.003)
LONGTERM			0.005*** (0.001)		0.005*** (0.001)	0.010*** (0.003)	0.001 (0.003)	0.003 (0.003)	0.012*** (0.004)	0.007** (0.004)	0.006* (0.004)	0.011*** (0.004)
INDULG			0.017*** (0.001)		0.034*** (0.001)	0.018*** (0.005)	0.018*** (0.005)	0.018*** (0.004)	0.025*** (0.005)	−0.002 (0.005)	0.015*** (0.005)	0.030*** (0.005)
FEMALE	0.242*** (0.021)	0.255*** (0.021)	0.277*** (0.021)	0.128*** (0.031)	0.175*** (0.032)	0.208*** (0.030)	0.267*** (0.029)	0.204*** (0.028)	0.314*** (0.034)	0.234*** (0.029)	0.197*** (0.029)	0.188*** (0.034)
AGE	0.009*** (0.001)	0.007*** (0.001)	0.006*** (0.001)	0.011*** (0.001)	0.010*** (0.001)	0.005*** (0.001)	0.009*** (0.001)	0.005*** (0.001)	0.000 (0.001)	0.008*** (0.001)	−0.005*** (0.001)	−0.002*** (0.001)
EDU	0.058*** (0.004)	0.046*** (0.004)	0.047*** (0.004)	0.041*** (0.006)	0.045*** (0.006)	0.044*** (0.006)	0.004 (0.006)	0.040*** (0.006)	0.089*** (0.007)	0.063*** (0.006)	0.042*** (0.006)	0.040*** (0.007)
RURAL											−0.133*** (0.037)	−0.148*** (0.045)
Country fixed effects	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y
Pseudo R ²	0.136	0.143	0.175	0.127	0.206	0.109	0.119	0.115	0.183	0.173	0.143	0.079
F-test/−2 log likelihood	529.176	358.273	306.231	25709.949	24231.579	27130.916	28319.956	29929.788	22353.527	27725.687	27950.623	22373.026
No. of obs.	23.516	23.516	23.087	23.107	23.107	23.088	23.088	23.088	23.088	23.088	23.088	23.088

Notes: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. For regressions (1)–(10), 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 3 Impact of external conditions on three PEBs conditional on the degree of internal motivation

	Recycling 1				Reduce water use 2				Buy green products 3			
	High Resp (a)	Mid Resp (b)	No Resp (c)	No Resp (c.2)	High Resp (a)	Mid Resp (b)	No Resp (c)	No Resp (c.2)	High Resp (a)	Mid Resp (b)	No Resp (c)	No Resp (c)
Norm	0.946*** (0.054)	1.113*** (0.044)	1.379*** (0.164)	1.423*** (0.038)	0.860*** (0.047)	1.033*** (0.038)	1.423*** (0.139)	1.243*** (0.055)	0.736*** (0.050)	1.034*** (0.050)	1.243*** (0.055)	1.486*** (0.245)
EnvWorry	0.137*** (0.054)	0.181*** (0.044)	0.027 (0.162)	0.090** (0.047)	0.090** (0.047)	0.153*** (0.038)	0.069 (0.139)	0.204 (0.187)	0.270*** (0.047)	0.231*** (0.050)	0.333 (0.232)	
BOTTLEBILL												
EcolInfra	0.121** (0.055)	0.045 (0.045)	0.171 (0.166)	0.188*** (0.038)	0.280*** (0.048)	0.024 (0.049)	0.304** (0.139)	−0.014 (0.141)	−0.253*** (0.049)	−0.117** (0.050)	−0.224 (0.242)	
FinProb	−0.377*** (0.080)	−0.334*** (0.068)	−0.253 (0.223)	−0.592*** (0.068)	−0.592*** (0.068)	−0.611*** (0.058)	−0.574*** (0.184)	0.134 (0.236)	−0.164** (0.082)	−0.245*** (0.092)	−0.271 (0.346)	
Female	0.196*** (0.053)	0.196*** (0.053)	−0.067 (0.164)	0.244*** (0.047)	0.244*** (0.047)	0.086** (0.038)	0.139 (0.139)	0.461*** (0.041)	0.373*** (0.048)	0.258*** (0.050)	0.463* (0.237)	
Age	0.011*** (0.002)	0.011*** (0.002)	0.000 (0.005)	0.013*** (0.001)	0.013*** (0.001)	0.013*** (0.001)	0.003 (0.003)	0.001 (0.005)	0.002 (0.002)	−0.003** (0.002)	−0.002 (0.007)	
Edu	0.055*** (0.011)	0.055*** (0.011)	0.023 (0.032)	0.029*** (0.008)	0.029*** (0.008)	0.042*** (0.097)	0.023 (0.024)	−0.013 (0.034)	0.087*** (0.010)	0.093*** (0.010)	0.088*** (0.046)	
SOCIAL VALUES	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	Y
CONTROLS	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	Y
Country Fixed Eff.	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	Y
Obs	10,816	12,192	881	10,816	10,816	13,400	1008	881	10,027	12,192	881	881
R-squared	0.245	0.255	0.313	0.050	0.050	0.064	0.103	0.194	0.175	0.153	0.187	0.187
p > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Log-likelihood	9092.293	12884.654	985.472	−5603.9995	−7962.3422	−626.099	12828.016	14507.877	11033.685	10661.343	557.204	

