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# Environmental Concerns and the Perceived Effectiveness of Fines and Incentives in Municipal Waste Management

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## ABSTRACT

Survey responses to environmental policy instruments may capture perceived behavioral effectiveness rather than abstract normative approval. This paper examines how environmental concern and information channels are associated with the selection of fines and incentives as measures that could encourage more frequent separate waste collection. Using repeated cross-sectional data from the Italian National Institute of Statistics (ISTAT) Aspects of Daily Life survey for 2017–2022, we distinguish between global/collective-oriented concern and local/proximate concern and between one-way media information and interpersonal information. The two outcomes are nonexclusive selections within a multiple-response survey battery. We estimate a bivariate probit model for the two binary outcomes and complement it with a multinomial specification that exploits the multiple-response structure of the survey item. The results show that both global/collective-oriented concern and local/proximate concern are positively associated with the endorsement of the two instruments, but global/collective-oriented concern is consistently the stronger correlate. These outcomes concern perceived effectiveness within the survey context and should not be interpreted as direct measures of political approval or policy legitimacy.

**JEL Classification:** H23, Q58, D64, D03

## 1 | Introduction

Designing effective environmental policies requires understanding not only economic incentives but also the behavioral and informational factors that shape how citizens evaluate and endorse alternative policy instruments (Kesternich et al. 2017). A growing literature shows that proenvironmental behavior is strongly influenced by social norms, moral orientations, and communication strategies (Berglund and Söderholm 2012; Chetty 2015). Other-regarding preferences, and altruistic motivations in particular, play an important role in sustaining collective action because individuals often act beyond narrow self-interest when environmental outcomes are perceived as socially shared and normatively relevant (Aprile and Fiorillo 2017; Aprile and Fiorillo 2023). These considerations are especially relevant in waste management, where compliance with sorting and recycling rules depends on both intrinsic motivations and the perceived fairness and legitimacy of policy instruments (Ferraro and Price 2013; Argentiero et al. 2025). In this context, local authorities increasingly rely on mixed policy designs that combine sanctions and rewards in order to promote cooperation and improve environmental performance (Argentiero et al. 2025; Boyle 2025).

This paper examines how environmental concern is associated with respondents' selection of fines and incentives as measures that could encourage more frequent household waste sorting. Throughout the paper, "endorsement" is used as shorthand for this survey-specific selection and does not denote referendum-style approval, policy legitimacy, or political acceptability in the

abstract. More specifically, we study whether different dimensions of environmental concern are related to the endorsement of punitive and incentive-based policy instruments in distinct ways. There is a large literature on the role of social preferences in cooperation and on the interaction between monetary incentives and intrinsic motivation (Fehr and Fischbacher 2002; Bowles and Polanía-Reyes 2012). Some contributions have also analyzed how altruistic or moral motivations may affect the design of environmental policy instruments, including Pigouvian taxation (Johansson 1997; Daube and Ulph 2016). Yet existing evidence offers limited insight into how environmental concern translates into endorsement of different regulatory tools. This is an important gap. From a conceptual perspective, broader environmental concern may increase endorsement of policy intervention by strengthening concern for collective welfare, fairness, and long-run environmental protection. Recent evidence also shows that citizens' attitudes toward climate-mitigation policies are heterogeneous and shaped by individual exposure to policy-relevant costs and risks, reinforcing the need to examine more carefully the correlates of endorsement across instruments and contexts (De Sario et al. 2023). At the same time, selection of fines and incentives need not coincide mechanically, because the two instruments embody different policy logics and may be perceived differently in their capacity to encourage compliance.

A second objective of the paper is to examine the role of information channels. The informational environment in which environmental policies are discussed has become increasingly fragmented. Traditional media, digital platforms, and interpersonal networks provide different narratives, frames, and normative cues that may shape environmental attitudes and policy legitimacy (Carvalho 2010; Junsheng et al. 2019; Caferra et al. 2025). Existing evidence suggests that media framing and source credibility can influence beliefs about the effectiveness of environmental measures, including sanctions and incentives (Godawska 2020; Rosenthal 2022). Mass media can affect salience and problem awareness (Sampei and Aoyagi-Usui 2009), whereas socially mediated communication may also transmit norms, trust, and practical validation through interpersonal interaction (Southwell and Yzer 2007; Liu et al. 2021). Understanding whether different information channels are associated with endorsement of fines and incentives is therefore relevant for the design of communication strategies that shape perceived effectiveness and compliance.

Using repeated cross-sectional data from the Italian National Institute of Statistics (ISTAT) survey Aspects of Daily Life for the period 2017–2022, we study the relationship between environmental concern, information channels, and endorsement of environmental policy instruments in waste management. The paper makes three contributions. First, it provides instrument-specific evidence by distinguishing explicitly between selection of fines and incentives rather than treating environmental policy endorsement as a unidimensional outcome. Second, it constructs two dimensions describing the scope and object of selected environmental concerns—global/collective-oriented concern and local/proximate concern—and examines whether they are differently associated with the two survey responses. Third, it distinguishes between one-way media information and interpersonal information and shows that these channels are not empirically equivalent in their association with endorsement of environmental policy. In addition, because the underlying survey item allows multiple responses, the analysis also examines the observable response patterns across fines and incentives, making it possible to distinguish exclusive from joint endorsement of the two instruments.

On the one hand, it clarifies that endorsement of environmental policy instruments is not a single latent attitude but may vary across policy instruments even within the same policy domain. On the other hand, it shows that both the structure of environmental concern and the nature of information exposure matter for understanding policy preferences. These associations are informative about perceived behavioral effectiveness in the survey context, but they are not direct measures of political support, legitimacy, or policy acceptability.

The remainder of the paper is structured as follows. Section 2 reviews the relevant literature. Section 3 presents the research hypotheses. Section 4 describes the data and empirical strategy. Section 5 discusses the results. Section 6 concludes and outlines the main policy implications.

## 2 | Literature Review

### 2.1 | Environmental Concern, Other-Regarding Motivations, and Evaluations of Sanctions and Rewards

The relationship between altruism and the enforcement of social norms through sanctions and rewards has been widely studied in behavioral economics, evolutionary psychology, and social neuroscience. Altruism—understood as a disposition to take into account the welfare of others even at a personal cost—extends beyond direct helping behavior to include actions that sustain cooperation within groups. A prominent mechanism in this literature is altruistic punishment, whereby individuals sanction norm violators even when doing so provides no direct material benefit (Fehr and Gächter 2002). This behavior reflects concern for collective welfare and fairness norms and is often interpreted as a key ingredient of stable cooperation. Recent evidence also suggests that altruistic dispositions are shaped by broader psychological and life-course factors, further supporting the view that prosocial orientations may have meaningful implications for policy attitudes and norm enforcement (Habyarimana and Kakkar 2025).

Experimental evidence from public-goods settings shows that individuals are often willing to incur costs in order to punish free riders and reward cooperative behavior (Fehr and Fischbacher 2004; Bowles and Gintis 2011). Such findings are consistent with strong reciprocity theory, according to which people are predisposed not only to cooperate but also to support mechanisms that sustain cooperation by sanctioning defection and rewarding compliance. More broadly, these studies suggest that support for sanctions and rewards may reflect moral and normative dispositions, not only narrow material self-interest.

