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Policies as Information Carriers: How Environmental Policies May Change Beliefs and Consequent Behavior

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ABSTRACT

This paper discusses how policy interventions not only alter the legal and financial frameworks in which an individual is operating, but can also lead to changes in relevant beliefs. We argue that such belief changes in how an individual perceives herself, relevant others, the regulator and/or the activity in question can lead to behavioral changes that were neither intended nor expected when the policy was designed.

In the environmental economics literature, these secondary impacts of conventional policy interventions have not been systematically reviewed. Hence, we intend to raise awareness of these effects. In this paper, we review relevant research from behavioral economics and psychology, and identify and discuss the domains for which beliefs can change. Lastly, we discuss design options with which an undesired change in beliefs can be avoided when a new policy is put into practice.

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"It's not what you look at that matters, it's what you see."

Henri David Thoreau

1 Introduction

Public policy is an important mean of guiding the behavior of individuals (Friedrich and Mason, 1940). This is particularly true in the environmental domain, which is characterized by externalities, asymmetric information and a lack of well-defined property rights. Market failure is ubiquitous, and policy interventions are needed to guide the behavior of individuals in order to align social and individual interests, and, ultimately, to protect the environment and natural resources from overexploitation. However, the search for the appropriate policy measure is not a trivial one, even more so when considering behavioral complexities highlighted in the fields of behavioral economics and social psychology (Gsottbauer and van den Bergh, 2011; Shogren and Taylor, 2008). In this paper, we reflect on how conventional policies (specifically, economic-incentive instruments and command-and-control) can cause an unintended change in beliefs, the behavioral consequences that can be expected from this change, and how policy design can be modified or complemented to deal with such changes in beliefs. As beliefs we understand an actor's subjective understanding about the (state of the) world and about herself.

In environmental policy, the classic approach to analysing human behavior is to assume that individuals act as if they were *homines oeconomici*. According to this view, individuals are perfectly informed and act rationally, consistently and purposefully in order to maximize their net gains (Kirchgässner, 2008). Since economic evaluation serves as the directive for decision-making, behavior can be effectively influenced by modifying prices or the available budget. Based on these assumptions,

scholars have worked on mechanisms for preventing inefficiencies and reaching Pareto efficient resource allocations. However, while theoretically sound, these mechanisms often fall behind expectations when applied in real policy settings (Bowles and Polanía-Reyes, 2012; Croson and Treich, 2014).

Reasons for the gap between predicted and real behavior are numerous, but a predominant one is that real human behavior is not congruent with the behavioral model used in standard economic theory. Decision-making is not the clean, rational, and straightforward process that it is assumed to be, but is characterized by bounded rationality. Decision-makers apply mental shortcuts and follow habits to ease the cognitive load in the decision-making process (Gigerenzer and Gaissmaier, 2011; Kahneman and Tversky, 2003). The use of these heuristics, however, can lead to biases in the perception of the decision situation, such as relevant benefits, costs or risks, and may prevent the decision-maker from maximizing her utility.

Previous reviews have done an excellent job of assessing the relevant literature on behavioral economics and these 'decision anomalies' and in elaborating their implications for environmental policy design (Carlsson and Johansson-Stenman, 2012; Croson and Treich, 2014; Gsottbauer and van den Bergh, 2011; Hanley and Shogren, 2005; List, 2005; Shogren and Taylor, 2008; Venkatachalam, 2008). The focus of these reviews is on understanding which heuristics and biases can play a role in the environmental domain in question, and how policy outcomes can be distorted by those behavioral 'failures'. In this paper, we want to go a step further by tapping into the underlying drivers of behavior: the beliefs of a decision-maker. We discuss how conventional policy approaches, such as economic incentives or legal regulations, can change the beliefs that are relevant for individual decision-making, and how this in turn can affect individuals' behavior in ways that were *not intended* by the policy. In order to keep a clear focus on where we see the most potential to contribute, we focus only on conventional policy approaches emphasized in environmental economics as effective ways for addressing externalities, specifically economic-incentive instruments and command-and-control. Thus, we do not review as independent interventions those approaches focusing on information provision or behavioral interventions, such as nudges, and the corresponding belief

changes that may be induced by these interventions.[1] However, where appropriate, we discuss the potential of some of these latter interventions as complements to the conventional policies that can help avoid or overcome negative belief changes induced by the conventional policies. In the paper, we will give examples on when and how they can be useful for this purpose.

Our intention with this paper is to raise awareness of the fact that environmental policies not only influence the legal and/or financial settings in which a decision-maker is operating but policies can also affect beliefs in unintended ways. A policy intervention may alter the beliefs an individual holds about relevant others, the regulator, the situation in question, or even about herself.[2]

In this paper, we systematically discuss the channels through which changes in beliefs can take place and link these to relevant insights and theories from behavioral research. In doing so, we take the perspective of the individual. This means we do not examine whether a policy intervention affects social norms, as done, for example, in Kinzig (2013) or Nyborg (2018). Rather, we examine whether the individual *believes* that the social norm has changed. Bénabou and Tirole (2016) provide an excellent primer on the relevance of beliefs in individual economic decision-making. They developed a formal model of behavior including specific aspects of beliefs about oneself. Our review, by comparison, is broader and also includes beliefs about relevant others, the regulator, and the targeted activity. It should be noted that our focus on individual decision-making also implies that we do not examine how beliefs

[1] Of course, information provision and behavioral interventions can also affect beliefs. In fact, this is often an explicit focus of such interventions. Yet, our focus is on unintended impacts on beliefs and we see the largest need to highlight these for economic-incentive and command-and-control approaches. We would like to refer readers interested in nudges as an environmental policy tool to Carlsson (2019) and Lindenberg and Papies (2019). We acknowledge that conventional policies, in addition to affecting beliefs, can also provide objective information that improves awareness or knowledge of the problem. However, this is not the focus of our review, which focuses on unintended effects on beliefs.

