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The Role of Curtailment Versus Efficiency on Spillovers Among Pro-Environmental Behaviors: Evidence from Two Towns in Granada, Spain

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Received: 8 December 2019; Accepted: 15 January 2020; Published: 21 January 2020



Abstract: In this paper we explore the existence of behavioral consistency between individuals' pro-environmental attitudes and behaviors in related domains (cross-domain), distinguishing between the following two types of behaviors that the literature has identified as entailing different levels of sacrifice on the part of the individual: curtailment, i.e., implying the adoption of daily habits, and efficiency behaviors, i.e., installation of efficient devices. Using a dataset on bottled water demand from two cities in southern Spain, we find evidence of behavioral consistency between the undertaking of certain pro-environmental habits related to household water consumption and the decision to consume (or not) bottled water. These effects are found only when curtailment behaviors are considered, but not in relation to efficiency behaviors. Moreover, our results suggest that policies fostering pro-environmental habits could prove more successful than the ones promoting pro-environmental attitudes or awareness. These results have important implications for the design of environmental campaigns and rebate programs.

Keywords: pro-environmental attitudes and behaviors; behavioral consistency; behavioral spillovers; averting behavior; zero responses; double-hurdle; bottled water

1. Introduction

The existence of behavioral spillovers from the promotion of pro-environmental attitudes (or awareness) and actual behaviors is widely acknowledged. The idea that the undertaking of certain pro-environmental behaviors may have an indirect effect on the adoption of other behaviors has long been recognized in the literature on environmental policy making (see, for example [1] or [2]). However, it was not until recently that this spillover has been attributed a significant importance [3,4].

Theories of moral consistency have long aimed at analyzing both the relationship between people's values and actual behaviors, and the coherence between subsequent behavioral choices, either within the same area or domain, e.g., indulging themselves to a caloric treat after having completed a demanding workout [5], or across different domains, e.g., the increased propensity for lying and stealing after shopping in green stores [6].

Value expression models of moral self-regulation predict that individuals tend to express their values in all their behavioral choices, independently of any past choice made [7,8]. Within this framework, moral consistency is predicted on the basis of a stable link between attitudes and behaviors [7] due to, among other reasons, the need for avoiding cognitive dissonance [1,9], and the wish to maintain a moral self-perception [10–13] or a social identity of being morally consistent [14–16].

However, several other authors do predict the existence of a certain level of dependence across behavioral choices made in subsequent moments in time. On the one hand, there is some evidence

that the undertaking of a moral act may cause positive spillovers, thus triggering other future moral behaviors [17]. On the other hand, an increasing number of studies points out the existence of negative spillovers in relation to behavioral choices, namely that the undertaking of a moral act may lead to a lower probability of adopting a subsequent moral choice [18].

Regarding pro-environmental behaviors, there is extensive evidence that such behavioral spillovers may occur in both signs and directions—either positive, such as increased sorting of packaging waste after the introduction of a food-waste collection program [4], or negative, such as increased electricity consumption after enrollment in a water conservation campaign [19]—and through very different channels. For example, it could be the case that the undertaking of a pro-environmental action leads to the adoption of subsequent more impactful pro-environmental behaviors [1,17,20] or, contrarily, that after performing an environmental act, individuals feel entitled to relax their moral performance in subsequent behaviors—what is known as moral licensing [16]. Actually, in some cases negative spillovers have even been found to lead to the so-called “rebound effect”, in which the initial positive impact of a pro-environmental behavior is compensated by the negative effects of other inconsistent subsequent actions, thus leading to a net negative impact on the environment [21].

Evidence of behavioral consistency and spillover effects in pro-environmental behaviors have been found both in relation to behavioral choices made within the same domain, such as decreased energy consumption among participants in green electricity programs [22], and also among behaviors within different domains—cross-domain spillovers [3,23]. This holds independently of whether the behaviors are directly related, e.g., increased salience towards packing waste prevention in households adopting recycling habits in relation to waste [20] or seemingly unrelated, such as increased propensity for discarding a sheet of paper in the recycling bin after receiving environmental information about other pro-environmental behavior, e.g., car-sharing. Finally, regarding the methods employed to analyze behavioral consistency and spillovers, we can find the ones based on statistics, as well as some others such as agent-based models [24] and psychological models [25–28].

The magnitude and importance of behavioral inconsistency with respect to pro-environmental behaviors have been systematically proved to be not deniable. Therefore, the consideration of that (in)consistency and the likely spillover effects among behaviors in response to environmental policies is essential for a successful implementation and an accurate assessment of the impact of certain environmental policies addressing people’s environmental attitudes, i.e., awareness and behaviors. Ideally, an adequate environmental policy should promote both direct effects on the targeted behavior as well as the indirect or unintended effects in other pro-environmental behaviors.

Within this context, this paper analyses behavioral/moral consistency between individuals’ pro-environmental attitudes and behaviors in related domains (cross-domain) by exploring an averting behavior that implies negative environmental externalities. The term “averting behavior” is often also referred to as defensive or mitigating behavior. It covers a wide range of actions that share the common feature of being undertaken with the objective of either preventing exposure to certain environmental risks or hazards, or mitigating and compensating for their effects after exposure [29]. Preventive actions could include, for example, the use of home air cleaners or purifiers for air pollution [30], using sunscreen lotion in order to reduce the risk of skin cancer [31], or installing water filtration systems and purchasing bottled water in order to avoid water contamination problems [32,33].

At an aggregate scale, the use of mitigating actions implies substantial costs for individuals and societies. These may involve monetary expenses, such as spending on medical care for illnesses caused by air pollution [34] or the purchase and installation of certain devices [35]; time costs, as such actions usually entail a change in daily activities [36]; as well as facing certain deprivations, such as reductions in outdoor time to avoid ozone exposure [37]. Some of these behaviors also entail negative environmental externalities, leading to substantial environmental costs. These externalities may include generating waste and residuals that are for the most part non-biodegradable, such as plastic bottles and active carbon filters for water or masks for air pollution; energy needs associated with transport and the use of certain devices [38], and heating and air conditioning [39]; or toxic substances

released into the atmosphere and maritime ecosystems, severely affecting their sustainability [40–42]. In addition, many of these averting behaviors are expected to further increase in the following decades due to climate change, demographic, and socioeconomic trends, with significant negative impacts on the environment being predicted as a consequence [39,43]. Therefore, it is expected that the choice over other more environmentally-friendly alternatives would be related to the individual's attitudes towards the environment and actual pro-environmental behaviors already undertaken in other domains.

However, existing research shows a substantial gap between people's attitudes towards the environment and their actual actions, also known as the "value–action gap" or "concern–action paradox" [44,45]. Thus, we study separately the influence of environmental attitudes and environmental behaviors in related domains. In addition, with respect to environmental behaviors, an additional level of disaggregation is considered in order to account for the type of pro-environmental behavior performed. Particularly, we place a separate focus on the two distinct classes of environmental behaviors that the literature has identified as entailing different levels of sacrifice on the part of the individual [46]: (1) efficiency, or one-shot behaviors, such as the installation of certain resource-saving technologies (e.g., installation of water-saving devices on faucets or the purchase of energy efficient dishwashers or washing machines); and (2) curtailment behaviors, including changing daily habits or making sacrifices in an attempt to preserve the environment [47], such as taking shorter showers or waiting until the dishwasher and washing machine are full before running them. Thus, the main difference between these two types of behavior lies in the fact that whereas the use of water-saving technologies does not require any sacrifice on the part of the individual, apart from the initial economic cost of installing such devices, having to forego long showers or not leaving the faucet running while brushing teeth entails daily sacrifices [47].

