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**ON THE DETERMINANTS OF PRO-
ENVIRONMENTAL BEHAVIOR:
A LITERATURE REVIEW AND GUIDE
FOR THE EMPIRICAL ECONOMIST**

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On the Determinants of Pro-Environmental Behavior: A Literature Review and Guide for the Empirical Economist

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Abstract

This paper provides a systematic review of current economic and psychological studies on the determinants of PEB published up to 2017. Our normative understanding and study of PEB can benefit from an integral review of these research traditions. Consequently, we identify various determinants of PEB that can be classified into four major types:

- Socio-demographic factors (personal capabilities)
- Attitudinal (psychological) factors
- Habits
- Contextual factors (individual, social and institutional)

Our paper shows that to understand the complex workings of PEB, it is no longer viable to study its determinants individually, but researchers must rather consider an interplay of these factors. In addition to the introduction of this intersectional approach, we show that measuring PEB in an adequate way requires the consideration of more than one or two distinct behaviors (multiple items) as the impact of the determinants differs depending on the analyzed behavior. PEB itself can also be distinguished into types of PEB (private vs public sphere behaviors, environmental activism). Additionally, our review gives an overview of the typical methodological approaches and systematizes the questions used to measure PEB. By combining results from economics and psychology, this work offers a starting point for a more intersectional and interdisciplinary understanding of PEB, and a guide for further empirical investigations.

Key words: determinants of pro-environmental behavior, ecological economics, review

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1. Introduction

Many environmental problems are anthropogenic in nature, meaning that these issues are driven by human behavior. Our current generation has changed the ecosystem faster and more exhaustively than any other generation before, proving that behavioral change is required for a sustainable future. Pro-environmental behavior (PEB) is complex in its variety as well as in its many causal influences (Stern, 2000). We need to understand drivers of behavior to effectively alter human behavior that contribute to environmental problems (Heimlich and Ardoin, 2008; Steg and Vlek, 2009). Behavioral and social sciences have devoted great effort to understand what drives PEB, by developing theories (Ajzen and Fishbein, 1980; Ajzen, 1985, 1991; Stern, 2000) that include internal, institutional and social factors. Pro-environmental behavior, a subject that has caught the interest of economists more recently has been investigated by researchers in the field of environmental psychology since the 1960s (for reviews, see, e.g. Hines et al., 1987; Kollmuss and Agyeman, 2002; Bamberg and Möser, 2007; Heimlich and Ardoin, 2008; Steg and Vlek, 2009; Klöckner, 2013; Gifford and Nilsson, 2014). While psychologists are more concerned with internal factors, economists focus more on external factors (Clark et al., 2003). An interdisciplinary approach combining knowledge from both disciplines is lacking, though such an approach is bound to provide concrete insights into the various determinants of PEB and their interplay in influencing behavioral change.

“Pro-environmental behavior (PEB)” can be defined from the actor’s standpoint and covers all behaviors undertaken by a single individual to reduce one’s negative environmental impact with a clear intention to change the environment (Stern, 2000; Kollmuss and Agyeman, 2002). Although PEB is determined by a broad range of socio-demographic and psychological determinants, reviewing recent studies indicates that interdisciplinary exchange about them is still limited, posing a research gap in their study. This review merges the knowledge of both disciplines and gives an overview of recent research findings by creating an interdisciplinary survey. As Stern (2000) writes, the role of an individual’s predisposition to act in a certain way can vary strongly depending on the context, the behavior and the actor. In our interdisciplinary review of the literature published in the last decade, we find that this important factor is not considered appropriately. The heterogeneous results in the

literature are due to the application of (1) different measurements of PEB and (2) usage of different control variables (internal vs external factors), rather than fundamental theoretical differences. To put it in economic terms, the coefficient of each determinant can either be positive or negative, given the specific type of behavior analyzed (low vs high cost behavior¹). A comprehensive understanding of PEB and derivation of a holistic picture requires the consideration of socio-demographic, psychological, habitual and contextual factors, and a structural interplay of these factors. Taking into consideration space and relevance, our review is relatively focused. We build on a foundation of existing knowledge (psychological frameworks) and ideas and combine economic with psychological findings to give an overview of the central variables that need to be considered in studying PEB, and suggest different ways to measure PEB, based on previous literature.

This paper is structured as follows: section 2 presents the selection of articles and the methodological approaches taken to measure PEB. In section 3, we explain the socio-demographic (personal capabilities), psychological, habitual and contextual factors (individual, social and institutional) that influence PEB. Section 4 concludes the paper with its limitations and implications.

2. Methodology

2.1. Selection of articles

The article selection of this review is based on an extensive and systematic review (Jan.-Nov. 2017) of relevant databases (Web of Science, EconLit, PsycINFO and Google Scholar). We searched these databases for commonly used terms of PEB (among others: pro-environmental behavior, ecological behavior, responsible environmental behavior, environmentally/ecologically responsible/friendly behavior). We primarily focused on peer-reviewed journal articles (included: 158), published in the English language, giving a preference to recent articles (post 2000), including relevant ones published before 2018.

¹For a discussion about this, see e.g. [Diekmann and Preisendörfer \(1992\)](#).