Neuroeconomic evidence points in a similar direction. Research shows that altruistic punishment activates reward-related brain regions, suggesting that norm enforcement may itself generate

intrinsic satisfaction (De Quervain et al. 2004; Buckholtz and Marois 2012). This implies that support for punitive and reward-based instruments may be rooted in other-regarding preferences and moral evaluations rather than being reducible to instrumental cost–benefit calculations (Gintis 2000; Camerer and Fehr 2006). Field evidence also shows that norm enforcement is not confined to laboratory settings, although its intensity varies across institutional and cultural contexts (Berger and Hevenstone 2016; Balafoutas and Nikiforakis 2012).

This literature is directly relevant to environmental policy. Several studies suggest that individuals with stronger prosocial orientations are more likely to endorse policy arrangements that reinforce collective welfare, including sanctions against violators and rewards for cooperative behavior (Alló and Loureiro 2014; Kube et al. 2012). At the same time, selection of fines and incentives should not be assumed to coincide automatically. Fines may be viewed as fairness-restoring instruments aimed at disciplining noncompliance, whereas incentives may be viewed as mechanisms that recognize and encourage desirable behavior (Falk et al. 2005; Nikiforakis 2008). The perceived legitimacy of each instrument therefore depends not only on general prosocial orientation but also on how different forms of environmental concern are translated into views about appropriate policy intervention.

This distinction matters in the environmental domain. A broad strand of research shows that environmental concern is not unidimensional but includes orientations that differ in object, scale, and motivational structure (Stern 2000; Schultz 2001; Corner et al. 2014). Concern for collective and long-run environmental threats may have different policy implications from concern centered on local environmental risks and personally proximate exposure. Yet the empirical literature has rarely examined whether different dimensions of environmental concern are associated differently with endorsement of sanctions and rewards. In the empirical analysis, the first index groups concerns whose objects are global or collective in scale, whereas the second groups concerns tied more closely to local or personally proximate conditions. In the remainder of the paper, "endorsement" refers only to respondents' selection of measures that could encourage their own household to sort waste more frequently, not to abstract normative approval of those measures.

## 2.2 | Information Channels and Endorsement of Policy Instruments

A second relevant body of literature concerns the role of information and communication channels in shaping policy attitudes. Research in political communication, behavioral public finance, and environmental communication shows that attitudes toward policy instruments are influenced not only by preferences and values but also by the informational environments in which those instruments are framed and discussed. Traditional media, digital platforms, and interpersonal networks may each transmit distinct cues about fairness, effectiveness, legitimacy, and compliance. For the purposes of this paper, the key point is that different channels may shape endorsement of environmental policy instruments through different mechanisms, even when they concern the same policy domain.

Traditional media have historically played a central role in shaping public awareness and normative evaluations of policy issues. Studies in the tax-compliance literature show that mass media campaigns can affect voluntary compliance, tax morale, and perceptions of fairness (Cyan et al. 2017; Hamed 2020). At the same time, negative media portrayals of scandals, inequities, or institutional failure can reduce trust and weaken compliance intentions (Saruç et al. 2021). These findings suggest that one-way information channels may influence policy attitudes by affecting salience, framing, and institutional credibility.

Digital media add a further layer of complexity. Online platforms allow more rapid circulation of information, interactive exposure, and targeted communication. Research shows that digital environments can correct misperceptions and strengthen endorsement of certain policy goals, but they can also amplify sensationalist or polarizing narratives that erode trust (Kalleitner and Bobzien 2024; Fišar et al. 2022). More generally, digital platforms reshape how people encounter policy-relevant information, often blending formal information, opinion, and emotional framing in ways that complicate the relationship between exposure and policy attitudes.

Interpersonal communication constitutes a distinct informational channel. Conversations with family members, friends, colleagues, and acquaintances may transmit not only information but also social validation, practical knowledge, and normative expectations (Frey and Feld 2003; Alm 2019; Owusu et al. 2023). Compared with impersonal media exposure, interpersonal communication may be more closely tied to trust, relational proximity, and perceived credibility. The communication literature has long emphasized that interpersonal discussion can reinforce or reshape the effects of mass communication by embedding policy messages within social relationships and everyday interaction (Katz and Lazarsfeld 1955; Southwell and Yzer 2007).

These distinctions are especially relevant for environmental policy. Media framing and source credibility can influence beliefs about environmental problems and endorsement of environmental action (Carvalho 2010; Rosenthal 2022). At the same time, interpersonal networks may reinforce social norms and practical attitudes toward environmentally relevant behavior, including recycling and waste sorting (Sujata et al. 2019; Liu et al. 2021). What remains less clear is whether different information channels are associated with endorsement of different kinds of policy instruments. In particular, there is limited evidence on whether one-way media exposure and interpersonal communication are differently related to endorsement of punitive and incentive-based measures. This paper addresses that issue by distinguishing explicitly between one-way media information and interpersonal information in the empirical analysis.

## 2.3 | Fines and Incentives in Environmental Policy Design

The literature on environmental policy design has long debated the relative role of punitive instruments and positive incentives in promoting compliance. Economic and behavioral research emphasizes that fines and incentives embody different mechanisms of behavioral change and may therefore elicit different

forms of policy acceptance. Fines rely on deterrence and sanctioning, whereas incentives work by rewarding desirable behavior and reducing the private cost of compliance. The relative acceptability of these instruments may depend on how citizens evaluate fairness, responsibility, and the legitimacy of state intervention.

A classic insight in this literature is that sanctions may backfire when they are perceived as converting moral obligations into priced transactions. Gneezy and Rustichini's (2000) argument that "a fine is a price" captures precisely this concern. Similarly, Frey and Oberholzer-Gee (1997) show that poorly designed economic instruments may crowd out intrinsic motivation when they are perceived as controlling or illegitimate. These studies suggest that endorsement of policy instruments depends not only on instrumental effectiveness but also on the normative meaning attached to the instrument.

At the same time, a substantial literature shows that incentives can be effective when they are transparent, credible, and embedded in broader policy designs that activate responsibility and social norms. Pay-As-You-Throw schemes, for example, link waste charges to household behavior and can reduce waste generation while reinforcing individual accountability (Bucciol et al. 2015; Homonoff 2018). More generally, integrated policy approaches that combine material incentives with normative framing can improve both perceived fairness and long-run behavioral change (Goldstein et al. 2008; Alló and Loureiro 2014).

Economic theory also underscores the efficiency properties of incentive-based instruments relative to some forms of command-and-control regulation (Stavins 2017; Hanley et al. 2019). Yet contextual features such as enforcement credibility, administrative capacity, and institutional trust shape the relative effectiveness of fines and incentives in practice (Harrington and Morgenstern 2007). In recent years, this debate has been complemented by work on nudges and behaviorally informed interventions, which highlights the importance of policy design, communication, and contextual framing in sustaining compliance (Thaler and Sunstein 2008; El Benni et al. 2025; Lemken et al. 2024).

