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Pro-environmental Behaviour & the Perception of Free-riding

An Experimental Study

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Preface

I would especially like to thank my supervisor Professor Dr. Lefevere for his dedicated supervision. He was very approachable and always willing to explain patiently when I had questions. I have frequently asked for his advice and he was always quick to reply (even the day before my deadline on a holiday). And although the topic of this paper, pro-environmental behaviour and the perception of free-riding, is not entirely his subject, Professor Lefevere showed himself very willing to think how best to tackle this topic. Next, I would also like to express my gratitude to my father for the interesting discussions about pro-environmental behaviour around the kitchen table and my mother for her unconditional support.

1. Introduction

As scientific knowledge about climate change and what we need to do to prevent it is now established, climate change has become mainly a political and social problem. The challenge now primarily is to implement substantial environmental policies and to change people's behaviour. Climate change is not the result of harmful intent but rather the consequence of the behaviour and lifestyles of billions of humans (Schulz, 2011). The anthropogenic emissions causing global warming are thus the result of actions taken by individuals, families, small groups, private firms, and local, regional, and national governments (Ostrom, 2010, Watson, 2003). And although many Belgians consider climate change as a big problem (Eurobarometer, 2020a), the behavioural responses have been rather muted (Thøgersen & Crompton, 2009). According to a recent report of the Intergovernmental Panel on Climate Change (IPCC) the current nationally stated mitigation ambitions as submitted under the Paris Agreement will not limit global warming to 1.5°C, as advised by the IPCC (2018). To meet the reduction targets needed to avoid dangerous levels of climate change, major technological, economic and behavioural changes across all sectors are necessary (Schulz, 2011; Spence & Pidgeon, 2010, p. 656). However, ambitious climate policies are unlikely to be implemented without strong public support for such measures (McGrath & Bernauer, 2017).

This thesis investigates people's willingness to engage in pro-environmental behaviour and it examines the determinants of that willingness. Specifically, it investigates the role that the collective action problem plays in people's readiness to act in a pro-environmental fashion. Unsustainable human behaviours represent a key cause of climate change and consumers can significantly influence climate change through their consumption patterns (Spence & Pidgeon, 2010). Two different ways in which individuals can contribute to climate change mitigation can be distinguished; they can engage in either indirect or direct pro-environmental behaviour (Kollmuss & Agyeman, 2002; O'Connor, Bard & Fisher, 1999; Tobler, Visschers, & Siegrist, 2012). *Indirect* pro-environmental action entails that people act as citizens and voters, supporting initiatives by the government to implement stricter climate policies. Although it has no direct impact, it is of substantial importance since the implemented policies can steer human behaviour into a more pro-environmental fashion. People can also act *directly* as individual actors and conscious consumers who decide to reduce their own ecological footprint. The term 'pro-environmental behaviour' includes more than climate change mitigation actions, like recycling for example. Yet, in this research, the focus will solely be on direct and indirect climate-related forms of pro-environmental behaviour. Both forms of addressing climate change differ substantially. Altering one's own lifestyle on a voluntary basis is different from supporting certain environmental policy proposals. Previous research has shown that direct and indirect actions are influenced by different factors (Kollmuss & Aygeman, 2002; Tobler, et al. 2012). My aim is to scrutinize one of these factors: the perception of free-rider behaviour by other people. The research question addressed is: "How does the perception of possible free-riding affect people's willingness to engage both in direct and indirect pro-environmental behaviour?"

Contemporary climate change is a distinct example of the collective action dilemma (Bohr, 2014; Góis, Santos, Pacheco, & Santos, 2019; Harring & Jagers 2013, Ostrom, 2010; Smith & Mayer, 2018). While it would be in everyone's interest to take collective action to avoid climate change, little action is being taken because no one wants to carry the burden of mitigating climate change alone. Therefore, we all face the likelihood of extremely adverse outcomes of a warming climate, unless many participants cooperate and take action.

The theory of collective action was most clearly established by Mancur Olson in 1965 and assumes people to be rational decision-makers. Collective action problems have been defined as situations in which individuals have little individual incentive to contribute to a collective good, whereas for society as a whole it would be beneficial if all they did (Olson, 1965; Smith & Mayer, 2018, p. 141). While all individuals benefit from collective action, many individuals choose to pursue individual rationality instead of behaving in society's long-term interests. Therefore, no collective action or joint action is taking place. Next to the two main reasons stated by Olson in 1965, the character of the good (non-excludable) and the character of the group (large), I focus on a third factor added later to the theory by multiple other researchers, i.e. the perception of free-riders. This is the aspect of the collective action problem that will be central in my study. Free-riders are people who receive the benefits of a collective good without contributing to its production (Bohr, 2014). Olson argued in his original theory that because of the first two reasons individuals are incentivized to free-ride. The fear for these free-riders and individuals' sensitivity to the principle of reciprocity is an aspect that further enhances the chance of the collective action problem presenting itself (Bohr, 2014; Ostrom, 1998; Ostrom, 2000). Since most people are conditional co-operators, the perception that others will not cooperate and show free-rider behaviour diminishes the chances of collective action. Individuals' sensitivity to the free-rider behaviour of others and the effect it has on their own pro-environmental intentions is what will be tested experimentally in this study. To the best of my knowledge, the role of the perception of free-riding behaviour on the individual level with regard to both direct and indirect pro-environmental has not been directly tested in empirical research.

Of course, the perception of what others will do, which is just one aspect of the broad collective action problem approach, is not the only reason individuals decide whether or not to show pro-environmental behaviour. Existing theories explain people's willingness to behave pro-environmentally by referring to a series of socio-demographic-, cognitive- and attitudinal factors. One of these alternative explanations, the low-cost hypothesis, can actually be linked to the broader theory of collective action. The low-cost hypothesis states that the subjective cost associated with pro-environmental behaviour determines the chance individuals will exhibit this behaviour (Diekmann & Preisendörfer, 2003). As the collective action dilemma is also about individuals not bringing sacrifices or making 'costs' for the collective good, the low-cost hypothesis will be incorporated in the research of this study, both as a separate explanatory variable and as a potential moderator variable.

To provide an answer to the research question, a survey-embedded experiment manipulating the perception of others' behaviour and measuring its effect on intentional behavioural change, was implemented in Flanders, the largest region of Belgium. Three types of behaviours are examined: consuming beef, travelling by plane and driving one's car. Concretely, the treatment consists of exposing participants to a short vignette that conveys information on the prevalence of the (possibility) of free-rider behaviour of others. The effect of exposure to such information on individuals' willingness to show both direct and indirect pro-environmental behaviour is investigated.

2. What explains pro-environmental behaviour?

This study relies on Kollmuss and Agyeman's definition of pro-environmental behaviour: "behaviour that consciously seeks to minimize the negative impact of one's actions on the natural and on the built world" (2002, p. 240). Kollmuss and Agyeman argue that the question of what shapes pro-environmental behaviour is such a complex question that it cannot be captured by one single theoretical framework. Gifford and Nilsson (2014) also state that a large number of factors influence pro-environmental concern and behaviour, making it far more complex than previously thought. This study recognizes that the answer to the question 'why and when do people act environmentally and what are the barriers to pro-environmental behaviour?' is extremely complex and multiple factors play a role in determining people's willingness to show pro-environmental behaviour. While acknowledging that many different other factors are important, the focus in this study will be on the role of just one of those factors: the perception of free-riding.

Pro-environmental behaviour is part of the mitigation-oriented strategies to fight climate change. Such strategies can be described as human interventions that address the root cause of the problem (Swim et al. 2011, p. 242). Often a distinction is made between direct pro-environmental behaviour and indirect pro-environmental behaviour (Kollmuss & Agyeman, 2002; O'Connor et al. 1999; Tobler, et al. 2012). Direct behaviour means that consumers decide to alter their own lifestyles in order to lower their greenhouse gas emissions, thus taking individual, voluntary action. Or, citizens can decide to support government initiatives that aim to mitigate climate change and reduce environmentally harmful behaviour, the indirect form of pro-environmental behaviour. This second form of addressing climate change is politically induced, as individuals are then expected to change their own behaviour later in response to governmental policies (Harring & Jagers, 2013). Government intervention can take many forms and different environmental policy instruments exist. Environmental taxes have gained in popularity over the last years. Such taxes are an example of a market-based approach that uses money as an incentive to steer people's environmental behaviour by rewarding or sanctioning it (Delreux & Happaerts, 2016, pp. 142-144). Other measures such as cap and trade systems, green subsidies, environmental standards, prohibitions or informational instruments are also being used. In this study the focus is on the impact of people's perception that the costs of mitigating climate change are shared equally and that others behave reciprocally. Therefore, support for environmental taxes is chosen in this study as the indirect pro-environmental behaviour. Taxes imply costs and this matches the collective action problem logic (for instance, green subsidies do not imply a cost).

In this theory section, I start by explaining three of the most basic theories of pro-environmental behaviour, namely the socio-demographic, cognitive, and attitudinal explanation. Next, I elaborate the collective action approach to pro-environmental behaviour and specifically the principle of reciprocity and the importance of the perception of free-riding; this leads to a number of hypotheses. Third, I introduce the low-cost hypothesis of pro-environmental behaviour and connect it to the collective action theory, resulting in a hypothesis on how costs might moderate the impact of free-rider perceptions.

2.1 Determinants of pro-environmental behaviour

Drivers of people's intention to behave pro-environmentally have been extensively researched over the past decades (Swim et al. 2010). For a long time, scholars examined whether certain *socio-demographic* characteristics might be able to explain why certain people decide to act pro-environmentally or not. O'Connor et al. (2002) say there seems to be no relationship between wealth and support for efforts to reduce greenhouse gas emissions. The level of education has an effect on acting pro-environmentally; people with a higher level of education are more likely to make conscious low-carbon lifestyle choices (Gifford & Nilsson, 2014; Samenza, et al. 2008). However, researchers agree that the level of education can only explain a small fraction of pro-environmental behaviour (Kollmuss & Aygeman, 2002, p.250). Bord and O'Connor (1997) state that a gender gap exists regarding environmental concern and pro-environmental behaviour. Women are more willing to change their behaviour (Harring & Jagers, 2018; Kollmuss & Agyeman, 2002, p.248), while men are more likely to support environmental government policies (O'Connor, et al.1999). Finally, O'Connor et al. (2002) and Samenza et al. (2008) found that age is a determining factor; younger respondents are more likely to alter their environmentally harmful behaviour. It is unlikely, though, that socio-demographic characteristics have a direct effect on behaviour. Rather there must be some kind of underlying mechanism at work that mediates the effect of the socio-demographic characteristics on individuals' propensity to behave pro-environmentally.

The oldest and simplest models of pro-environmental behaviour are based on the linear assumption that environmental knowledge (cognitive explanation) leads to pro-environmental attitudes and this, in turn, leads to pro-environmental behaviour (Kollmuss & Agyeman, 2002). Indeed, researchers suggest that *cognitive* explanations might shed some more light on the matter. Multiple possible beliefs have been found to play a role. First, according to a multitude of studies, knowledge about the causes of climate change is a powerful predicator of pro-environmental behavioural intentions (Gifford & Nilsson, 2014; O'Connor, et al. 1999; O'Connor, et al. 2002; Swim et al. 2011). Citizens are unlikely to exhibit pro-environmental behaviour if their knowledge about the topic is limited. Nevertheless, environmental knowledge must be regarded as a necessary but not sufficient condition for conscious pro-environmental decision-making. Second, Truelove and Parks (2012) suggest that the belief that a certain behaviour actually mitigates climate change (whether accurate or not) is strongly related to the intention to perform that perceived climate change mitigating behaviour. Third, climate risk perceptions have a positive and significant effect on individuals' environmental behaviour as well. People who expect that climate change will have adverse effects, such as lower standards of living and food shortages, are more willing to bring sacrifices to reduce emissions (Bord & O'Connor, 1997; O'Connor, et al. 2002; Smith & Mayer, 2018).

Next to beliefs, political *attitudes* have proven to correlate with people's propensity to behave pro-environmentally (Harring & Jagers, 2018; McGrath & Bernauer, 2017). Tobler et al (2012) argue that this factor is an important determinant of indirect climate-friendly behaviour. Other research suggests that amongst left-oriented people there is more support for environmental taxes (Harring & Jagers, 2013; O'Connor, et al. 2002). These findings might not be very surprising as any policy instrument implies state intervention and the acceptance of this act of power varies greatly amongst left and right citizens and their political preferences. Overall, citizens on the right side of the political spectrum are found to be more state intervention-averse and tax-averse than citizens on the left side.

Apart from the general left-right orientation, multiple studies conclude that positive attitudes toward the environment and environmental concern affect pro-environmental behaviour (Diekmann & Preisendörfer, 2003; Gifford & Nilsson, 2014; Harring & Jagers, 2018). But, in all, attitudes have been found to have a varying and relatively small impact on climate-friendly behaviour. Bamberg and Möser (2007) found in a meta-analysis that there is only a moderate relationship between environmental attitudes and pro-environmental behaviour. Hence, the simple assumption that attitudes linearly affect behaviour has proven to be a great simplification of the different drivers of pro-environmental behaviour (Kollmuss & Agyeman, 2002). There is a gap between environmental attitudes on the one hand and actual pro-environmental behaviour on the other (Bohr, 2014; Gifford & Nilsson, 2014). This research aims to assess whether the perception of free-riding affects people's willingness to behave pro-environmentally and whether this theory is able to explain part of the puzzle why people with pro-environmental attitudes do not always exhibit pro-environmental behaviour.