[2] A related term commonly used in the psychology literature is 'perception'. We understand as 'perception' the process by which we acquire information about the world, on the basis of which decision-makers form, confirm or update their 'beliefs'. To ease readability and link to relevant literature in economics we predominantly use the term 'beliefs' in this paper.

influence the behavior of organizations, networks, or groups of decision-makers, unless the relevant decisions are made by a single individual.

Existing research on the secondary effects of environmental policies concentrates on potential crowding effects (Frey and Stutzer, 2012; Rode *et al.*, 2015). We complement this research by discussing its insights in a broader framework of possible belief changes.[3] This enables us to identify points which have been neglected in the discussion around crowding effects. We base our arguments on insights derived from recent research in behavioral economics and social psychology. Our intention is to initiate a discussion on which beliefs can change following a policy intervention and how the design of policies can be amended to circumvent negative effects or to affect the beliefs of individuals in a desirable direction.

This paper proceeds as follows. Before illustrating potential changes in beliefs, we briefly review in Section 2 the conventional ways through which environmental policy aims to influence behavior, namely, via a change in financial or legal terms. In Section 3, we systematically list the domains for which a change in beliefs can take place and thereby influence individual decision-making. We discuss changes in the individual's self-image (Section 3.1), the beliefs about relevant others (Section 3.2), the beliefs about the regulator (Section 3.3), and the beliefs about the decision situation in question (Section 3.4). Each subsection summarizes the key insights from the relevant literature and discusses how policy interventions can alter the prevalent beliefs. We conclude each subsection with recommendations for policy design. In Section 4, we present conclusions.

2 Conventional Ways to Influence Behavior with Environmental Policy

Before examining the beliefs through which policy interventions may alter behavior unintentionally, we briefly review the two main ways through which environmental policy conventionally aims to alter behavior.

[3]Crowding effects may also be due to changes in preferences (Bowles and Polanía-Reyes, 2012) besides changes in beliefs (Dufwenberg *et al.*, 2011; Ellingsen, 2012). In this paper we focus on changes in beliefs.

The first approach is ***changing relative prices or payoffs***. For instance, an environmental tax leads to an increase in the costs of an environmentally harmful activity, thereby making the activity relatively more costly to the producer. Similarly, an environmental subsidy increases the producer's benefits from a more socially-desirable activity, thereby making that activity relatively more profitable. Prominent examples of environmental subsidies are subsidies on solar panels or public payments for environmental services, such as agri-environmental payments to farmers (Engel *et al.*, 2008). The change in relative payoffs leads to a shift in the producers' supply functions and a new market equilibrium emerges in which consumers react directly to the price change and indirectly via a potential shift in demand functions as their income constraints get tightened or relaxed.[4]

The second approach of influencing behavior with environmental policy is ***changing the legal constraints***. Environmental laws or regulations define what behavior is permitted and what activities are illegal. Emission standards, for example, set a quantitative limit on the permissible amount of specific (air) pollutants released, while technology standards prescribe the use of particular technologies, such as end-of-pipe filters.

Throughout this paper, we will refer to two exemplary (environmental) policy interventions to illustrate the effects discussed. On the one hand, environmental taxes and subsidies (including public payments for environmental services) will serve as examples of the economic-incentive approach to environmental policy. On the other hand, standards are used as an example of the command-and-control approach. Typically, policy interventions aim at altering one domain, either the payoffs or the legal constraints. However, side effects on the other domain are not uncommon. For example, declaring an area as a nature reserve restricts the (legal) action space of the individuals living and operating in the area. But, at the same time, the new legal setting also changes the financial starting position of the individual by restricting, for example, the harvesting possibilities. The expected payoff from the prohibited activity, in this case from harvesting, is reduced to zero (in a world

[4] Although these effects can be seen as producers updating their information about costs and benefits of the activities, these are all intended effects of the policy. Our review focuses on unintended effects.

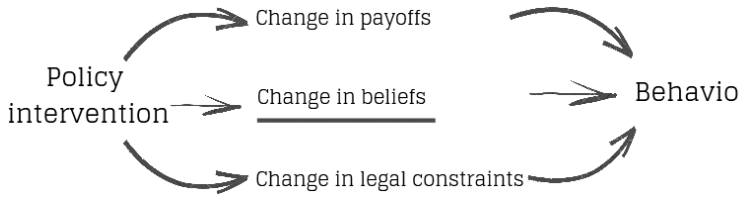

Figure 1: Potential drivers of behavioral change.[6]

with perfect enforcement) or at least mitigated by the product of the monitoring probability and the penalty. In the following section, we discuss further domains through which policy interventions may affect the decision-making process of an individual. Namely, we examine how policy interventions evoke changes in relevant beliefs,[5] which can in turn also trigger a behavioral response (see Figure 1).

