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Abstract

Behavioral environmental economics (BEE) is an emerging field that combines principles from behavioral and environmental economics along with psychological theory to study how human behavior influences environmental issues. It recognizes that human behavior often deviates from the rational actor model assumed in traditional environmental economics and seeks to understand the psychological, social, and emotional factors that influence people's decisions related to the environment. By gaining insights into the human decision-making mechanism, BEE can better explain economically relevant environmental behavior and increase the predictive power of existing models. The field guides the design of effective and tailored-specific policy interventions that work with human behavioral tendencies, such as using defaults, framing, and social reinforcement to "nudge" people toward environmentally friendly choices. While behavioral insights can complement traditional policy tools, broader reforms are also needed to achieve sustainability. New trends derived from interdisciplinary research combining Environmental Psychology and Behavioral Economics are discussed. Overall, BEE offers a more realistic understanding of human decision-making and can help maximize the environmental benefits achieved through limited resources.

1. Introduction

1.1. The emerging field of Behavioral Environmental Economics (BEE)

Humans have long disregarded the impact of their actions on the environment. Resource utilization has been characterized by an excessive dependence on fossil fuels and the exploitation of natural resources. Further, the dominance of a linear economic model far from the modern circular framework that promotes sustainability led societies to struggle with global environmental challenges like pollution, waste management, biodiversity degradation, and climate crisis. Today, governments are prioritizing environmental issues, as illustrated in the EU Green Deal. However, environmental policies fail to recognize the significance of individual actions and collectively overlook significant potential for cost-effective mitigation. Behavioral environmental economics is an emerging area that applies the principles of behavioral economics to study environmental issues, whilst it aims to offer a more accurate understanding of individuals' decision-making process concerning the environment (Bucciol et al., 2023, p.5).

BEE is a field that combines behavioral economics and environmental economics to better understand how human behavior relates to environmental issues. Behavioral economics integrates insights from psychology into neoclassical economic theory to provide more realistic models of human decision-making. Environmental economics examines how economic activity impacts the environment through the use of scarce resources (Thaler, 2016). By bringing these two fields together, environmental behavioral economics aims to explain and predict how psychological, social, and emotional factors influence people's decisions that affect the environment (Bento, 2021).

The key idea behind BEE is that human behavior often deviates from the rational actor model assumed in traditional environmental economics. People face cognitive limitations in processing information, use heuristics or mental shortcuts, and are influenced by social preferences and norms (Bento, 2021). These factors can lead to environmentally relevant behaviors that seem irrational from the perspective of pure self-interest. For example, people may reject cost-effective energy efficiency improvements in their homes due to hassle factors, status quo bias, or lack of trust (Allcott & Mullainathan, 2011). They may also fail to consider the collective benefits of pro-environmental actions, instead focusing on the short-term costs to them.

By embedding the psychology of decision-making process, environmental behavioral economics can better explain phenomena like energy overconsumption, lack of engagement in voluntary conservation programs, and resistance to environmental regulation or pricing policies (Bento, 2021). It guides the design of policy interventions that work with human behavioral tendencies rather than against them. Approaches emphasized in the literature include using defaults, framing, and anchors to "nudge" people toward environmentally friendly choices, providing credible information through eco-labeling, encouraging social reinforcement of desired behaviors, and structuring incentive programs to leverage loss aversion and other biases (Bento, 2021).

Key research areas in BEE include energy efficiency and conservation, transportation choices, waste disposal and recycling, water use, environmental risk perception, and consumer purchasing of green products (Bernabéu, 2023). For example, studies find that non-price interventions like feedback, social comparisons, and goal-setting can substantially reduce residential energy and water demand. Other work shows that framing can increase uptake of public transportation and separate waste collection (Bernabéu, 2023). Research also examines how heuristics shape risk perceptions of climate change, air pollution, and other environmental hazards in ways that affect behavioral responses.