2.2 The collective action problem

In 1965, Mancur Olson argued in *The Logic of Collective Action* that "unless the group is quite small or unless there is coercion or some other special device to make individuals act in their common interest, rational, self-interested individuals will not act to achieve their common or group interest" (p.2). This problem put forward by Olson is known as the collective action problem, commonly referred to as the free-rider problem. It holds that in most large groups individuals have an incentive not to contribute to the collective good, creating a tension between individual and collective rationality (Bohr, 2014). According to the theory, most individuals will not voluntarily change their behaviour because the action needed is associated with a *cost* to be paid by individuals, while the outcome of this action is beneficial for everyone (Ostrom, 2010).

Olson states that the collective action problem occurs due to two main reasons. First, he argues that someone who cannot be excluded from obtaining the benefits of a collective good once the good is produced, has little incentive to voluntarily contribute to the provision of that good. As such, the collective action problem mainly plagues 'goods' that can be defined as *non-excludable goods* or free-use goods. It is a good everyone can benefit from even when they have not contributed to producing or maintaining it. Exactly this non-excludable character makes that there is no incentive for individuals to contribute to the good. There is no selective incentive for the individuals who contributed that distinguishes them from the ones who did not contribute. Second, especially in *large groups* Olson says the chance of collective action problems increases strongly. In large groups individuals have limited individual impact on the production of the collective good, the group is so large that their own contribution is futile. In small groups, in contrast, most members have a strong incentive to cooperate as their own contribution has a substantial impact on the outcome. Hence, in the original theory of Olson, individuals are not incentivized to contribute because of the character of collective goods (non-excludable) and of groups (large). Rather for an individual it is individually rational not to contribute and show free-rider behaviour; free-riding individuals enjoy the benefits of a collective good without contributing to its production or continuation (Bohr, 2014). Since all rational individuals think according to this 'rational' logic, no joint action is taking place and no free-use good is produced, while it would be in everyone's collective interest if it were.

A third factor as to why a collective action dilemma might present itself is individuals' *fear of free-riders* and the principle of reciprocity. While this factor is not explicitly stated in Olson's initial theory of collective action, it has extensively been proven to be an important factor for individuals deciding whether to cooperate or not (Bohr, 2014; Ostrom, 1998; Ostrom, 2000). Multiple experiments have demonstrated that most people are in fact conditional co-operators, meaning that they are only willing to cooperate when they estimate others will reciprocate and behave likewise (Ostrom, 2000; Shinada & Yamagishi, 2007). Most individuals adhere to the principle of reciprocity which means that they tend to react to the positive actions of others with positive responses and to the negative actions of others with negative responses. Reciprocity is in fact a basic norm taught in all societies (Ostrom, 1998). Therefore, most individuals are willing to participate in action for the collective good as long as they believe that others will do likewise, that the costs are shared equally and that their efforts will not be exploited. If people, however, believe they are the only ones making sacrifice and bearing the cost, while others are showing free-rider behaviour, they will stop exhibiting cooperative behaviour. Hence, it is the fear that others will free-ride and possibly negate the sacrifices made by the active participant that inhibits individuals from taking collective action. As such, the fear of others showing free-riding behaviour and behaving non-reciprocally poses a barrier to individuals taking joint action and to them behaving pro-environmentally (Bohr 2014).

The theory of the collective action predicts that climate mitigation action will be plagued by the collective action problem since it is an interdependent global problem that stems from actions of billions of people all over the world (Ostrom, 2010). A stable climate can be defined as a non-excludable good since it is not possible to exclude people from enjoying the benefits of a stable climate (McGrath & Bernauer, 2017). Therefore, climate change mitigation is regarded by many as a prime example of a global collective action dilemma (Bohr, 2014; Góis, et al, 2019; Ostrom, 2010; Smith & Mayer, 2018). Most individuals would benefit from a certain action, in this case lowering the global greenhouse gas emissions emitted in the atmosphere that cause global warming. However, this solution has an associated individual cost that is economic cost but also consists of effort and time. Consequently, it is implausible that any individual actor wants to undertake action alone. Different types of collective action problems exist and global warming has been described as a collective action problem in different ways. For instance, whereas some regard climate change as an example of a 'public goods dilemma' (Bohr, 2014; Diekmann & Preisendörfer, 2003; McGrath, & Bernauer, 2017) others believe it to be an exemplary case of 'the tragedy of the commons' (Góis, et al, 2019; Watson, 2003). Regardless of the precise nature of the dilemma, there is little discussion in the literature that climate change presents a prime collective action problem.

One of the particularities of climate change is that it is a global problem. The international scale implies that public support for installing climate mitigating policies in different countries plays a role (Góis, et al, 2019). McGrath & Bernauer (2017) examined whether citizens confronted with free-riding problems associated with unilateral climate policy had lower levels of support for implementing such climate policy. Surprisingly, they found that citizens are nonreciprocal in their international climate policy preferences. In their study public opinion was hardly impacted by considerations of what *other* countries where doing in the area of climate action. This suggests that the perception of free-riding on an international scale does not play a major role in citizens' support for national climate policy. In my study, I look at the domestic level instead. Does a sensitivity of the behaviour of others play a role on a national scale? It is quite possible that citizens are rather indifferent and nonreciprocal with regard to what another country is doing but that they are more sensitive to the behaviour of their fellow citizens. If faraway China is not very ambitious in taking climate action, this may be something very different than your own neighbour frequently showing environmentally harmful behaviour. Maybe the principle of reciprocity and the fear of free-riding have a bigger impact on the national scale since the behaviour is more tangible and visible. Bohr (2014) investigated the role of the free-rider fear on pro-environmental behaviour on the national level. He focussed on the role of individuals' generalized trust, i.e. the expectation that others will behave cooperatively. He assumed that this trust predicted individuals' inclination to expect free-riding and thus to behave pro-environmentally or not. Yet, Bohr did not explicitly expose people to information regarding others' free-riding behaviour, and only focussed on indirect pro-environmental behaviour. Hence, this study contributes to the literature, first, by focussing *both on the direct and indirect* route to pro-environmental behaviour; second, by explicitly exposing individuals to *information about actual free-riding*; and third, by focussing on the perception of free-riding *within one country* and not in between countries. Nonetheless, because previous literature indicates that generalized trust is an important factor in predicting cooperation toward a public good and showing pro-environmental behaviour it will be controlled for in the analyses (Bohr, 2014; Harring & Jagers, 2013; Smith & Mayer, 2018).

In this study, the main effect examined is the possible impact of the perception that others will engage in free-riding on individuals' willingness to exhibit both direct and indirect pro-environmental behaviour. In case of *direct* behaviour, it is quite possible that although people care about the environment and are in theory willing to voluntarily change their lifestyle because of the mentioned socio-demographic, cognitive, or attitudinal reasons, they might not display direct pro-environmental behaviour because they believe others will not alter their own behaviour. Hence, in case these citizens are exposed to information stating that very few people are changing their lifestyles but are rather free-riding, I expect them to also be less inclined to behave pro-environmentally, compared to people who are not exposed to such information. And the other way around, in case citizens are exposed to information stating that most people are changing their lifestyles and are not free-riding, I expect them to also be more prepared to act in a direct pro-environmental manner, compared to people who are not exposed to such information. This leads to the following hypotheses whereby the effect of non-free-riding cues is compared to that of free-riding cues and to that of the absence of cues about what others are doing.

> H1a: Compared to individuals who are not exposed to information about other citizens' behaviour, individuals who are exposed to information suggesting that other citizens *do* behave in a direct pro-environmental fashion are more inclined to show direct pro-environmental behaviour themselves.

> H1b: Compared to individuals who are exposed to information suggesting that other citizens *do not* behave in a direct pro-environmental fashion, individuals who are not exposed to information about other citizens' behaviour are more inclined to show direct pro-environmental behaviour themselves.

> H1c: Compared to individuals who are exposed to information suggesting that other citizens do *not* behave in a direct pro-environmental fashion, individuals who are exposed to information suggesting that other citizens *do* behave in a direct pro-environmental fashion are more inclined to show direct pro-environmental behaviour themselves.

Though not entirely the same, a similar line of reasoning can be applied to people's willingness to show *indirect* pro-environmental behaviour; here as well I expect free-riding perceptions generated by free-riding cues to play a role. The idea is that support for an environmental tax depends on the perception that people will follow the rules and pay the tax (Harring & Jagers, 2013). Thus, in case individuals perceive they are the only ones sacrificing and bringing offers (paying a tax) for the collective good (a stable climate) then these individuals will be less inclined to support the tax (Bohr, 2014). Consequently, when people are exposed to information suggesting that it is possible to circumvent the environmental tax (thus allowing for free-riding), it is expected that they suspect that many others will actually exhibit free-riding behaviour and behave non-cooperatively by not paying the tax. In the next step, this perception will make individuals less inclined to support the proposed environmental tax. This is in line with previous research of Hammar, Jagers and Nordblom (2009) who found that people's propensity to accept increased taxes depended on the extent to which it is possible to evade the tax. This leads to the following hypotheses again comparing non-free-riding cue effects with that of free-riding cues and of the absence of cues.

> H2a: Compared to individuals who are not exposed to information about a potential policy measure, individuals who are exposed to information about a potential policy measure that *does not allow* the possibility of free-riding behaviour are *more* inclined to show indirect pro-environmental behaviour and support the policy.

> H2b: Compared to individuals who are exposed to information about a potential policy measure that *allows* the possibility of free-riding behaviour, individuals who are not exposed to information about a potential policy measure are *more* inclined to show indirect pro-environmental behaviour and support the policy.

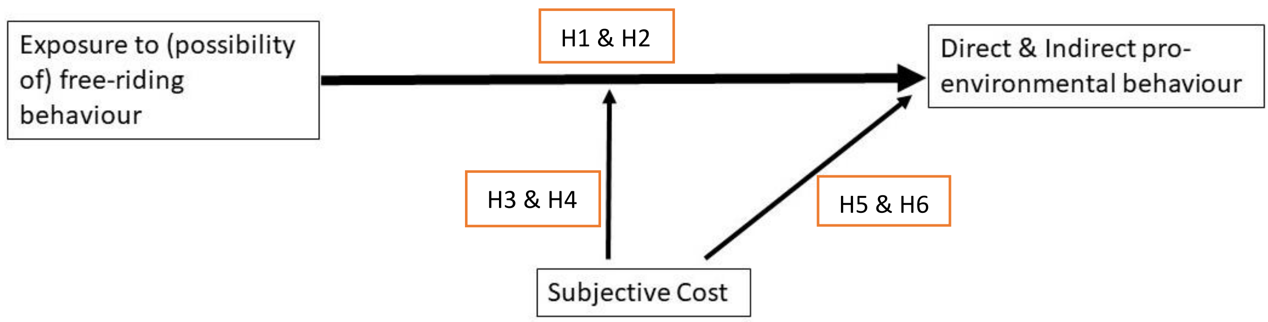
> H2c: Compared to individuals who are exposed to information about a potential policy measure that *allows* the possibility of free-riding behaviour, individuals who are exposed to information about a potential policy measure that *does not allow* the possibility of free-riding behaviour are *more* inclined to show indirect pro-environmental behaviour and support the policy.

It should be noted that in case of a watertight tax, in theory, no free-riding behaviour is possible. In fact, state intervention and state coercion is often said to be the solution to the free-rider problem (Mansbridge, 2014). However, in case a tax is not watertight and easy to evade, the state leaves room for free-riders and is not acting as a reliable external authority that enforces the same rules onto everybody.

Although my two sets of main hypotheses are seemingly identical, both routes to pro-environmental behaviour are not expected to be impacted by the collective action problem and the free-riding cues in the same way. The underlying mechanism that produces the causal effect is not identical. In case of *direct* behaviour, the free-riding cue is very explicit as it contains information about what others are *actually* doing. In case of the *indirect* behaviour, people are solely given information about the extent to which the proposed legislation is evadable, thus only suggesting the *possibility* of free-riding by others. Still, there are reasons to believe that in both cases, free-riding cues will lead to defection.

The different hypotheses tested in this study are depicted in Figure 1. The figure not only contains the two base hypotheses (*H1* and *H2*) but also additional hypotheses that are related to the concept of the subjective cost of the expected pro-environmental behaviour.

Figure 1. Causal map and overview of hypotheses



According the theory of collective action individuals will not behave in favour of the collective good as there is no incentive to do this and as there is a certain cost associated with contributing to the collective. Hence, next to the fear of free-riding preventing individuals from showing cooperative behaviour as hypothesized in *H1* and *H2*, the cost associated with showing cooperative behaviour might also play a role in deciding whether or not a collective action problem presents itself. Therefore, the subjective cost of cooperative behaviour is in my understanding also part of the broad framework of the collective action theory. By including the subjective cost in the analysis, this research aims to take into account individual heterogeneity. Among individuals who get the same cues about free-riding I anticipate there to be differences according to the cost these individuals believe their possible pro-environmental behaviour entails. In other words, not everyone will be influenced to the same extent by exposure to free-riding cues. Individuals' subjective cost is expected to have a direct effect on people's willingness to engage in pro-environmental behaviour (*H3* and *H4*) and it perhaps conditions the main effect of exposure to free-riding information (*H5* and *H6*). In the next section the theory of subjective cost and how it might interact with free-riding perceptions will be discussed.