3 Relevant Belief Domains

The effect policy interventions may have on the decision-makers' beliefs can best be illustrated by distinguishing the domains in which potential changes in beliefs may take place. Generally, the domain can lie inside or outside of the decision-maker. For example, a policy intervention may lead individuals to see their own actions or personal norms in a different light, and thus lead to a change in their self-image. This represents a change in the decision-maker's beliefs about herself/himself. Alternatively, the individual may perceive an aspect of the outside world differently and hence modify her belief about the world. This constitutes then a change in the decision-maker's world-view. Specifically, policy interventions can convey information about and affect the decision-maker's world-view with respect to (i) relevant others, (ii) the regulator, and (iii) the situation in question. Figure 2 illustrates the respective

[5]This does not mean that a change in beliefs necessarily occurs. The policy intervention may also just reinforce an existing belief of, for instance, a social norm or value.

[6]There are also other potential changes which may take place due to policy interventions, such as, for example, a long-term change in preferences. However, for the scope of this paper we focus on short- and medium-term effects via beliefs.

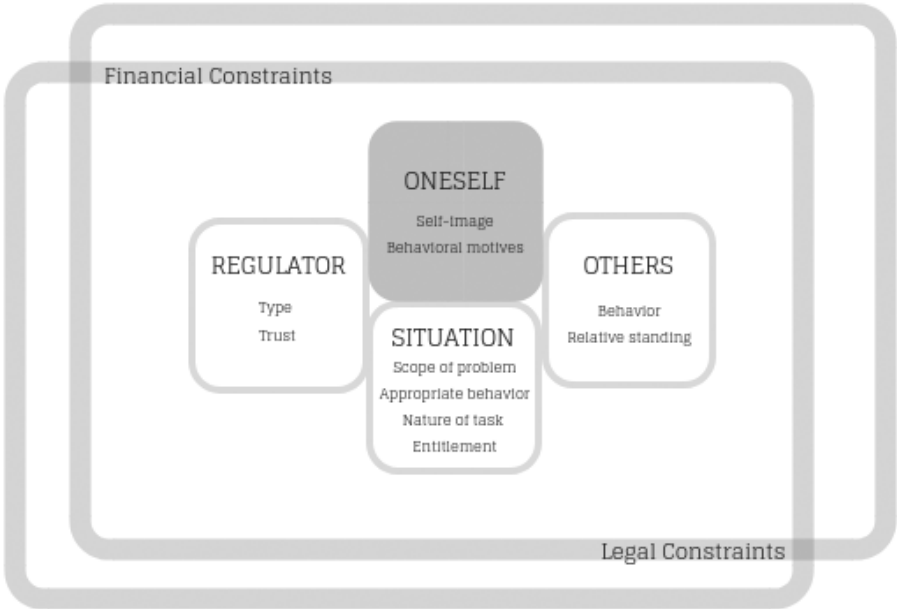

Figure 2: Relevant belief domains.

domains for which changes in beliefs can take place. In the following sections, we discuss in detail each belief domain with respect to (i) how the beliefs affect behavior, (ii) how environmental policy may affect the relevant beliefs, and (iii) implications for policy design.

3.1 Beliefs Regarding Oneself

To understand the world and oneself better, humans continuously reflect on their actions and beliefs. In this section, we discuss belief changes regarding one's self-image and behavioral motives.

3.1.1 Beliefs Regarding One's Self-image and Behavioral Motives

Since Akerlof and Kranton (2000), self-identity is a widely accepted component in the utility functions. Self-identity is based on a set of beliefs about one's preferences, moral norms, and abilities. According to dual self-theory, the decision-maker takes on two roles during the decision-making process (Bénabou and Tirole, 2006; Bodner and Prelec,

2003). First, the decision-maker acts as the decider, who chooses the action which fits her preferences best. For example, she purposefully chooses the behavior that contributes to the (self-)image she desires to create about herself. Second, the decision-maker acts as a judge, that means she interprets the action ex-post and uses past behavior as a diagnostic tool to determine who she is in terms of the preferences and norms she holds.

Acting pro-environmentally is therefore often motivated not only by a concern for the environment, but also by the decision-makers' desire to be an environmentally conscious person. A pro-environmental deed is ex-ante motivated by the preferences the decision-maker holds, including a preference for good environmental quality or a self-centered preference to be an environmentally-conscious person. Ex-post, when acting as a judge about own actions, any action which affirms an aspect of the self that the decision-maker appreciates, generates a utility gain since the action makes this aspect of the self more salient (Bem, 1972). By contrast, any action which contradicts the self-image, i.e., the decision-maker's notion of who she is and who she wants to be, causes a utility loss (Brekke *et al.*, 2003). Ex-post the pro-environmental deed thus confirms a self-centered preference to be an environmentally-conscious person and thereby creates additional utility when the individual's assumption of her own 'goodness' is confirmed (Dal Bó and Terviö, 2013).