BEE complements regulation, emission pricing, and technological solutions to environmental problems. By themselves, these conventional policy tools may fall short due to a lack of political will, uncertainty over costs, or unresponsiveness to human behavior (Blau, 2021). Insights from environmental behavioral economics can make policy more effective at the margins. Some critique it however for emphasizing marginal behavior change while neglecting broader reforms needed for sustainability (Blau, 2021). Integrating behavioral insights with regulation and pricing may offer the most promising policy mix. Environmental behavioral economics applies knowledge of real human decision-making to persistent environmental challenges. Continued research will inform the design of policy tools, information programs, and other interventions that work with the grain of human behavior. Careful empirical study of behavioral responses will help maximize the environmental benefits achieved through limited public and private resources.

The primary objective of this paper is to discuss the impact that diverse behavioral economics interventions have on encouraging eco-friendly actions in a

variety of contexts, such as energy conservation, waste management, mode selection, and consumer spending. It highlights the importance of mental models and behavioral factors such as non-cognitive skills and social preferences for fostering a societal transition towards environmental sustainability (Gkargkavouzi et al., 2019a). Moreover, it showcases the numerous defaults, frames, and social reinforcement tactics from the field of behavioral economics that are efficient in encouraging eco-friendly practices. The paper focuses on the theoretical foundations and policy applications of environmental behavioral economics. It highlights key debates regarding the potential and limitations of "nudging" individual behavior versus implementing broader reforms (Geweke, 2020). Research gaps around culture, ethics, and behavioral heterogeneity are also discussed. Overall, this review clarifies the contributions of an environmental behavioral economics perspective for designing effective and realistic environmental policy.

2. Association of Behavioral Economics, Psychology, and Environmentalism

2.1. What does Behavioral Economics offer to environmentalism?

BEE integrates insights from psychology and behavioral science into neoclassical environmental economics. This emerging field aims to develop more realistic models of human decision-making to better understand and influence environmentally relevant behaviors (Cardell, 2022). With environmental sustainability challenges like climate change growing more urgent, studying how actual human behaviors deviate from rational economic assumptions has become increasingly important. Researchers and policymakers pursue determining how to encourage voluntary actions by implementing optimal incentives (Kesternich et al., 2017).

Traditional environmental policy has relied heavily on market-based instruments and technological solutions based on standard economic theory (Cardell, 2022). However, factors like loss aversion, status quo bias, and social preferences cause people to respond differently than the rational actor models would predict (Samuelson et al., 2015). BEE research demonstrates the need to complement market mechanisms and technology with tools like choice architecture, social norms marketing, and behavioral incentive design grounded in psychological insights (Cardell, 2022).

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A major research focus has been identifying behavioral failures that lead to overconsumption of resources like energy and water. For example, people are inattentive to wasting electricity or water when the cost per unit is small, a phenomenon called the "energy paradox" (Geweke, 2020). Experiments find that interventions like feedback, social comparisons, and goal-setting can substantially reduce household resource demand, often at low cost (Geweke, 2020). Other empirical work examines how framing, defaults, and heuristics influence environmental risk perceptions, transportation choices, and consumer purchases with environmental impact (Geweke, 2020).

BEE draws heavily on concepts from behavioral economics that challenge the assumptions of perfect rationality and pure self-interest associated with neoclassical Homo economicus models (Geweke, 2020). By integrating psychological insights into economic analysis, behavioral economics provides more realistic representations of human cognition, preferences, and social influence (Ginther, 2022). When applied in the environmental domain, this allows for improved understanding and prediction of behaviors relevant to resource consumption, climate impacts, environmental regulation, and sustainability.

A fundamental concept is bounded rationality: people face internal cognitive constraints that limit their ability to process information and make optimal decisions (Bolis et al., 2017). For complex environmental choices like purchasing fuel-efficient vehicles or adopting renewable energy systems, consumers lack complete information and the brainpower to identify truly utility-maximizing options (Ginther, 2022). Instead, they use simplified decision heuristics and mental shortcuts. For example, individuals may evaluate climate risks based on affect and past experience rather than scientific data. Reliance on such heuristics reduces mental effort but can lead to objectively poor decisions.