2.3 Main effect and interaction effect of subjective cost

Although I expect the perception of free-riding to affect people's willingness to engage in pro-environmental behaviour, the expected behaviours themselves also carry different costs for different individuals. As such, it is important to account for the subjective cost that individuals attribute to their possible direct and indirect pro-environmental behaviours (Tobler et al, 2012). The low-cost hypothesis is a theory that takes this subjective cost into account. The basic idea of the low-cost hypothesis is that environmental concern or environmental attitudes primarily have the ability to influence pro-environmental behaviour in situations connected with low 'costs' and with little inconvenience for the individuals involved (Diekmann & Preisendörfer, 2003). Costs in this context are not limited to financial costs but should be understood in a broader psychological sense, including other factors such as discomfort, time and effort (Kollmuss & Aygeman, 2002). Low cost behaviours can then be defined as situations in which the decision taken has no serious personal consequence for the decision-makers involved (Diekmann & Preisendörfer, 2003; p.447). As Tobler et al. (2012) argue, its low-cost character eases the transformation of attitudes in corresponding behaviour as the classic attitudinal models of pro-environmental behaviour predict. However, when behaviours are associated with high costs people are less likely to exhibit them. Hence, according to the low-cost theory the strength of the effect of environmental attitudes diminishes when behavioural costs increase. Confirming this assumption, previous research has found that environmentally concerned people tend to engage in low-cost behaviours such as recycling but that they are less likely to show high-cost behaviours like reducing flying that is considered more costly and inconvenient (Diekmann & Preisendörfer, 2003; Kollmuss & Aygeman, 2002; Tobler, et al. 2012).

It is important to note that the cost associated with a certain behaviour is different for each individual, the same absolute cost can be subjectively perceived as higher or lower (Diekmann & Preisendörfer, 2003; Tobler, et al. 2012). For example, for people who live in the countryside and have limited public transport alternatives, an additional tax on driving might carry a larger subjective cost compared to people who live in the city and who have ample public transport alternatives. So, in considering the cost of behaviour, I focus on an individual's subjective perception of cost. In line with what previous research suggests, I anticipate that people are more willing to make a sacrifice and behave pro-environmentally when they perceive that changing their environmentally harmful behaviour bears a low cost for them. Contrary, I expect that in case of a high cost of behavioural change, people are less inclined to behave pro-environmentally. Hence, as depicted in Figure 1, the direct effect of subjective cost on pro-environmental inclinations can be translated in two additional hypotheses.

> H3: Compared to pro-environmental behaviour that bears a high subjective cost, individuals are more inclined to show *direct* pro-environmental behaviour that bears a low subjective cost.
>
> H4: Compared to pro-environmental behaviour that bears a high subjective cost, individuals are more inclined to show *indirect* pro-environmental behaviour that bears a low subjective cost.

While the studies examining the low-cost hypothesis all focus on how cost interacts with pro-environmental *attitudes*, this study focusses on the effect of exposure to free-rider cues on pro-environmental intentions. I anticipate a similar interaction of cost and free-riding cues. The associated cost of certain behaviour may act as a moderator and may influence the main effect of free-riding exposure on pro-environmental behaviour. The strength of the effect of the free-riding perception on pro-environmental behaviour might vary depending on individuals' subjective cost of the behaviour. In line with the low-cost hypothesis I expect that the strength of the effect of free-rider exposure diminishes when behavioural costs increase. Thus, I anticipate that free-rider information will have a rather small impact on individuals' propensity to behave pro-environmentally when the associated subjective cost is high. Individuals will not be willing to sacrifice in favour of the collective good regardless of what others do, as the cost of adopting pro-environmental behaviour is simply too high for them. So, on high levels of cost, the free-rider cues will not have an effect. Contrary, in case of low subjective cost I expect individuals to be more sensitive to the (perception) of the behaviour of others and the cue will have a stronger effect as the subjective cost is low. These expectations lead to the following two interaction hypotheses.

> H5: The effect of exposure to free-rider information on the inclination to show *direct* pro-environmental behaviour is stronger for individuals who attribute a low cost to that behaviour than for individuals who attribute a high cost to that behaviour.
>
> H6: The effect of the exposure to free-rider information on the inclination to show *indirect* pro-environmental behaviour is stronger for individuals who attribute a low cost to that behaviour than for individuals who attribute a high cost to that behaviour.

This interaction effect (*H5* and *H6*) as depicted in Figure 1 has, to the best of my knowledge, not yet been researched and might shed more light on when and why individuals decide to behave pro-environmentally or not. It could provide some nuance to the narrow definition of collective action problem, by taking into account individuals' heterogeneity and by including the cost people have to make to realize the collective good.

3. Research design

To provide an answer to the research question, I fielded a survey-embedded experiment investigating the perception of others' behaviour and (intentional) behavioural change. The aim was to measure to what degree free-riding perceptions play a role with regard to both direct (voluntary change) and indirect (support for an environmental tax) pro-environmental behaviour. The advantage of using a survey-experiment is twofold. First, experiments are especially suitable to investigate the presence of a causal effect (Bryman, 2012, p. 175) and my study examines causal effects. Second, the impact of information exposure on attitudes and behaviour is a common topic in the field of political communication, and is commonly studied through these kinds of experiments (Lecheler & De Vreese, 2011; Slothuus & De Vreese, 2010; Van Gorp, 2006).

3.1 Sample

Participants in my survey experiment were recruited through the University of Antwerp's citizen panel (https://www.ua-burgerpanel.be/wat/). This panel is an opt-in panel that works with self-selection: "M²P's citizens panel consists of ordinary citizens who are willing to participate in a short online survey a few times a year" (Universiteit Antwerpen, 2018). The panel is commonly used for academic purposes and several peer-reviewed publications based on it have been published, especially using experimental designs (Beckers, 2019). Because the citizen panel is an opt-in panel, the sample used in this research cannot be regarded as a representative probability sample of the Flemish population. The individuals responding the survey questions are people who decided to enrol in the panel and to participate in political science research. The research population is Belgian citizens living in Flanders who are at least 18 years old and thus eligible to vote. A larger than proportional group of highly educated people and politically informed people participate in the citizen panel.

This lack of representativeness is a disadvantage. However, with the experimental randomization in my research I am mainly interested in *between-group* differences. As I am mainly interested in effects of manipulation, the base-line composition of the sample is a little less problematic. Many similar studies looking for between-group differences use convenience, non-probability samples (Mullinix, Leeper, Druckman, & Freese, 2015). Further, in my analysis, I will check through the use of moderator variables whether there is a larger effect amongst certain subgroups in the sample.

More specifically, I will check whether the effect of exposure to free-riding information differs for individuals with a higher subjective cost associated with adopting pro-environmental behaviour (*H5* and *H6*). Because the citizen panel is an opt-in sample, respondents self-select into participating rather than being drawn with known probability from a well-specified population, as is the case in probability samples. Therefore it has been argued that convenience samples always differ from representative population samples in multiple and possibly unmeasured ways (Mullinix, et al. 2015, p.4). However, my sample is definitely much more diverse and much larger than in case I, a master student, had tried to mobilize participants in my own social network and had collected my own sample through snowball/convenience sampling methods. Additionally, Mullinix et al. (2015) found that convenience samples do not appear to consistently generate false negatives, false positives, or inaccurate effect sizes. Rather their research indicated that considerable similarities exist between treatment effects found in convenience samples and nationally representative population-based samples. Thus, although there are some disadvantages in using the M²P citizen panel, the selected sample of people is still a lot more heterogeneous and a lot larger compared to other non-probability samples; and the fact that it is a convenience sample does not necessarily make the results less reliable.

The survey experiment ran over two survey waves. In total, 4,000 respondents where invited for the first survey. Respondents could participate in the first survey between 3 March 2021 and 22 March 2021. In total 2,312 respondents participated in the first wave and the response rate was 57.8%. Only respondents who participated in wave 1 where invited seven days later to participate in wave 2. Respondents could participate between 29 March and 19 April 2021. In total 1,859 respondents participated in the second wave and the response rate was 80.4%. After controlling whether the respondents finished both surveys, were at least 18 years old, and took at least 10 seconds to read the experimental vignette, the actual N in the analyses is N=1,658.

As expected and in line with the composition of the citizen panel, the sample underrepresents young people aged 18-29 (3% in sample versus 18% in population) and aged 30-44 (14% versus 23.0%), while overrepresenting older people aged 65-plus (34% compared to 20%). It also contains more male respondents (73% versus 49% in population) and respondents are higher educated (72% compared to 37% in the population). Finally, the sample also overrepresents Green voters (14% versus 10%[1]). Since the sample is not representative for the Flemish population, I include controls for *age*, *gender*, *level of education* and *political left-right self-placement* in the models.

3.2 Procedure

To avoid cueing respondents with environmental questions before exposure to the treatment, two consecutive surveys were conducted. The first questionnaire included questions regarding the control variables and moderator variables. After respondents agreed to the informed consent form, it measured respondents' socio-demographic characteristics, political attitudes, general trust, environmental attitudes and subjective cost associated with adopting certain pro-environmental behaviour. In the second questionnaire, first some additional socio-demographic variables and (non-environmental related) political attitudes were measured. Subsequently participants were randomly exposed to one of the different free-rider treatments through the use of vignettes (see below for description of stimuli). After exposure, respondents were asked manipulation check questions to examine whether or not the treatment was successful (see Table 2). Then, the dependent variable, namely participants' willingness to engage in direct and indirect pro-

[1] Elections Flemish region 2019.

environmental behaviour, was measured and participants were fully debriefed on the nature and purpose of the experiment.

3.3 Stimuli

Respondents were randomly shown one of 18 vignettes that vary the topic (beef consumption, flight behaviour, driving behaviour), free-riding cue (control, free-rider, no-free-rider), and behaviour type (direct or indirect). Table 1 presents the different experimental conditions.

Table 1. Experimental conditions and number of observation per condition (total N=1,658)

Environmentally harmful behaviour	Direct pro-environmental Behaviour (change own behaviour)	Indirect pro-environmental Behaviour (support tax)
Beef consumption	1. Free-rider condition (N= 91)	10. No-free-rider condition (N=92)
	2. No free-rider condition (N= 89)	11. Free-rider condition (N=86)
	3. Control condition (N= 95)	12. Control condition (N=96)
Flight behaviour	4. Free-rider condition (N=91)	13. No-free-rider condition (N=89)
	5. No-free-rider condition (N=94)	14. Free-rider condition (N=96)
	6. Control condition (N=94)	15. Control condition (N=89)
Driving behaviour	7. Free-rider condition (N=94)	16. No-Free-rider condition (N=92)
	8. No-free-rider condition (N= 91)	17. Free-rider condition (N=89)
	9. Control condition (N= 94)	18. Control condition (N=96)

Because exposure to conditions was differentiated and randomized between respondents, and because the dependent variable was only measured once (only after exposure) a between-subjects design is used and not a within-subjects design. The design compares the effect of the different treatments across groups. Randomization checks show that the conditions do not significantly differ from each other in terms of age, gender, education and left-right position[2].

The key independent variable is exposure to information cues suggesting (the possibility of) free-riding behaviour. More specific, the stimuli consisted of fabricated vignettes that resembled the layout of a newspaper article. Further on I will explain why I have chosen this exact stimulus. In the vignettes the extent to which others display direct pro-environmental behaviour or the extent to which a proposed environmental tax is evadable was manipulated. In case of direct behaviour, the perception of the share of other people showing voluntary environmental behaviour was varied. Respondents were exposed to information stating that “only a small minority of 18% of the Flemish people are willing to change their behaviour” (free-rider condition), or that “a large majority of 82% of Flemish people are willing to change their behaviour” (no-free-rider condition). In case of the indirect treatment, respondents were exposed to information stating that “a new tax proved not to be watertight and it was easy for some citizens to escape it” (free-rider condition), or that “a new tax proved to be watertight and it was very difficult for citizens to escape it” (no-free-rider-condition). For each activity, a control condition was also included in which no information was given about the behaviour of others or about the nature of the environmental tax. Figure 2 shows the different vignettes the respondents could receive. The italic text marks what is differentiated across conditions.

[2] Distributions of age ($F(17) = 1.035$, p=.415), gender ($X^2(34)$ = 34,466, p =.445), education($X^2(34)$ = 47,329 ,p =.064) and left-right position ($F(17)$ = 1,515, p =0,081) did not significantly differ between conditions.