Related to the decision-maker's belief of her self-image are her beliefs about why she behaves in a certain way. Research suggests that when a particular behavior is freely chosen, the decision-maker interprets it as a manifestation of her true preferences and personal norms (De Charms, 1968). If, on the other hand, an external intervention promotes or inhibits a behavior, the decision-maker may attribute the same behavior to the extrinsic incentive and no longer to her own desire to act pro-environmentally. In this situation, the perceived locus of control shifts from the individual to the external factor motivating the action and a 'crowding out' of the intrinsic motives to act pro-environmentally may take place (Frey, 1999; Frey and Jegen, 2001).[7]

[7]This mechanism is the essence of several theories in the psychological literature, such as the hidden costs of rewards (Deci and Ryan, 1985), self-determination theory (Deci *et al.*, 1999), and the over-justification effect (Lepper and Greene, 1978).

For environmental policy, this means that a decision-maker can be motivated to act pro-environmentally by policy interventions, but whether she also continues pursuing the pro-environmental behavior (in a different decision situation or when the policy incentive is removed) depends on what behavioral motives she assigns ex-post as the driving force for action. On the one side, policy interventions can 'crowd in' pro-environmental behavior if the decision-maker perceives the external incentive as recognition of her efforts. For instance, an environmental tax can reassure a decision-maker that abstaining from certain behaviors coincides with the behavior of an environmentally-conscious person. On the other hand, the implementation of an environmental tax can lead the decision-maker to conclude that she does not carry out the harmful activity because she is a person who cares about the environment, but because abstaining makes economic sense. Gneezy and Rustichini (2005) demonstrate in this context that decision-makers can understand a fine as a price for inappropriate behavior, and by paying the fine individuals free themselves from the moral obligation to act appropriately. In a similar manner, payments for environmental services can also lead to a reversal in the perceived causality. If the decision-maker attributes certain behaviors to the incentive of a payment, and no longer to an intrinsic desire to behave in an environmentally-responsible way, it can happen that she refuses to perform the (targeted) activity once payments are no longer offered in exchange. In the literature on payments for environmental services, this aspect is listed as one of the dangers seen in 'commercializing nature' (Chervier *et al.*, 2019; Muradian and May, 2010).

Whether external incentives actually act as substitutes or complements to intrinsic motives to act pro-environmentally, such as the desire for environmental quality or the desire to act as an environmentally conscious person, depends strongly on the context and how the incentives are implemented (Bowles and Hwang, 2008). Hence, it is advisable to reflect carefully on what inferences about the self-concept of the decision-maker the policy intervention promotes and to frame the policy accordingly. For example, where intrinsic motivation is a relevant driver of pre-policy behavior, adverse effects on beliefs can be alleviated by portraying payments for environmental services as an acknowledgement of the desired activities and not as a compensation (Leimona, 2015). In the case of environmental taxes

and prohibitions, on the other hand, it is advisable to introduce them as a mechanism for protecting the commons. Pre-policy surveys and interviews with focus groups can provide knowledge on why decision-makers perform or omit the behavior of interest ex-ante. Understanding behavioral motives can thus help to design policies that do not interfere with the self-image of the decision-makers. If crowding out is expected and cannot be avoided, it may be necessary to increase the tax or subsidy over time to counteract the decrease in intrinsic motivation.

3.2 Beliefs about Relevant Others

In the previous section, we illustrated how policy interventions can affect the way decision-makers perceive themselves. These belief changes, however, only capture one side of the story. Individuals are not isolated decision-makers, but social beings who care about the opinion and actions of others. In this section, we examine how the beliefs regarding others influence a decision-maker's behavior, specifically the belief about (i) the behavior of relevant others and (ii) the individual's relative standing among these others. Again, we discuss how policy interventions can alter the individual's beliefs in this regard and how policies could be designed to prevent adverse effects. Relevant others are peers whose abilities, qualification and background are similar to those of the decision-maker. The relevant others encompass people who form the social environment of the decision-maker and who are operating in the same or in a similar action space.

3.2.1 Beliefs about the Behavior of Others

Regarding the belief about the behavior of others, two behavioral drivers of interest have been identified over decades of behavioral research. The first is the preference for conformity (Cialdini and Goldstein, 2004; Luzzati, 1999). The second is conditional co-operation, i.e., the fact that a considerable share of individuals are only willing to act pro-socially when others do so as well (Fischbacher *et al.*, 2001). In both cases, decision-makers are aligning their behavior to the behavior observed in others. This, of course, also applies to pro-environmental behavior. Alpizar *et al.* (2008) show, for example, that donations to the

preservation of a national park significantly increase when information about the contributions of others is provided.