2.2. Methodological approaches in the literature

Studies in the field of environmental behavior research follow different methodological approaches, namely, questionnaires (cross-sectional & panel data), interviews and experiments (field & laboratory), as elaborated in this section. But, a majority of studies are based on survey data, which have the advantages of low (financial) costs and relative ease of execution (Kormos and Gifford, 2014). Respondents are usually asked if or how often they engage in a particular behavior, ranging from 'never' to 'always' (likert-scale; 5 up to 11 pts)². PEBs differ in complexity, investment costs (time, money) and impact on the environment (e.g. Stern, 2000; Schmitt et al., 2018). The number of behaviors (overview: Table ??, Appendix) used to measure PEB differs highly within the studies (about 3 to 50 different behaviors), causing a broad heterogeneity in study results. The behaviors can be assigned to different behavioral clusters (e.g. water/energy saving, political actions etc.). Going a step further, some studies group behaviors into PEB indices (e.g. Lynn and Longhi, 2011; Binder and Blankenberg, 2017; Schmitt et al., 2018) to capture relevant behavior in a more adequate way, but fail to mention what kind of PEB they really measure. Stern (2000) summarizes that environmentally significant behavior can be distinguished into four categories, namely (1) environmental activism (e.g. involvement in organizations), (2) nonactivist behaviors in the public sphere (political behaviors like e.g. petitioning), (3) private-sphere environmentalism (household behaviors like e.g. water saving, energy use, travelling modes) and (4) other environmentally significant behaviors. One point missing in most studies is the identification of the kind/ category of behavior and a hint to the fact that the influence of certain determinants and their consequences (in terms of utility possibly gained due to the behavior) are related to the type of behavior measured.

Most studies are based on cross-sectional data with clear focuses (specific topic; tailored questionnaire) but lack the dimension of possibility, allowing causal inferences. In contrast, studies based on panel-datasets allow the establishment of causal links between variables.

²There is a strong relation between self-reported & objective PEB (Kormos and Gifford, 2014). Self-reported questions about environmental issues are only weakly affected by social desirability bias (Milfont, 2009). There is no evidence for inaccurate reporting (Lam and Cheng, 2002). Peer-reports correspond with self-reports (Villacorta et al., 2003) and cross-evaluation improves the quality of the questionnaires (Lam and Cheng, 2002).

But, for e.g., household panel-datasets (SOEP, BHPS, etc.) are usually not tailored to a particular research question.

In contrast to self-reports, device measurements (e.g. meter readings of electricity), peer-ratings and observations by trained persons are more objective ways of measurements (Kormos and Gifford, 2014). Experiments (Sturm and Weimann, 2006; Osbaldiston and Schott, 2012), which help analyze “cause and effect” by way of their simple (non-complex) design prove to be another efficient method to study PEB. The increasing number of experiments require their own review, like the one done before by (Sturm and Weimann, 2006).

3. Determinants of PEB

A complete understanding of PEB determinants requires a consideration of socio-demographic (personal capabilities) (3.1), attitudinal (psychological) (3.2), habitual (3.3) and contextual (3.4) factors (individual, social and institutional) and their interplay.

Associated literature in the field of psychology began by studying linear models of PEB and subsequently evolved to consider more complex models like the “Norm Activation Theory” (Schwartz, 1973, 1977), “Theory of Reasoned Action” (Ajzen and Fishbein, 1980), “Theory of Planned Behavior” (Ajzen, 1985, 1991). Of great interest here is the theory of environmentally significant behavior (Stern, 2000) which develops a conceptual framework for environmentally friendly behavior, building on the “Values-Beliefs-Norms Theory (VBN)” (Stern et al., 1999).³ We use the theoretical approaches to identify relevant factors that determine PEB and thus need to be considered in further investigations. This section identifies and outlines a plethora of PEB determinants.

3.1. Socio-demographic factors (personal capabilities)

We first start with socio-demographic factors, which can be viewed as indicators or proxies for personal capabilities (Stern, 2000).

³Further works (Shove, 2010; Klöckner, 2013) build upon these models, like the integrated framework designed to encourage PEB (Steg et al., 2014).

3.1.1. Age

Age impacts the consumption of fair trade products negatively (McCluskey et al., 2009), but it would be simplistic to assume that older people do not care about environmental issues in general, as there is a broad variability regarding concerns for and attitudes towards environmental issues amongst older people (Wright et al., 2003). Environmental beliefs generally decline with age and older people engage less often in “active” behaviors (joining environmental groups, outdoor recreation activities) but report more “homebased” PEBs (reading environmental magazines; recycling). This is explained by the level of energy and stamina required to participate in different activities (Johnson et al., 2004). These findings are supported by a meta-analysis (Wiernik et al., 2013), covering different behavioral clusters (like avoiding harm, engaging with nature, conserving nature, spreading knowledge of sustainability, sustainable consumption, political behaviors, etc.).

PEB seems to follow a life-cycle, with the lowest possible point situated at the life milestone where people begin parenting (children bring in constraints - such as money and time - for parents) (Longhi, 2013). Individuals below 30 and individuals between 60 to 69-years, in specific, are inclined to act more ecologically in 2010, in comparison to their behavior in 2001 (cohort & learning effects) (Otto and Kaiser, 2014).

3.1.2. Education

Education increases PEB (environmental reading, recycling, joining an environmental group, nature participation) (Johnson et al., 2004) and educated people are more aware and more concerned with social welfare (Johnson et al., 2004; Torgler and Garcia-Valiñas, 2007; Meyer, 2015). Higher education impacts positively on certain behaviors (consumption of recycled paper products, boycott of over-packaged items, not turning the heating up, turning off the tap), while a lower level of education is positively related to other forms of PEB (turning TV off overnight, switching off lights, using public transport) (Lynn and Longhi, 2011). An increase in years of schooling is related to higher PEB (8 behaviors regarding technical change and saving) without exerting an impact on cost-saving pro-environmental actions (Chankrajang and Muttarak, 2017).