As far as we are concerned, this distinction, usually employed in studies analyzing pro-environmental attitudes and behaviors, has not been explored yet in relation to behavioral consistency and spillovers. Since each type of behavior may lead to different types of behavioral spillover effects (i.e., positive or negative), it may have important implications in terms public policy, as policies aimed at fostering efficiency behaviors usually differ from those promoting curtailment actions [47]. The same applies to interventions tackling the promotion of pro-environmental attitudes and behavioral change.

Additionally, one important issue when dealing with averting expenditures is the substantial percentage of households that do not consume any amount. Zero consumption may arise for several reasons and econometric modeling strategies will vary according to the economic interpretation of those zero values. However, this fact has often been overlooked in the literature of averting behaviors, with possible implications in terms of bias in the estimations. In this paper, we propose an empirical strategy to deal with the existence of a substantial number of zero consumption values in databases on averting behavior consumption and expenditures. Specifically, we use a generic, more flexible, double-hurdle approach that allows us to model averting behaviors without presenting any particular hypothesis regarding the reasons why households do not adopt said behaviors—e.g., non-participation vs. corner solutions—and to test the underlying distributional assumptions in order to choose among specifications.

In order to illustrate and validate the model presented in this paper, we use data on bottled water consumption from a 2014 household survey conducted in the towns of Baza and Guadix, in the province of Granada, Spain. The bottled water industry is known to generate numerous environmental externalities. The amount of water needed to produce 1 liter of bottled water is 1.32 liters, contributing to the depletion of aquifers and spring waters [48]. In addition, most plastic bottles are discharged after use into landfills [49], and the energy needs associated with bottling and transporting the water significantly add to its environmental footprint [50]. Therefore, since the use of bottled water is an averting behavior that poses a number of significant negative environmental externalities and can be substituted by other more environmentally-friendly alternatives (e.g., filtering water), it might be expected that the decision to consume bottled water would be influenced by the individual's attitudes

and behaviors towards the environment performed in other domains. Moreover, we observe that a significant number of households do not use bottled water as an averting behavior, thus resulting in the abovementioned feature of a substantial proportion of zero consumption records.

In a nutshell, the main objectives of this paper are the following:

Objective 1: Contributing to the study of (cross-domain) behavioral spillovers by distinguishing between pro-environmental attitudes and behaviors, and two types of behaviors, i.e., curtailment and efficiency.

Objective 2: Proposing an econometric strategy to deal with the substantial proportion of zero consumption records in databases on averting behaviors without relying on previous assumptions about the data generating process.

The remainder of the paper is structured as follows. The model specification is outlined in Section 2, along with the data and methodology proposed for the empirical analysis. The results are presented in Section 3, as well as the relevant robustness checks. Section 4 provides a discussion of the results, while Section 5 concludes with a summary of the main findings and policy implications.

2. Methods

2.1. Model Specification

The model of averting behaviors developed in this work aims to reflect the nature of the decision-making process underlying the decision to undertake a certain averting behavior (in this paper, purchase of bottled water as a defensive response), without making any prior assumptions as to the process generating the decision.

As mentioned earlier, one important issue when dealing with certain averting expenditures, is the high proportion of households that do not consume any amount. There may be several reasons for zero consumption. Infrequency of purchase is a typical one. However, it would not seem to apply to this particular category of expenditures; rather, it is more likely that non-participation or corner solutions are occurring. It may be that some individuals are simply non-consumers of a certain mitigating product or behavior, that is, for particular reasons they decide not to “participate” in the market for that product; however, if those reasons (e.g., the environmental beliefs explored in this paper) were not present, these individuals would consume a positive amount. Corner solutions, on the other hand, arise from the consumer’s utility-maximizing decision not to consume at all, given their budget constraints.

This is an important distinction, as econometric modeling strategies will vary according to the economic interpretation of those observed zeros. Until now, the majority of existing studies exploring averting behaviors have focused only on studying the decision to consume or the probability of performing certain averting behaviors, treating it as a dichotomous variable, without modeling the actual intensity of consumption. In the infrequent occasions when actual expenditures have been explored, they have usually been investigated through the use of Heckman selection models [51,52] or similar approaches [53], thus assuming a-priori the non-participation hypothesis. However, the fact that zeros in the field of averting behaviors can also arise from corner solutions has not been addressed. Within the context discussed above, the modeling approach of this paper is based on a generic double-hurdle approach [54], in which it is assumed that consumers must pass two hurdles before a positive consumption is observed. First, they decide on whether or not to perform an averting behavior and, second, they make a decision as to the level of performance or intensity of consumption.

Analytically speaking, a representative household is assumed to display a latent utility derived from performing an averting behavior (in this study, drinking and using bottled water for household consumption purposes instead of using water from the tap or installing filtration systems). If that utility is positive, they will decide to undertake the averting behavior and consume a certain amount; otherwise, they will choose not to.

$$\text{Participation equation : } S = f(s, a, e) \quad (1)$$

Once consumers have decided to undertake it, their next decision will be how much to consume. Thus, the intensity Equation (2) of interest is:

$$\text{Intensity equation : } Y^* = g(s, a, e) \quad (2)$$

where s is a variable reflecting whether or not the household undertakes the averting behavior, and Y is the quantity consumed. s is a vector of variables including socioeconomic variables, a is a vector that includes all variables related to the factors influencing averting behaviors, and e is a vector that includes environmental variables concerning attitudes and pro-environmental behaviors.

The processes governing the decisions to undertake averting behaviors are complex and influenced by multiple objective and subjective factors that have been extensively studied.

The underlying principle is that households undertake averting behaviors to ensure a certain level of quality of the environmental goods they consume, or, as Bartik [55] puts it, “the quality of their personal environment.” Thus, the decision to adopt such a defensive behavior is expected to depend on the objective, pre-existing quality of environmental conditions faced by consumers [32,35,55–57]. However, it has been widely found that consumer judgements about environmental quality and harmful environmental risks are not strictly rational [58–61]. Actually, when explaining the undertaking of averting behaviors, perceived measures of environmental quality have proved to be more relevant instead [62].

As for health risks, they have also been long recognized as one of the main reasons for households undertaking defensive actions. However, given that, as with environmental quality, households may not be capable of accurately assessing the importance of the risks they are exposed to [60], subjective measures of health risks are usually employed in empirical works. Similarly, the presence of individuals belonging to vulnerable populations (e.g., young children, elderly people, or individuals with poor health status) has been acknowledged to generate risk aversion, sometimes triggering the decision to undertake averting behaviors [33,53,63].

Particularly in relation to the averting behavior explored in the empirical part of this paper, these and other factors seem to affect the decision to adopt bottled water consumption as an averting behavior. Although some studies have used the objective quality of water as a means to assess the willingness to pay for an increase in water quality [32,35,57], perceived measures have proved to be more relevant in explaining actual behavior [62]. However, evidence on the impact of perceived water quality is mixed. While several studies find that the poorer the perceived tap water quality, the more likely households are to consume bottled water [62,64,65], others find no statistically significant influence of perceived water quality [53,66,67].

Other non-health related aspects of tap water quality are often found to affect the demand for bottled water as an averting behavior within the household. These mainly involve organoleptic (aesthetic) characteristics such as taste, odor (typically chlorine), color, and turbidity (i.e., the extent to which the water has particles in suspension). Research suggests that these sensorial characteristics are at least as important as consumers’ perceptions of quality and health risks when deciding on whether or not to undertake averting actions related to drinking water [51,63]. A poor organoleptic assessment has been found to systematically increase the likelihood of the household consuming bottled water [51,63,64,67,68].