Despite these advances, two gaps remain particularly relevant for the present paper. First, the literature rarely studies how different dimensions of environmental concern relate to endorsement of fines and incentives. Although much is known about how incentives affect behavior and intrinsic motivation, less is known about how pre-existing environmental concern shapes endorsement of alternative policy tools. Second, the role of information channels in structuring endorsement of environmental sanctions and rewards remains underexplored. Existing work suggests that media coverage and social discourse can amplify or weaken policy legitimacy depending on tone, credibility, and framing (Dermont 2019; Vössing and Weber 2019; Bailey et al. 2022; Wang et al. 2020), but there is limited evidence on how these channels map into endorsement of specific environmental instruments. Recent evidence also shows that citizens' attitudes toward climate-mitigation policies vary systematically with occupational exposure, reinforcing the broader point that policy endorsement is heterogeneous across individuals and contexts (De Sario et al. 2023).

Taken together, the literature suggests that endorsement of environmental policy instruments should not be understood as a single, undifferentiated attitude. It is likely to depend on both the motivational structure of environmental concern and the informational environment in which policy instruments are evaluated. These considerations motivate the empirical analysis that follows, which distinguishes between selection of fines and incentives, separates global/collective-oriented concern from local/proximate concern, and examines whether one-way media and interpersonal information are differently associated with endorsement of environmental policy intervention.

## 3 | Research Hypotheses

This study examines how environmental concern and information channels are associated with the endorsement of environmental policy instruments, specifically fines, and incentives in municipal waste management. The dependent variables capture a survey-specific assessment of potentially behavior-changing measures rather than abstract normative approval. The first hypothesis builds on the literature on altruism, norm enforcement, and environmental concern. Behavioral economics and social-preference theory suggest that individuals with stronger other-regarding orientations are more likely to support institutional arrangements that sustain cooperation and protect collective welfare (Fehr and Gächter 2002; Bowles and Gintis 2011). At the same time, the broader literature on environmental attitudes indicates that environmental concern is not unidimensional and may reflect distinct motivational structures (Stern 2000; Schultz 2001). Concern for wider environmental threats may therefore be associated differently with endorsement outcomes than concern centered on local and personally proximate environmental risks. Accordingly, our first hypothesis is as follows:

**Hypothesis 1.** *Individuals with stronger environmental concern are more likely to select fines and incentives as measures that could encourage household waste sorting, and this association is expected to be stronger for global/collective-oriented concern than for local/proximate concern.*

The second hypothesis concerns information channels. Research on media influence and communication suggests that policy attitudes are shaped not only by underlying values but also by the informational contexts in which policies are framed and discussed. One-way media channels may affect salience, problem framing, and perceptions of institutional effectiveness, whereas interpersonal communication may transmit norms, trust, and socially validated interpretations of policy tools (Frey and Feld 2003; Southwell and Yzer 2007; Rosenthal 2022). These considerations imply that different information channels need not be empirically equivalent in their association with endorsement of environmental policy instruments.

This leads to the second hypothesis:

**Hypothesis 2.** *One-way media information and interpersonal information display distinct associations with the selection*

*of fines and incentives as measures that could encourage household waste sorting.*

A final issue concerns the structure of endorsement itself. Selection of fines and incentives need not be treated as mutually exclusive attitudes. In the context of waste management, individuals may endorse one instrument, the other, both, or neither. This suggests that the relevant empirical question is not only whether environmental concern and information channels increase endorsement in general but also whether they are associated with exclusive endorsement of a single instrument or with broader endorsement of policy intervention. If stronger environmental concern is associated with a broader perception that policy measures could encourage household behavior, it should be associated more strongly with joint selection of both instruments than with one-sided selection alone.

This consideration motivates the third hypothesis:

**Hypothesis 3.** *Stronger environmental concern is more strongly associated with joint selection of fines and incentives than with exclusive selection of only one of the two measures.*

Taken together, these hypotheses frame the paper's empirical contribution in three respects. First, they allow us to examine whether different dimensions of environmental concern are differently associated with endorsement outcomes. Second, they make it possible to assess whether information channels are heterogeneous rather than interchangeable. Third, they recognize that endorsement of environmental policy instruments may take the form of joint rather than exclusive selection within a multiple-response survey item. We test these hypotheses using large-scale survey data from Italy and econometric models that account for both the joint determination of endorsement outcomes and the multiple-response structure of the underlying survey item.

These hypotheses concern responses within the survey's multiple-response household-behavior question and do not imply general political approval or policy legitimacy.

## 4 | Data and Empirical Strategy

### 4.1 | Data and Survey Question

The empirical analysis uses repeated cross-sectional data from the Italian National Institute of Statistics (ISTAT) survey Aspects of Daily Life for the period 2017–2022. The survey provides nationally representative information on household characteristics, environmental attitudes, service satisfaction, and everyday behaviors. Its broad coverage makes it well suited to studying individual endorsement of environmental policy instruments in the context of municipal waste management.

The AVQ survey uses a multistage sampling design in which municipalities and households are sampled, and all members of selected households are interviewed. The public-use files contain the survey coefficient COEFIN, from which, following ISTAT guidelines, we construct the weight used in the robustness analysis as COEFIN/10,000, and the anonymized household identifier PROFAM. They do not contain the official stratum and primary-sampling-unit identifiers needed to reconstruct the complete ISTAT sampling design. We therefore retain the unweighted specifications as the main benchmark and report weighted estimates as a robustness check. In these models, standard errors are clustered at the household-year level, defined by the interaction of survey year and PROFAM, to account for within-household dependence. This procedure uses the survey-design information available in the public-use files but does not reconstruct the complete ISTAT sampling design.

The analysis focuses on the survey item asking what could encourage the household to start or to engage more frequently in separate waste collection. The wording of the question is important because respondents may select more than one option. Among the available responses, this paper focuses on two policy instruments: fines and tax or tariff incentives. We define an indicator for fines equal to one when the respondent selects the option referring to fines and zero otherwise. We define an indicator for incentives equal to one when the respondent selects the option referring to tax or tariff incentives and zero otherwise.

These outcomes capture whether respondents select fines or incentives as measures that could encourage more frequent separate waste collection within the survey's multiple-response battery. They should therefore be interpreted as endorsement outcomes within that survey context rather than as referendum-style approval of the two instruments in the abstract.

Because the survey item allows multiple responses, the two outcomes are interpreted as nonmutually exclusive endorsement measures rather than as exclusive alternatives. This feature of the survey design is central to the empirical strategy adopted below. In the estimation sample, 11.9% of respondents select neither fines nor incentives, 2.3% select fines only, 23.4% select incentives only, and 62.4% select both instruments. The prevalence of joint endorsement suggests that the two policy instruments are often viewed as complementary rather than competing options within the response battery.

Table 1 reports descriptive statistics for the estimation sample used in the baseline model. In that sample, fines are selected by 64.7% of respondents and incentives by 85.7%. The table also reports the distribution of the four observable response patterns, the main explanatory variables, and the control variables used in the empirical specifications.

### 4.2 | Dependent Variables and Response Patterns

The empirical analysis uses two related sets of dependent variables. The first set consists of the two binary measures defined above: selection of fines and selection of incentives. These variables are used in the baseline bivariate probit model to examine how environmental concern and information channels are associated with endorsement of each policy instrument while allowing for correlated unobservables across the two equations.