When compared to factors like income or employment status, education has the highest

impact⁴ on PEB and is correlated with more awareness and interest in environmental issues (Longhi, 2013). Education usually affects environmental concerns by increasing knowledge about environmental issues (Franzen and Meyer, 2010), but analyzing global warming concerns shows that education (treated as endogenous) does not have any impact on this type of concern (Chankrajang and Muttarak, 2017).

3.1.3. Income

Income has no effect on going green (De Silva and Pownall, 2014) and no impact on being a strong environmentalist (Owen et al., 2010). But there is a small observable positive connection between income and PEB (Hines et al., 1987). An increase in green house gas emissions (GHG) (Ala-Mantila et al., 2014), and other types of emissions (Büchs and Schnepf, 2013; Bruderer-Enzler and Diekmann, 2015), and the energy requirement (Moll et al., 2005) in households is directly related to an increase in income. But households with higher incomes are also more likely to participate in green electricity programs (Clark et al., 2003) and the willingness to pay for green electricity also increases with income (Zorić and Hrovatin, 2012).

An increase in income is usually related to a reduction of available free time (value of time increases), leading e.g. to a reduction of recycling behavior (Ferrara and Missios, 2005). Analyzing cross-sectional data indicates that on the level of individual action, household income has no effect on PEBs in general (Whitmarsh and O'Neill, 2010). A more detailed analysis of panel-data, using a PEB index, shows that higher wages and a higher equivalised household income are correlated with lower individual PEB (Longhi, 2013). A focus on single behaviors shows that poorer people tend to exhibit more PEB - e.g., increased usage of public transportation and a reduction of their heating costs (Longhi, 2013). People are more likely to engage in PEB if it is not costly (in terms of money, time, effort and convenience) (Diekmann and Preisendörfer, 2003). They do not readily give up more essential, costly behavior, like e.g. traveling, in specific, as it is considered an important part of people's lifestyle (Lorenzoni et al., 2007). Traveling is rather determined by restrictions on income and personal resources (King et al., 2009). But on the contrary, increase of income is associated with an increasing EC behavior (Stern et al., 1999) and people with a higher income and education are more

⁴Educated individuals score 1.4- 1.6 points higher on the PEB scale on average (0 - 44 points).

likely to engage in water conservation practices (Berk et al., 1993).

Being unemployed is a special situation in which a person faces a fall in income and an increase in available time. On considering unemployment, it is revealed that PEBs related to time and effort will increase, while behaviors primarily based on money will decrease (Meyer, 2016). Being unemployed or retired predicts cases of higher PEBs (index, 11 behaviors like transport and water saving behaviors) (Binder and Blankenberg, 2017). A work-life imbalance does not affect PEB (Melo et al., 2018).

3.1.4. Gender

Men and women differ significantly in their PEB (Eisler et al., 2003)⁵. Women exhibit higher PEB than men (Lynn and Longhi, 2011; Longhi, 2013), a difference which has been confirmed across nations (Hunter et al., 2004). All other things being equal, women are 3.9% more likely to buy environmental-friendly products and combat cold by wearing more clothes rather than by turning on the heating in their surroundings (Lynn and Longhi, 2011). Women report stronger environmental attitudes and more PEB (meta-analysis) (Zelezny et al., 2000) and are readier to make a connection between environmental conditions and their other values, performing more environmental action (Stern et al., 1993). Women are more concerned than men, even when controlling for other variables like income or educational background (Franzen and Meyer, 2010). These findings are robust across time, nations and samples (McCright and Xiao, 2014).

Some studies find no (Hines et al., 1987) or only small gender effects (Blocker and Eckberg, 1997), which can be explained by the chosen behavior. Women, for e.g., report more recycling behavior (home-based environmental behavior), but men show more external behavior (reading environmental material or participating in environmental groups) (Johnson et al., 2004).

3.1.5. Household structure

Living in a household restricts people’s behavior regardless of their attitudes, as it requires coordination with other people’s attitudes, and comes with time constraints (Shove, 2010).

⁵Altruism (more distinct for females) e.g. explains PEB differences (Gilligan, 1982; Stern et al., 1993; Dietz et al., 2002).

PEB of individuals is shaped by their household structure, the size of which has a negative effect on PEB (Clark et al., 2003; Johnson et al., 2004; Longhi, 2013) and environmental concerns in general (Johnson et al., 2004), but impacts positively on PEBs like recycling and nature participation (Johnson et al., 2004). As mentioned with regard to the *Income factor*, households with a higher income are more likely to participate in green electricity programs but a larger number of household members decreases the likelihood of participation (Clark et al., 2003). Additionally, individuals increase emissions (household gas & electricity) with their everyday behavior (Abrahamse and Steg, 2011). Analyzing household structures shows that single women scored highest in PEB, followed by couples without children. Couples with children (see 3.1.1) show the lowest PEB (Longhi, 2013).