With respect to the socio-demographic variables, income is usually considered a determinant. Bottled water is expected to be a normal good, so higher-income households are predicted to show both a higher probability of purchasing bottled water [66,68,69] and a higher level of demand. However, some papers find no significant influence of the income variable [70]. Similarly, education is usually included as a proxy for the household’s knowledge, and empirical evidence on its expected sign is mixed [51,62,65]. The length of time that household members have been living in their town [65,68] and the household size have also been analyzed, again with mixed evidence [53,68].

Finally, some aspects related to residential water may also potentially affect bottled water demand. That is the case of water rationing and supply cuts. Since drinking water is a human necessity, frequent

cuts in service may trigger the need to purchase and store bottled water. Similarly, some aspects related to the price for tap water, such as being charged on a marginal basis [68], or the influence of average price for tap water [62] have been considered in the literature. Finally, a number of aspects related to the perceived quality of the service has also been examined. For instance, Doria [67] included satisfaction with tap pressure, finding no significant influence on the propensity to consume bottled water.

2.2. Data, Sample, and Variables

We used data from a household survey conducted in the towns of Baza and Guadix, in the province of Granada (southern Spain). Baza and Guadix have populations of 20,668 and 18,928 inhabitants, respectively [71]. The two towns are nearly 50 km apart and are served by two different water utilities. In general, objective water quality parameters are fairly good and exceed the official standards (Values of objective water quality parameters from the last chemical analysis performed are available from the authors on request). Violations of health-related water parameters in this area are rare (only one episode has been recorded and it was due to torrential rains in 2008). However, service interruptions due to network overload are not uncommon, occurring mainly in the summer, when nearly 28,000 and 23,000 tourists are added to the regular populations of Baza and Guadix, respectively [72], creating excess demand.

The region exhibits certain characteristics that make it an interesting setting for this study. In their last available study of the global market in 2014, the Beverage Marketing Corporation rated Spain as the 4th largest per capita consumer of bottled water in Europe and 9th in the world in total consumption [73]. Moreover, Spain is a country subject to either water stress or severe water stress throughout most of its territory [74]. In particular, the towns of Baza and Guadix are located in the Guadalquivir River Basin, a basin under severe water stress [74] that has long suffered from water scarcity problems, a situation that is expected to worsen in the future. These circumstances have made water management of paramount concern in the region, thus leading to certain water conservation policies (e.g., water rationing) being applied to residential water demand.

The survey was carried out by a social research consulting company (Ipsos) in 2014 and administered to a population of 10,062 households in Baza and 9704 in Guadix [72], from which a representative sample of 594 households (305 in Baza and 289 in Guadix) was extracted. Proportional quota sampling was carried out, with quotas based on gender and age in each stratum. Questionnaire development included the use of several focus groups and a pilot pre-test. Interviewers were trained before the survey was launched and careful instructions were incorporated into the questionnaire on what information should be conveyed and how responses should be gathered. The survey was administered door-to-door with a response rate of 80%. According to interviewers, respondents were generally very receptive to the interview. (Interviewers rated respondents as an average of 4.51 on a scale from 1 -very unreceptive- to 5 -very receptive-). With respect to the information included in the survey, this database contains a broad set of perceived water quality indicators, as well as the usual socioeconomic controls. Responses regarding individuals' perception on tap water management (e.g., tap water price or interruptions in the service) were also gathered.

In order to measure environmental attitudes, the individual had to respond to a series of questions aimed at accurately measuring attitudinal factors, from which an aggregate index on pro-environmental attitudes was built (Appendix A). In addition, respondents were asked a wide range of questions on environmental behaviors in order to account for the different levels of individuals' environmental involvement (efficiency and curtailment actions).

Individuals were asked whether or not the household regularly used bottled water as the main source of drinking and in-house water (e.g., for cooking) and the quantity in liters of bottled water consumed per week. It should be noted that when households were asked about bottled water consumption, particular emphasis was placed on the fact that it measured the use of bottled water as an averting behavior and regular source of drinking water inside the household; away-from-home or sporadic consumption was not considered.

Table 1 presents the definition and main descriptive statistics of the variables included in the analysis.

Table 1. Descriptive statistics and definition of the variables.

Set of Variables	Variable	Description	N	Mean	SD	Min	Max
Dependent variables	Bottledwater	Household reports consuming bottled water on a regular basis (Dummy)	528	0.322	0.468	0	1
	Quantity	Bottled water consumption (in liters per week)	528	4.333	7.748	0	48
Socioecon.	Municipality	Household is located in Baza (Dummy)	528	0.496	0.501	0	1
	HholdIncome	Household income (Ordinal)	528	6.417	3.677	1	14
	NoEduc	Respondent has not completed any formal education level (Dummy)	528	0.047	0.213	0	1
	BasicEduc	Respondent has completed elementary education (Dummy)	528	0.348	0.477	0	1
	Secondary_Educ	Respondent has completed secondary education (Dummy)	528	0.303	0.460	0	1
	HighEduc	Respondent has completed university studies, whether an undergraduate degree, master's, or PhD (Dummy)	528	0.301	0.459	0	1
	Length	Length of time that the respondent has been living in their town (Years)	528	35.55	19.85	1	86
	Hsize	Household size (Number of members in the household)	528	2.955	1.157	1	6
	Childrenlessthan2	The household reports having members under 2 years old (Dummy)	528	0.0720	0.259	0	1
Water quality and service perception	Quality	Satisfaction with water quality: 1 (very unsatisfied) to 5 (very satisfied)	528	4.027	1.109	1	5
	Serviceperc	Satisfaction with wastewater service: 1 (very unsatisfied) to 5 (very satisfied)	508	3.415	1.178	1	5
Organoleptics	Color	Respondent perceives that water is not clear: 1 (totally disagree) to 5 (totally agree)	528	1.509	0.893	1	5
	Smell	Respondent perceives that water has some odor: 1 (totally disagree) to 5 (totally agree)	528	1.555	0.878	1	5
	Taste	Respondent perceives that water has some taste: 1 (totally disagree) to 5 (totally agree)	523	1.740	1.064	1	5

Table 1. Cont.

Set of Variables	Variable	Description	N	Mean	SD	Min	Max
Interruptions	Cutfreq	Incidence of water supply cuts that the respondent noticed during the summer: 0 (never) to 5 (very frequently, more than 10 times)	528	1.246	0.508	1	4
	Cutdisruption	Supply cuts caused inconvenience to respondent: 1 (a little) to 5 (a lot)	528	4.214	0.959	1	5
Environm. variables	Envconcernavg	Respondent's average value reported for a set of environmental attitudes	528	3.940	0.512	1.50	5
	Envworried	Respondent's environmental concern is over the mean of the sample (Dummy)	528	0.540	0.499	0	1
	Watereff	The household has installed some water-saving devices on faucets, showers, or cisterns (Dummy)	528	0.616	0.487	0	1
	filling_dishwasher	Respondent reports waiting until the dishwasher and washing machine are full before running them (Dummy)	499	0.972	0.165	0	1
	Closing_taps	Respondent reports turning off the faucet while brushing their teeth or shaving (Dummy)	528	0.936	0.246	0	1
	Reducing_shower	Respondent reports trying to reduce the duration of his/her shower (Dummy)	528	0.928	0.2587	0	1
	Waterhabitindex	Index indicating number of water conservation habits held by the respondent (Count)	528	2.78	0.48	0	3
Price variables	Priceperception	Respondent's perception of tap water price: 1 (very cheap) to 5 (very expensive)	513	3.780	0.834	1	5

With respect to the dependent variables, 32.2% of the households reported purchasing bottled water on a regular basis. Mean bottled water consumption was 4.33 liters per week, but this mean also included households that did not consume bottled water at all. Among those households that purchased a positive amount of bottled water, the mean value of water consumption was 13.7 liters per week. Figure 1 presents the distribution of the consumption values for those households that reported consuming bottled water.