Figure 2. Example Stimuli for Direct free-rider/no-free-rider beef (top left), Direct control all (top right), Indirect free-rider/no-free-rider beef (bottom left), Indirect control all (bottom right)

MINORITY/MAJORITY **OF FLEMISH PEOPLE WILLING TO EAT LESS BEEF TO ACT ON CLIMATE**

BRUSSELS | The IPCC, the scientific commission that advises the United Nations on climate change, says that human diet is a major cause of climate warming. Especially beef production is associated with high greenhouse gas emissions. In order to see to what extent the Flemish people are prepared to adapt their own behaviour, the Flemish government organized a survey among a representative sample of 1000 Flemish people about their beef consumption. The first results reveal some surprising findings. It appears that *only a small minority of 18%/a large majority of 82%* of the Flemish people are willing to change their behaviour and consume less beef to prevent further global warming.

RESEARCH ON WILLINGNESS OF FLEMISH PEOPLE TO ***EAT LESS BEEF/TO FLY LESS/TO USE THE CAR LESS*** **TO ACT ON CLIMATE**

BRUSSELS | The IPCC, the scientific committee that advises the United Nations on climate change, says that *human diet/personal transport* is a major cause of global warming. Especially beef *production/travelling by plane/driving one's own car* is associated with high emissions of greenhouse gases. In order to see to what extent the Flemish people are prepared to adapt their own behaviour, the Flemish government is organizing a survey among a representative sample of 1000 Flemish people about their *beef consumption/flight behaviour/driving behaviour.* The results of the survey will be made available in a new report by the Flemish government in a few weeks' time.

FIGHT AGAINST CLIMATE CHANGE: TAX ON BEEF ***DIFFICULT/EASY*** **TO MAKE WATERTIGHT**

BRUSSELS | The IPCC, the scientific committee that advises the United Nations on climate change, says human diet is a major cause of global warming. Especially, beef production is associated with high greenhouse gas emissions. Therefore, there will soon be a hearing in Parliament about a possible additional tax on beef. Experts say that in countries where such a tax has already been introduced the measure was *difficult/easy* to enforce. The new tax on beef proved *not to be watertight and it was easy for some citizens to escape it/to be watertight and it was very difficult for citizens to escape it.*

FIGHT AGAINST CLIMATE CHANGE: DEBATE OVER TAX ON ***BEEF/FLIGHT TICKETS/CAR USE***

BRUSSELS | The IPCC, the scientific committee that advises the United Nations on climate change, says *human diet/personal transport* is a major cause of global warming. Especially, *beef production/travelling by plane/driving one's own car* is associated with high greenhouse gas emissions. Therefore there will soon be a hearing in Parliament about a possible additional tax on *beef/flight tickets/car use.* Experts say that such taxes have already been introduced in a number of countries. The effects and results of the new tax *on beef/flight tickets/car use* in those countries will be discussed in the hearing.

I chose to examine three environmentally harmful activities that are part of many people's daily lives: beef consumption, taking an airplane, and driving the car (Tobler, et al. 2012). Since these activities are part of people's personal lives the intended behavioural change can be achieved on a voluntary basis or through government interference. This makes that I can realistically employ the three types of activities for indirect and for direct pro-environmental action. In addition, since the activities are related to personal preferences and lifestyles, reducing this kind of environmentally harming behaviour can bear a high cost for individuals. To increase external validity, I examine three *different* types of behaviour. This decreases the chance that my results depend on the specificities of one type of behaviour. Other types of environmentally harming behaviour could have been selected in the study. Examples are consuming non-seasonal food (Samenza, et al. 2008) or not saving water (Tobler et al. 2012). However, I chose the three activities mentioned above because a fair amount of Belgians eat beef, travel by plane and drive their car and there are differences among Flemings in the three activities (some do not fly, for example, or do not eat beef). One can thus expect the cost of refraining from the three activities to vary between respondents.

My stimulus, a newspaper article, was chosen for a multitude of reasons. First, I opted to present the stimulus as a newspaper article because mass media such as newspapers and television news remain, at least in Europe, citizens' main information source about current affairs (Eurobarometer, 2020b). Modern politics is thus *mediated*, meaning that most citizens receive information on politics and political issues through the media (Mazzoleni & Schulz, 1999). Therefore, using mock newspaper articles that resemble the layout of a newspaper article enhances the natural validity and the external validity of this research. Second, the focus in this research is on the national level and that is why my vignettes relate to the domestic (in this case: Flemish) population. Third, since I investigate both direct and indirect behaviour of citizens it is better to look at the national scale. This is the policy level that needs to ratify most policies and that needs to gather enough public support in order for these policies to get implemented. Additionally, the national level is still the most visible and most important policy level for most citizens. Fourth, the IPCC as the source of information in the article was a deliberate decision as this scientific committee of the United Nations is widely recognized as a reliable authority regarding climate change research. The article was free of opinions by the journalist, limiting the article content to 'facts' stated by the IPCC. Further, the Flemish government has a good deal of climate competences, so this makes the manipulation realistic, again enhancing its natural validity. Finally, Gifford and Nilsson argued that individuals are less willing to behave pro-environmentally when their knowledge and education about the topic is limited (2014). Therefore, the vignettes provide some concrete and tangible information about the environmental consequences of the activity in question. Hence, every subject got the same basic information and lack of behaving pro-environmentally cannot be contributed to lack of knowledge (about the environmental consequences of this specific activity).

3. 4 Measurements

The dependent variable is individuals' willingness to exhibit, direct and indirect, pro-environmental behaviour. The *willingness to show direct pro-environmental behaviour* was measured by asking the respondents: "To what extent are you personally willing to undertake the following actions against climate change?". Respondents indicated their willingness to "eat less beef", "use the car less" and "fly less" on a 11-point scales ranging from "Totally not willing" (0) to "Totally willing" (10). The *willingness to show indirect pro-environmental behaviour* was measured by asking the respondents to indicate on a similar 11-point scale "To what extent are you personally willing to support the following policies against climate change?". In this case the policies were a new tax on beef, a new tax on using the car, or a new tax on airplane tickets. By explicitly asking respondents to what extent they are personally willing to do the following things in response to global warming, only individuals' intentional behaviour is measured, thereby ensuring that the measure is not contaminated by other reasons such as saving money or health improvement (Gifford and Nilsson, 2014).

While the respondents were only exposed to one vignette about one type of activity (beef, flying, driving) in a direct or indirect setting, all respondents were asked about their direct and indirect pro-environmental intentions. This was done to make the link between the vignette and the questions asked afterwards not too obvious. Hence, all respondents were asked to answer questions with regard to the three activities and with regard to their direct and indirect behaviour. The order of these two questions (direct and indirect) differed depending on the vignette the respondents were shown. Individuals who received a direct-condition treatment (1-9) where first asked a question about their own direct behaviour, and individuals who received an indirect-condition treatment (10-18) first received a question regarding their own indirect behaviour. The order of the activities within the direct and indirect question was randomized.

The hypothesized moderator variable was measured in the first wave to avoid a cueing effect. In order to capture a respondent's *subjective cost (H3, H4, H5, H6),* respondents were asked how much effort it would cost them to reduce beef eating, plane taking and car driving on a 0-10 scale[3]. Hereby trying to encompass the personal consequences of reducing this behaviour for the respondent involved (Diekmann & Preisendörfer, 2003).

In addition to the moderator variable, previous research suggests that pro-environmental behaviour is affected by multiple other factors. Therefore, I control for respondents' *gender* (0 = Male, 1 = Female), *age,* level of *education[4]*, *ideological left-right placement* (0= left, 10= right) and *generalized trust*[5]. Additionally, three questions regarding the respondents' *environmental attitudes* on a 0-10 scale were asked to account for differences in respondents' overall attitude towards climate change[6]. A reliability analysis indicates that the 3 questions can be combined in a single scale (Cronbach's alpha = 0.740).

The manipulation check questions ask respondents to rate on a 5-point scale ranging from "Totally disagree" (1) to "Totally agree" (5) the extent to which they agreed with seven statements about the article they had to read. Table 2 shows that respondents consistently answered the questions as intended, across all seven manipulation checks (all t-tests are statistically significant). Hence, I can conclude that the respondents were effectively exposed to the different treatments and noticed the content of the vignettes. Table 2 presents the different t-tests regarding all different manipulation check statements.

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[3] "We are now showing you a number of things that people can do for environmental reasons. For each of them, can you tell us how much effort doing these things would cost you (if you were to do them) or how much it is already costing you at the moment (if you are already doing them)?". (0= very little effort, 10= a lot of effort)

[4] 1 = No or lower education or High school not finished, 2 = Finished high school, 3 = Higher education (reference category)

[5] Measured through the ESS measure for trust (European Social Survey, 2018) (1) In general, would you say that most people can be trusted, or that you cannot be careful enough when dealing with people? (2) Do you think most people would try to take advantage of you if they had the chance, or would they try to be honest? (3) Would you say that people usually try to be helpful or that they mostly take care of themselves? These questions are the same as used in multiple surveys of the European Social Survey (European Social Survey, 2018). Cronbach's alpha 0.833.

[6] (1) "Suppose a choice has to be made between protecting the environment and employment. Where would you place yourself on this scale?" (0 = employment, 10 = protecting the environment). (2) "To what extent do you agree with the following statements: I would give up part of my income if I was sure it would improve the environment?" (0 = totally not agree, 10 = totally agree). (3) "Some people believe that climate change can be stopped by technological innovations alone. Others believe that fundamental behavioural changes are also needed to stop climate change. Where would you place yourself on this scale?" (0 = technological innovations are sufficient, 10 = behavioural changes are also needed).

Table 2. Manipulation checks of treatment

Manipulation checks	Mean (SD)	T-value & P-value
1. *"The article was about a new tax as part of the fight against global warming"*	Indirect conditions (10-18): 4.34 (1.01) Direct conditions (1-9): 1.39 (0.90)	t(1645)=62.43 p=.000
2. *"The article was about a new climate tax that experts say is difficult to make watertight"*	Indirect free-rider conditions (11, 14, 17): 4.39 (0.98) Indirect no-free-rider conditions (10, 13, 16): 1.80 (1.23)	t(515.05)=27.09 p=.000
3. *"The article explained the results of a survey of the Flemish government".*	Direct free-rider & no-free-rider conditions (1, 2, 4, 5, 7, 8): 3.18 (1.629) Direct control conditions (3, 6 ,9): 1.60 (1.017)	t(795.82)=17.10 p=.000
4. *"The article indicated that many Flemings want to change their own behaviour to combat global warming."*	Direct no-free-rider conditions (2, 5, 8): 4.43 (0.952) Direct free-rider conditions:(1, 4, 7): 1.37 (0.863)	t(541.50)=39.46 p=.000
5. *"The article was about meat consumption"*	Direct & indirect conditions beef (1, 2, 3, 10, 11, 12): 4.60 (0.846) All other conditions: 1.11 (0.468)	t(1647)=107.684 p=.000
6. *"The article was about airplane travel"*	Direct & indirect conditions flying (4, 5, 6, 13, 14, 15): 4.73 (0.719) All other conditions: 1.19 (0.654)	t(1647)=100.146 p=.000
7. *"The article was about car driving"*	Direct & indirect conditions driving (7, 8, 9, 16, 17, 18): 4.44 (0.957) All other conditions: 1.16 (0.575)	t(1645)=86.482 p=.000

4. Results

The research question addressed in this study is whether the perception of free-riding affect people's willingness to engage both in direct and indirect pro-environmental behaviour. To provide an answer to this question I undertake several analyses and conduct a large number of statistical tests. First, independent t-tests examine the effect of experimental treatment in a bivariate manner. Next, multivariate regressions incorporating the treatment but taking different control variables into account are conducted. Finally, multivariate regressions are estimated that include the hypothesized interaction-effect with subjective cost (*H5* and *H6*).

Since the activities (beef, flying, driving) differ markedly from each other I decided to run all models for all three types of activity separately. In fact, the histograms of the dependent variables included in Appendix show that the frequency distribution is quite different for each activity (Figure A1). The first aim of the t-tests and regressions is to provide an answer to hypotheses *H1a, H1b, H1c* (effect of treatment on direct behaviour) and *H2a, H2b, H2c* (effect of treatment on indirect behaviour). Previous research suggests that multiple control variables should be included.

In order to explain what my regressions look like, Table 3 presents the output of two complete exemplary multivariate regression models with all control variables included for direct and indirect driving with free-rider vs. no-free-rider treatment. Similar regressions were conducted for all 18 comparisons, in Appendix the full table with all the complete multivariate regression outputs is included (Table A2). It is important to keep the structure of these regressions in mind when looking at all results. Due to the fact that there is too much output, I need to summarize all statistical tests.