3.1.6. *Environmental knowledge*

Environmental knowledge can be described as the amount of information individuals have regarding environmental issues, and their ability to understand and evaluate the impact of these issues on the environment. In short, environmental knowledge comprises knowledge of both the problem and the impacts of the said problem. The possession of such environmental knowledge increases the likelihood of PEB (Hines et al., 1987). As a result, one strategy to change people's behavior is to provide them with new knowledge to influence their attitudes towards environmental issues (Steg and Vlek, 2009). For example, providing households with tailored information regarding their energy use reduces their energy use (Abrahamse et al., 2007). In contrast, direct repeated information about the causes of climate change does not lead to the cutting down of carbon consumption (King et al., 2009), indicating that the type of information delivered and the mode of information delivery is relevant.

One individual's ecological world-view varies strongly from that of another, depending on environmental knowledge in combination with socio-economic determinants (Halkos and Matsiori, 2017). People with environmental knowledge (e.g. about GHG emissions), knowledge about energy saving behaviors and environmental values are more likely to engage in energy-saving behaviors (Pothitou et al., 2016). The environmental knowledge of tourism students positively impacts their intention to take part in eco-tourism activities (Fatima et al., 2016). Lack of knowledge, confusion created by conflicting information, etc., act as

barriers to PEB (Lorenzoni et al., 2007).

3.2. Attitudinal factors

While some attitudinal factors like e.g. norms, beliefs and values seem to have an impact on behavior in general, other factors may affect only certain types of behavior.

3.2.1. Beliefs

Belief describes the expectation that behaving in a certain way results in a certain outcome and can be distinguished in three types of beliefs, namely behavioral, normative and control beliefs. They are indirectly related to behavior as they influence respective constructs that determine PEB (attitudes, norms and perceived behavioral control) (Ajzen, 1991). Festinger (1962) proposes that we unconsciously seek consistency in our beliefs. The inconsistency between information about environmental degradation and current beliefs leads to an avoidance of information about environmental problems as a means of retaining mental consistency, partly explaining climate denialism (Lorenzoni et al., 2007). An individual's belief in climate change only has a small up to moderate effect on their willingness to behave in a climate-friendly way (meta-analysis) (Hornsey et al., 2016). In general, the sum of beliefs (cognitive and affective) about a specific behavior results in attitudes (Klöckner, 2013).

3.2.2. Attitude

“A person's attitude toward some object constitutes a predisposition on his part to respond to the object in a consistently favorable or unfavorable manner” (Ajzen et al., 1973, p.41). There is a relationship between protective action and attitudes towards specific PEB (energy conservation; recycling) (Hines et al., 1987), but the degree of the relationship between environmental attitude and behavior depends on the scale used (Tarrant and Cordell, 1997). Attitudes impact behavior (Ajzen, 1987) and the willingness-to-pay for the environment (Kotchen and Reiling, 2000; Choi and Fielding, 2013). Attitudes towards energy conservation in combination with perceived behavioral control increase people's intention to reduce household energy use (Abrahamse and Steg, 2011). The intensity of organic food consumption is also significantly related to the respondent's attitude towards consumption and

the environment ([Welsch and Kühling, 2016](#)), but implicit attitudes towards environmental-friendly food are not associated with sustainable consumption⁶ ([Panzone et al., 2016](#)).

3.2.3. Awareness

Awareness is "knowing the impact of human behavior on the environment" ([Kollmuss and Agyeman, 2002](#)). People often state that they are uncertain about the causes of climate change and perceive it as a distant threat ([Lorenzoni et al., 2007](#)). When natural disasters occur, people become more aware of climate change. Values, place attachment and the awareness of disaster's consequences impact PEB positively ([Zhang et al., 2014](#)). Awareness, in combination with education, impacts people's willingness to participate in a green electricity program ([Zorić and Hrovatin, 2012](#)). People with a high awareness of ecotourism are more likely to financially support ecotourism projects in the locations visited by them, showing a willingness to pay more today in exchange for a better experience in the future ([Meleddu and Pulina, 2016](#)). The complexity of environmental problems, people's incapability to trace climate change directly to its origin and the lack of observable, overwhelmingly significant signs - such as a natural disaster - to prove that it is an ongoing process act as limitations to environmental awareness ([Kollmuss and Agyeman, 2002](#)).

3.2.4. Values

Values influence behavior indirectly by activating norms, thereby creating a feeling of moral obligation ([Schwartz, 1977](#)) to act pro-environmentally ([Nordlund and Garvill, 2003](#)). Values are the basis of environmentalism ([Stern, 2000](#)) and a stable source of ongoing PEB ([Steg, 2016](#)). Both ecocentric and anthropocentric values are associated with PEB ([Kaida and Kaida, 2016](#)) and they slightly increase awareness of environmental problems ([Nordlund and Garvill, 2003](#)). PEBs like reduction and reuse behavior are determined by a mixture of values, knowledge, and concerns ([Barr, 2007](#)). Values generally influence PEB through three different channels: by the perceived importance and likelihood of behavioral consequences, by norm activation and via environmental self-identity ([Steg et al., 2014](#)).

⁶Overview of SC: e.g., [Jackson \(2005\)](#); [Tripathi and Singh \(2016\)](#).

3.2.5. Norms

Norms⁷ are shared beliefs and can be described as vague guides to behavior in actual situations (Schwartz, 1977). Norms impact positively on PEB (Nordlund and Garvill, 2003; Thøgersen, 2008; Culiberg and Elgaaied-Gambier, 2016; Farrow et al., 2017) and can be divided into social and personal norms (Schwartz and Howard, 1982; Thøgersen, 2006), with social norms impacting a wide range of behaviors (review: Farrow et al., 2017). The impact of norms on PEB depends on the degree of its internalization (Thøgersen, 2006). Social norms become personal norms through internalization (Schwartz, 1977), but their impact on individual energy-saving practices is, at best, small (Arimura et al., 2016).