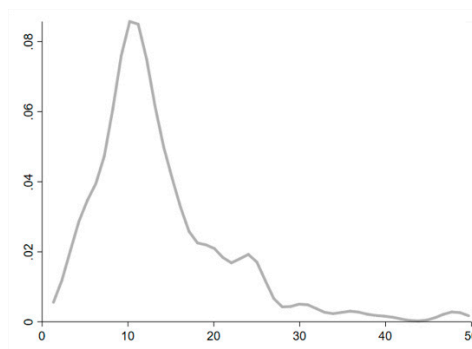


Figure 1. Distribution of bottled water demand in liters per week (authors' own elaboration).

Regarding sample composition, mean household size in the sample was 2.95 members, close to the mean value of 2.51 for Spain [75]; 7.2% of the households had at least one child younger than two years old. Likewise, mean household income was within the range of €1801–2100 per month, only slightly lower than the census mean of €2174 for Spain [75] (this is not surprising as Andalusia, the region of Spain where Baza and Guadix are located, is one of the poorest Autonomous Communities in Spain).

2.3. Empirical Strategy

Regarding the modeling methodology, the first issue that we had to deal with was the fact that the sample contained a high percentage of households reporting no consumption of bottled water (67.8%). As mentioned earlier, this is a common feature in many averting behaviors. Thus, in order to model the demand, we departed from a generic double-hurdle approach [54] in which it is assumed that consumers must pass two hurdles before a positive consumption is observed. First, they decide on whether or not to consume bottled water (choosing bottled water as their averting behavior) and, once they have decided to consume, they determine the quantity to be consumed. In econometric terms, these decisions can be expressed by the two following Equations (3) and (4):

$$\text{Participation equation : } S = \gamma Z + v \quad (3)$$

$$\text{Intensity equation : } Y^* = \beta X + u \quad (4)$$

where v and u are assumed to have a bivariate normal distribution with zero means, standard deviations σ_u and σ_v , respectively, and correlation ρ . Z and X are the covariates affecting each decision explained in the previous section. Since we do not observe utility, instead of S we can only observe whether or not they have actually participated in the market, which is reflected in a binary choice variable (Equation (5)):

$$D = \begin{cases} 1, & s > 0 \\ 0, & s \leq 0 \end{cases} \quad (5)$$

As we explain below, estimation methods vary according to the assumptions about the relationship between the two decisions (joint distribution of the errors) and the process that generates the data (observability rule).

When corner solutions are encountered, values within a certain range are observed as a single value [76]. Particularly for the case considered here, when a consumer's underlying utility derived from consuming bottled water is negative ($Y^* \leq 0$), the utility-maximizing decision will be to not consume Equation (6):

$$\text{Observed consumption : } Y = Y^* \text{ when } Y^* > 0 \ (D = 1), \ Y = 0 \text{ otherwise} \quad (6)$$

Estimation under this type of censoring of the dependent variable was addressed by Tobin [77] using a mixture of discrete and continuous distributions. However, one drawback of the Tobit models (as they are usually referred to) is that they estimate only one set of coefficients, implying that the variables in the model affect both the decision to consume and the consumption choice in the same direction. In the setting of this study, this premise may be too restrictive, as there are reasons to believe that the group of factors that influence the choice of bottled water over other averting behaviors related to water consumption are different from the ones that determine the quantity eventually consumed. In order to account for this possibility, we used a more flexible model proposed by Cragg [78], which allows the participation and intensity equations to be independent and governed by different mechanisms, yielding two different sets of estimations. Thus, in Cragg's models, independence of the disturbance terms (u and v) is assumed ($\rho = 0$), and the participation and consumption equations are estimated, respectively, by means of a Probit and a truncated regression.

When $\gamma = \beta/\sigma_v$ and provided that the same set of regressors is used for both equations, Cragg's specification will collapse to a Tobit model [76]. A likelihood ratio (LR) test on this restriction proposed by Lin and Schmidt [79] can be used to choose between Cragg's and Tobit specifications.

On the other hand, when non-participation is suspected as the underlying process generating zero consumption, Heckman selection models should be applied. In this case, consumption will only be observed when the individuals pass the participation rule ($D = 1$), that is, once they have chosen bottled water as their averting behavior (Equation (7)):

$$\text{Observed consumption : } Y = D \cdot Y^* \quad (7)$$

Under this scenario, the final observed consumption could be biased if there were unobserved factors affecting both the decision to consume and the quantity actually consumed. Therefore, under Heckman models, dependence of the disturbance terms (u and v) is presumed in order to account and correct for the possibility of the existence of selection bias. Parameters in the system can be estimated through either full information maximum likelihood (FIML) or two-step estimation [80] and, after estimation, the independence assumption can be tested by means of an LR test. In the event that the errors were found to be correlated, the existence of selection bias in our sample would be confirmed, and Ordinary Least Squares (OLS) would yield inconsistent estimates. However, in the case of $\rho = 0$, independence of the two decisions can be assumed and two-part models, in which a Probit and OLS equations are estimated separately for each decision, have proved more efficient. Moreover, when $\rho = 0$, a Vuong test for non-nested models to test for the truncated normal against the lognormal specifications can be applied to choose between Cragg's and Heckman (this is true when $\log(y)$ is effectively treated as the dependent variable) specifications [81].

In addition, when using Heckman selection models, in order for the system to be properly identified, Z must contain at least one regressor, also known as an exclusion restriction, which must belong to the participation equation while being exogenous to the consumption decision, and thus not included in X .

Finally, in order to determine the magnitude of the response of the variable of interest to a change in one of the independent variables, marginal effects should be calculated. Here, we are interested in predicting unconditional marginal effects, that is, the potential change in bottled water consumption that could be achieved through a public policy affecting one of the independent variables. In the case of Heckman models, unconditional partial effects can be interpreted directly from the estimation results.

However, in Cragg's approach, obtaining unconditional marginal effects requires some extra calculations of marginal impacts (Equation (8)):

$$\frac{\partial E[y|Z, X]}{\partial x_j} = \gamma_j \phi(Z\gamma) \left[X\beta + \sigma \lambda \left(\frac{X\beta}{\sigma} \right) \right] + \Phi(Z\gamma) \beta_j \left[1 - \lambda \left(\frac{X\beta}{\sigma} \right) \left\{ \frac{X\beta}{\sigma} + \lambda \left(\frac{X\beta}{\sigma} \right) \right\} \right] \quad (8)$$

where ϕ is the normal density function, Φ is the normal distribution function, and $\lambda\left(\frac{X\beta}{\sigma}\right) = \phi\left(\frac{X\beta}{\sigma}\right)/\Phi\left(\frac{X\beta}{\sigma}\right)$ is the inverse Mills ratio (IMR).

2.4. Endogeneity

Another issue to be addressed is that in the proposed model, the index on water-saving habits could be endogenous. Water-saving habits might be expected to be jointly determined with bottled water consumption if there were individual unobservable characteristics that drive both the decision to consume bottled water and the decision to reduce household water consumption by adopting certain habits.