Notes: Standard errors in parentheses. ***, $p < 0.01$, **, $p < 0.05$, * $p < 0.10$. The Nagelkerke R^2 and McFadden -2 log likelihood are reported at the end of the table. Equation (1.a2)–(1.c2) excludes social values indicators and country fixed effects due to collinearity with BottleBill.

socio-cultural values in her/his country (c), by her/his personal level of intrinsic motivation to undertake that specific behavior, by her/his own assessment of the green infrastructures locally available and by the presence of a container deposit scheme in her/his country. We also run an OLS regression to assess how the total number of PEBs adopted by each individual is affected by the same set of variables.

$$PEB_{(i,b)} = F(\text{socio-cultural values}_{(c)}, \text{intrinsic motivation}_{(i,b)}, \text{external conditions}_{(i,c)}) \quad (1)$$

The response variables $PEB_{(i,b)}$ capture whether an individual (i) reported having engaged in one of the eight behaviors (b) in the previous month.

- 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.

The full list of explanatory variables and their description is included in Table 1.

We first run the model against the entire dataset, with the sole exclusion of Cyprus, for which we lacked data on socio-cultural values. We then re-run the model using logit regression after clustering groups depending on their level of ascription of responsibility for caring for the environment. Three levels of responsibility are identified, $HighResp_{(i)}$, $MediumResp_{(i)}$, and $NoResp_{(i)}$. Comparing the results across the three groups for a given PEB should give an indication of whether different individuals—as identified by varying degree

of ascription of responsibility—react differently to the same external conditions. 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.

5 | RESULTS AND DISCUSSION

5.1 | Relative importance of intrinsic motivation, external conditions and socio-cultural values

Results of the regression performed on the entire dataset are reported in Table 2. In regressions (1)–(9), we analyzed the eight PEBs separately, capturing 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 regression (0.a–c), in which the response variable represents the sum of the PEBs adopted by the individual.

As shown by the R^2 values reported in the table, the parameters in the model were successful in explaining 7.9%–20.6% of the variation in the response variable, a level that, given the complexity of human behavior, is considered significant for studies with individual persons as units of analysis and a heterogeneous sample (Langbein, 2015). 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. However, all the VIF and Condition