Behavioral economics also recognizes that people weigh costs and benefits differently depending on framing. Prospect theory shows that individuals place greater importance on potential losses than equivalent gains. Environmental applications include evidence that consumers are more motivated to avoid wasting energy and water than to achieve equivalent savings (Ginther, 2022). Framing emission cuts as losses instead of gains also reduces climate policy support.

The endowment effect and status quo bias emerge from loss aversion, whereby people demand more to give up something they already have than to acquire it initially. In areas like recycling programs and congestion charges, these biases impede the adoption of unfamiliar environmental behaviors, even if objectively beneficial. Defaults are powerful due to status quo preference. For example, green energy defaults significantly increase voluntary purchases of renewable power.

Behavioral economics recognizes that people care about more than self-interest. Social preferences like altruism, reciprocity, and conformity shape environmental choices ranging from donations to "green" charities to participation in conservation initiatives (Ginther, 2022). The influence of norms and comparisons to similar others is well-established, including applications to reducing household energy use through neighbor comparisons.

Behavioral environmental policy often leverages insights like defaults, reference dependence, and social motivations to nudge people toward environmentally preferable behaviors without mandating them. However, some argue that excessive focus on tweaking behaviors risks diverting attention from broader reforms needed for sustainability (Stern, 2011). Integrating behavioral insights with regulation and market mechanisms may produce the most impact.

Core behavioral principles provide micro-foundations for theoretical developments like behavioral welfare economics that incorporate realistic psychology into formal analysis (Ginther, 2022). For example, models examine welfare implications when consumers make systematic cognitive errors regarding environmental product attributes or costs. Research identifies conditions where behavioral welfare exceeds standard measures, such as green defaults that align with true preferences (Allcott & Knittel, 2019).

Behavioral environmental economics also intersects with evolutionary perspectives. Evolutionary psychology suggests current behaviors and biases evolved because they maximized fitness in ancestral hunter-gatherer environments, unlike modern conditions. Applications include evidence that evolution shaped short-term biases and heuristic thinking that contribute to undervaluing long-term environmental risks like climate change. However, some question the relevance of evolutionary psychology to understanding contemporary environmental behavior (Goodman, 2023).

Increasingly, research also integrates insights from behavioral economics with other disciplines like neuroscience. Neuroimaging studies examine how brain regions associated with emotions, morality, and cognition activate when people make environmental judgments. This emerging field of neuroeconomics can uncover subconscious influences on overt environmental behaviors. However, neuroscience-based policy applications raise ethical issues that warrant caution (Goodman, 2023).

Overall, core concepts from behavioral economics provide an important theoretical lens for modeling and interpreting environmentally relevant behavior. Challenging the assumptions of perfect rationality and pure self-interest allows environmental behavioral economics to better represent real-world decision-making and offer policy guidance firmly grounded in empirical evidence. Continued theoretical developments building on the psychological micro-foundations established by behavioral economics will further advance the field.

2.2. Decision-Making Biases and Environmental Choices

A major focus of environmental behavioral economics involves identifying systematic biases and heuristics that lead to suboptimal or irrational choices affecting the environment (Green, 2021). Understanding these decision-making tendencies enables designing policy interventions that work with human psychology rather than against it. Key biases empirically shown to shape environmentally significant behaviors include present bias, confirmation bias, the visibility effect, social norms, reference dependence, and affect heuristics.

Humans exhibit present bias preferring immediate payoffs even if greater long-run costs result. This generates time-inconsistent preferences where future intentions differ from actions with immediate costs. Present bias helps explain behaviors like overusing scarce environmental resources in the present despite intending to conserve more for the future. Evidence shows present bias reduces the uptake of green energy contracts with upfront premiums despite long-term savings. It also limits the adoption of costly one-time environmental investments like home weatherization and solar panels (Green, 2021). Policy responses like financing and behavioral nudges can help overcome present bias regarding environmental actions with deferred and uncertain rewards.

Confirmation bias leads people to selectively acquire and interpret new information to confirm pre-existing beliefs while rejecting contradicting evidence. Regarding environmental issues like climate change, confirmation bias interacts with motivated reasoning, whereby people process information to support identities and worldviews (Green, 2021). This helps explain polarization over climate science. Confirmation bias also manifests in choices like purchasing inefficient vehicles that confirm positive self-images (Allcott, 2011). Debiasing strategies include exposing people to evidence contradicting their view before presenting confirming data in a balanced way.