In order to account for endogeneity in the framework of selection models, Wooldridge [81] proposed a two-step approach in which a probit model is estimated for the selection indicator, including all exogenous variables (i.e., instruments for the endogenous regressor, exogenous regressors in the intensity equation, and exclusion restrictions) and then the IMR is computed and included in a 2SLS estimate of the structural equation (equation of interest). Since standard errors are incorrect when the IMR coefficient is statistically different from zero, bootstrapping should be applied [81].

For corner solution models (Tobit and Cragg's), a control function approach is used. In a first step, the endogenous variable is regressed on the exogenous regressors and the set of instruments, and, after estimation, the residuals are retrieved. Estimated residuals are included in the models' equations. The inclusion of this error term in the equations of interest corrects for endogeneity, and the test for the significance of the error term becomes a test for endogeneity. As in the case of selection models, the inclusion of a generated regressor from a previous estimation is addressed using bootstrapping.

A final issue is finding valid and relevant instruments. For this purpose, we use several questions capturing the household's concern and willingness to act related particularly with the efficient and sustainable use of water resources and supply networks (see Appendix B). These variables are expected to be correlated with the household's decision on engaging in water-saving habits, but not to affect the demand for bottled water.

3. Results

Results of the different estimated models are reported in Table 2. First, models with endogeneity correction for *waterhabitindex* were run. Tests for validity, relevance of the instruments, and endogeneity are reported in Table 3. In the Heckman model, since the second stage is a 2SLS, the validity and relevance of the instruments were confirmed by a Sargan test of overidentifying restrictions and an F-test of excluded instruments [82], respectively. However, the Hausman test for endogeneity failed to be rejected, indicating that there was no need for the use of an instrument. In the case of Cragg's model, as proposed by Wooldridge [81], an F-test of excluded instruments is performed, confirming the instruments' validity. (After running the structural equation with the control function (residual from the first stage) included, instrumental variables should not belong to the structural equation. Under that logic, the structural equation with endogeneity correction is run (including all instruments except for one) and an F-test on those instruments is conducted. In order for those instruments to be valid, they should not be jointly significant in an F-test of excluded instruments. The test is invariant to the choice of excluded instrument [81]). Moreover, an F-test on the first stage regression also indicates relevance. Nevertheless, the t-test on the coefficient of the estimated residual was not rejected, also pointing to the fact that endogeneity correction for this variable was not necessary in Cragg's specification. Thus, models without endogeneity correction were run.

Table 2. Heckman selection full information maximum likelihood (FIML), two-part, Tobit, and Cragg's model estimates (N = 493; Censored = 332).

VARIABLES	Heckman		OLS	Tobit	Cragg	
	Participation	Intensity			Participation	Intensity
Municipality	−0.225	0.0339	0.0816	−1.776	−0.228	2.518
	(0.146)	(0.100)	(0.0965)	(1.996)	(0.145)	(1.709)
Childrenlessthan2	0.455 *		−0.0669	4.160	0.435 *	−0.643
	(0.245)		(0.135)	(3.216)	(0.254)	(2.362)
Length	−0.0108 ***	−0.00425	−0.00257	−0.150 ***	−0.0109 ***	−0.0288
	(0.00380)	(0.00269)	(0.00250)	(0.0527)	(0.00379)	(0.0450)
Hholdincome	−0.00687	−0.00907	−0.00877	−0.230	−0.00707	−0.357
	(0.0214)	(0.0130)	(0.0135)	(0.284)	(0.0209)	(0.246)
Hsize	−0.0417	0.185 ***	0.187 ***	0.817	−0.0360	3.405 ***
	(0.0600)	(0.0365)	(0.0380)	(0.815)	(0.0596)	(0.720)
BasicEduc	0.0254	0.129	0.167	−0.0632	−0.0105	3.283
	(0.363)	(0.263)	(0.271)	(5.115)	(0.359)	(5.076)
SeconEduc	0.170	0.251	0.253	3.003	0.154	5.256
	(0.374)	(0.276)	(0.289)	(5.305)	(0.370)	(5.341)
Higheducation	0.0818	0.104	0.130	1.624	0.0635	3.263
	(0.386)	(0.277)	(0.286)	(5.415)	(0.380)	(5.315)
Color	0.159	−0.00158	−0.0255	1.862	0.148	−0.796
	(0.0970)	(0.0610)	(0.0600)	(1.279)	(0.0963)	(1.044)
Smell	0.0842	0.00276	−0.00382	1.047	0.0872	0.729
	(0.0989)	(0.0536)	(0.0548)	(1.264)	(0.0955)	(0.965)
Taste	0.141 *	0.0768 *	0.0518	2.144 **	0.121	1.148
	(0.0780)	(0.0433)	(0.0406)	(0.990)	(0.0753)	(0.718)
Quality	−0.317 ***	−0.112 **	−0.0558	−3.985 ***	−0.315 ***	−0.931
	(0.0769)	(0.0550)	(0.0400)	(0.983)	(0.0761)	(0.718)
Serviceperc	0.102	0.00571	−0.0186	1.117	0.114 *	−0.328
	(0.0647)	(0.0410)	(0.0373)	(0.850)	(0.0649)	(0.666)
Cutfreq	0.346 **	0.0241	−0.0271	3.813 **	0.381 ***	−0.760
	(0.148)	(0.0867)	(0.0784)	(1.844)	(0.147)	(1.376)
Cutdisruption	0.0525	−0.00908	−0.0217	0.488	0.0541	−0.223
	(0.0733)	(0.0439)	(0.0441)	(0.987)	(0.0731)	(0.813)
Envconcernavg	0.305	0.118	0.0433	3.925	0.303	0.250
	(0.255)	(0.180)	(0.177)	(3.458)	(0.246)	(3.169)
Envworried	−0.120	0.0361	0.0761	−0.373	−0.115	2.083
	(0.231)	(0.152)	(0.157)	(3.156)	(0.227)	(2.803)
Watereff	−0.0427	−0.000460	−0.000347	−0.123	−0.0465	0.226
	(0.148)	(0.0983)	(0.102)	(2.043)	(0.148)	(1.827)
Waterhabitindex	−0.429 **	−0.361 **	−0.299 **	−7.319 **	−0.422 **	−6.192 **
	(0.208)	(0.144)	(0.143)	(2.852)	(0.206)	(2.599)

Table 2. Cont.

VARIABLES	Heckman		OLS	Tobit	Cragg	
	Participation	Intensity			Participation	Intensity
Priceperception	−0.0100 (0.0860)	0.110 ** (0.0522)	0.118 ** (0.0536)	0.636 (1.161)	−0.00102 (0.0853)	1.746 * (0.969)
Constant	−1.363 (0.276)	1.006 (0.272)	1.527 * 1.527 *	−23.75 15.51 ***	−1.433 (1.213)	−4.188 (15.60)
ρ	0.614 (0.439)					
Σ	−0.672 *** (0.140)				7.779963 *** (0.5984736)	
LR test of independent equations	$\chi^2_1 = 1.08$ (0.2977) ^a					

Standard errors in parentheses. *, **, and *** denote 10%, 5%, and 1%, respectively; ^a P-values.

Table 3. Tests for endogeneity, validity, and relevance for Heckman selection (FIML) and Cragg's model estimates with endogeneity correction for the variable *waterhabitindex*.