Displayed norms, like the internalized motivation of parents to behave environmentally friendly, influences children’s self-determined motivation for PEB (Grønhøj and Thøgersen, 2012). Country-level norms influence the norms of family and friends, which in turn affect their PEB (Culiberg and Elgaaied-Gambier, 2016). People are aware of norms (like preventing pollution), but if others pollute, they are likely to do so as well. Social norms which guide people to base their actions on symbolic-affective motives (e.g. referring to cars as status symbols) negatively affect PEB (Steg et al., 2001). Behaviors such as traveling by plane for holidays or using the car regularly are socially-accepted, guided by present norms and go unquestioned and are therefore difficult to change (Jackson, 2005; Lorenzoni et al., 2007). If being green became a shared social norm in a society, the benefit of a green-self image would multiply (Welsch and Kühling, 2018). Acting in accordance with one’s (environmental) norms is either accompanied by positive (pride) or negative (guilt) feelings, in cases where one does not act in accordance with these norms (Steg et al., 2014). The influence of norms on PEB is also mediated by anticipated emotions (3.2.9) (Rezvani et al., 2017).

3.2.6. Identity

Norms and values impact behavior, but they are dependent on a person’s position in a certain social context. Identity defines who somebody is - their social category (Akerlof and Kranton, 2000, 2010) - by considering the influences exerted on them by social interaction.

⁷Economists describe norms as informal institutions (based on e.g., imitation & tradition) influencing behavior.

Community characteristics impact self-proclaimed environmentalism and influence a person’s predisposition to an environmental-friendly identity (Owen et al., 2010). Social identity predicts PEB, but the visibility of behavior moderates the relationship (Brick et al., 2017). People are more likely to make pro-environmental decisions if their social identity is related to a group that beholds environmental norms (Fielding and Hornsey, 2016). The self-expression of individuals is analogous, or at least close, to their perceived identity, which impacts PEB (Owen et al., 2010; Whitmarsh and O’Neill, 2010), even stretching to different choices of consumption (Barbarossa et al., 2017). People who identify themselves as green are likely to have, for e.g., positive perceptions of electronic vehicle attributes (Schuitema et al., 2013).

Identity mediates the relationship between values and PEB (Gatersleben et al., 2014) and values impact identity, which in turn impacts consumer intentions (Barbarossa et al., 2017). Californian environmentalists make greener consumption choices for household transportation, compared to the average consumer (Kahn, 2007). A green identity increases the extent and intensity of green behavior. But even the greenest (self-identified) individuals do not exhibit all PEBs all the time (Binder and Blankenberg, 2017).

3.2.7. *Environmental concern*

Environmental concern⁸ is defined as “the awareness or insight of individuals that the natural state of the environment is threatened through resource overuse and pollution by humans” (Franzen and Meyer, 2010, p.220). Actual disasters lead to worries regarding nature and as a result, more environmental concern (Goebel et al., 2014; Berger, 2010). Environmental concern positively impacts PEB (39 behaviors) (Schmitt et al., 2018) and leads to an increased propensity to volunteer, especially if individuals are very concerned about the environmental situation at hand (Binder and Blankenberg, 2016). They also influence purchasing behavior, energy consumption, (Tatić and Činjurević, 2010; Urban and Ščasny, 2012) and sustainable food consumption (Panzone et al., 2016).

The impact of environmental concerns on PEB (recycling of paper, plastics and organic material; use of watersaving installations) decreases with increasing behavioral costs (Diek-

⁸Studies about the facets of environmental concerns: e.g., Van Liere and Dunlap (1980); Fransson and Gärling (1999); Schultz (2001); Xiao and Dunlap (2007); Dorsch (2014).

mann and Preisendörfer, 2003). Wealth, measured in Per Capita GDP (1000\$) predicts pro-environmental concern (Franzen and Meyer, 2010). Environmental concerns increase garbage reduction but do not impact any other PEB (reduction of garbage and electricity, gas and automobile use) (Fujii and Gärling, 2003). Climate change concerns positively impact water and electricity mitigation behavior, especially in pro-environmentally motivated households (Nauges and Wheeler, 2017), and increase the probability of undertaking relevant action or paying for climate change mitigation (Dienes, 2015).

3.2.8. Locus of control & personal responsibility

Locus of control (LOC) refers to the perception of individuals as to whether they can change or achieve a desired outcome by their own actions or not. External LOC attributes an outcome to an external force, whereas an internal LOC means that outcomes can be achieved by personnel behavior. People with an internal LOC are more likely to take action related to PEB as changing an outcome seems more likely (Hines et al., 1987; Knussen et al., 2004; Johnson et al., 2004). If people possess an external LOC, they tend to externalize responsibility and ask for collective action. People in the UK, for e.g., perceive climate change as a collective problem, prioritizing and expecting government action - introduction of regulations or laws that push the people to act - ahead of and more than individual action, which they consider to be an insignificant difference (Lorenzoni et al., 2007). Energy savings and carbon reduction is highly dependent on one's own moral obligation (felt responsibility), while felt obligation influences behavior that is stronger than one's own perceived control (Chen, 2016). A denial of personal responsibility seems to be a major barrier for PEB (Lorenzoni et al., 2007).