Also the concept of social norms refers to the behaviors that the decision-maker believes others are engaging in. Social norms are commonly understood as the grammar of social interactions (Bicchieri, 2005). Changes in the belief about what others do (descriptive norm) or approve of (injunctive norm) can consequently lead to behavioral change (Bicchieri, 2017; Cialdini *et al.*, 1990). Thus, the belief about the prevalent social norms is highly relevant for environmental policy. It may be that a decision-maker realizes only through a policy intervention that she behaves differently from her peers. For instance, the introduction of a policy to promote recycling may lead an individual to realize that people around her are engaging less in recycling than she does. In the worst case, she also stops recycling and aligns her behavior with her belief about common behavior. In the literature, this destructive dynamic is known as the boomerang effect (Schultz, 2007). In the case of payments for environmental services, a similar point can be made. Introducing a compensation scheme for applying environmentally-friendly practices may make pro-environmental land users aware that others do not act pro-environmentally. This realization may weaken their motivation to continue acting pro-environmentally, particularly in domains in which no compensation is offered.

On the other hand, policy interventions can also alter the belief about others' behavior in a supportive manner. The introduction of a compulsory recycling policy can, e.g., also lead the decision-maker to believe that now also others recycle, which makes her own recycling meaningful in contributing to reaching a threshold. In this case, the belief change crowds-in the pro-environmental action.

For the design of policies, it is, therefore, advisable to be aware of the degree to which individuals can observe the behavior of others and the information which is communicated about the behavior of others via the policy intervention. If individuals can easily observe the behavior of others, belief changes as discussed in this subsection are not a concern. If the behavior of others is not easily observable, as the case for many activities impacting the environment, the framing of the policy can be adjusted to counter the potentially harmful change in beliefs regarding the behavior of others. For example, when implementing

an environmental policy, it can be supported by a campaign which delineates the policy measure as supporting an already ongoing shift towards more environmentally-friendly behavior. Similarly, a payment for environmental services program could be framed as rewarding the significant proportion of decision-makers who are already willing to act pro-environmentally.[8]

3.2.2 Belief about One's Relative Standing

We next discuss the role of social comparison and how policy interventions can influence the belief of one's own performance in comparison with that of others. The concern about one's relative position is a well-recognized driver of human behavior (Veblen, 1899). The relevance of social comparison for individual behavior can be illustrated with the relative income effect: individuals have limited interest in how much they earn in absolute terms; for their subjective well-being it predominantly matters how much they earn relative to others (Clark *et al.*, 2008).

Policy interventions for that matter can provide new information on the basis of which individuals alter their belief about their relative performance among the relevant others. This realisation may undermine the motivation to act pro-environmentally, as described in the previous section, but can also reinforce the efforts if the behavior is associated with social status (Ariely *et al.*, 2009; Ball, 2003; Lindbeck, 1997).

For instance, Ek and Söderholm (2008) examined the choice between green and grey electricity and Sexton and Sexton (2014) analysed purchase motives for hybrid vehicles. Both studies find that besides economic factors and environmental preferences, also status concerns influence the decision-making. Similarly, Howarth (1996) discusses the effect of status on consumption and highlights that, when status concerns are present, the tax rate needed to change behavior differs significantly from the optimal rate, calculated only on the basis of

[8]However, doing so may conflict with achieving additionality in the provision of environmental services (Engel *et al.*, 2008). Yet, a study by Alpizar (2014) indicates that the exclusion of persons who have already provided the environmental services prior to the introduction of payments can be perceived as unfair and crowds out their motivation to provide the service any longer.

economic factors. Alpizar *et al.* (2005) show that status concerns not only matter in the consumption of classic positional goods, such as cars or houses, but also for the consumption of less materialistic goods or actvities, such as vacations.

To illustrate our point, let us assume that the consumption of a good or activity, for example, flying, generates social status benefits for the decision-maker as a by-product of the consumption of the good. In this case, a Pigouvian tax needs to be adjusted upwards to outweigh these additional benefits. However, the reverse case is also possible: the relevant others may care about the environmental damage caused by flying. In this case, refraining from traveling by air could create status benefits, in which case the tax rate could be set at a lower level. In the agricultural sector, changing to organic farming, for example, may lower prestige in conventional farming communities. Consequently, agri-environmental payments must be higher than the opportunity costs to compensate for the loss of status and incentivize a switch. However, for more widely accepted measures such as flowering strips, payments set at the opportunity costs may be sufficient to motivate farmers to carry out the measures.

Hence, how a decision-maker reacts to a policy and to what extent a policy intervention is needed depends crucially on the decision-maker's perception of what behavior she believes creates prestige among her peers. For researchers and policy-makers, it is, therefore, crucial to understand what type of behavior scores well in the social comparison.

If prosocial behavior can provoke status benefits, desirable behavior can additionally be promoted through measures increasing the visibility of the behavior. For policy design, this could mean that a conventional policy is supplemented by a measure to make environmentally-friendly and prestigious behavior visible. For example, a subsidy for electric cars can be complemented with the option of a license plate indicating that the car is electric.[9] Similarly, households that receive a subsidy for heat insulation could receive a sticker for their door showing that their house is climate-friendly.

[9]For example, in Germany, electric car owners can opt for a license plate with an E at the end.

3.3 Beliefs about the Regulator

The regulator is the third type of actor about whom the decision-makers hold beliefs, which may, in turn, influence behavior[10] and can be affected by a policy intervention. Two forms of beliefs are central in this context: (i) the decision-maker's belief about what type of regulator she is facing, and (ii) the decision-maker's perception about what kind of beliefs the regulator holds about her and the other actors.