Table 3. Output of two series of exemplary multivariate regression models with regard to driving behaviour. Comparison of effect of no-free-rider treatment with effect of free-rider treatment

	Model 1 coeff (SE)	Model 2 coeff (SE)	Model 3 coeff (SE)	Model 4 coeff (SE)	Model 5 coeff (SE)	Model 6 coeff (SE)
Direct behaviour (less car driving) N=185						
Treatment (free-rider vs. no-free-rider)	.739 (.454)	.648 (.448)	.893 (.421)*	.886 (.408)*	.876 (.398)*	.617 (.345)
Age		-.003 (.016)	.002 (.015)	-.003 (.015)	-.002 (.015)	-.004 (.013)
Gender		1.258 (.502)*	1.003 (.472)*	.964 (.458)*	.952 (.447)*	.824 (.386)*
Education		.836 (.397)*	.533 (.375)	.199 (.375)	.195 (.353)	.070 (.316)
Left-right placement			-.464 (.087)***	-.381 (.087)***	-.341 (.086)***	-.115 (.080)
Generalized trust				.452 (.127)***	.483 (.125)***	.251 (.111)*
Subjective cost					-.199 (.063)**	-.192 (.054)**
Environmental Attitudes						.716 (.091)***
Adjusted R^2	.007	.055	.180	0.228	0.265	0.453
Constant	7.40	3.70	6.65	4.74	5.40	2.407
Indirect behaviour (supporting driving tax) N= 181						
Treatment (free-rider vs. no-free-rider)	.731 (.540)	.468 (.535)	.947 (.473)*	.795 (.447)	.835 (.448)	.493 (.420)
Age		-.016 (.019)	.001 (.017)	-.008 (.016)	-.010 (.016)	-.008 (.015)
Gender		.645 (.612)	.346 (.538)	.364 (.507)	.313 (.509)	.598 (.475)
Education		1.119 (.400)**	.866 (.352)*	.569 (.337)	.557 (.337)	.526 (.312)
Left-right placement			-.748 (.102)***	-.615 (.100)***	-.583 (.104)***	-.235 (.116)*
Generalized trust				.623 (.129)***	.635 (.130)***	.402 (.127)**
Subjective cost					-.073 (.072)	.005 (.068)
Environmental Attitudes						.748 (.138)***
Adjusted R^2	.005	.056	.275	.357	.357	.473
Constant	4.910	2.255	5.768	2.536	2.819	-2.217

Note p=.05 *, p=.01 **, p=0.001 ***

All tests and their results are summarized in Table 4. The table contains the t-tests, the main effect regressions and interaction effect regressions. Since I will discuss the results of the t-tests and regressions together, I incorporate them both in a single table. Concerning the regressions, the table only includes the relevant coefficients with regard to the treatment effect (and with regard to the interactions with the treatment). Yet, in all regressions reported in the table, all control variables of Model 3 (*age, gender, level of education* and *left-right placement*) as shown in Table 3 are included. Column 3 of Table 4 indicates whether the difference between the means of the two compared conditions goes in the hypothesized direction (+) or in the opposite direction (-). It prints the symbol in bold when the effect found in the t-test or/and a main effects regression is significant (the direction of the coefficient never changes between t-test and regression), the same in case the interaction effects regressions is significant.

Table 4. Summary results of experimental treatment: t-tests, main effect and interaction effect regressions

Comparison	Activity	t-test		Main effect (treatment) regression (with controls)	Interaction effect regression - subjective cost	
		Direction	Sig.(p)	Coeff. Sig.(p)	Interaction effect Coeff. Sig.(p)	Main effect treatment Coeff. Sig.(p)
Direct control < No-free-rider	Beef consumption	-	.583	-.023 .955	-.097 .489	.181 .795
	Flight behaviour	-	.164	-.404 .319	**-.285** **.016**	.473 .386
	Driving behaviour	**+**	**.014**	**1.272** **.002**	**.255** **.038**	-.187 .785
Direct Free-rider < control	Beef consumption	**+**	**.017**	**.708** **.083**	.172 .210	.025 .972
	Flight behaviour	+	.194	.236 .545	**.276** **.017**	.465 .380
	Driving behaviour	-	.439	-.358 .366	**-.272** **.038**	-1.004 .167
Direct Free-rider **<** No-free-rider	Beef consumption	+	.116	.639 .158	.075 .620	.156 .811
	Flight behaviour	-	.906	-.121 .763	-.008 .942	.008 .989
	Driving behaviour	**+**	.105	**.893** **.035**	-.017 .906	.818 .285
Indirect control **<** no-free-rider	Beef consumption	+	.331	.422 .373	.259 .100	-.689 .441
	Flight behaviour	-	.870	-.302 .558	.007 .965	-.056 .945
	Driving behaviour	+	.352	.367 .446	-.074 .559	.900 .279
Indirect free-rider **<** control	Beef consumption	-	.501	-.358 .445	-.137 .407	-.286 .741
	Flight behaviour	-	.261	-.229 .607	-.022 .880	.337 .622
	Driving behaviour	+	.673	.494 .295	0.087 .584	.804 .289
Indirect free-rider **<** No-free-rider	Beef consumption	+	.744	.126 .792	.123 .170	-.403 .644
	Flight behaviour	-	.184	-.557 .207	-.015 .913	-.393 .561
	Driving behaviour	**+**	.177	**.947** **.047**	.167 .316	.092 .923

In the remainder of this results section, I will first discuss the evidence with regard to my key hypotheses *H1* and *H2* by using both the t-test and the main effect regression evidence. Then I briefly examine the evidence of the multiple covariates (controls) included in the regressions. Next, I discuss the main effect of the explanatory variable subjective cost as formulated in hypotheses *H3* and *H4*. Finally, I present the results of the interaction effect regressions that tests *H5* and *H6* and examines whether the effect of the free-rider treatment varies across different levels of subjective cost.

The results of the t-tests suggest (in Appendix Table A1 contains all data) that the difference in respondents' average willingness to behave pro-environmentally according to the treatment is statistically significant only twice. Individuals who are exposed to the driving control treatment have a lower average willingness to show direct pro-environmental behaviour (M=6.05; SD=3.00) than the individuals exposed to the driving no-free-rider treatment (M=7.14; SD=2.96). This difference is significant: $t(182.92)=-2.49$ $p<0.05$, confirming *H1a* for driving behaviour. Next, also the difference in willingness to exhibit direct pro-environmental behaviour for individuals exposed to the beef consumption control treatment (M=7.20; SD=2.34) and individuals exposed to the beef consumption free-rider treatment (M=6.20; SD=3.21) is significant, $t(184)=2.41$ $p<0.05$. This confirms *H1b* for beef consumption. According to the t-tests no other differences in means are significant at a p-level of .05. This outcome does, overall, suggest that free-rider treatment does not matter hugely but the effect does materialize in some cases. Importantly, when the t-tests suggest an effect in the opposite, negative direction, that negative effect is in none of the cases statistically significant nor does it approach significance. So, the only two significant t-tests go in the expected direction and none are significant in the opposite direction. Hence, the t-tests offer some but modest evidence in support of *H1a* and *H1b*, although the effects seem highly contingent on the type of behaviour.

While beef consumption and driving behaviour do seem to comply with the expectations to some extent, the same cannot be said about flying. For flight behaviour only in one out of six t-tests the direction of the difference between means is as anticipated. However, none of the flying effects are significant. Hence, it appears that there is no significant effect of free-rider exposure on individuals' willingness to behave pro-environmentally with regard to their flying.

The main effect regressions in Table 4 confirm the overall picture that the free-rider treatment matters to some extent for beef eating and car driving but not for flying. For beef consumption, when controlling in the main effect regression for *age, gender, level of education* and *left-right placement*, the treatment effect on direct beef consumption found in the t-test decreases but is still significant on a p=.1 level (p=.083). With regard to driving behaviour again one effect of exposure is significant in the t-test but when controlling for *age, gender, level of education* and *left-right placement* in the regression this effect even increases and becomes significant on a p=.01 level (p=.002). Further, the regressions reveal two more significant effects for driving behaviour, which implies that the treatment effect becomes significant when taking alternative explanations into account. First, the difference between direct free-rider treatment and direct no-free-rider treatment becomes significant. As one can see in Table 3 there is, from Model 3 onwards (coeff. .89), a significant effect that goes in the expected, positive direction. When gradually further including all control variables, the no-free-rider effect remains significant at the p=.05 level in Model 4 (coeff. .89) and Model 5 (coeff. .88). Second, the difference between indirect free-rider treatment and indirect no-free-rider treatment also becomes significant. However, the results are less strong. Only in Model 3 does the expected, positive effect show up in a statistical significant fashion (coeff. 95). This is the only case in which exposure to the possibility of free-riding behaviour has a significant effect on indirect pro-environmental intentions. So, there is some support for the hypotheses, especially with regard to car driving and a little less with regard to beef eating. However, I do not observe any support for my hypotheses when it comes to flight behaviour.

Based on Table 4, I can conclude that there are four significant effects in line with my hypotheses that the perception of free-riders influences individuals' intention to behave pro-environmentally. Yet, there are not only differences between types of activities (beef, flying, driving) but also between direct and indirect behaviour. Three effects were significant for direct pro-environmental behaviour (*H1b* beef consumption, *H1a* driving behaviour, *H1c* driving behaviour), and only one for indirect pro-environmental behaviour (*H2c* driving behaviour). Hence, it seems that the effect of free-riding cues on people undertaking pro-environmental behaviour can to some extent be confirmed for direct pro-environmental behaviour (*H1a, H1b, H1c*), more specifically for beef consumption and driving behaviour. However, it is not quite possible to say the same with regard to indirect pro-environmental behaviour. Only in one out of nine analyses, and only when specifically controlling for *age, gender, level education* and *left-right placement*, a single significant effect is found. Thus, the results suggest that free-rider cues may affect people's willingness to change their own way of life in a pro-environmental manner, but free-rider cues do not affect their support for the government imposing green taxes to (force them to) change their behaviour (*H2a, H2b, H2c*).

In addition to the effect of the free-rider treatment, the multivariate regressions control for multiple theoretically relevant covariates among which subjective cost. Table 5 summarizes the effects the different covariates have on direct and indirect pro-environmental behaviour; results are taken from the same series of regressions including the variables according to the exemplary regressions shown in Table 3. Table 5 shows how often a variable was found to have a significant effect (with p=.05) on the outcome variable. The number of regressions in which those variables were included varies strongly as in the different models different variables were included. The socio-demographics are included in all regressions (45 to be precise) while environmental attitudes are added last with less observations as a consequence (9). I discuss the effect of each covariate in the order presented in Table 5.

Table 5. Number of significant effects of covariates in main effect multivariate regressions

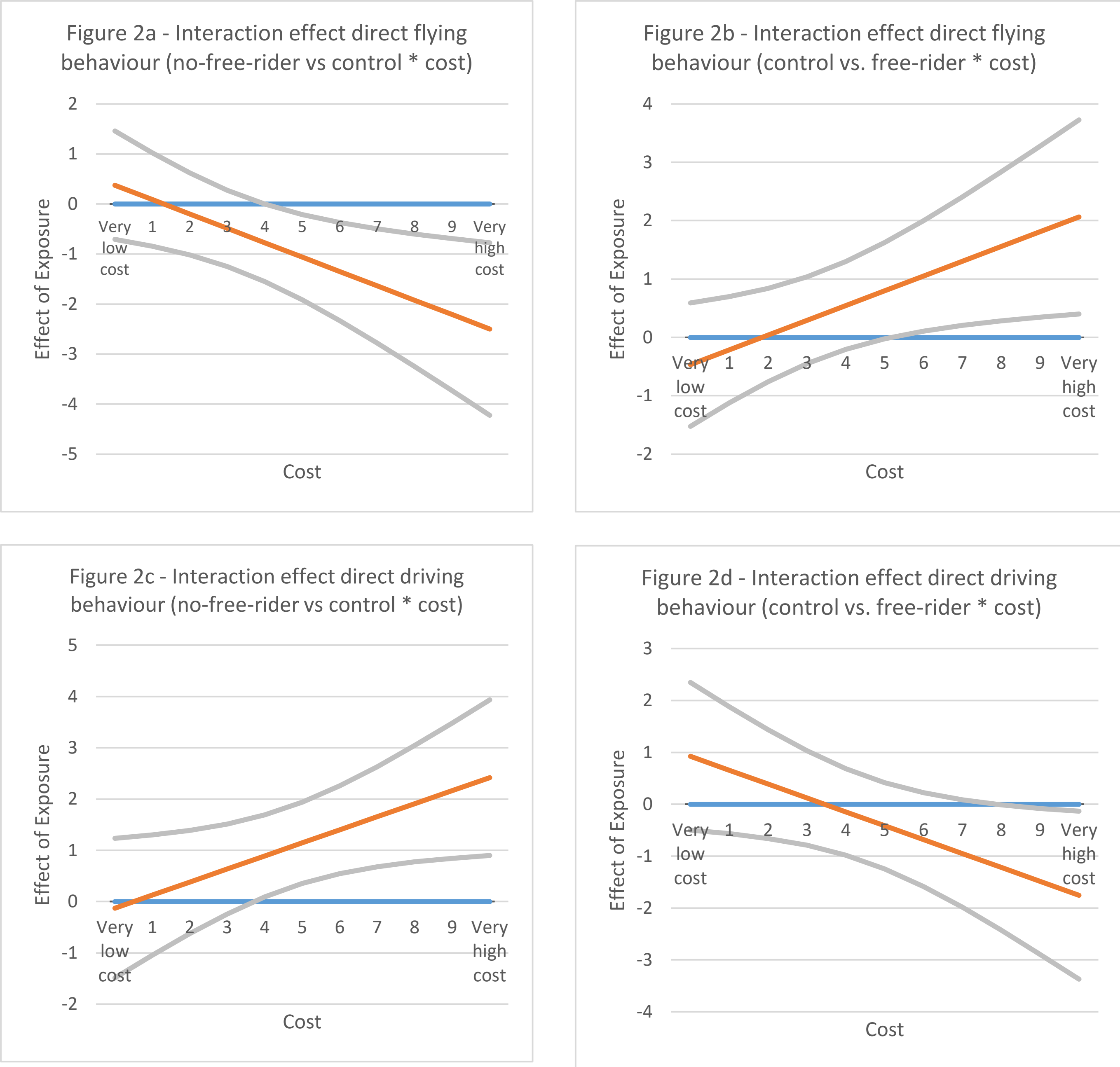
Variables	**Direct (%)**	Beef consumption	Flight behaviour	Driving behaviour	**Indirect (%)**	Beef consumption	Flight behaviour	Driving behaviour	**Total (%)**
Age	14/45 (31.1%)	0/15	14/15	0/15	4/45 (8.9%)	0/15	4/15	0/15	18/90 (20%)
Gender	24/45 (53.4%)	7/15	5/15	12/15	12/45 (26.7%)	8/15	0/15	4/15	38/90 (42.2%)
Level of Education	10/45 (22.2%)	8/15	0/15	2/15	24/45 (53.3%)	14/15	4/15	6/15	34/90 (37.7%)
Left/right placement	28/36 (77.8%)	9/12	9/12	10/12	32/36 (88.9%)	11/12	10/12	11/12	60/72 (83.3%)
Generalized trust	7/27 (25.9%)	0/9	2/9	5/9	12/27 (44.4%)	2/9	2/9	8/9	19/54 (35.2%)
Subjective cost	18/18 (100%)	6/6	6/6	6/6	11/18 (61.1%)	5/6	6/6	0/6	29/36 (80.6%)
Environmental attitudes	9/9 (100%)	3/3	3/3	3/3	9/9 (100%)	3/3	3/3	3/3	18/18 (100%)