The visibility effect describes the human tendency to judge risks and benefits based on how easily they come to mind versus statistical realities (Green, 2021). Vividly recalled events like nuclear accidents shape perceived risk, while diffuse impacts like climate change are underweighted because associated harms remain invisible without direct experience. Similarly, people favor environmental actions with tangible personal benefits like recycling or green product attributes while downplaying diffuse collective benefits like emission cuts. Communication strategies making intangible risks and spillover benefits more salient can leverage the visibility effect to promote broad environmental actions.

Individuals are heavily influenced by what they perceive others do and approve of rather than independently evaluating choices. Social norm marketing and comparisons with neighbors' energy use, recycling, or driving successfully reduce resource demand (Green, 2021). However, norm interventions must avoid reinforcing high-usage outliers as acceptable descriptive norms. Social influence also spreads behaviors like green technology adoption through networks. Overall, leveraging social motivations provides low-cost means to nudge environmental behaviors, but norm reinforcement can also impede change.

Decisions depend greatly on arbitrary reference points rather than objective utility, a phenomenon called reference dependence (Green, 2021). For example, people demand more money to sell an item they possess compared to buying the identical item initially, known as the endowment effect. This status quo bias impedes the adoption of environmental policies like congestion pricing that change familiar reference states. Framing emissions reductions as "losses" versus "gains" also reduces climate policy support due to loss aversion. Reference dependence limits rational

cost-benefit analysis of environmental choices. Policy can leverage status quo bias by making desired behaviors the default, though defaults must be selected judiciously.

The affect heuristic describes reliance on emotions and gut reactions to judge risks and benefits rather than reason. Affect shapes perceived environmental risks related to climate change, pollution, and nuclear waste in biased ways that distort policy support. Emotions like hope, fear, and worry also direct attention and resources toward some risks over others regardless of probability. While affect often misleads, emotional reactions contain information policy must account for. Communicating environmental risks' emotional impacts along with scientific data can leverage effect while avoiding pitfalls of solely emotional reasoning. Together these systemic decision-making tendencies help explain irrational or selfish environmental behaviors. The biases interact in complex ways, such that loss aversion and confirmation bias may reinforce each other to impede acceptance of climate policies. Behavioral environmental economics offers concrete guidance for designing interventions like defaults, incentives, and information framing to work with human psychology to achieve better socio-ecological outcomes.

The developing field of environmental behavioral economics, which draws from a variety of academic fields, has made significant progress in recent years in elucidating the complexities of human decision-making on the topic of environmental sustainability(Kosten, 2021).Cognitive biases and heuristics have been proven to have a significant role in people's decisions to engage in behaviors that harm the natural world. It has been demonstrated that concepts like as loss aversion, the endowment effect, and social preferences have a significant impact on the decisions that are made about the environment(Kosten, 2021).

2.3. *The role of psychological insights in Environmental Behavioral Economics research*

Psychology plays a central role within the field of environmental behavioral economics. Psychological theories and research methods enable a richer understanding of the personal and social factors that motivate human environmental behaviors (Clayton et al., 2015). At the individual level, environmental psychology examines how perceptions, values, attitudes, personality traits, identities, cognitive biases, and emotions relate to conservation behaviors. This can identify target beliefs

and characteristics for interventions. At the interpersonal level, environmental psychology explores how phenomena like social norms, social modeling, persuasion, and social support influence sustainability and points to effective group-based intervention strategies.

At the systemic level, environmental psychology highlights the reciprocal interactions between individuals and their physical, social, economic, and political environments. Research in this vein elucidates how contexts like available infrastructure and public policies shape green behaviors, in turn informing contextual modifications to enable sustainability. Overall, environmental psychology supplies theories of human motivation and behavior change that guide the design of impactful interventions at multiple levels. It also contributes empirical methods like surveys, controlled experiments, and field studies to rigorously evaluate environmental policies and programs. Psychology is thus critical for translating environmental behavioral economics insights into effective solutions to pressing sustainability challenges.