Tests	Heckman	Tests	Cragg	
			Participation	Intensity
Hausman	0.02 (0.8951)	T-test on the included residual	−0.44 (0.663)	1.13 (0.257)
Sargan test	0.1914 (0.6618)	F-test of exclusion of instruments	0.761 (0.6835)	0.743 (0.6897)
F-test of excluded instruments (First stage 2SLS)	15.50 (0.0014)	F-test (First stage)	3.00 (0.0305)	

p-values are reported in parentheses.

In the Heckman specification, *Childrenlessthan2* was used as an exclusion restriction. Having children less than two years old has been found to impact the likelihood of purchasing bottled water (as was suggested in the literature reviewed), but it does not necessarily affect the amount consumed. As expected, Table 2 shows that it was a significant determinant of the decision to consume (participation equation in Heckman model), but it did not affect the quantity consumed in a separate OLS estimate of the intensity equation, thus representing an adequate exclusion restriction.

The Heckman model yielded a ρ value of 0.614. However, a direct test for the existence of the selection effect ($\rho = 0$) could not be rejected, implying independent errors. In addition, an LR test for the independence of the two equations could not be rejected, suggesting that a separate probit model should have been estimated for the participation equation and a regression model on the intensity decision, rather than the Heckman specification.

Results for the Tobit and Cragg's model were also reported (Table 2). An LR test [79] for the restriction of the Tobit model yielded a value of 28.7, rejecting the null hypothesis that $\gamma = \beta/\sigma_v$ at a 1% level, and thus pointing to the suitability of Cragg's more flexible specification rather than the Tobit. Finally, a Vuong test for non-nested models was performed to compare the lognormal and truncated specifications. With a value of −0.146 and a p-value of 0.010, the Vuong test was rejected at the 1% level, implying that Cragg's model was preferred to the Heckman model, and thus providing support for the hypothesis of corner solutions being the process governing observed zero consumption. Therefore,

Cragg's specification was the final modeling choice. In any case, results were found to be very robust across the various econometric specifications (see Table 2).

In order to study the magnitude of the effect of those variables on both the probability of consuming and the quantity of bottled water consumed, marginal effects were computed. For the intensity equation, we reported unconditional marginal effects (Table 4) accounting for the total potential effect on bottled water consumption (that is, both the direct effect on quantity and the indirect effect through the change in the probability of consuming) that could be achieved through a change in each of the independent variables. For the standard errors to be valid, we estimated them using bootstrapping [81].

Table 4. Marginal effects for the Cragg's model estimates.

VARIABLES	Marginal Effects	
	Participation	Intensity (Unconditional)
Municipality	−0.0638819 (0.0404749)	−0.2073927 (0.7594287)
Childrenlessthan2	0.1219732 * (0.0651619)	1.417454 (1.030329)
Length	−0.0030683 *** (0.0009935)	−0.0466816 *** (0.0180355)
Hholdincome	−0.0019846 (0.0054422)	−0.1132304 (0.101826)
Hsize	−0.0100926 (0.0171237)	0.7046737 ** (0.3108281)
BasicEduc	−0.0029481 (0.0863704)	0.7668188 (2.175619)
SeconEduc	0.043138 (0.1146203)	1.845703 (2.508469)
Higheducation	0.0178282 (0.1038933)	1.030414 (2.320931)
Color	0.0416047 (0.0288384)	0.3420471 (0.5051409)
Smell	0.0244638 (0.0303447)	0.4946904 (0.56174)
Taste	0.0340424 (0.0268369)	0.7211814 ** (0.3493412)
Quality	−0.0883292 *** (0.0297569)	−1.368968 (0.3534333)
Serviceperc	0.0318698 (0.0207237)	0.3311705 (0.2342998)
Cutfreq	0.1069017 * (0.0591058)	1.194052 (0.8170846)

Table 4. Cont.

	Marginal Effects	
Cutdisruption	0.0151802 (0.0268184)	0.1412496 (0.3591169)
Envconcernavg	0.0849113 (0.0731812)	1.157794 (1.155939)
Envworried	−0.0321705 (0.0640323)	0.0954011 (0.9549162)
Watereff	−0.0130449 (0.0382911)	−0.1129135 (0.617297)
Waterhabitindex	−0.1182606 ** (0.0487385)	−3.045422 *** (1.009367)
Priceperception	−0.0002867 (0.0262441)	0.4243339 (0.4545721)

Standard errors in parenthesis are computed using bootstrapping with 100 iterations. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Robustness Checks

In order to show the robustness of the estimations, Tables 5 and 6, respectively, display step-wise estimations by groups of variables for the participation and intensity equations of the final model choice (Cragg's Tobit specification). Moreover, in the previous section, robustness across different methodological specifications was also shown.

Table 5. Robustness checks. Participation equation of the final chosen model (Cragg's Tobit).

	Model 1 (Socioecon.)	Model 2 (+Water Quality)	Model 3 (+Interruptions)	Model 4 (+Environ.)	Model 5 (+Price Perception)
Municipality	−0.333*** (0.120)	−0.322 ** (0.134)	−0.293 ** (0.136)	−0.247 * (0.143)	−0.228 (0.145)
Childrenlessthan2	0.438 ** (0.223)	0.538 ** (0.246)	0.520 ** (0.250)	0.462 * (0.249)	0.435 * (0.254)
Length	−0.0125 *** (0.00328)	−0.0102 *** (0.00364)	−0.00995 *** (0.00366)	−0.0106 *** (0.00373)	−0.0109 *** (0.00379)
Hholdincome	−0.0294 * (0.0172)	−0.0222 (0.0191)	−0.0114 (0.0198)	−0.00631 (0.0206)	−0.00707 (0.0209)
Hsize	−0.0124 (0.0520)	−0.0332 (0.0573)	−0.0471 (0.0580)	−0.0422 (0.0592)	−0.0360 (0.0596)
BasicEduc	0.0653 (0.315)	0.0779 (0.357)	0.0847 (0.358)	−0.0209 (0.356)	−0.0105 (0.359)
SeconEduc	0.217 (0.325)	0.231 (0.365)	0.225 (0.368)	0.112 (0.366)	0.154 (0.370)
Higheducation	0.327 (0.331)	0.215 (0.373)	0.234 (0.375)	0.0861 (0.374)	0.0635 (0.380)

Table 5. Cont.

	Model 1	Model 2	Model 3	Model 4	Model 5
Color		0.167*	0.144	0.153	0.148
		(0.0916)	(0.0936)	(0.0954)	(0.0963)
Smell		0.0717	0.0633	0.0638	0.0872
		(0.0933)	(0.0937)	(0.0938)	(0.0955)
Taste		0.134*	0.126 *	0.124 *	0.121
		(0.0737)	(0.0738)	(0.0749)	(0.0753)
Quality		−0.322 ***	−0.319 ***	−0.311 ***	−0.315 ***
		(0.0737)	(0.0744)	(0.0758)	(0.0761)
Serviceperc		0.0981	0.118*	0.116*	0.114*
		(0.0615)	(0.0628)	(0.0637)	(0.0649)
Cutfreq			0.289 **	0.331 **	0.381 ***
			(0.140)	(0.145)	(0.147)
Cutdisruption			0.0739	0.0674	0.0541
			(0.0705)	(0.0718)	(0.0731)
Envconcernavg				0.348	0.303
				(0.243)	(0.246)
Envworried				−0.130	−0.115
				(0.223)	(0.227)
Watereff				−0.0909	−0.0465
				(0.147)	(0.148)
Waterhabitindex				−0.344 *	−0.422 **
				(0.193)	(0.206)
Priceperception					−0.00102
					(0.0853)
Constant	0.108	0.379	−0.368	−1.576	−1.433
	(0.368)	(0.559)	(0.706)	(1.159)	(1.213)
Observations	528	503	503	503	493
Log-likelihood	−865.12747	−783.29806	−780.59767	−772.90769	−762.65091
Sigma	8.2275 ***	8.1389 ***	8.1170 ***	7.8541 ***	7.7799 ***
	(0.63770)	(0.6430)	(0.63992)	(0.60618)	(0.59847)

Standard errors in parentheses. *, **, and *** denote 10%, 5%, and 1% significance levels, respectively.