The second set of outcomes exploits the multiple-response structure of the survey item more explicitly. Specifically, we

**TABLE 1** | Descriptive statistics for the baseline estimation sample.

| Set | Variable | *N* | Mean | SD | Min | Max |
|---|---|---|---|---|---|---|
| *Y* | Fines selected = 1 | 127,048 | 0.647 | 0.478 | 0 | 1 |
| *Y* | Incentives selected = 1 | 127,048 | 0.857 | 0.350 | 0 | 1 |
| *Y* | Neither fines nor incentives selected = 1 | 127,048 | 0.119 | 0.324 | 0 | 1 |
| *Y* | Fines only selected = 1 | 127,048 | 0.023 | 0.151 | 0 | 1 |
| *Y* | Incentives only selected = 1 | 127,048 | 0.234 | 0.423 | 0 | 1 |
| *Y* | Both fines and incentives selected = 1 | 127,048 | 0.624 | 0.484 | 0 | 1 |
| *E* | Global/collective-oriented concern (global environmental threats, 0–1) | 127,048 | 0.564 | 0.233 | 0 | 1 |
| *E* | Local/proximate concern (local pollution, 0–1) | 127,048 | 0.300 | 0.196 | 0 | 1 |
| *I* | One-way media information (0–1) | 127,048 | 0.351 | 0.193 | 0 | 1 |
| *I* | Interpersonal information (0–1) | 127,048 | 0.110 | 0.153 | 0 | 1 |
| *X* | Gas-service satisfaction (1 = *not satisfied*, 4 = *very satisfied*) | 127,048 | 3.121 | 0.569 | 1 | 4 |
| *X* | Electric-service satisfaction (1 = *not satisfied*, 4 = *very satisfied*) | 127,048 | 2.974 | 0.604 | 1 | 4 |
| *X* | Local environmental-quality satisfaction (1 = *not satisfied*, 4 = *very satisfied*) | 127,048 | 2.788 | 0.714 | 1 | 4 |
| *X* | Perceived municipal waste fees (1 = *low*, 3 = *high*) | 127,048 | 2.668 | 0.485 | 1 | 3 |
| *X* | Age (15 classes: 0–2 to 75+) | 127,048 | 11.536 | 2.387 | 5 | 15 |
| *X* | Female | 127,048 | 0.491 | 0.500 | 0 | 1 |
| *X* | Number of household members | 127,048 | 2.773 | 1.206 | 1 | 9 |
| *X* | Children in household | 127,048 | 0.572 | 0.495 | 0 | 1 |
| *X* | Single | 127,048 | 0.305 | 0.461 | 0 | 1 |
| *X* | Divorced | 127,048 | 0.089 | 0.285 | 0 | 1 |
| *X* | Widowed | 127,048 | 0.081 | 0.273 | 0 | 1 |
| *X* | Education (1 = *primary*, 4 = *graduate/postgraduate*) | 127,048 | 2.708 | 0.921 | 1 | 4 |
| *X* | Sport practice = 1 | 127,048 | 0.261 | 0.439 | 0 | 1 |
| *X* | Professional status (1 = *inactive*, 3 = *employed*) | 127,048 | 2.023 | 0.960 | 1 | 3 |
| *X* | Economic satisfaction, last 12 months (1 = *not satisfied*, 4 = *very satisfied*) | 127,048 | 2.579 | 0.722 | 1 | 4 |

*Note:* Statistics are computed on the exact baseline bivariate-probit estimation sample for 2017–2022. Fines and incentives denote selection of the corresponding survey options. The environmental-concern battery permits at most five selections; each concern index equals the number of selected items in its group divided by five. For binary variables, the mean is the sample proportion and the standard deviation equals $\sqrt{[p(1-p)]}$.

distinguish between four observable response patterns: endorses neither fines nor incentives, endorses fines only, endorses incentives only, and endorses both fines and incentives. This four-category outcome makes it possible to study whether the key regressors are associated with exclusive endorsement of one instrument or with broader joint endorsement of both. In the Supporting Information appendix, we also consider a supplementary classification that distinguishes between endorsement of policy instruments and endorsement of nonpolicy measures.

This distinction between binary endorsement measures and response-pattern outcomes serves two purposes. First, it preserves comparability with a standard binary-response framework. Second, it makes the interpretation of the survey item more transparent by explicitly incorporating the fact that respondents may endorse more than one facilitator at the same time.

The relevant contrast in the data is therefore not a forced choice between fines and incentives. Rather, respondents may endorse neither, one, or both instruments and may also rely on alternative nonpolicy facilitators included elsewhere in the survey battery. The empirical objective is thus to study patterns of endorsement within a multiple-response choice environment, not preferences over mutually exclusive policy options.

The four-category outcome is defined only when both focal survey responses are observed. Observations with a missing response to either the fines or incentives row are left missing and are never assigned to the "neither" category. For direct comparability, the response-pattern multinomial logit is estimated on the exact baseline bivariate-probit sample of 127,048 observations.

### 4.3 | Environmental Concern Measures

The main explanatory variables are two indices of environmental concern: global/collective-oriented concern and local/proximate concern. Both indices are constructed from the battery of environmental-problem items available in the ISTAT survey and are normalized to range from 0 to 1. The original survey item reads: "Quali dei seguenti problemi ambientali la preoccupano maggiormente? (massimo 5 risposte)" ("Which of the following environmental problems concern you most? [maximum five responses]"). Each index equals the number of selected items in the corresponding group divided by five. None of the 232,429 respondents with a nonmissing concern battery, and none of the 127,048 observations in the baseline estimation sample, exceed the five-response limit. Excluding above-limit observations therefore leaves the estimation sample and all baseline estimates unchanged. The distinction is motivated by the idea that some environmental issues are perceived primarily in terms of broader collective and long-run threats, whereas others are more closely linked to direct local exposure and immediate individual well-being.

The global/collective-oriented index aggregates concern for global or collective-scale environmental threats, whereas the local/proximate index aggregates concern for local pollution and personally proximate environmental risks. In the baseline specification, the two indices enter the model separately. This allows the empirical analysis to assess their distinct associations with endorsement outcomes rather than imposing a single relative measure. In the estimation sample, the mean of global/collective-oriented concern is 0.564, and the mean of local/proximate concern is 0.300.

To assess the robustness of the results, Appendix S1 reports two additional exercises. First, the concern indices are reconstructed using an alternative classification of the underlying items and, separately, after excluding the most ambiguous items. Second, environmental concern is parameterized using the mean of global/collective-oriented and local/proximate concern together with their difference. These supplementary analyses are intended to verify that the main results do not depend on a single coding decision.

### 4.4 | Information-Source Measures

To capture how respondents acquire environmental information, we distinguish between one-way media information and interpersonal information. The first index includes information sources characterized by predominantly unidirectional communication, such as television, radio, newspapers, magazines, and web-based channels. The second index includes sources embedded in social interaction, such as friends, relatives, colleagues, and other interpersonal contacts. Both measures are normalized to range from 0 to 1.