Age is a predictor of people's willingness to behave pro-environmentally only with regard to flight behaviour: the older respondents are the more willing they are to fly less and to support a flying tax. *Gender* is found to be a determinant of pro-environmental behaviour. Especially with regard to beef consumption and driving behaviour, women are more inclined to behave in a pro-environmental fashion (both direct and indirect). The same applies to individuals with a higher *level of education.* With regard to *left-right placement*, left-oriented people exhibit more pro-environmental behaviour. Fifth, *generalized trust* has a positive effect, meaning that individuals with higher levels of *generalized trust* are more inclined to show both direct and indirect pro-environmental behaviour.

H3 and *H4* stated that, compared to pro-environmental behaviour that bears a high subjective cost, individuals are more inclined to exhibit direct *(H3)* and indirect *(H4)* pro-environmental behaviour that bears a low subjective cost. As Table 5 indicates, *subjective cost* is significant in 80.6% of the models. In case of direct pro-environmental behaviour, subjective cost always has a significant effect. For indirect behaviour the effect of subjective cost is significant for beef consumption and flight behaviour but not for driving behaviour. The effect of subjective cost on willingness to behave pro-environmentally is always negative (see Table A2 in appendix), meaning that the propensity to show pro-environmental behaviour decreases as the cost associated with adopting more pro-environmental behaviour increases. Hence, both *H3* for all three behaviours and *H4* for beef consumption and flight behaviour can be confirmed. Last, *environmental attitudes* appear to be a very strong predicator of people's propensity to behave pro-environmentally. In *all* models that include this variable the effect of environmental attitudes is strongly significant.

Finally, Table 4 also provides information about the multivariate regressions that are estimated including the hypothesized interaction effect with subjective cost (*H5* and *H6*). I expected the free-rider cues to have a larger effect when the cost of exhibiting the behaviour is low, and thus the expected sign of the interactions to be negative. Due to the limited analytical power and the low N per analysis, I decided not to include any control variables in these regressions and I only incorporated both explanatory variables, exposure to free-riding information and individuals' subjective cost, and the interaction term between both. Table 4 indicates that the interaction-effect is significant in four different models only; all significant effects are found in models predicting *direct* behaviour, the interaction effect is not significant in any of the *indirect* behaviour models. To get a more accurate picture of the four significant interaction effects, I calculated for each of them the marginal effect of exposure to the (no-)free-rider treatment versus the control conditions, for varying degrees of subjective cost.

Figure 3. Interaction effects between free-rider cues and subjective cost



Note: orange lines indicate the actual predicted values, the grey lines show the 95% confidence interval

In all interaction-effects depicted in the four graphs above, the effect of exposure to (no-)free-rider cues becomes significant in case of high subjective costs; the grey line of the confidence interval only departs from the blue zero-effect line at high levels of subjective cost (right side of the graphs). Two of the interaction effects are positive, with an upward slope (Figure 3b and 3c), which goes against my expectation and contradicts *H5*. Yet, two of the four interaction effects are negative (Figure 3a and 3d). However, since these negative effects are *below* the zero-line and not above it, they do not support *H5* either. Higher subjective cost makes the effect of non-free-rider cues more negative, but the initial main effect was negative to start with. So, it is not the case that on higher levels of cost the positive effect of non-free-riding exposure diminishes; rather the negative effect becomes even more negative. Therefore, *H5* must be rejected. In case of indirect pro-environmental behaviour no significant interaction-effects are found to start with, hence also *H6* must be rejected.

Table 4 indicates that with regard to flight behaviour the main effect of the no-free-rider cue compared to the control condition is not in the anticipated direction but in the opposite direction (see Table 4 direction), whereas the main effect of free-rider cue compared to the control condition goes in the expected direction (+). In case of driving behaviour it was the other way around, the main effect of the no-free-rider cue compared to the control condition follows the direction as anticipated (+), while the effect of free-rider exposure compared to the control condition goes in the direction contrary to my expectations (-). Thus, the effect of exposure to free-riding information for individuals with a high subjective cost seems to have a contradicting effect for the different types of activities. Therefore, it appears as though for people with a higher cost it does not matter what exact information – i.e. free-rider or no-free-rider – they are exposed to. Merely the exposure to information about public opinion, and information about the intended behaviour of others appears to trigger an effect. This is a rather odd finding which cannot be explained on the basis of the collective action problem theory.

Based on the results discussed above it is quite clear that the three activities included in this research, i.e. beef consumption, flight behaviour and driving behaviour, differ substantially from each other. It seems that different variables are at play for the different activities. For instance, the effect of exposure to (the possibility of) free-rider behaviour was only in some cases significant for beef consumption and driving behaviour but never for flight behaviour. Next, different control variables proved to be significant for different behaviours. Hence, the results suggests that different considerations play a different role for the three activities included. Next, the results also indicate that the drivers of *direct* pro-environmental behaviour differ from those of *indirect* pro-environmental behaviour. For instance, only one significant effect was found of exposure to free-riding cues (nature of a tax) on individuals' inclination to show indirect pro-environmental behaviour. For direct pro-environmental behaviour three such main effects were found to be significantly positive.

5. Discussion

Contrary to my expectations, the results for beef consumption, flight behaviour and driving behaviour turned out to differ significantly from one another. The effects of free-riding cues varied substantively across activities. This demonstrates the importance of including different types of activities in the analysis. Next, the results also indicate that the determinants of direct pro-environmental behaviour differ substantially from those of indirect behaviour; free-rider cues mattered more for the former. In this section, I briefly reflect about these unexpected results and put forward a number of possible explanations.

In this study, I focused attention on just one element of the broader collective action problem framework, namely the fear of free-riders. But the theory of collective action contains other elements that could have influenced the results. First, climate change is a transboundary problem that results from an extraordinarily large number of actions taken by a vast number of individuals (Ostrom, 2010). The fact that both so many different actors and so many different activities are the source of the problem may inhibit people from taking action as they believe their own actions to be futile. For this reason, it is quite plausible that even if people are exposed to information indicating that most people are willing to behave cooperatively with regard to one specific activity – eating beef, flight by plane or driving the car – they may not act pro-environmentally. This because they consider their contributions with regard to this specific activity useless, as there are so many other environmentally harmful activities that will negate their efforts made with regard to this specific activity (see also Samenza, et al. 2008). So, the free-riding information may not have impacted the respondents to a great extent, since they reasoned that even if many citizens diminish, for instance, car driving it will not help a lot because there are still so many other things that have negative consequences for the climate.

Second, Olson (1965) argues that selective incentives that distinguish between those individuals who contribute to the common interest and those who do not, might provide an answer to the free-rider problem. These selective incentives can be social incentives such as social pressure and social norms. Social pressure in large groups can be generated through mass media, in the event that the media consistently points to the worthiness of the collective interest (Olson, 1965, p.63). In recent years, the mass media, at least in Belgium, have taken up an active role in advocating climate consciousness and in making individuals aware of their role as consumers. Therefore, the media might have effectively created pressure that encourages Belgian citizens to do their part. Next to social pressure, also social norms, shared understandings about actions that are obligatory, permitted or forbidden, can serve as selective incentives (Ostrom, 2000, p.114). In most industrialized countries, norms of pro-environmental behaviour and climate consciousness have become increasingly important and culturally shared (Fritsche, Jonas, Kayser, & Koranyi, 2010). For example, littering is increasingly 'not done' and also the idea of 'flight shaming' is taking roots. People feel guilty when they take the plane and are ashamed when others learn about their plane travels. It could be that these norms, in so far as they are internalized, make people less susceptible to free-rider cues. Regardless of the behaviour of other people, individuals with strong prescriptive environmental norms are willing to act pro-environmentally. And this may explain why free-rider cues only mattered to a limited extent.

One other, overarching explanation for my study's divergent results across activities is that the control variables included in the analysis differ in their importance depending on the activity and kind of behaviour (direct or indirect) involved. Some of my findings about the control variables are in line with previous work while other findings seem to contradict previous research. *Age* is only a significant predictor with regard to flight behaviour, the older respondents are the more willing they are to behave pro-environmentally. This is not in line with prior research suggesting that younger respondents are more likely to alter their environmentally harmful behaviour (O'Connor et al, 2002; Samenza et al, 2008). Next, the results indicate that *women* are overall more inclined to show both direct and indirect pro-environmental behaviour. Nor does this finding correspond to previous literature which suggested that women are more willing to act in a direct pro-environmental fashion, while men are more likely to act in an indirect pro-environmental fashion (Harring & Jagers, 2018; Kollmuss & Agyeman, 2002, p.248; O'Connor, et al.1999). Third, in this study, individuals with a higher *level of education* are more inclined to show pro-environmental behaviour, confirming previous research (Gifford & Nilsson, 2014; Samenza, et al. 2008). This is in particular the case for beef consumption and for indirect pro-environmental behaviour. This means that people with a higher level of education make more climate conscious choices regarding their diet and are less tax-averse. Next, both *left-right placement* and *generalized trust* are strong determinants of the willingness to act pro-environmentally. These findings are again in line with prior research (Bohr 2014; Harring & Jagers, 2013; McGrath & Bernauer, 2017; O'Connor, et al. 2002; Tobler et al, 2012). Last, previous literature states that there is only a moderate relationship between environmental attitudes and pro-environmental behaviour (Bamberg & Möser, 2007; Kollmuss & Agyeman, 2002). Yet, my results indicate that there is a strong significant effect of having pro-environmental attitudes on the willingness to show pro-environmental behaviour. Therefore it appears that positive pro-environmental attitudes might be a strong pre-condition for individuals to behave pro-environmentally. If individuals do not care about environment or climate, it is very unlikely they will make sacrifices in favour of the climate. In fact, perhaps these environmental attitudes can also be interpreted within a collection action framework, they do not form an explanation of pro-environmental behaviour that is totally disconnected from the theory I tested in this study. Indeed, one could say that people with strong pro-environmental attitudes attribute more value to the non-excludable, collective good that a stable climate is. In a sense, the environmental attitudes grasp to what extent people care about the collective good that they might co-produce. Therefore I think it is possible to incorporate environmental attitudes within the broad collective action theory. Note that I asked the respondents about their *intention* to show pro-environmental behaviour. It might be that environmental attitudes are a greater predictor of individuals' intention to exhibit pro-environmental behaviour than of their *actual* behaviour.

Another possible explanation for the different direct free-rider effects across types of activities (beef, driving, flying) is that different alternative pro-environmental behaviours exist for the three environmentally harmful behaviours. So, while respondents may have felt keen to engage in pro-environmental behaviour, this may not have been apparent from their answers as they answered to continue their environmentally harmful behaviour. For example, instead of reducing car driving individuals can also buy a fuel-efficient or an electrical car out of environmental considerations. Because these alternative ways of showing pro-environmental behaviour with regard to the three activities were not included in my research, some insight and nuance might have gone lost and I might have concluded that people were not willing to behave pro-environmentally while in reality they were. Probably, there are more alternatives for car driving than for flight behaviour and beef consumption.

Last, with regard to direct flying and driving behaviour, the interaction effects uncovered some odd findings (Figure 3). Individuals with a high cost (for both flying and driving) appear to be indifferent to the number of other people (18% or 82%) showing pro-environmental behaviour. The mere exposure to public opinion information seems to trigger the effect, be it negative or positive. However, in case of driving behaviour, one possible explanation for this unexpected finding might be that the manipulation did not create the perception I aimed for; although the manipulation check indicates a significant difference between the free-rider and no-free-rider conditions (see manipulation check 3, Table 2). It is possible that for individuals with a high subjective cost for driving the information that 18% of the Flemish citizens are willing to reduce their environmental behaviour, might be perceived as already quite a big share of the population. In that case, if these respondents perceive that about one fifth of the population is willing to change their driving behaviour in favour of the environment, these individuals might reason that, according to the principle of reciprocity, they should as well try to reduce their driving behaviour (although it entails a high cost for them). Hence, instead of 18% being a free-rider cue it could, for some people, rather be a no-free-rider cue.