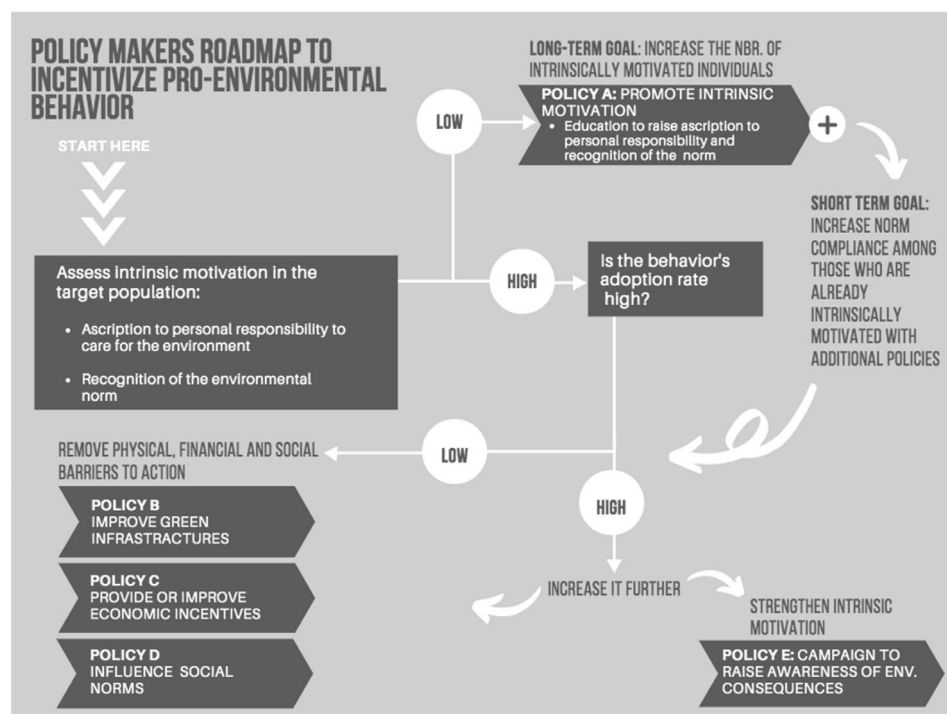


FIGURE 6 Policy makers roadmap to incentivize pro-environmental behavior
Source: Produced by the authors

Index values were well below the threshold values for multicollinearity of 10 and 30, respectively.

The most notable finding is that, across all the PEBs observed, the estimated parameters for intrinsic motivation—that is, *Norm*, *HighResp*, and *EnvWorry*—dominate the external factors; they have the highest absolute value among the estimated regressors.³ 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. The biggest impact is represented by the recognition of the norm, followed by the personal responsibility coefficient.

The relative predominance of intrinsic motivation over external conditions and socio-cultural factors is also demonstrated by pseudo- R^2 values in regression (0.a–c). In (0.a), intrinsic motivation alone accounts for 13.6% of the variation in the response variable.⁴ Incrementally adding external conditions (regression 0.b) and socio-cultural values (regression 0.c) leads to marginal increases to the pseudo- R^2 values, 14.3% and 17.5% respectively.

External conditions are represented by the *Ecolnfra* and *BottleBill*, their coefficients are statistically significant and have positive sign in regression (0.b), showing that the presence of green infrastructures and monetary incentives increase the numbers of PEBs adopted. These coefficients change to a non-statistically significant and negative coefficient respectively once socio-cultural values are included (regression 0.c), possibly due to the high correlation between these two classes of variables. In the recycling regression (1), both coefficients are statistically significant with positive sign, suggesting that both green infrastructures and the presence in the country of a container deposit legislation positively affect the probability that individuals will recycle. Additionally, the coefficient for green infrastructures is not statistically significant or has negative sign when the other behaviors are considered in isolation, thus leading to inconclusive results. This shows that the presence of an external apparatus, which facilitates certain PEBs, does not necessarily induce the adoption of other unrelated PEBs, and reflect the fact that some PEBs, such as reducing water and energy use do not depend on green infrastructures.

Financial constraints affect most PEBs negatively with the exception of green traveling, diminished car use and energy and water saving. 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/he is less likely to act in a norm-consistent way (Cialdini et al., 1990, p. 204). The *FinProb* coefficient is statistically significant and positive for “reduce water consumption,” and “green traveling” which is also expected considering that these behaviors reflect positively in savings. Unexpectedly, the *FinProb* coefficient is not statistically significant in the “reduce energy consumption.” 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 is more likely to control the final bill 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. Although, as income rises, a volumetric tariff scheme might be an ineffective mean to induce water-saving behavior among richer individuals.