3.3.1 Belief about the Regulator's Type

Independent of the specific matter, a regulator can be an authoritarian or libertarian type and can either believe in bottom-up regulations or prefer top-down orders. By choosing a certain regulatory instrument, he reveals information about these underlying preferences.[11] Prohibitions, for example, are a sign that the regulator believes mainly in the exercise of authority. By contrast, the introduction of an environmental tax or the provision of payments for environmental services signals that the regulator believes that resources are most efficiently allocated through market-like forces. The mere promotion of voluntary agreements, including contracts for payments for environmental services negotiated between users and providers of ecosystem services, indicates that the regulator is of the libertarian type.

This belief about the regulator's type can influence how the decision-maker reacts to the policy. Particularly when the ruling style does not match the decision-maker's view of how the state should govern, conflicts are likely. Support for this conclusion comes from research on tax compliance. Here, studies have shown that taxpayers are more willing to pay their taxes when they perceive the tax authorities as a friendly, understanding, and service-oriented institution (Alm and Torgler, 2011). For policy design, it is thus recommended that attention is given to the communication of the severity of the problem that

[10] A recent study from Drupp *et al.* (2019) shows that industrial fishermen behave less honestly in experimental games when confronted with their disliked regulator, the EU.

[11] In the context of financial regulations, Drazen (1998) describes a similar idea of how policies can lead to unexpected perverse effects because the regulations were understood as signals about the type of the regulator, e.g. his toughness and/or as indications of how future regulations will look like.

accompanies a new policy measure, instead of allowing the discussion to drift in an ideological debate about appropriate governing styles.

3.3.2 Belief about the Regulator's Level of Trust

Which belief the decision-maker finally forms about the regulator depends also on the decision-maker's perception of the regulator's beliefs about her as an actor.[12] These beliefs can be twofold. First, does the decision-maker believe that the regulator has faith in her (intrinsic) motivation to act pro-environmentally? Second, does the decision-maker believe that the regulator trusts in the decision-maker's ability to self-regulate? Both beliefs reflect a perception of how much the regulator trusts the decision-maker.

From behavioral research, we know that (the perception of) trust can be a powerful behavioral driver. A number of studies show that individuals act more pro-socially and invest more efforts in performing their tasks when principals are perceived as trusting 2007.

Controls and monitoring, by contrast, are believed to be signals of distrust, and the decision-makers lower their performance efforts as a consequence (Dickinson and Villeval, 2008; Falk and Kosfeld, 2006). For example, Fehr and Rockenbach (2003) showed that cooperation is strongest when it is commonly known that penalizing incentives are available, but the principal refrains from using them. Trustworthiness, on the other hand, is seen as lowest when the principal decides that a sanctioning mechanism automatically kicks in as soon as efforts are too low. In summary, agents reward trust with positive reciprocity and punish distrust with negative reciprocity (Fehr and Gächter, 2000; Fehr *et al.*, 1997; Fehr and Schmidt, 2000).

For the choice of environmental policies, we can thus state that regulatory approaches differ in the degree of trust signaled. When applying an environmental tax, the regulator has chosen a negative, prohibiting measure to regulate behavior, while a subsidy is a positive, enabling one. At the same time, the choice of a price mechanism (both tax or subsidy) may be understood as a signal that the regulator is confident in the decision-maker's ability to self-regulate. Furthermore,

[12] In contrast to beliefs regarding oneself, this corresponds with second-order beliefs; what does the decision-maker think the regulator believes about her.

the regulator must believe that the 'forces of the market' are strong enough to push the harmful activity to the desired level. A regulation, by contrast, defines clearly the behavior that is legally allowed and does not allow the decision-maker to decide for herself which approach or way of behaving is best.

The decision-maker's perception of a regulator's trust is not only relevant for the implementation of a new policy, but also for its enforcement. Tyler (1990) argues in this context that people obey the law if they believe it is legitimate, and procedural fairness is one key determinant of this belief. There is initial evidence in the environmental domain to support this view. Winter *et al.* (2007), for example, find that coercion as an enforcement style of agri-environmental regulations lowers future compliance. And in the case of payments for environmental services, these hidden costs of control may in part explain why the majority of the payment schemes — despite being formally conditional on the adoption of specific activities — do not strictly enforce this conditionality in practice (Wunder, 2018).

For policy practice, we therefore recommend examining how decision-makers perceive treatment by the responsible governing body, such as the agency responsible for environmental protection or the enforcement authority. This will crucially influence the willingness of the actors to comply with the authority's requests. Adjustments in enforcement style, signaling procedural fairness, and communicating an understanding for the decision-maker's situation (for example, regarding the impact of weather on farmers' performance in terms of environmental service provision) can likely help to promote compliance with policies and uptake of payments for environmental services.

3.4 Beliefs about the Situation

Policies may also induce inferences about the situation in question and the desired change in behavior. Strictly speaking, the inferences are again based on the decision-maker's beliefs of how the regulator sees the situation in question. Specifically, we ask whether the decision-maker can form beliefs about (the regulator's belief about) (i) the scope of the problem, (ii) appropriate behavior of the decision-makers, (iii) the nature of the task in question, and (iv) the associated understanding of the underlying entitlements.