Besides the disparities between the three activities, the results also indicate that direct and indirect pro-environmental behaviour differ in terms of their drivers. This is in line with previous literature (Kollmuss & Aygeman, 2002; Tobler, et al. 2012). My research indicates that the perception of free-riding mostly influences direct pro-environmental behaviour. This might be due to multiple reasons. First, individuals may be less favourably inclined towards state intervention steering their behaviour in general than towards voluntarily changing their own behaviour. A lower overall willingness to support environmental taxes, and people's predisposition against taxes, might be a plausible explanation for the lack of free-rider cue effects on indirect pro-environmental behaviour. Second, the methodological choice for an environmental tax as the proposed policy instrument might have influenced people's willingness to show indirect pro-environmental behaviour. Individuals' sensitivity to taxes is linked to their political attitudes. Generally, people on the right hand side of the political spectrum are more tax-averse than left-oriented people. For that reason, it is quite possible that in case another policy instrument was chosen, for instance emission caps, this would have led to other results regarding indirect pro-environmental intentions. Some confirmation for this reasoning might be found in the fact that left-right placement was in a very large majority of the models a significant determinant of indirect pro-environmental behaviour (Table 5); clearly political attitudes are at play here.

In addition, the indirect conditions exposed respondents to the *possibility* of free-rider behaviour, whereas respondents in the direct conditions were exposed to information *explicitly* stating how many people would free-ride. Thus, it is possible that the free-rider manipulation was much stronger for the direct conditions than for the indirect conditions which could explain why I found (some) expected results for direct but not for indirect behaviour. Finally, the subjective cost might be different for direct than for indirect pro-environmental behaviour. In case individuals decide to pay the imposed tax instead of changing their behaviour as intended by the tax, the subjective cost merely becomes a financial cost. Hence, the financial means an individual has might influence that individual's willingness to exhibit indirect pro-environmental behaviour. Rich people may be relatively unaffected by the tax and may, as a consequence, not be very sensitive to the free-rider cue. Some support for this explanation is that individuals' *level of education*, assuming that this is a good indicator of financial status, was found to have a significant effect in 22% of the direct behaviour models and 53% of the indirect behaviour models. For direct behaviour the cost is more equal for everyone and it depends less on one's economic status; it regards voluntarily changing your lifestyle you cannot buy your way out of. Perhaps, therefore free-riding cues mattered more for direct than for indirect behaviour.

6. Conclusion

The aim of my research was to investigate the effect of free-rider perceptions on pro-environmental behaviour. Free-rider perceptions and the principle of reciprocity are one aspect of the broader collective action theory. Previous literature found that there is a gap between environmental attitudes and the act of behaving in a pro-environmental fashion (Bohr, 2014; Gifford & Nilsson, 2014; Kollmuss & Agyeman, 2002). Other literature indicates that most people are conditional co-operators, they are willing to participate in action for a collective good as long as they believe others will do likewise (Bohr 2014, Ostrom, 1998; Ostrom, 2000; Shinada & Yamagishi 2007). Hence, I argued that taking into account the perception of free-riding might shed more light on the gap between environmental attitudes and behaviour. My study added to the literature, first, by incorporating both the direct and indirect pathways to pro-environmental behaviour; second, by explicitly exposing individuals to information about free-riding; and third, by focusing on the perception of free-riding within one country.

The results indicate that, overall, the effect of the free-riding perception is limited. The exposure to free-rider information mainly affects direct pro-environmental behaviour and only beef consumption and driving behaviour (not flying). Hence, *H1* could be cautiously confirmed for driving behaviour and beef consumption but not for flight behaviour. With regard to indirect pro-environmental behaviour (*H2*) not a lot of supportive evidence was found; the free-riding perception hardly played a role. Yet, concerning individuals' subjective cost, strong effects were found. Individuals were more inclined to exhibit both direct and indirect pro-environmental behaviour when the cost associated with reducing environmentally harmful behaviour was low, confirming both *H3* and *H4*. Finally, the hypothesized interaction-effects of free-rider cues and subjective cost were not found. Both *H5* and *H6* had to be rejected.

The consideration to include three different types of behaviour in the study in order to decrease the chance that the results would depend on the specificities of one type of behaviour, proves to be a good decision. As the results of the different activities (eating less beef, travelling less by airplane, and driving one's car less) differ substantially from each other, it is clear that the different drivers of pro-environmental behaviour are depended on the type of activity examined. My results contribute to the existing literature of pro-environmental behaviour that speaks quite generally about pro-environmental behaviour and sometimes neglects that different types of activities are impacted by different drivers. Next, the results confirm previous findings that direct and indirect pro-environmental behaviour differ significantly from each other (Kollmuss & Aygeman, 2002; Tobler, et al. 2012). On that account, this study underscores the need to always clearly distinguish these two types of pro-environmental behaviour.

As Kollmuss and Agyeman argued already back in 2002, the question of what shapes pro-environmental behaviour is a complex question. It is influenced by a large number of factors and cannot be captured by a single theoretical framework. The results of this research definitely confirm this statement and indicate that different activities, and direct or indirect pro-environmental behaviours, are influenced by different factors and considerations. My findings add another layer of complexity to the question of what drives pro-environmental behaviour by suggesting that the fear of free-riders is indeed one such driver. Yet, in the way in which it was operationalized in this study, free-riding fear only plays a modest role and only with regard to beef consumption and driving. Additionally, my research seems to suggest, although in an unexpected manner, that the fear of free-riding may play a different role when costs are low then when costs are high. However, the exact meaning of this finding remains unclear and further research is needed to shed more light on this intricate matter.

My research design has certain disadvantages that make me cautious to generalize my findings to the wider population. First, as stated above, the sample included in this research is recruited through the use of an opt-in panel that overrepresents higher-educated respondents, male respondents and people aged over 65. While all these factors were controlled for in the analysis, and the experimental design assumes an equal distribution of these characteristics per condition (see randomization checks, p.15), it is still possible that the composition of the sample has distorted the results. Second, the sample consists of 1,658 respondents. Because I included 18 different conditions in the research design and exposed each respondent to one experimental vignette only, the sample is quite fragmented and this seriously diminishes the statistical power of my analysis. Third, as I employed a survey-embedded experiment, the respondents are in an artificial, abstract situation (sitting behind their computer) when they answer the questions included in the survey. Hence, their answers might be different from the behaviour they would actually exhibit in the real world. Therefore, the ecological validity of the findings is limited. Fourth, with regard to indirect behaviour, one environmental policy instrument was chosen, i.e. environmental taxes. It is quite plausible that this influenced the results. It could be that other types of indirect pro-environmental behaviour are differently affected by the fear of free-riding. On that account, the findings with regard to indirect behaviour are in fact the findings for one specific type of indirect pro-environmental behaviour, thus again one needs to be cautious generalizing the results. Fifth, it is important to acknowledge that by using survey questions the reported, intentional behaviour is measured and not the actual behaviour. The assumption is that intended behaviour reflects actual pro-environmental behaviour change. However, this assumption might be inaccurate since respondents may have the tendency to respond in a socially desirable way (Bryman, 2012, p.228; Gifford, & Nilsson, 2014; McGrath & Bernauer, 2017). Especially since most questions included in the survey were about the environment, the reported pro-environmental behaviour is possibly affected by some sort of 'ecological correctness'. Last, my question with regard the direct pro-environmental behaviour asked to what extent individuals where inclined to reduce consuming beef, travelling by plane or driving their car. Yet, it might be that some people were already doing some of these things out of environmental considerations. For that reason, it would have been better to control for the pro-environmental behaviour the respondents already showed. In other words, different baselines could have been taken into account.

While my research helps to shed a little more light on people's considerations when they decide whether or not to show pro-environmental behaviour, more research is definitely needed. I think *how* information about climate change is communicated to the greater public could be an interesting avenue for future research. In this study respondents were exposed to dry, base rate information stating that according to a recent survey a certain percentage of Flemish people is willing to behave pro-environmentally. However, according to the exemplification theory, exposing respondents to more vivid and personalized examples of pro-environmental behaviour enhances the chance that respondents are impacted by the information they were exposed to. Therefore, researching the precise effect of exposure to these more personalized ways of climate change information could prove to be insightful.

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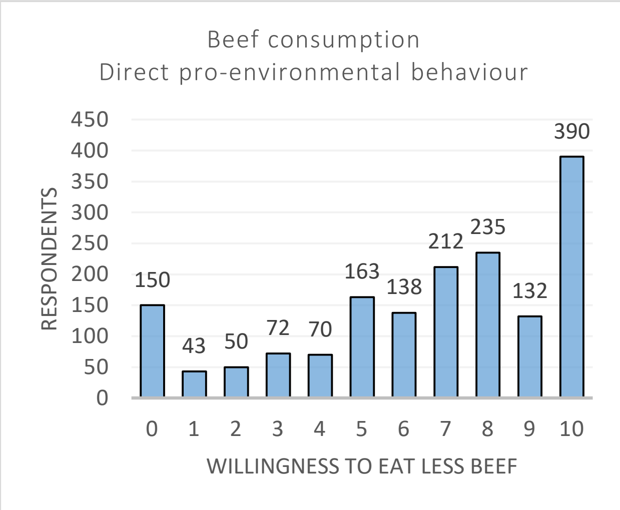
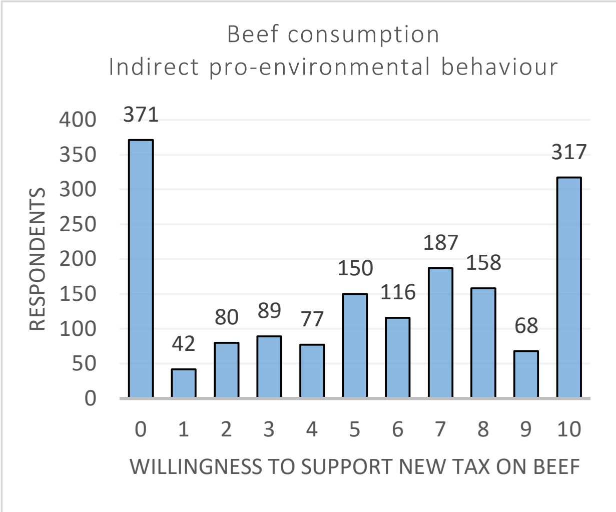
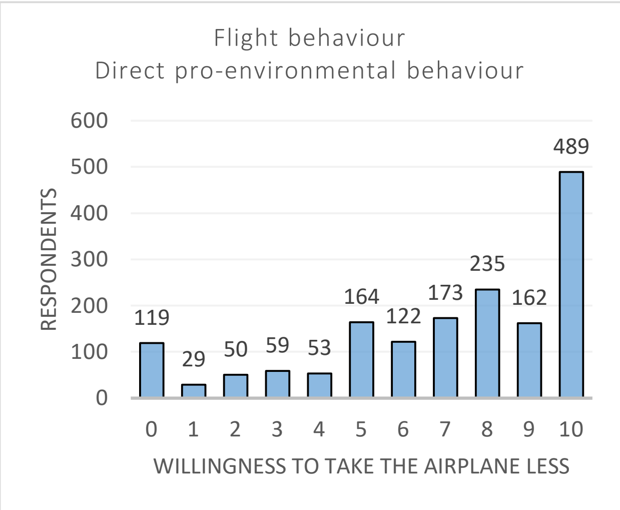
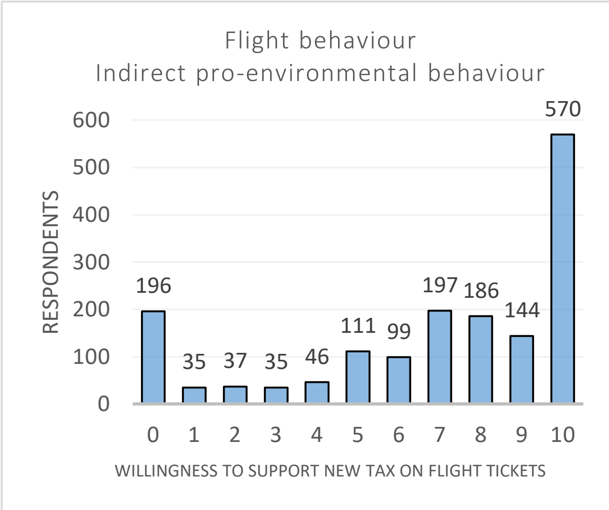
Appendix