3.2.9. Emotions

Emotions as a predictive force for behavior have been neglected in cognitive psychology and neuro-science for a long time (Damasio, 1998). Emotions are a mental state of readiness, based on one's own thoughts or appraisals of events (Bagozzi et al., 1999), and are related to behavior. An emotional involvement with the topic increases the likelihood of relevant action, given that the emotional involvement shapes attitudes and awareness (Kollmuss and

Agyeman, 2002).⁹ Emotions can support PEB promotion and education programs, especially in the field of consumer behavior (Rezvani et al., 2017). Anticipated emotions influence consumption decisions more than experienced emotions (Mellers et al., 1999; Schuitema et al., 2013) and they affect the intention to act pro-environmentally (Rezvani et al., 2017). Emotions have no impact on the probability of giving (pro-environmental donation behavior), but influence the donated amount (Ibanez et al., 2017).

3.3. *Habits*

Habits is a distinct type of causal variable according to the VBN theory (Stern, 1999). Habits are automatic responses in specific situations which do not require conscious intention (routine behavior) (Ouellette and Wood, 1998; Knussen et al., 2004). A resistance to change behavioral patterns as a result of long held habits is a PEB barrier (Lorenzoni et al., 2007; Carrus et al., 2008). Behavior, like travel patterns, is determined by habit rather than by rational calculation (Verplanken et al., 1997; Bamberg et al., 2003; Lorenzoni et al., 2007) and habitual drivers, for e.g., usually do not weigh the pros and cons of alternative transportation modes (Steg and Vlek, 2009). Giving up car use in favor of public transportation is found to involve “high costs” (Diekmann and Preisendörfer, 2003), even if public transportation is more environmentally friendly. However, a temporal interruption of people’s travel patterns (car drivers have to use public transportation) leads to a long-term reduction in car use (Fujii et al., 2001; Fujii and Gärling, 2003).

3.4. *Contextual factors*

Beside the above presented determinants, other contextual factors like individual, social and institutional determinants are likely to influence human behavior.

Social factors (peers): Individuals do not behave like monads. Following e.g. certain norms is related to peers, given that people searching for conformity, trying to avoid social disapproval or wish social approval of others (Farrow et al., 2017). Individuals with social ties to others who hold pro-environmental norms are more likely to engage in PEB (Videras

⁹Emotional disconnection is due to the fact that information about environmental degradation is often discomfoting & challenges current ways of living (Kollmuss and Agyeman, 2002).

et al., 2012). Peers also positively influence the intensity of green consumption (Welsch and Kühling, 2016), positively impact the guiding of recycling behavior (Ari and Yilmaz, 2016) and influence the adoption of GHG mitigation of their neighbors (Babutsidze and Chai, 2018). Concerns about one’s own reputation also influence individuals PEB (Alpizar and Gsottbauer, 2015). Another form of social influence is e.g. the working environment, showing that a firm’s environmental strategy (green climate) e.g. positively influences employees intentions and green behavior (Norton et al., 2017).

Individual factors: One decade ago, the happiness approach emerged as a novel approach to environmental valuation (Welsch and Kühling, 2009). In doing so, it can be viewed as a further way, beside the mainstream economic approaches (stated and revealed preferences), which are based on a purely anthropocentric perspective. Overall, studies indicate that PEB impacts positively on the intention to engage in future PEB (Hartmann et al., 2017) and that PEB is associated with higher subjective well-being (e.g., Villacorta et al., 2003; Brown and Kasser, 2005; Jacob et al., 2009; Welsch and Kühling, 2010; Suárez-Varela et al., 2016; Kaida and Kaida, 2016; Binder and Blankenberg, 2016; Schmitt et al., 2018). For a review of the relationship between SWB and sustainability, see: Kasser (2017).

One further individual factor is an individuals connection to nature (CN). CN (review: Restall and Conrad (2015)) describes the subjective connection of an individual to nature (Zelenski and Nisbet, 2014) and this connection affects (environmental) attitudes and values, and also strongly impacts ecological behavior and SWB (Mayer and Frantz, 2004). People associating themselves with nature are also more likely to possess environmental concern (Schultz et al., 2004). One limitation in these studies about CN is that the used scale is discussed controversially (Perrin and Benassi, 2009). Similar to the above mentioned connection to nature, also place attachment, an attitude exhibited by people, affects pro-environmental intention (Ramkissoon et al., 2012). The identification with a certain place can lead to identity, sustainable behavior and sustainable attitudes (Uzzell et al., 2002).

Alongside the emerging literature of identity, self-image and its role for PEB, also partisanship and ideology influence environmental attitude (Guber, 2013). Democratic and

Liberal-Left students show more environmental attitudes than Republican and Conservative students (Dunlap, 1975). Left-wing parties and individuals with similar political orientations exhibit more pro-environmental beliefs and attitudes (Neumayer, 2004). The States for example are confronted with highly political polarization between the left (belief in climate change) and the right wing (no climate change beliefs). Using data from a 2000 Gallup Poll of 1,004 adults, McCright and Dunlap (2011) show that people of the left wing (political orientation) are more likely to hold beliefs about global warming compared to people from the more right wing and the beliefs have strengthen over the past years.