3.4.1 Beliefs about the Scope of the Problem

Policy interventions can convey information about how common a problem is or how severe the environmental harm is (believed to be). For example, an increase in the water price can be understood as signal for existing water scarcity and hence creates awareness for the problem (Tang *et al.*, 2013).[13] While the fact that the government decides to intervene can be interpreted as an indication that a wider societal problem exists, the choice of a particular policy instrument helps to define the scope of the problem. Choosing a tax as the regulatory instrument may be interpreted as an appropriate instrument to regulate a widespread, but moderate problem. The tax rate may also give indications on the social costs of the activity. Prohibitions, on the other hand, may be understood as a more powerful regulatory instrument against sporadic, but extremely harmful activities. Softer policy approaches such as information campaigns could be seen as measures to address common, less environmentally harmful behavior. If this is true, legal regulation may also strengthen the belief that a problem is serious, while a tax may lead to the belief that a problem is less serious. In this case, the tax rate might need to be adjusted upwards to compensate for this effect on beliefs.

3.4.2 Beliefs about Appropriate Behavior

Also the situation in which the behavior is carried out is decisive (Tversky and Kahneman, 1981). This is because the nature of the decision situation provides the decision-maker with clues about what behavior might be appropriate in a given situation.

Following this logic, policy interventions can alter a decision-maker's belief of what behavior is appropriate in the given situation. Experimental studies have shown, for example, that the introduction of a fine or monetary remuneration can motivate a decision-maker to exercise strategic reasoning rather than basing a decision on moral arguments, and this can reduce or crowd-out pro-social behavior (e.g., Frey and

[13]Following Tang *et al.* (2013) and Sudarmadi (2001) the perception of the water scarcity can consequently create environmental awareness which in turn is understood as an individuals' attention and concern to the environment problem, and this reinforces a behavioral response.

Oberholzer-Gee, 1997). In other words, the introduction of an environmental policy using economic incentives may change people's perception of behavior that is inappropriate versus appropriate as long as one pays the tax or forgoes the subsidy associated with the behavior. Bowles and Polanía-Reyes (2012) argue that these effects can be understood as framing effects in which the behavior changes due to a change in the decision frame. This argument has also been put forth in the previously mentioned literature on the dangers of 'commercializing nature' via payments for environmental services (Chervier *et al.*, 2019; Muradian and May, 2010).

Policy implications are similar to those discussed in the previous subsection. If a crowding out effect is expected and cannot be avoided, the tax or subsidy may be raised to counteract the effect. To avoid a potentially counter-productive change in beliefs, however, the environmental policy could be framed in a way that emphasizes that the environmentally harmful behavior is not socially desirable. For example, payments for environmental services can be framed as a reward for behaving more appropriately, while an environmental tax can be communicated as an incentive to reduce inappropriate behavior.

3.4.3 Beliefs about the Nature of the Task

A policy intervention may change a decision-maker's understanding of the activity in question.

First, the intervention may make the decision-maker aware of previously unknown alternatives. For example, agri-envrionmental payments may draw farmers' attention to practices they have not been familiar with before. Secondly, the decision-maker may through the policy intervention gain new information about the private costs or benefits associated with the activity in question. Finally, the choice and extent of a policy intervention may indicate (the regulator's convictions regarding) the difficulty and elaborateness of a measure. The latter two points are closely linked. Whether a task is carried out, such as the adoption of a conservation measure, depends on the individual's subjective belief of how difficult and (economically) attractive the task is. From studies on general principal–agent settings, such as work environments, it is known that agents understand the level of a reward as a signal for the

prinicipal's perception of the difficulty or complexity of the task to be performed (Gigerenzer and Selten, 2002; Simon, 1997).

A tax or payment, for example, indicates that a behavioral change is believed to be doable. The level of the tax rate or payment allows inferences on the level of effort that the regulator thinks the change in behavior involves on the part of the decision-maker. A prohibition, by contrast, signals that the regulator considers modifications within the practice in question as not possible. If the decision-maker recognizes from the level of the payment (or tax rate) that the regulator finds the execution (or reduction) of the task difficult and/or laborious, this can affect the behavior of decision-makers in two ways. On the one hand, this realization can discourage decision-makers from taking action. On the other hand, this realization can also motivate the decision-maker to take up the challenge.

For policy design, it is therefore crucial that a communication strategy accompanies the introduction of the policy measure. The strategy should state that the task is feasible. And it should state either that decision-makers are equipped with the necessary resources and skills, or that support from the regulatory body is offered.

3.4.4 Beliefs about Underlying Entitlements

The choice of a particular environmental policy also conveys information on how the governing body understands the entitlements linked to the associated activities. This message may or may not be consistent with the decision-maker's belief of her entitlement rights.