Table 6. Robustness checks. Intensity equation of the final chosen model (Cragg's Tobit).

	Model 1	Model 2	Model 3	Model 4	Model 5
VARIABLES	(Socioeconomic)	(+Water Quality)	(+Interruptions)	(+Environment)	(+Price Perception)
Municipality	3.589 ** (1.580)	3.754 ** (1.621)	3.383 ** (1.674)	2.769 (1.716)	2.518 (1.709)
Childrenlessthan2	−1.399 (2.364)	−1.125 (2.421)	−0.805 (2.439)	−1.068 (2.367)	−0.643 (2.362)
Length	−0.0395 (0.0429)	−0.0194 (0.0448)	−0.0158 (0.0448)	−0.0236 (0.0447)	−0.0288 (0.0450)
Hholdincome	−0.158 (0.222)	−0.267 (0.243)	−0.290 (0.245)	−0.294 (0.244)	−0.357 (0.246)
Hsize	3.296 *** (0.695)	3.298 *** (0.728)	3.388 *** (0.738)	3.623 *** (0.723)	3.405 *** (0.720)
BasicEduc	2.854 (5.026)	4.804 (5.283)	4.353 (5.300)	2.756 (5.107)	3.283 (5.076)
SeconEduc	3.051 (5.115)	5.900 (5.457)	5.680 (5.488)	3.920 (5.328)	5.256 (5.341)
Higheducation	2.113 (5.137)	3.831 (5.386)	3.382 (5.392)	1.336 (5.230)	3.263 (5.315)
Color		−0.542 (1.054)	−0.396 (1.063)	−0.569 (1.051)	−0.796 (1.044)
Smell		0.572 (0.987)	0.469 (1.001)	0.756 (0.982)	0.729 (0.965)
Taste		0.760 (0.723)	0.777 (0.721)	1.129 (0.723)	1.148 (0.718)
Quality		−0.999 (0.733)	−1.033 (0.734)	−1.219 * (0.711)	−0.931 (0.718)
Serviceperc		−0.333 (0.691)	−0.250 (0.701)	−0.321 (0.674)	−0.328 (0.666)
Cutfreq			−1.146 (1.381)	−1.122 (1.380)	−0.760 (1.376)
Cutdisruption			0.138 (0.809)	−0.102 (0.819)	−0.223 (0.813)
Envconcernavg				−0.414 (3.192)	0.250 (3.169)
Envworried				2.842 (2.804)	2.083 (2.803)
Watereff				−0.0183 (1.827)	0.226 (1.827)
Waterhabitindex				−6.108 ** (2.530)	−6.192 ** (2.599)
Priceperception					1.746* (0.969)
Constant	0.520 (5.675)	1.048 (7.076)	5.267 (14.83)	5.267 (14.83)	−4.188 (15.60)
Observations	528	503	503	503	493

Standard errors in parentheses. *, **, and *** denote 10%, 5%, and 1% significance levels, respectively.

Reported likelihood refers to the joint estimation of the two equations in the model (Probit and truncated regression).

4. Discussion

In the previous section, results of the empirical exercise were presented. This section is devoted to the discussion of the main results encountered, given our research objectives.

As expected, we find that some factors, such as poorer perception of tap water quality, increases the probability of drinking bottled water, but not affecting the quantity eventually consumed. This

suggests that characteristics related to water quality tend to affect the decision to use bottled water more than the amount consumed once the individual has decided to purchase bottled water as an averting behavior. Although perceived taste is not significant in any of the equations when estimated separately, the joint marginal effect on quantity is significant, suggesting that a policy intervention targeted at this variable would also be expected to affect bottled water consumption.

We also find that households with children younger than two years old report a higher probability (12.2%) of choosing to consume bottled water. This result is in line with the literature [53] and seems to indicate that when households display a higher level of risk aversion, their propensity to consume bottled water is also higher. The length of time that the consumer has been living in the same town seems to lead to a decreased probability of purchasing bottled water. This is usually explained by the fact that familiarity leads to a reduction in risk perception [60], and with time people become accustomed to the organoleptic characteristics of their tap water [83]. Quantity, however, seems to be better explained by household size, that is, as expected, bottled water consumption is predicted to increase with the number of members in the household.

With respect to the variables related to service interruptions, a perception by the household that supply cuts are more frequent is shown to lead to a higher probability of purchasing bottled water, though this does not affect the level of consumption. A marginal increase in this indicator, while holding all other indicators constant, is expected to increase the probability of purchasing bottled water by up to 10.7%. This result suggests that, as we expected, service interruptions could generate a need to keep bottled water to guard against a lack of water supply. However, the length of disruption does not seem to affect either the probability of consuming or the quantity of bottled water consumed.

As for the analysis of the relationship with other pro-environmental attitudes and behaviors performed in related domains, our results show that environmental concern does not translate into a reduction in either the probability of consuming bottled water or the quantity consumed. Contrarily, we do observe that those individuals that consistently undertake a higher number of daily water-saving habits, such as curtailment behaviors, also show both a lower probability of choosing to consume bottled water and consume a lower quantity, which suggests the existence of behavioral (cross-domain) consistency from practicing other pro-environmental behavior (i.e., water conservation) on the undertaking of behaviors that entail negative externalities. Moreover, the joint effect of this variable (*envoconcernavg*) is found to be the most sizeable one, with a marginal increase in this indicator, while holding all other indicators constant, predicted to reduce consumption by up to 22% of the current average consumption per week exhibited by the households in the sample. However, the observed effect is not found in relation to behaviors of the efficiency-type. The fact that individuals engage in efficiency behaviors, that is, one-time behaviors such as installing certain types of water-saving devices, does not seem to be related to either consumption of bottled water or the level of consumption itself. Thus, these results seem to suggest that individuals showing a higher level of commitment towards preventing environmental degradation in their daily lives are more prone to adopting other behaviors entailing similar levels of sacrifice in order to reduce their environmental impact.

Finally, price perception is also found to affect bottled water consumption. These results suggest that households that perceive tap water as more expensive tend to consume more bottled water. Since tap water is significantly cheaper than bottled water, households' perceptions about the relative high cost of tap water may be explained by their difficulty to interpret the water bill as has been consistently shown [84–87].

Before concluding, certain limitations have to be addressed, hoping that they pose opportunities and challenges for improvement of future research. The first limitation relates to the sample employed in this paper, which comprises cross-sectional data. Relying on a panel could improve the analysis in several manners. First, it would permit one to apply panel data techniques that would better get rid of the unobserved individual heterogeneity. Second, it allows one to observe individuals in different points in time and explore how changes in attitudes and behaviors across time transmit to other behavioral choices in both related and unrelated domains.

Another limitation derives from the fact that the results presented in this paper constitute an empirical exercise within a particular context. These results may, therefore, vary across settings (for instance, in developing countries). Thus, we encourage other researchers to replicate the analysis in their specific research settings to confirm whether the main conclusions can be extrapolated to other contexts.