Institutional factors: One further factor, also interacting as well as displaying certain norms, are the institutional factors. While policy-makers emphasize the role of laws and embrace them, the effects of these on PEB have still not been conclusively analyzed. Environmental sanctions, employed in the context of environmental policy, prove to be an appropriate deterrent in Germany (Almer and Goeschl, 2010). Specific policies could be helpful in the promotion of recycling behavior (Kirakozian, 2016) and even the advice and threat of sanction increase cooperation (waste management) in the beginning, but the effect disappears as soon as the sanction is applied (Festré et al., 2017).

The current status of the state as an institutional setting also influences PEB with people in developed economies possessing intentions of PEB are more likely to exhibit PEB than people in developing countries (meta-analysis: Morren and Grinstein, 2016). This might be due to, that also the pollution is higher in more developed countries. In general, the rise of GHG emissions (carbon dioxide) in a country is related to the stage of industrial evolution of a country and its share of older people (Menz and Welsch, 2012). One broad discussion in this line is the question about the interaction between income (money) and PEB. The environmental Kuznets curve (EKC) e.g. describes the relationship between income and environmental quality (macro level), assuming that economic beginning is associated with environmental degradation, followed by the second phase of growth related to environmental improvements (turning point: 8000-10000 dollars per capita) (Grossman and Krueger, 1995). The existence of this curve is discussed controversially (Stern, 2004). Within the EU, there are e.g. big differences in green purchase behavior (Liobikienė et al., 2016). An experimental

approach to analyze the influence of institutional settings shows that acting in collective ways helps to act pro-environmentally. Experimental evidence is given for the fact that resources will soon be destroyed (overexploitation of resources) if the extraction decision is made by individuals, while resources are sustained in a setting with democratically voted decision ([Hauser et al., 2014](#)).

4. Conclusion

To alter effectively human behavior that contributes to environmental problems we need to understand the drivers of behavior. PEB itself is complex in its variety as well as in the causal influences on it ([Stern, 2000](#)). An accurate understanding is important to successfully design studies, questionnaires, experiments and interventions in this research field. Focusing only on certain determinants can lead to misinterpretations regarding the causes of PEB. The literature on pro environmental behavior has developed rapidly in recent years, but there is room for further work. This paper offers a holistic overview of the economic and psychological PEB literature, presenting the determinants and behaviors which need to be considered in future empirical research.

We show that the number of behaviors used to measure PEB differs highly within the studies, causing a broad heterogeneity in study results. PEB is a heterogeneous construct and should be treated as such. This is in line with the claims of e.g. [Stern \(2000\)](#), who summarizes that environmentally significant behavior can be distinguished in four categories, namely (1) environmental activism (e.g. involvement in organizations), (2) nonactivist behaviors in the public sphere (political behaviors like e.g. petitioning), (3) private-sphere environmentalism (household behaviors like e.g. water saving, energy use, travelling modes) and (4) other environmentally significant behaviors.

We use the “Theory of Environmentally Significant Behavior” ([Stern, 2000](#)) as a starting point and take into account all the variables discussed in the models thus building on a foundation of existing knowledge and ideas. We refrain from discussing and presenting the different psychological models, given the extant literature already doing this. Based on our review, we summarize that PEB is determined by an interplay of socio-demographic (personal capabilities), attitudinal (psychological), habitual and contextual factors (individual, social

and institutional), which differ in their intensity. Looking into current studies shows that the coefficient of each determinant can either be positive or negative, given the specific type of behavior analyzed (low vs high cost behavior), also depending on the used behavioral factors.

Based on the stated research problems (used factors and used measures for PEB), there is a significant need for better data and the development of techniques to support more accurate empirical assessments of pro-environmental behavior. Work in these areas should help improve behavioral policy and achieve finally a more effective use of resources. There are several points that future research can draw and adhere to, given the room for improvement and further discourse. (1) There is a need for more complex models in applied work (integrated frameworks) using the identified factors which determine behavior. (2) More complex studies with questionnaires covering all relevant behavioral clusters are required in order to support the understanding of the impact of different determinants on single PEBs measurements. These studies can pave the way for a PEB index which covers a comprehensive spectrum of behaviors, able to measure PEB in an appropriate way. Thereby, the usage of panel-data instead of pure cross-sectional data could improve it, given that it allows the casual drawing of conclusions. Nevertheless, researchers should be careful about the validity of variables and consider the necessity of well-defined types of PEB (Lam and Cheng, 2002; Chao and Lam, 2011; Kormos and Gifford, 2014). (3) On the individual as well as the societal level one of the biggest questions is in face of the imminent climate change, which effects are partly already felt, we need to discuss how to mitigate the serious negative impacts humans are having on the environment.

Our study is not free of limitations. Firstly, this review primarily includes studies based on self-reported questionnaires, which is the standard in doing research about pro-environmental behavior. Secondly, not all articles reviewed in the study directly helped us address the specific issues identified in this paper. Reports and articles published outside the purposes of this review may also be reviewed by future researchers in order to further validate the results of this review article and draw our attention to analyze impact and identify further research gaps and new directions in the area of pro-environmental behavior research.

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Appendix A

According to [Stern \(2000\)](#), is it possible to distinguish PEB into four categories, namely (1) environmental activism, (2) nonactivist behaviors in the public sphere, (3) private-sphere environmentalism and (4) other environmentally significant behaviors. We use this as a starting point to give an overview of the different questions currently used in the literature. Tables [1,2](#) and [3](#) summarize the typical questions used. The questions differ in details of wording and are sometimes asked in a reverse coded manner. They vary in their degree of specification (e.g. “recycling” vs “recycling of paper, plastic,..”): Especially the number of behaviors used to measure PEB differs highly within the studies. Furthermore, some of these questions have to be double checked. While writing to politicians is probably archaic, other behaviors, like “online shopping” ([Whitmarsh and O’Neill, 2010](#)) are not that environmentally friendly, if packets are, for e.g. returned to seller.