This distinction reflects the idea that mass-mediated and socially mediated information environments may shape policy attitudes through different mechanisms. One-way media may primarily affect salience and framing, whereas interpersonal communication may also transmit social norms, trust, and relational reinforcement. In the estimation sample, the mean of one-way media information is 0.351, whereas the mean of interpersonal information is 0.110.

As an additional robustness check, Appendix S1 further disaggregates information channels into three blocks—traditional media, digital/web information, and interpersonal information—to verify whether the baseline two-channel distinction masks important heterogeneity across source types.

### 4.5 | Empirical Strategy

The baseline empirical specification is a bivariate probit model for endorsement of fines and incentives. Let $F_i$ denote selection of fines and $I_i$ denote selection of incentives. The two binary outcomes are modeled as latent-variable processes:

$$F_i = 1\left[F_i^* > 0\right], I_i = 1\left[I_i^* > 0\right].$$

The latent equations are specified as follows:

$$F_i^* = \alpha_1 + \beta_{1G} G_i + \beta_{1L} L_i + \beta_{1W} W_i + \beta_{1P} P_i + X_i' \gamma_1 + \mu_r + \tau_t + \varepsilon_{1i},$$

$$I_i^* = \alpha_2 + \beta_{2G} G_i + \beta_{2L} L_i + \beta_{2W} W_i + \beta_{2P} P_i + X_i' \gamma_2 + \mu_r + \tau_t + \varepsilon_{2i},$$

where $G_i$ is global/collective-oriented concern, $L_i$ is local/proximate concern, $W_i$ is one-way media information, $P_i$ is interpersonal information, $X_i$ is a vector of controls, and $\mu_r$ and $\tau_t$ denote region and year fixed effects, respectively. The control vector includes age, gender, household size, children in the household, marital-status indicators, education, sport practice, professional status, economic satisfaction, satisfaction with local environmental quality, satisfaction with gas and electric services, and perceived municipal waste fees.

The error terms are allowed to be correlated across equations. This is appropriate because selection of fines and incentives is empirically related and may share unobserved determinants. The corresponding system statistics are reported with the baseline estimates in Table 2.

To exploit the multiple-response structure of the survey item more fully, the baseline bivariate probit is complemented by a multinomial logit model defined over the four response patterns discussed above: neither, fines only, incentives only, and both. This specification allows the analysis to distinguish whether the key regressors are associated with exclusive endorsement of a single instrument or with broader joint selection of both instruments.

Because the multinomial logit relies on the independence-of-irrelevant-alternatives assumption, we also derive marginal effects at means for the four joint outcome probabilities directly from the baseline bivariate probit. This provides a response-pattern comparison that does not impose the multinomial IIA restriction.

Appendix S1 reports additional extensions and robustness checks, including alternative classifications of environmental concern, an alternative parameterization of concern, interaction models, a policy-versus-nonpolicy response-pattern specification, a detailed

**TABLE 2** | Baseline bivariate probit estimates for fines and incentives.

| Variable | (1) Fines | (2) Incentives |
|---|---|---|
| Global/collective-oriented concern (global environmental threats, 0–1) | 0.3721*** | 0.3883*** |
| | [0.0176] | [0.0205] |
| Local/proximate concern (local pollution, 0–1) | 0.2770*** | 0.3102*** |
| | [0.0206] | [0.0239] |
| One-way media information (0–1) | −0.0306 | 0.0812*** |
| | [0.0210] | [0.0255] |
| Interpersonal information (0–1) | 0.0617** | 0.0628** |
| | [0.0250] | [0.0311] |
| Gas-service satisfaction (1 = *not satisfied*, 4 = *very satisfied*) | −0.0006 | −0.0186** |
| | [0.0076] | [0.0094] |
| Electric-service satisfaction (1 = *not satisfied*, 4 = *very satisfied*) | 0.0103 | −0.0638*** |
| | [0.0072] | [0.0091] |
| Local environmental-quality satisfaction (1 = *not satisfied*, 4 = *very satisfied*) | −0.0406*** | −0.0180*** |
| | [0.0054] | [0.0066] |
| Perceived municipal waste fees (1 = *low*, 3 = *high*) | 0.0099 | 0.2522*** |
| | [0.0078] | [0.0090] |
| Age (15 classes: 0–2 to 75+) | 0.0089*** | −0.0153*** |
| | [0.0025] | [0.0030] |
| Female | −0.0152** | −0.0003 |
| | [0.0076] | [0.0091] |
| Number of household members | −0.0062 | −0.0050 |
| | [0.0048] | [0.0058] |
| Children in household | 0.0051 | 0.0280** |
| | [0.0113] | [0.0135] |
| Single | 0.0037 | −0.0622*** |
| | [0.0111] | [0.0133] |
| Divorced | 0.0041 | −0.0507*** |
| | [0.0140] | [0.0166] |
| Widowed | −0.0747*** | −0.0224 |
| | [0.0154] | [0.0180] |
| Education (1 = *primary*, 4 = *graduate/postgraduate*) | −0.0478*** | −0.0019 |
| | [0.0048] | [0.0057] |
| Sport practice = 1 | 0.0077 | −0.0111 |
| | [0.0088] | [0.0106] |
| Professional status (1 = *inactive*, 3 = *employed*) | −0.0160*** | 0.0068 |
| | [0.0045] | [0.0055] |
| Economic satisfaction, last 12 months (1 = *not satisfied*, 4 = *very satisfied*) | 0.0216*** | −0.0051 |
| | [0.0053] | [0.0064] |
| Constant | 0.1536*** | 0.6020*** |
| | [0.0591] | [0.0714] |
| Year fixed effects | Yes | Yes |
| Region fixed effects | Yes | Yes |
| Observations | 127,048 | 127,048 |
| Log-likelihood | −120,722 | −120,722 |
| Cross-equation error correlation | 0.712 | 0.712 |
| Wald test of independent equations | 15,558 | 15,558 |
| *p* value | 0.000 | 0.000 |

*Note:* Robust standard errors are reported in brackets. All specifications include year and region fixed effects. The cross-equation correlation, Wald test, and log-likelihood refer to the bivariate system as a whole. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

summary of sample construction and missing-data rules, and a three-block information-source specification, scale-comparable effects, and an alternative breadth-and-composition parameterization of environmental concern. These supplementary exercises are used to assess the stability and interpretability of the baseline results. Appendix S1 documents the reduction from the pooled 2017–2022 file to the complete-case baseline sample, reports missingness for every variable used in the baseline model, compares included and excluded observations, and presents reduced-control specifications estimated on larger samples.

## 5 | Results

### 5.1 | Baseline Evidence: Endorsement of Fines and Incentives

Consistent with the survey design, these estimates should be interpreted as associations with the selection of fines and incentives as encouraging measures within the response battery, rather than as associations with abstract policy approval detached from that context.

Table 2 reports the baseline bivariate probit estimates for the two endorsement outcomes. The model includes the two environmental-concern measures, the two information-channel measures, the full set of controls, and year and region fixed effects.

The estimated cross-equation error correlation is positive (0.712), and the null hypothesis of independent equations is strongly rejected, confirming that the two endorsement outcomes are jointly determined and should not be modeled as unrelated binary responses.