Finally, complementing the proposed analysis with an experimental or quasi-experimental design would also be desirable. Although it is true that experiments are sometimes difficult to conduct in behavioral contexts, this type of implementation would allow one to best identify the causal patterns generating behavioral spillovers. We believe that this would constitute an interesting line for future research, as it would allow one to significantly contribute to some ongoing discourse on the design and implementation of pro-environmental public policies.

5. Conclusions

The existence of behavioral spillovers has long been acknowledged in the literature on environmental policy. There is extensive evidence that undertaking pro-environmental behaviors may cause indirect effects on other environmental actions. The magnitude of these indirect effects may not be deniable. Therefore, an accurate cost–benefit analysis of environmental policies should account for both the intended direct effects on the targeted behavior and the possible unintended indirect effect on other behaviors.

Within this framework, the objective of this paper is to explore the existence of behavioral consistency between pro-environmental attitudes and behaviors in related domains (cross-domain), by exploring certain averting behaviors that entail environmental negative externalities. We further introduce a distinction between two types of pro-environmental behaviors, namely efficiency and curtailment actions [47], that, as far as we are concerned, have not been explored before in the literature of behavioral/moral consistency and spillovers. In addition, an econometric strategy is proposed in order to deal with the substantial proportion of zero responses usually found in empirical studies on averting behaviors.

Using a dataset on bottled water consumption from two cities in southern Spain facing severe water scarcity, the results conclude that neither environmental concern nor efficiency-type behaviors (i.e., installation of certain resource-saving technologies) are predictors of reduced bottled water consumption. However, individuals that more consistently engage in curtailment-type behaviors (i.e., daily habits or sacrifices to preserve the environment) seem to show both a lower probability of shifting to bottled water and lower levels of bottled water consumption, with the magnitude of this effect being the most sizable of all the variables considered in our study. We also find that when households perceive tap water service interruptions as being more frequent, the probability of shifting to bottled water consumption increases. Furthermore, the perception that tap water is more expensive leads to higher levels of bottled water consumption. Finally, we realize that some of the distributional methodological assumptions previously imposed in the literature prove to be restrictive and are not always supported by the data.

Therefore, our results suggest the existence of behavioral cross-domain consistency of performing certain pro-environmental behaviors and the undertaking of other behaviors that entail environmental negative externalities. However, this effect is found in relation with curtailment behaviors, but are not existing when efficiency or one-shot behaviors are considered. Moreover, the results seem to indicate that public policies aimed at promoting pro-environmental habits could prove more successful than promoting pro-environmental attitudes in containing behaviors that entail environmental negative externalities. This may have significant implications in terms of environmental policy making, as policies aimed at promoting curtailment actions usually differ from those fostering efficiency behaviors. Likewise, policies addressed at raising environmental awareness are different from the ones promoting behavioral change. In addition, the results point out that accounting for the effects of environmental public policies in terms of their impact on other activities and behaviors is key for an accurate

assessment of the cost–benefit analysis of those policies. Finally, in order to prevent unintended effects, the importance of coordinating public policies is highlighted, even if they are targeted at seemingly unrelated domains.

An important conclusion related to the modeling of averting behaviors is that when a significant number of households do not undertake an averting behavior in question, special attention should be paid to the modeling strategy. Improper modeling of zero consumption may give rise to biased conclusions. This has further important implications for environmental valuation, given that exploring averting behaviors is a usual method to obtain the WTP (willingness to pay) for environmental goods [30,55,88]. Thus, the empirical strategy proposed in this paper is expected to avoid bias in the estimates of the effects of environmental public policies and environmental valuation methods based on averting behaviors.

Author Contributions: Conceptualization, M.S.-V. and A.D.; methodology, M.S.-V.; software, M.S.-V.; validation, M.S.-V. and A.D.; formal analysis, M.S.-V. and A.D.; investigation, M.S.-V. and A.D.; resources, M.S.-V. and A.D.; data curation, M.S.-V.; writing—original draft preparation, M.S.-V. and A.D., writing—M.S.-V. and A.D.; visualization, M.S.-V.; supervision, M.S.-V. and A.D. All authors have read and agreed to the published version of the manuscript.

Funding: Marta Suárez-Varela gratefully acknowledges the financial support of the Spanish Ministry of Economy and Competitiveness and the European Regional Development Fund (project ECO2016-75237-R). Ariel Dinar would like to acknowledge support from the NIFA Multistate Project W3190 “Management and Policy Challenges in a Water-Scarce World”.

Acknowledgments: This paper was completed while the first author was hosted as a visiting scholar at the University of California, Riverside, School of Public Policy. Marta Suárez-Varela gratefully acknowledges the financial support of the Spanish Ministry of Economy and Competitiveness and the European Regional Development Fund (project ECO2016-75237-R). She is also grateful to her advisors, Andrés Picazo-Tadeo and Juan Máñez-Castillejo, for their advice and support during the elaboration of the paper and beyond. Ariel Dinar would like to acknowledge support from the NIFA Multistate Project W3190 “Management and Policy Challenges in a Water-Scarce World”.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A : Set of Questions Used to Evaluate the Level of Environmental Concern

1. I am concerned about future generations when I think of the environmental situation we are going to leave them with.
2. If society continues to carry on a consumerist lifestyle, we are heading towards an environmental disaster.
3. When I watch or read the news about environmental problems, I feel shamed or raged.
4. The great majority of Spanish people do not act in an environmentally responsible manner.
5. The limits to economic growth in the industrialized world have already been reached or they will be reached soon.
6. In my opinion, environmental problems are being very overstated by the advocates of ecologist movements.
7. It is clear that now-a-days politicians are doing very little for the protection of the environment.
8. In order to protect the environment, we must all be willing to change our current lifestyles.
9. Some measures aimed at protecting the environment should be applied, although they could lead to job losses in the economy.

In order to build the index of environmental attitudes, the respondent was first asked whether he or she agrees with the statements included in this set, with answers ranging from 1 (strongly disagree) to 5 (strongly agree). Some of the values were recoded so that 5 always reflected the highest level of environmental concern. A mean of the values given by the respondent was then calculated and used as a proxy for their level of concern (Envconcernavg). As depicted in Figure A1, the distribution of this variable was right-skewed and, on average, households reported to have a high level of concern about environmental problems (3.94 out of 5). For this reason, in addition to the average, we decided to include a dummy, indicating whether the household’s level of environmental concern was above

average, that is, whether they were relatively more concerned than average about the environment (Envworried).

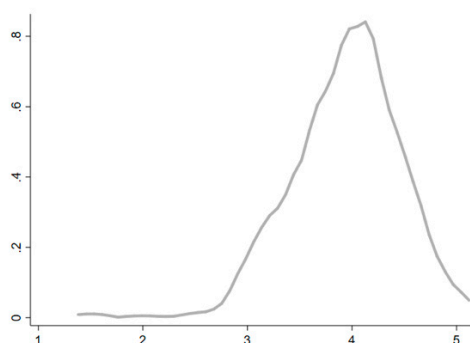


Figure A1. Distribution of the variable envconcernavg (average value in a set of questions on environmental attitudes). Source: Own elaboration.

Appendix B : Set of Questions Used as Instruments for the Index on Water-Saving Habits

1. Do you think that, in accordance with EU standards, your municipality should take steps towards a more efficient and sustainable use of water resources and, particularly, towards reducing network losses? [Yes/No]
2. Do you have a rough idea of the percentage of water network losses in your municipality? [Yes/No]
3. Would you be willing to pay an extra amount in your water bill to ensure more decisive action to improve the current state of the supply networks? [Yes/No]

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