Table 1: Questions to measure “Private-sphere environmentalism”

Private-sphere environmentalism	
e.g. (Whitmarsh and O’Neill, 2010; Lynn and Longhi, 2011; Longhi, 2013; De Leeuw et al., 2015; Binder and Blankenberg, 2017; Brick et al., 2017; Melo et al., 2018; Schmitt et al., 2018)	
Recycling	Energy use
<ul style="list-style-type: none"> - Separate items for recycling - Use recycling bins for paper, cardboard, cans, glass - Compost garden or kitchen waste - Reuse paper or glass - Buy products with less packaging - When I’m outside, I avoid littering - Decide not to buy something because it has too much packaging - Avoid excess packaging in purchases 	<ul style="list-style-type: none"> - Hang clothes to dry instead of using a dryer - Shut off electrical appliances when not in use - Reduce home air-conditioning use - Turn off lights when not in use - Reduce hot water temperature - Leave your TV on standby for the night - Minimize use of home heating - Put more clothes on when you feel cold rather than putting the heating on or turning it up - Leave the fridge door open while I think about what to eat
Conservation of water	Transport
<ul style="list-style-type: none"> - Turn off tap when soaping - Minimize number of baths or showers - Turn off tap when washing dishes - Run washer/dryer only when full - Minimize water use in yard or garden - Turn off tap when brushing teeth 	<ul style="list-style-type: none"> - Walk or cycle (for short journeys less than 2 or 3 miles) - Drive economically (e.g., braking or accelerating gently) - Take fewer flights when possible - Car share with others who need to make a similar journey - Use public transport (e.g. bus, train) rather than travel by car - Use public transit or carpool - Use an alternative to traveling (e.g., shopping online)
Nutrition	Consumption - Food
<ul style="list-style-type: none"> - Eat a diet based on organic, local, or free-range food - Eat a vegetarian diet - Eat food which is organic, locally-grown or in season - Avoid eating meat - Eat dairy products such as milk, cheese, eggs or yogurt - Consume biological products 	<ul style="list-style-type: none"> - Buy locally produced foods - Buy organic food - Grow your own food - Waste less food - Buy food at a farmer’s market
Consumption Reuse	Consumption Products
<ul style="list-style-type: none"> - Trade or share products with others rather than buy - Buy used products instead of new ones - Make your own products instead of purchasing - Fix something rather than buying something new - Use reusable bag/ Take your own shopping bag when shopping - Reuse or repair items instead of throwing them away - Carry a reusable water bottle - Use both sides of the paper sheet when drawing or printing a document 	<ul style="list-style-type: none"> - Buy energy-efficient appliances /Buy high-efficiency light bulbs - Buy environmental-friendly products - Buy environmental friendly soaps or cleaners - Buy products made from recycled materials - Buy recycled paper products such as toilet paper or tissues

Table 2: Questions to measure Environmental activism & Nonactivist behaviors in the public sphere

Environmental activism & Nonactivist behaviors in the public sphere	
e.g. (Stern, 2000; Whitmarsh and O'Neill, 2010; Dono et al., 2010; De Leeuw et al., 2015; Brick et al., 2017; Schmitt et al., 2018)	
Political/ Environmental behavior	Environmental citizen behavior
<ul style="list-style-type: none"> - Signing of (online) petitions - Write to politicians about an environmental issue - Demonstration/ protest for an environmental issue - Being a member in an environmental-protection group - Engagement in an environmental-protection group - Support pro-environmental candidates - Voting for green candidates 	<ul style="list-style-type: none"> - Talk to children about how food is grown - Spreading environmental knowledge - Attend pro-environmental meetings - Boycott products/ firms harming the environment (write protest letters) - Protecting-nature activities - Reading environmental publications - Educate yourself about the environment - Discuss environmental topics, either in person or with online posts (Facebook, Twitter, etc.)

Table 3: Questions to measure “Other environmentally significant behaviors”

Other environmentally significant behaviors	
Long term PEB decisions	Intention - Willingness-to-pay
<ul style="list-style-type: none"> - Installed a more efficient heating system - Bought/ built an energy-efficient home - Installed insulation products at home - Changed to a green energy tariff - Installed a renewable energy system (e.g., solar panels, wind turbine) - Bought a water-saving product (e.g., low-flush toilet) - Bought a low-emission vehicle (e.g., hybrid, electric, bio-fuel) 	<ul style="list-style-type: none"> - Willingness to prioritize environment over economy - Willing to pay much higher taxes in order to protect the environment - Willing to pay much higher prices in order to protect the environment - Willing to accept cuts in standard of living to protect the environment - Willingness to pay extra dollars per year for income tax if the extra money is to be spent to protect the environment - How much increase in gasoline prices, in cents per gallon would you be willing to pay if the money was spent to protect the environment? - Intention to sign up for a residential green electricity contract - Support for a tax on carbon dioxide
e.g. (Melo et al., 2018; Schmitt et al., 2018)	e.g. (Stern et al., 1993; Whitmarsh and O'Neill, 2010; Dono et al., 2010; Hornsey et al., 2016; Hartmann et al., 2017)

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