The baseline estimates yield three main results. First, both global/collective-oriented concern and local/proximate concern are positively and significantly associated with selection of fines and incentives. However, the estimated coefficient on global/collective-oriented concern is larger than that on local/proximate concern in both equations. In the fines' equation, the coefficients are 0.372 and 0.277, respectively; in the incentives' equation, they are 0.388 and 0.310. This pattern suggests that both dimensions of environmental concern matter but broader concern for global environmental threats is more strongly related to the selection of the two potentially behavior-changing measures than concern for local pollution alone.

Second, the two information channels are not empirically equivalent. One-way media information is not significantly related to selection of fines, but it is positively and significantly associated with selection of incentives. By contrast, interpersonal information is positively associated with endorsement of both policy instruments. This indicates that information channels operate heterogeneously across outcomes and that socially mediated information is associated with a broader pattern of instrument selection than the aggregated one-way media measure.

Third, the control variables reveal a number of systematic patterns, although they are not the central focus of the paper. Selection of incentives is higher when respondents perceive municipal waste fees as high and lower among older respondents. Selection of fines is also positively associated with age, whereas local environmental-quality satisfaction is negatively associated with selection of both instruments. These controls are included primarily to isolate the associations of concern and information from observable sociodemographic and contextual heterogeneity.

Formal Wald tests confirm that the coefficient on global/collective-oriented concern is significantly larger than that on local/proximate concern in both the fines and incentives equations and that the two concern variables are jointly significant in each equation (Table S3).

Because coefficient magnitudes in nonlinear models are not directly interpretable as probability effects, Table 3 reports the corresponding marginal effects at means for the key regressors.

The marginal effects confirm the substantive importance of the concern variables. A one-unit increase in global/collective-oriented concern is associated with a 13.8 percentage-point increase in the probability of selecting fines and an 8.4 percentage-point increase in the probability of selecting incentives. The corresponding effects of local/proximate concern are positive but smaller: 10.3 percentage points for fines and 6.7 percentage points for incentives. These results reinforce the conclusion that environmental concern is multidimensional and that global/collective-oriented concern is the stronger correlate of endorsement of both policy instruments.

**TABLE 3** | Marginal effects at means from the baseline bivariate probit.

| Variable | (1) Fines | (2) Incentives |
|---|---|---|
| Global/collective-oriented concern (global environmental threats, 0–1) | 0.1376*** | 0.0844*** |
| | [0.0065] | [0.0044] |
| Local/proximate concern (local pollution, 0–1) | 0.1025*** | 0.0674*** |
| | [0.0076] | [0.0052] |
| One-way media information (0–1) | −0.0113 | 0.0177*** |
| | [0.0078] | [0.0055] |
| Interpersonal information (0–1) | 0.0228** | 0.0137** |
| | [0.0093] | [0.0068] |
| Observations | 127,048 | 127,048 |

*Note:* Marginal effects are evaluated at covariate means. Standard errors are reported in brackets. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

The marginal effects also clarify the role of information channels. One-way media information has no statistically significant effect on selection of fines, but it increases the probability of selecting incentives by 1.8 percentage points. Interpersonal information increases the probability of selecting fines by 2.3 percentage points and the probability of selecting incentives by 1.4 percentage points. Taken together, the baseline results indicate that concern and information should not be collapsed into single relative measures: both concern dimensions matter, and the two information channels display distinct empirical associations with endorsement outcomes.

## 5.2 | Response Patterns in the Multiple-Response Survey Item

The baseline bivariate probit establishes how the main regressors relate to endorsement of each policy instrument separately. However, because the underlying survey item allows multiple responses, it is also important to examine how the same regressors relate to the full structure of observed response patterns. Table 4 reports multinomial logit estimates for the four-category outcome that distinguishes between respondents who endorse neither fines nor incentives, fines only, incentives only, and both instruments. The base outcome is endorsement of neither fines nor incentives.

The multinomial estimates show that global/collective-oriented concern and local/proximate concern are positively associated with all three nonreference categories, but their strongest association is with the category capturing joint endorsement of both fines and incentives. The coefficient on global/collective-oriented concern is 0.918 for the "both" category, compared with 0.480 for "fines only" and 0.469 for "incentives only." Local/proximate concern displays the same ranking, although with smaller magnitudes. This result indicates that stronger environmental concern is associated less with exclusive selection of a single measure and more with joint selection of both measures.

**TABLE 4** | Multinomial logit estimates of response patterns across fines and incentives.

| Variable | (1) Fines only | (2) Incentives only | (3) Both |
|---|---|---|---|
| Global/collective-oriented concern (global environmental threats, 0–1) | 0.4796*** | 0.4693*** | 0.9179*** |
| | [0.0938] | [0.0466] | [0.0414] |
| Local/proximate concern (local pollution, 0–1) | 0.3351*** | 0.3878*** | 0.7058*** |
| | [0.1062] | [0.0552] | [0.0487] |
| One-way media information (0–1) | 0.1114 | 0.2887*** | 0.1476*** |
| | [0.1144] | [0.0595] | [0.0536] |
| Interpersonal information (0–1) | 0.5194*** | 0.2446*** | 0.2574*** |
| | [0.1410] | [0.0726] | [0.0657] |
| Gas-service satisfaction (1 = *not satisfied*, 4 = *very satisfied*) | 0.0230 | −0.0414* | −0.0307 |
| | [0.0435] | [0.0216] | [0.0195] |
| Electric-service satisfaction (1 = *not satisfied*, 4 = *very satisfied*) | −0.0610 | −0.2026*** | −0.1232*** |
| | [0.0435] | [0.0206] | [0.0188] |
| Local environmental-quality satisfaction (1 = *not satisfied*, 4 = *very satisfied*) | −0.1692*** | −0.0315** | −0.0851*** |
| | [0.0292] | [0.0155] | [0.0140] |
| Perceived municipal waste fees (1 = *low*, 3 = *high*) | −0.0685* | 0.6013*** | 0.4142*** |
| | [0.0397] | [0.0209] | [0.0181] |
| Age (15 classes: 0–2 to 75+) | −0.0161 | −0.0619*** | −0.0259*** |
| | [0.0143] | [0.0071] | [0.0063] |
| Female | −0.0483 | 0.0087 | −0.0172 |
| | [0.0416] | [0.0212] | [0.0189] |
| Number of household members | −0.0096 | −0.0069 | −0.0156 |
| | [0.0264] | [0.0135] | [0.0121] |
| Children in household | −0.0753 | 0.0365 | 0.0372 |
| | [0.0617] | [0.0313] | [0.0278] |
| Single | −0.0323 | −0.1759*** | −0.1136*** |
| | [0.0623] | [0.0308] | [0.0274] |
| Divorced | 0.1461** | −0.0835** | −0.0581* |
| | [0.0739] | [0.0386] | [0.0343] |
| Widowed | 0.0525 | 0.1023** | −0.0615* |
| | [0.0810] | [0.0415] | [0.0364] |
| Education (1 = *primary*, 4 = *graduate/postgraduate*) | 0.0365 | 0.0978*** | −0.0170 |
| | [0.0260] | [0.0135] | [0.0119] |
| Sport practice = 1 | 0.0033 | −0.0399 | −0.0140 |
| | [0.0484] | [0.0245] | [0.0220] |
| Professional status (1 = *inactive*, 3 = *employed*) | −0.0394 | 0.0331*** | −0.0034 |
| | [0.0252] | [0.0126] | [0.0113] |