In the second regression for recycling (2), we introduce the interaction term *BottleBill*FinProb*. The coefficient is statistically significant with a positive sign. This suggests that economic incentives are effective in limiting the negative impact of economic difficulties on PEB. 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. (ii) However, if an individual with economic problems resides in a *Bottle Bill* country, she/he is 2 percentage points more likely to recycle her/his trash (60%) than if she/he resides elsewhere (58%).

The five 0–100 indexes of socio-cultural values we included showed that predominant values in societies can explain a meaningful part of PEB adoption rates. Particularly, indulgent societies are more likely to engage in almost any PEB. Individuals living in more long-term oriented societies are also more likely to adopt a higher number of PEBs. They are more likely to adopt any behavior except for reducing water and energy use. Both findings are expected since more indulgent societies are usually linked to a greater sense of control (Hofstede & Minkov, 2010), which can instill a greater sense of responsibility; and caring for the environment implies the ability to take into consideration future consequences. In individualist societies, people are less likely to reduce car use, purchase green label products and reduce waste.

Additionally, socio-demographic controls show 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 except renouncing to drive 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 et al., 2004; Kollmuss & Agyeman, 2002) and hold more pro-environmental attitudes (Dietz et al., 1998; Vaske et al., 2001). Age correlates positively with all the PEBs observed except for green traveling and reduced car use, 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 for water saving.

5.2 | Clustering individuals by level of responsibility ascription

Table 3 summarizes the estimated results for the same model with the exception that survey respondents were divided into clusters. Logit split regressions are performed on three groups clustered by their level of personal ascription of responsibility for preserving the environment (*a* equals to high responsibility, *b* to medium responsibility and *c* to no responsibility at all). 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).

The rationale is to assess whether people with differing levels of ascription of responsibility react differently to external conditions and whether changes apply to different kinds of PEB, as defined by their effect on income. The regressions include country fixed effects and social values indicators. The regressions for recycling, however, are also computed including *BottleBill* but excluding country and social values controls due to collinearity with this variable (Equation 1.a2–1.c2).

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 of responsibility, environmental concern alone is not conducive to adopting PEB.

The availability of “green infrastructures”—captured by *Ecolnfra*—is relevant only to high/medium levels of ascription of responsibility, the coefficient is not statistically significant in the regressions for the *NoResp* group. This implies that, without a minimum level of motivation, green infrastructures alone are not effective. Green infrastructures appear to negatively affect green label purchases for medium/high levels of responsibility, a result of difficult interpretation. Container deposit schemes for used bottles positively impact recycling rates—the *BottleBill* coefficient is statistically significant with positive sign—but only for the *HighResp* group (Equation 1.a2–1.c2).

6 | CONCLUSIONS

This article used a cross-country dataset to empirically investigate the reason behind different PEB adoption rates across the EU. To do so, our empirical model, based on survey data of 28,000 individuals across the EU's 28 member states (in 2018), assessed the relative strength of predominant socio-cultural values, intrinsic motivation and green infrastructures on eight self-reported PEBs.

PEB depends on all the three classes of factors analyzed. However, we find that intrinsic motivation—mostly internalized environmental norms, but also awareness of environmental consequences and ascription to personal responsibility towards the environment—is the leading force behind the eight PEBs considered. This finding is consistent across the eight PEBs examined and it is consistent with conclusions in Cecere et al. (2014). Consequently, since intrinsic motivation varies widely across the countries analyzed, diverging outcomes in the EU can be mainly

attributed to differences in the level of intrinsic motivation in its national populations and to heterogeneous responses to the same policy.

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 or green infrastructures). This finding highlights a potential limit for the effectiveness of external conditions: they can only be effective in promoting PEB among individuals who have a minimum level of intrinsic motivation.

Based on our results we advise that policy makers should start by assessing the level of intrinsic motivation—specifically ascription of personal responsibility and recognition of the environmental norm—for a given behavior in their target population. These data are regularly surveyed within EU (Eurobarometer) and elsewhere, and they include reports with summary statistics. If these average values are low or if a consistent proportion of individuals rejects any environmental responsibility; the policy should focus primarily on increasing both responsibility ascription and norm recognition. Policy makers should, however, be conscious that changing intrinsic motivation is a long-term goal (Thøgersen & Ölander, 2002).