Psychological and behavioral factors play a crucial role in understanding observed trends and predicting compliance with rules, as well as the long-term effects of environmental policy (Halkos& Managi, 2023). New developments in the disciplines of environmental and resource economics. Economic Analysis and Policy, 77, 513–522.). Likewise, the social aspect, which becomes apparent through societal preferences or norms of cooperation and reciprocity, is equally significant. The social component not only mediates the direct consequences of a policy or exogenous shock, but it also has significant indirect effects that cannot be ignored. Indirect effects often have a major impact and emerge as externalities, either positive or negative on groups of people who are connected to those experiencing the direct consequences (Mayer et al. 2023, p.7).

Environmental Psychology and Behavioral Economics represent overlapping fields that offer tremendous opportunities for interdisciplinary research in environmentalism. To the best of our knowledge, only studies within the environmental valuation (i.e., Lopez-Mosquera et al., 2014; Halkos & Matsiori, 2016; 2017; 2018; Gkargkavouzi et al., 2019b) or green purchasing context (i.e., Sharma et al., 2023) apply interdisciplinary approaches to explain human behavior. A variety of psychological constructs and theoretical frameworks can broaden the armory of researchers in explaining cognitive dimensions of behavior and the human decision-making mechanism. For instance, there are scarce evidence of the association of

personality traits measured via the well-established Big Five Personality Model (or O.C.E.A.N.[1]) and behavioral intentions like willingness to pay for environmental goods and services (Boyce et al., 2019).

Works on the psychological adaptation to climate change showcase the need to shed light on the reasons that some people adapt to the risks of climate change, explain adaptation behavior and the role of motivational factors, including risk perceptions, experiences with climate-related hazards, and perceived responsibility, coping strategies, self and collective efficacy, and psychological distance (van Valkengoed & Steg, 2019; Cianconi et al., 2021).Similarly, an emerging trend focuses on the negative impact of climate crisis on mental health and showcases the need to study new psychological variables like eco-anxiety - fundamentally distress about climate change and its impacts on the landscape and human existence (Coffey et al., 2021; Halkos and Bousinakis, 2010; 2017)-, and transilience -perceived capacity to persist, adapt, and positively transform in the face of an adversity (Lozano Nasi, Jans & Steg, 2023). Last, insights from Ecopsychology that explores humans' psychological interdependence with the rest of nature and the implications for identity, health, and well-being (Kahn & Hasbach, 2012), can foster a holistic approach in behavioral research and contribute to the theoretical foundations of Environmental Behavioral Economics.

2.4. Evaluating the Success of Behavioral Economics in the environmental context

*T*o encourage people to make environmentally responsible decisions, behavioral economics has emerged as a potent instrument. This goal is to evaluate the effectiveness of various behavioral economics treatments in promoting environmentally friendly behaviors in a variety of settings by applying economic and psychological concepts (Cardell, 2022). Behavioral economics has produced important advancements in the field of energy conservation. Utilities have been able to successfully persuade consumers to reduce energy use by giving real-time feedback on individual energy usage and allowing individuals to compare their usage to that of their peers. This method effectively incentivizes energy saving by appealing to the fundamental human urge for social comparison and competitiveness.

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[1] OCEAN stands for Openness - Consciousness - Extraversion – Agreeableness- Neuroticism

In the field of waste management, "nudging" and other behavioral economics treatments have proved successful in increasing recycling rates and decreasing garbage output. Individuals can be influenced to make more ecologically responsible decisions by minor adjustments in the design of recycling bins or the positioning of disposal alternatives (Cardell, 2022). Behavioral economics has helped encourage environmentally responsible mode selection. Traffic congestion and emissions have been reduced thanks to incentives like lower public transit costs during off-peak hours or congestion pricing.

The realm of consumer purchasing is another important area where behavioral economics has shown promise in encouraging eco-friendly actions. Carbon labels and other sustainability certifications tell consumers about a product's impact on the environment, allowing them to make more ethical purchases. The success of these behavioral economics initiatives demonstrates the significance of human psychology in encouraging eco-friendly behavior. The potential of behavioral economics may be effectively harnessed by policymakers and organizations to address critical environmental concerns by aligning actions with cognitive biases and heuristics (Cardell, 2022).