Taxes and prohibitions are expressions of the polluter-pays-principle, conveying that the decision-maker has no fundamental right to conduct the environmentally-harmful activity. Environmental subsidies and payments for environmental services imply that decision-makers have a right to conduct the harmful activity and must be compensated in order to refrain from it. Since this view often corresponds more with the beliefs of decision-makers, subsidies and payments are often more readily accepted and are therefore politically easier to implement. However, there is a risk that the message of a steward-rewarded principle also alters the beliefs of decision-makers not targeted by the policy regarding their right to conduct harmful activities. For example, farmers from a natural reserve in Nicaragua, where the concept of payments for environmental

services (PES) has been widely publicized since the implementation of a specific silvopastoral PES scheme on private lands, are allegedly demanding compensatory PES for protecting the remaining forests on their properties (Van Hecken and Bastiaensen, 2010). This implies that it is important to communicate clearly why PES are introduced in certain areas or for certain activities, and not for other areas or activities. In this regard, the practice of introducing PES in protected areas, which is sometimes observed in developing countries, also needs to be seen critically as it may undermine the very concept of a protected area (Brimont and Karsenty, 2015).

Avoiding market framing in the implementation of a policy can be another approach to avoiding undesirable belief changes regarding entitlement rights. For example, when the dialogue with local communities in Bolivia on a possible PES started, the respective implementing agency quickly realized that the use of the word 'payments' was causing problems as the word was associated with privatization and land appropriation (Wunder and Vargas, 2005). Part of the solution in addressing this included reframing the program as 'compensation', although in the end participants preferred to discuss the project simply in terms of 'improved management of hydrological resources'. Avoiding terms like 'markets' or 'payments' would probably have facilitated the implementation process (Wunder and Vargas, 2005). Similarly, it has been argued that framing PES as rewards could be preferable in order to emphasize that those providing environmental services are acting in a socially-desirable manner (Leimona, 2015; Ochieng, 2016).

4 Conclusion

In this paper, we intended to raise awareness of the multiple levels at which a policy intervention can induce changes in beliefs, which in turn may change the behavior of decision-makers in unexpected ways. Not every belief change will translate into a behavioral change, but unintended changes in beliefs do have the potential to hinder or even pervert originally intended effects of environmental policies. We therefore consider it important to be aware of the belief dimensions that such secondary effects can emerge from and to make them part of the policy analysis.

We have discussed four belief domains that may be affected by policy measures: (i) a decision-maker's self-image and the beliefs about her behavioral motives, (ii) her beliefs about relevant others, (iii) her beliefs about the regulator, and (iv) her beliefs about the targeted activity. We conclude that all aspects of a policy package are relevant for the beliefs of the decision-maker. This means belief changes can be induced by (i) the mere fact that the government intervenes, (ii) the choice of the policy instrument, and (iii) its magnitude. Furthermore, the manner in which the policy is introduced and the way the policy is enforced may impact the decision-maker's beliefs in the aforementioned four belief domains.

It should also be noted that the impacts are context-dependent and are likely to be mediated by factors such as how the government is generally perceived (for example, the degree of corruption) and political narratives. Communication is in this context a political instrument itself which can influence behavior, for example, through narratives that are changing beliefs about the state of the world. However, political narratives can also be an insurmountable barrier when they stand in the way of the behavioral change that the political intervention seeks to bring about.

In this paper, we have also discussed how policy design can be adjusted to account for the potential changes in the relevant beliefs. Such policy implications can involve (i) the choice of instrument, (ii) the extent of the instrument (for example, adjusting the level of an environmental tax or subsidy to account for anticipated belief changes), and/or (iii) adjusting the framing of a policy or complementing them with other behaviorally-informed interventions.

Obviously, we cannot offer a one-size-fits-all policy recommendation on how to prevent detrimental effects from unintended or disregarded belief changes. Yet, in the following we offer some approaches which, in our opinion, can help to avoid unexpected surprises.

First, before starting the design of a policy intervention it can be advisable to conduct interviews with decision-makers of interest in order to collect information about the prevalent beliefs and attitudes, on the one hand, and to understand what motivates the decision-makers to act as they currently do, on the other hand.

Second, during the policy design phase, special attention should be paid to how the implementation of the new policy measure is communicated. A more effective communication strategy may refer to the social costs that the current behavior is causing, conveys the objectives of the new policy, clarifies why this objective is important, and emphasizes already existing positive behavior among individual decision-makers.

Further, we recommend evaluating the likely responses to an intervention before the policy measure is introduced to an entire sector or market. One method is to run a randomized controlled trial where possible (for an introduction to this approach, see, for example, Banerjee and Duflo, 2017). A vignette study can be another way how to gain first insights on potential changes in beliefs. Under this method, subjects are presented with hypothetical scenarios, and their resulting beliefs, attitudes, and (hypothetical) behavioral responses are elicited (Atzmüller and Steiner, 2010). For policy enforcement, we suggest that fines are communicated as a signal of public disapproval of a given action (Bowles and Polanía-Reyes, 2012) rather than as an exercise of power, and that procedural fairness in policy enforcement be conveyed. Lastly, we recommend to assess the adherent belief systems for each case anew. Beliefs are variable, contextual, and may change over time. Carattini *et al.* (2018), for example, showed people's perception of the effectiveness and political acceptability of a waste tax changed once implemented.

As a final caveat we acknowledge that our paper focused on individual behavior and as such is most relevant to the behavior of individual consumers, land users and small-scale businesses. For larger-scale companies, the degree to which belief affect the behavior is less clear. Nevertheless, companies are ultimately a collective of individuals and as such our discussion may still be of some relevance.

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