(Continues)

**TABLE 4** | (Continued)

| Variable | (1) Fines only | (2) Incentives only | (3) Both |
|---|---|---|---|
| Economic satisfaction, last 12 months (1 = *not satisfied*, 4 = *very satisfied*) | 0.0506* | −0.0391*** | 0.0076 |
| | [0.0300] | [0.0150] | [0.0134] |
| Constant | −0.9207*** | 0.1782 | 1.0088*** |
| | [0.3283] | [0.1657] | [0.1483] |
| Year fixed effects | Yes | Yes | Yes |
| Region fixed effects | Yes | Yes | Yes |
| Observations | 127,048 | 127,048 | 127,048 |

*Note:* The base outcome is neither fines nor incentives. Fines and incentives denote selection of the corresponding survey options. Robust standard errors are reported in brackets. All specifications include year and region fixed effects. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

**TABLE 5** | Marginal effects at means from the response-pattern multinomial logit.

| Variable | (1) Neither | (2) Fines only | (3) Incentives only | (4) Both |
|---|---|---|---|---|
| Global/collective-oriented concern (global environmental threats, 0–1) | −0.0779*** | −0.0050*** | −0.0539*** | 0.1367*** |
| | [0.0039] | [0.0019] | [0.0057] | [0.0065] |
| Local/proximate concern (local pollution, 0–1) | −0.0605*** | −0.0047** | −0.0365*** | 0.1017*** |
| | [0.0047] | [0.0021] | [0.0068] | [0.0077] |
| One-way media information (0–1) | −0.0181*** | −0.0012 | 0.0290*** | −0.0098 |
| | [0.0052] | [0.0023] | [0.0068] | [0.0078] |
| Interpersonal information (0–1) | −0.0257*** | 0.0064** | 0.0030 | 0.0163* |
| | [0.0063] | [0.0028] | [0.0081] | [0.0094] |
| Observations | 127,048 | 127,048 | 127,048 | 127,048 |

*Note:* Each column reports the marginal effect on the probability of the corresponding response pattern, evaluated at covariate means. Standard errors are reported in brackets. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

The information variables reveal a similarly nuanced pattern. One-way media information is positively associated with "incentives only" and "both" but not with "fines only." Interpersonal information is positively associated with all three nonreference categories, with the largest coefficient in the "fines only" category. These results suggest that information channels do not simply affect the overall level of endorsement; they are also linked to the form that endorsement takes across alternative response patterns.

As in the bivariate case, the multinomial coefficients are more informative when translated into probability effects. Table 5 reports marginal effects at means for the four response categories.

The marginal effects sharpen the interpretation of the multinomial estimates. Global/collective-oriented concern reduces the probability of selecting neither instrument by 7.8 percentage points and increases the probability of selecting both by 13.7 percentage points. It also reduces the probability of selecting incentives only by 5.4 percentage points and, more modestly, fines only by 0.5 percentage points. Local/proximate concern has the same qualitative pattern, though again with smaller magnitudes. These results indicate that the principal association of stronger environmental concern is a shift away from nonendorsement or one-sided endorsement and toward joint endorsement of fines and incentives.

The information variables also yield differentiated probability effects. One-way media information reduces the probability of endorsing neither instrument by 1.8 percentage points and increases the probability of endorsing incentives only by 2.9 percentage points, whereas its effects on fines only and both instruments are not statistically significant. Interpersonal information reduces the probability of endorsing neither instrument by 2.6 percentage points, increases the probability of endorsing fines only by 0.6 percentage points, and is positively associated with joint endorsement at the 10% level. This pattern remains consistent with the view that interpersonal information is linked to broader selection across the response battery, whereas one-way media information is more selectively associated with incentives.

Overall, the response-pattern analysis leads to a clear conclusion: Selection of fines and incentives is not best understood as

opposite ends of a single choice. The dominant empirical pattern is joint endorsement, and the strongest correlates of policy-instrument endorsement are associated precisely with that joint-endorsement category. This result is important because it shows that the multiple-response nature of the survey item is not a nuisance feature of the data but an informative part of the phenomenon under study.

Table S21 verifies this conclusion using the four joint outcome probabilities derived directly from the baseline bivariate probit. The effects show that stronger environmental concern shifts probability primarily toward joint selection of fines and incentives. The increase in the probability of selecting both instruments is 0.1453 for global/collective-oriented concern and 0.1095 for local/proximate concern.

The response-pattern outcome was also reconstructed so that missing focal responses are never classified as neither. Consequently, Tables 4 and 5 use the exact bivariate-probit sample of 127,048 observations. The policy-versus-nonpolicy extension uses 126,926 observations because it additionally requires complete responses to the six nonpolicy rows.

### 5.3 | Robustness and Supplementary Analyses

Appendix S1 reports a survey-design robustness check. Table S20 compares the unweighted benchmark with a bivariate probit estimated using the weight derived from COEFIN and standard errors clustered at the household-year level. The weighted specification uses 127,048 observations in 70,644 household-year clusters. The marginal effects for global/collective-oriented concern and local/proximate concern remain positive and highly significant for both fines and incentives and are slightly larger than in the unweighted benchmark. The information-channel estimates are less stable: Interpersonal information is no longer statistically significant, whereas one-way media information is negative at the 10% level for fines and positive at the 5% level for incentives. The central concern results are therefore robust to the feasible weighting and household-clustering adjustment, whereas the information-channel associations should be interpreted more cautiously. The same table shows that the concern results are virtually unchanged with region-by-year fixed effects and with ordinal controls entered categorically.

Appendix S1 also reports a compact set of additional subgroup heterogeneity checks for the baseline specification. These supplementary estimates are not presented as part of the main empirical contribution, but they allow us to verify whether the core qualitative findings are preserved across selected demographic splits.

Appendix S1 also documents the reduction of the analytical sample from 269,439 to 127,048 observations. The largest cumulative losses occur when the information-source measures, the service and local-context controls, and the environmental-concern measures are required. Included and excluded observations differ most clearly in age, education, household size, and household composition, indicating that complete-case selection is not compositionally neutral. Nevertheless, reduced-control specifications estimated on 168,747 and 166,063 observations produce marginal effects at means for global/collective-oriented and local/proximate concern that are close to those of the full baseline model. The central results concerning environmental concern are therefore not driven by the inclusion of the complete control set, although the observed sample-composition differences remain a limitation.

Table S22 reports scale-comparable effects for one-standard-deviation and one-interquartile-range changes in the two concern indices. For a one-standard-deviation change, global/collective-oriented concern is associated with increases of 3.2 percentage points for fines and 2.0 percentage points for incentives, compared with 2.0 and 1.3 percentage points for local/proximate concern; the same ranking holds for interquartile-range changes. Table S23 complements this comparison by replacing the two indices with the total number of environmental concerns selected and the global/collective-oriented share of those selections. Both breadth and composition are positively associated with the selection of fines and incentives.