There are, however, other policy avenues that can increase PEB adoption rates in the shorter term and that can run in parallel with the long-term objectives mentioned above. If the target population is highly motivated but norm observance is low, it may be an indication that interventions should focus on facilitating the behavior financially, physically or socially.

Influencing social norms: National level socio-cultural values are the second factor affecting PEB. Social values and norms influence behavior indirectly, by influencing the norms that individuals internalize, but also directly through compliance with what individuals perceive as social expectations. While cultural values are hard to change, ample evidence supports that social norms can be influenced. Norm nudges are behavioral interventions aimed at changing social expectations. They can induce shifts in behavior by changing what people think others will do or approve of (Bicchieri and Mercier, 2014).

Using economic incentives: Monetary rewards to recycle proved to be effective to increase recycling rates, particularly for highly motivated individuals and for financially strained ones. We observed that financially distressed individuals are less likely to adopt PEBs that imply higher costs (such as buying green label products) or that are cost neutral (such as recycling); but that they are more likely to engage in PEBs when they imply clear cost savings (such as reducing water usage) or rewards (such as returning empty vessels to container deposit collection schemes). Reframing the choice context into economic terms—by attaching an economic value to the behavior—appeared to be successful in raising the observance of the environmental norm in this group.

Beyond providing economic incentives, policy makers should *analyze the pre-existing ones*. Pricing schemes of water and energy utilities can discourage excessive consumption through volumetric pricing schemes or increasing block tariffs. Conversely, with contracts that offer market-prices, the user is more likely to try to reduce the final bill by using electricity at off-peak times rather than by diminishing

total usage.⁵ As another example, individuals may refrain from energy-efficiency investments, even when it is economically convenient to do so in the long-run, for lack of financial means. Financing schemes that highlight the economic benefits of energy-efficiency investments would extend this opportunity to more people.

Providing or improving infrastructure: Some behaviors—such as reducing water and energy consumption—do not need green infrastructures to be carried out, while others are highly dependent on the availability of safe biking lanes, recycling bins, and so forth. Green infrastructures increase the number of PEBs adopted for this latter group and it can increase adoption rates among individuals that are already motivated. They are, however, less likely to be effective on those who do not ascribe to at least a minimal level of responsibility for the environment.

Strengthening intrinsic motivation: Individuals that recognize the moral norm related to the behavior—for example, “One should reduce car use”—and that ascribe to responsibility for the state of the environment become more likely to perform the behavior if they are also aware of the consequences of not performing it—for example, bad air quality, congestion and GHGs emissions. Information campaigns targeting this aspect will not, however, be effective on individuals that do not ascribe to any personal responsibility for the environment.

The flowchart below summarizes these steps (Figure 6).

The considerations above lead us to conclude that raising intrinsic motivation should in the long term decrease the number of non-intrinsically motivated individuals—that is, defectors—, while progressively extending the effectiveness of the other policy tools to a broader portion of the target population. Consequently, the ideal approach should combine long-term educational efforts with short/medium-term policies aimed at facilitating PEB materially and socially.

The main limitation in this study is linked to data availability. The lack of municipal level data regarding the different green infrastructures in Europe obliged us to rely on proxies. The development of a coherent database of green infrastructures in Europe in the future would offer a chance to refine the analysis.

To date, no comprehensive research has been undertaken on the impact of economic problems on PEB. Future research avenues may include an overview of how PEBs' observance rates have evolved since the beginning of the Great Recession and a study on the conditions and extent to which individuals trade environmental and economic priorities.

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ENDNOTES

- ¹ We include in the count United Kingdom, which was still a EU member state at the time our dataset was created and at the time this paper was being written.
- ² A dichotomy first defined by Guagnano et al. (1995).
- ³ Since all the intrinsic motivation and external conditions variables are dummies, the analysis concerning the magnitude of the estimated coefficients among these variables is straightforward.
- ⁴ The pseudo- R^2 result is 11.9% when excluding demographic control variables.
- ⁵ A related future research topic could be aimed at clarifying whether it is more environmentally beneficial to smooth energy consumption through off peak-times or to just diminish total usage, given different compositions of the energy source mix.

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