3. Policy considerations in the BEE field

By gaining a knowledge of human psychology, we can develop treatments that cooperate with that field to encourage environmentally responsible behavior. Policymakers have several options available to them when it comes to encouraging environmental stewardship, some of which include instructional campaigns, targeted awards, and subtle prods(Louviere, 2022). However, there is still a significant distance to travel. In the burgeoning field of environmental behavioral economics, there is still a great deal to be learned about the complexity of human behavior and the connection between the two and the environment. To make use of this industry's full potential to bring about positive change and clear the way for a more sustainable future, it is necessary to overcome the limitations that now exist and to keep investigating new areas of research(Louviere, 2022).

There is a lack of empirical information about the relationship between behavioral and traditional economic policy interventions aimed at promoting pro-environmental behavior. While behavioral and traditional economic policy

interventions are often employed in combination, previous works have mostly concentrated on combining evidence from individual initiatives (Alt et al., 2024). Policy mixes are more effective than the most effective single intervention of their constituents, suggesting that combined policies are unlikely to have negative consequences, while there is a variation in the effectiveness of policy combinations concerning different types of environmental behavior. Thus, combining traditional interventions with behavioral economic interventions produces greater synergy effects compared to combining interventions from the same domain.

The diminishing marginal utility of income is one factor that contributes to the disparity in efficacy amongst policy mixtures within and across different domains. It also suggests that there may be synergies between interventions that appeal to both extrinsic and intrinsic motivation of individuals. When the choice context is complex, it can be more difficult for people to understand and consider the effects of various interventions on their behavior. Implementing a combination of policy measures is more effective in promoting sustainable behaviors than relying on a single intervention.

Research has emphasized the importance of combining conventional economic policies with behavioral economic interventions. Conventional economic strategies, such as carbon taxes or subsidies, can be used in conjunction with behavioral economic methods, which use gentle pushes or incentives to enhance decision-making abilities. By integrating these approaches, policymakers may effectively tackle environmental issues from several perspectives, considering both financial and non-financial motives (Alt et al., 2023).

Environmental policies are primarily based on the use of Pigouvian pricing to address externalities. Consequently, the main emphasis has been on implementing first-best solutions for resolving market failures. Therefore, typical approaches to resolving environmental issues often involve implementing regulatory measures (such as regulations and fines) or providing economic incentives (such as opportunity costs, subsidies, and premium prices). Although economic incentives and coercion may seem appealing in theory, they often face practical limitations, such as the common issue of public acceptance of carbon pricing measures. In certain circumstances, the dependence on financially significant incentives and penalties may indicate a lack of confidence, which could subsequently diminish the inherent motivation for participating in environmentally friendly actions. Recent research underlines the

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significance of creating environmental policies that preserve or enhance inherent reasons to adhere to the policies. Nevertheless, further investigation is required to comprehend the impact of economic desires, social norms, and contextual factors on behavior.

"Green nudges" have also been suggested as a crucial environmental policy instrument. Nudges can also be more economically efficient than alternatives. Multiple survey-based studies have recorded substantial approval for nudges from the public, legislators, and even companies. However, there is a rising worry that nudges, whether they are green or not, may be less detrimental (Sunstein, 2017). Recent studies have indicated that the effectiveness of green nudges can vary depending on a given context and may be moderate in magnitude and temporary in nature (Carlsson et al., 2021). Three often overlooked behavioral factors contribute to the failure of green nudges, specifically: (i) individual preferences and beliefs, (ii) levels of attention and emotions, and (iii) habitual decisions and barriers – both intra and interpersonal. These factors may shed light on why green nudges are not as successful as expected in various situations, however, they may also apply to a broader spectrum of nudges and behaviors. More efficient and groundbreaking policy tools that target behavior change should consider a broad spectrum of psychological and cognitive factors that influence the complex decision-making process (Shreedhar, 2023; p.287).

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