Taken together, the supplementary analyses reinforce three conclusions. First, the distinction between global/collective-oriented and local/proximate concern is empirically meaningful and robust to alternative coding strategies. Second, information channels are heterogeneous and should not be reduced to a single undifferentiated measure. Third, the main substantive result of the paper—the strong association between environmental concern and joint endorsement of fines and incentives—remains stable across a wide range of alternative specifications.

### 5.4 | Main Empirical Findings

Taken together, the results point to three main conclusions. First, environmental concerns are multidimensional: Both global/collective-oriented concerns and local/proximate concerns are positively associated with endorsement of environmental policy instruments, but global/collective-oriented concern is consistently the stronger correlate. Second, information channels are heterogeneous rather than interchangeable: Interpersonal information is positively related to selection of both instruments, whereas one-way media information is more selectively associated with selection of incentives. Third, the multiple-response structure of the survey item is substantively informative, because the strongest associations of the key regressors emerge for joint selection of fines and incentives rather than for exclusive selection of only one measure.

## 6 | Conclusions and Policy Implications

This paper has examined how environmental concern and information channels are associated with respondents' selection of fines and incentives as measures that could encourage household waste sorting. Using repeated cross-sectional ISTAT data for 2017–2022, the analysis models selection of fines and selection of incentives as two related but nonexclusive endorsement outcomes within a multiple-response survey battery and complements the baseline bivariate probit with a response-pattern analysis that exploits the underlying structure of the survey item. This empirical strategy is important because joint endorsement

of the two instruments is common in the data and should not be treated as a marginal feature of the response process.

Three main findings emerge. First, environmental concern is multidimensional, and both global/collective-oriented concern and local/proximate concern are positively associated with endorsement of environmental policy intervention. At the same time, global/collective-oriented concern is consistently more strongly associated than local/proximate concern with endorsement of both fines and incentives. Second, information channels matter but not uniformly. Interpersonal information is positively associated with selection of both instruments, whereas one-way media information is positively associated with selection of incentives but not with selection of fines. Third, the response-pattern analysis shows that the strongest empirical associations are not with exclusive endorsement of one instrument over the other but with joint endorsement of both fines and incentives. In the context of the survey question, stronger environmental concern appears to be linked primarily to a broader perception that both measures could encourage household behavior rather than to exclusive selection of either fines or incentives.

These findings have two main implications for environmental policy design. First, respondents' perceived effectiveness of waste-management measures appears to be related not only to immediate local concerns but also to broader environmental considerations connected to collective and long-run threats. Communication strategies may therefore be more effective when they connect waste-management rules to wider environmental goals, such as environmental protection, intergenerational responsibility, and the preservation of shared resources. Second, because respondents frequently select both fines and incentives, policy design need not be framed exclusively as a choice between punishment and reward. In many cases, both instruments are identified as potentially encouraging household behavior, suggesting that integrated policy packages may be perceived as more effective than a narrow focus on a single tool.

The results also point to differentiated communication implications. The positive association between interpersonal information and selection of both instruments suggests that socially mediated communication may reinforce perceptions of instrument effectiveness by transmitting norms, trust, and practical validation through everyday networks. By contrast, the more selective association between one-way media information and selection of incentives suggests that impersonal communication channels may be better suited to emphasizing positive compliance mechanisms and tangible individual benefits. More broadly, the evidence indicates that environmental governance should pay attention not only to which instruments are adopted but also to how those instruments are communicated across different information environments.

Appendix S1 analyses strengthen confidence in the main results. The qualitative findings remain stable under alternative classifications of environmental concern, under an alternative parameterization based on mean and difference components, under alternative groupings of information sources, and under supplementary specifications that contrast policy and nonpolicy response patterns. It also clarifies sample construction and missing-data treatment: The response-pattern multinomial logit uses the exact baseline sample of 127,048 observations, whereas the policy-versus-nonpolicy extension uses 126,926 observations because it additionally requires complete responses to the six nonpolicy rows.

The paper has several limitations. First, the data are observational and repeated cross-sectional, so the analysis identifies associations rather than causal effects. Reverse causality and omitted-variable bias cannot be ruled out. Second, the dependent variables capture respondents' selection of measures that could encourage their household within the survey battery rather than normative policy approval, actual compliance behavior, or revealed political choices. Third, although the robustness exercises show that the results are not driven by a single coding rule, the classification of environmental concern into global/collective-oriented and local/proximate dimensions is necessarily imperfect and should be interpreted as an analytically useful approximation rather than as a uniquely correct mapping of environmental attitudes. Fourth, the survey does not provide a direct measure of political ideology or conservatism comparable to the main covariates used here, so the analysis cannot fully address that dimension of heterogeneity. Finally, the evidence refers to Italian waste management and should be generalized cautiously to other policy domains or institutional contexts.

Within these limits, the paper contributes to the literature in three ways. First, it shows that endorsement of environmental policy instruments should not be treated as a unidimensional outcome. Second, it shows that separating global/collective-oriented concern from local/proximate concern yields more informative results than collapsing them into a single relative measure. Third, it highlights that information channels are heterogeneous in their association with endorsement outcomes. More broadly, the evidence suggests that perceptions of potentially behavior-changing environmental measures are associated not only with immediate self-interest but also with the structure of environmental concern and the informational environments through which policy messages are received.


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### Data Availability Statement

The data that support the findings of this study are available in ISTAT–Aspetti della Vita Quotidiana (at https://www.istat.it/microdati/aspetti-della-vita-quotidiana/). These data were derived from the following resources available in the public domain: ISTAT–Aspetti della Vita Quotidiana (https://www.istat.it/microdati/aspetti-della-vita-quotidiana/).

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## Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Table S1:** Full response battery and coding of outcomes. **Table S2:** Item-by-item coding of environmental-concern and information-source measures. **Table S3:** Wald tests for the baseline bivariate probit. **Table S4:** Descriptive distribution of policy versus non-policy response patterns. **Table S5:** Multinomial logit estimates of policy versus non-policy response patterns. **Table S6:** Marginal effects at means from the policy-versus-non-policy multinomial logit. **Table S7:** Wald tests for the policy-versus-non-policy multinomial logit. **Table S8:** Robustness to alternative classifications of environmental concern. **Table S9:** Marginal effects at means under alternative concern classifications. **Table S10:** Wald tests for robustness models with alternative concern classifications. **Table S11:** Bivariate probit estimates under the mean-and-difference parameterization. **Table S12:** Marginal effects at means under the mean-and-difference parameterization. **Table S13:** Wald tests under the mean-and-difference parameterization. **Table S14:** Bivariate probit estimates with concern-by-information interactions. **Table S15:** Marginal effects at means from the interaction model. **Table S16:** Wald tests for the interaction model. **Table S17:** Sample construction, variable-level missingness, sample composition, and reduced-control robustness. **Table S18:** Robustness to a three-block information-source specification. **Table S19:** Selected subgroup heterogeneity checks for the baseline specification. **Table S20:** Survey-design and specification robustness. **Table S21:** Joint-outcome marginal effects at means derived from the bivariate probit. **Table S22:** Scaled marginal effects for one-standard-deviation and one-interquartile-range changes in environmental concern. **Table S23:** Alternative breadth-and-composition parameterization of environmental concern.