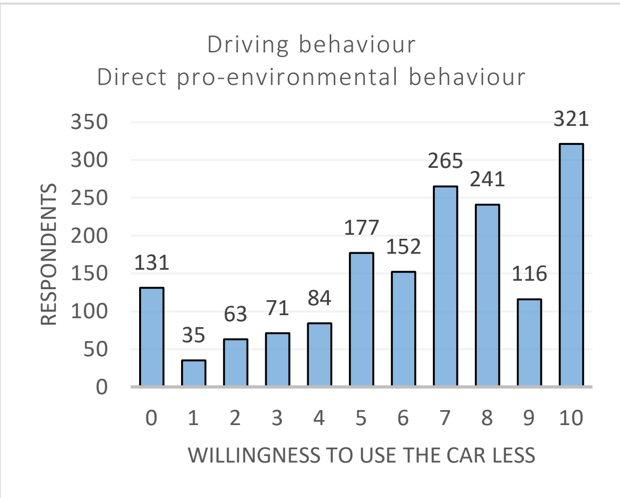
A1. Histograms-Dependent variable per activity











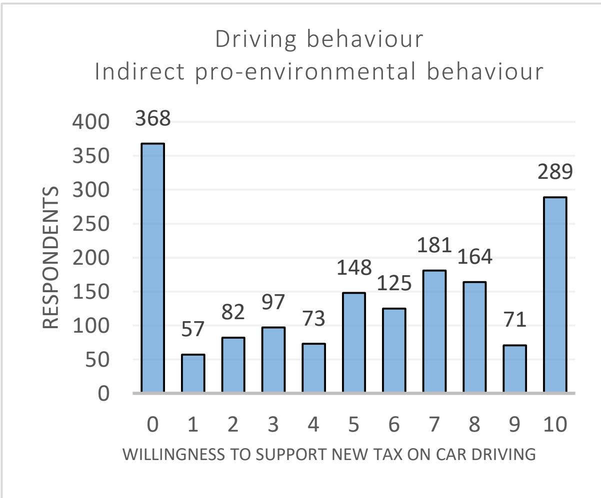


Table 1A. Results of the t-tests

Hypotheses tested	Mean (SD) per activity	T-value & P-value
H1a: no-free-rider condition compared to control condition	Beef consumption Control condition: 7.190 (2.433) No-free-rider condition: 6.955 (3.306)	t(182)=-0.550 p=.583
	Flight behaviour Control condition: 7.468 (2.722) No-free-rider condition: 6.883 (3.008)	t(184.117)=-1.398 p=.164
	Driving behaviour Control condition: 6.053 (2.999) No-free-rider condition: 7.143 (2.961)	t(182.920)=2.488 p=.014
H1b: control condition compared to free-rider condition	Beef consumption Control condition: 7.190 (2.433) Free-rider condition: 6.186 (3.214)	t(184)=2.405 p=.017
	Flight behaviour Control condition: 7.468 (2.723) Free-rider condition: 6.934 (2.843)	t(181.952)=1.304 p=.194
	Driving behaviour Control condition: 6.053 (2.996) Free-rider condition: 6.404 (3.204)	t(185.169)=-0.776 p=.439
H1c: no-free-rider condition compared to free-rider condition	Beef consumption Free-rider condition: 6.186 (3.214) No-free-rider condition: 6.955 (3.306)	t(177.548)=1.580 p=.116
	Flight behaviour Free-rider condition: 6.934 (2.843) No-free-rider condition: 6.883 (3.008)	t(182.896)=-0.119 p=.906
	Driving behaviour Free-rider condition: 6.404 (3.204) No-free-rider condition: 7.143 (2.961)	t(182.612)=1.627 p=.105
H2a: no-free-rider condition compared to control condition	Beef consumption Control condition: 5.326 (3.808) No-free-rider condition: 5.8590 (3.666)	t(184.994)=0.974 p=.331
	Flight behaviour Control condition: 6.674 (3.695) No-free-rider condition: 6.584 (3.599)	t(175.877)=-0.164 p=.870
	Driving behaviour Control condition: 5.138 (3.694) No-free-rider condition: 5.651 (3.651)	t(183.982)=0.934 p=.352
H2b: control condition compared to free-rider condition	Beef consumption Control condition: 5.326 (3.808) Free-rider condition: 5.686 (3.3720)	t(178.918)=-0.674 p=.501
	Flight behaviour Control condition: 6.674 (3.695) Free-rider condition: 7.219 (2.848)	t(183)=-1.127 p=.261
	Driving behaviour Control condition: 5.138 (3.694) Free-rider condition: 4.910 (3.611)	t(180.814)=0.442 p=.673
H2c: no-free-rider condition compared to free-rider condition	Beef consumption Free-rider condition: 5.686 (3.372) No-free-rider condition: 5.859 (3.666)	t(175.956)=0.326 p=.744
	Flight behaviour Free-rider condition: 7.219 (2.848) No-free-rider condition: 6.584 (3.599)	t(183)=-335 p=.184
	Driving behaviour Free-rider condition: 4.910 (3.611) No-free-rider condition: 5.651 (3.651)	t(178,912)=1.355 p=.177

Table A2. Complete table with all multivariate regression outputs

Comparison	Variables	Model 1 coeff (SE) p-value	Model 2 coeff (SE) p-value	Model 3 coeff (SE) p-value	Model 4 coeff (SE) p-value	Model 5 coeff (SE) p-value	Model 6 coeff (SE) p-value
Direct: no-free-rider condition compared to control condition	Beef Treatment	-0.234 (0.426) p= 0.583	-0.010 (0.416) p=0,981	0.023 (0.405) p=0.955	-0.026 (0.406) p= 0.950	-0.068 (0.396) p= 0.865	-0.134 (0.378) p= 0.724
	Age		-0,010 (0.014) p= 0.454	-0.006 (0.014) p=0.646	-0.005 (0.014) p= 0.740	-0.001 (0.013) p= 0.914	0.002 (0.013) p= 0.845
	Gender		1.059 (0.453) p= 0.020	0.884 (0.444) p= 0.048	1,005 (0.452) p= 0.028	0.823 (0.445) p= 0.066	0.952 (0.425) p= 0.026
	Education		0.943 (0.344) p= 0.007	0.971 (0.335) p=0.004	0.775 (0.366) p= 0.036	0.675 (0.358) p= 0.061	0.566 (0.342) p= 0.100
	Left-right placement			-0,268 (0.082) p= 0.001	-0.234 (0.086) p= 0.007	-0.173 (0.086) p= 0.0.46	-0.016 (0.090) p= 0.862
	Generalized trust				0.176 (0.132) p= 0.185	0.202 (0.129) p= 0.120	0.157 (0.124) p= 0.207
	Subjective cost					-0.223 (0.070) p= 0.002	-0.222 (0.067) p= 0.001
	Environmental attitudes						0.444 (0.103) p= 0.000
	Adjusted R^2	-0.004	0.066	0.114	0.118	0.160	0.237
	Constant	7.189	3.758	4.997	3.998	4.782	1.629
	N=184						
	Fly Treatment	-0.585(0.419) p=0.164	-0.562(0.417) p= 0.180	-0.404 (0.404) p= 0.319	-0.464 (0.401) p=0.249	-0.390 (0.369) p=0.291	-0.364 (0.351) p= 0.301
	Age		0.032 (0.016) p= 0.046	0.041 (0.016) p= 0.010	0.040 (0.015) p= 0.010	0.039 (0.014) p= 0.007	0.040 (0.013) p= 0.003
	Gender		0.740 (0.471) p= 0.118	0.505 (0.458) p= 0.272	0.334 (0.459) p= 0.467	0.357 (0.422) p=0.399	0.229 (0.403) p= 0.571
	Education		0.159 (0.368) p= 0.667	0.145 (0.355) p= 0.683	-0.005 (0.357) p= 0.989	-0.010 (0.329) p= 0.975	0.029 (0.313) p= 0.925
	Left-right placement			-0.325 (0.085) p= 0.000	-0.277 (0.087) p= 0.002	-0.215 (0.080) p= 0.008	-0.061 (0.084) p= 0.466
	Generalized trust				0.272 (0.120) p= 0.025	0.288 (0.111) p= 0.010	0.183 (0.108) p= 0.093
	Subjective cost					-0.331 (0.057) p= 0.000	-0.288 (0.055) p= 0.000
	Environmental attitudes						0.436 (0.099) p= 0.000
	Adjusted R^2	0.005	0.021	0.089	0.110	0.248	0.317
	Constant	7.468	4.212	5.472	4.269	4.991	2.129
	N=188						
	Drive treatment	1.090 (0.438) p= 0.014	0.979 (0.435) p=0.025	1.272 (0.398) p=0.002	1.298 (0.397) p=0.001	1.180 (0.379) p= 0.002	0.955 (0.338) p= 0.005
	Age		0.014 (0.016) p= 0.380	0.024 (0.014) p= 0.096	0.022 (0.014) p= 0.121	0.019 (0.014) p= 0.170	0.019 (0.012) p= 0.117
	Gender		1.315 (0.499) p= 0.009	1.004 (0.456) p= 0.029	1.005 (0.455) p= 0.028	0.811 (0.434) p= 0.063	0.980 (0.386) p=0.012
	Education		0.182 (0.373) p= 0.625	-0.135 (0.341) p= 0.692	-0.197 (0.343) p= 0.567	-0.134 (0.334) p= 0.688	-0.271 (0.298) p=0.364
	Left-right placement			-0.537 (0.084) p=0.000	-0.492 (0.090) p= 0.000	-0.381 (0.089) p= 0.000	-0.192 (0.083) p= 0.022
	Generalized trust				0.177 (0.128) 0.170	0.207 (0.122) p= 0.092	0.054 (0.111) p=0.627
	Subjective cost					-0.276 (0.059) p= 0.000	-0.276 (0.053) p=0.000
	Environmental attitudes						0.643 (0.094) p= 0.000
	Adjusted R^2	0.027	0.051	0.221	0.224	0.305	0.450
	Constant	6.053	3.127	1.272	5.089	5.992	2.593
	N=185						

Comparison	Variables	Model 1 coeff (SE) p-value	Model 2 coeff (SE) p-value	Model 3 coeff (SE) p-value	Model 4 coeff (SE) p-value	Model 5 coeff (SE) p-value	Model 6 coeff (SE) p-value
Direct: control condition compared to free-rider condition	Beef Treatment	1.003 (0.417) p= 0.017	0.782 (0.414) p=0.060	0.708 (0.407) p=0.083	0.708 (0.407) p=0.084	0.498 (0.391) p=0.204	0.363 (0.340) p=0.287
	Age		-0.009 (0.015) p= 0.524	-0.003 (0.015) p=0.819	-0.004 (0.015) p= 0.786	-0.005 (0.014) p=0.725	0.000 (0.012) p= 0.973
	Gender		1.422 (0.437) p= 0.001	1.206 (0.435) p= 0.006	1.183 (0.438) p=0.008	0.755 (0.429) p=0.080	0.635 (0.372) p=0.090
	Education		0.484 (0.356) p= 0.176	0.450 (0.349) p= 0.199	0.486 (0.356) p=0.174	0.494 (0.339) p= 0.147	0.377 (0.294) p= 0.202
	Left-right placement			-0.247 (0.086) p= 0.004	-0.260 (0.089) p=0.004	-0.225 (0.085) p= 0.003	-0.043 (0.078) p= 0.582
	Generalized trust				-0.063 (0.116) p= 0.587	-0.033 (0.111) p= 0.767	-0.110 (0.096) p=0.254
	Subjective cost					-0.296 (0.068) p= 0.000	-0.221 (0.060) p= 0.000
	Environmental attitudes						0.705 (0.091) p= 0.000
	Adjusted R^2	0.025	0.088	0.124	0.121	0.201	0.400
	Constant	7.189	4.445	5.705	6.128	7.713	2.980
	N= 186						
	Fly Treatment	0.534 (0.409) p= 0.194	0.415 (0.406) p= 0.308	0.236 (0.389) p= 0.545	0.242 (0.390) p= 0.537	0.190 (0.359) p= 0.598	0.168 (0.352) p= 0.633
	Age		0.035 (0.014) p= 0.016	0.045 (0.014) p= 0.001	0.045 (0.014) p= 0.001	0.046 (0.013) p= 0.000	0.048 (0.012) p=0.000
	Gender		1.149 (0.458) p= 0.013	0.995 (0.438) p= 0.024	0.983 (0.441) p= 0.027	1.042 (0.406) p= 0.011	0.828 (0.404) p= 0.042
	Education		-0.025 (0.356) p= 0.944	0.068 (0.340) p= 0.842	0.054 (0.345) p= 0.877	-0.085 (0.318) p= 0.789	-0.086 (0.311) p= 0.783
	Left-right placement			-0.360 (0.082) p=0.000	-0.350 (0.089) p= 0.000	-0.238 (0.085) p= 0.005	-0.118 (0.092) p= 0.201
	Generalized trust				0.032 (0.115) p= 0.782	0.098 (0.106) p= 0.357	0.039 (0.106) p= 0.714
	Subjective cost					-0.323 (0.056) p= 0.000	-0.312 (0.055) p= 0.000
	Environmental attitudes						0.333 (0.107) p= 0.003
	Adjusted R^2	0.004	0.044	0.131	0.127	0.260	0.292
	Constant	7.468	4.013	4.941	4.773	5.095	2.999
	N=185						
	Drive Treatment	-0.351 (0.452) p= 0.439	-0.313 (0.439) p= 0.476	-0.358 (0.395) p= 0.366	-0.418 (0.392) p= 0.288	-0.324 (0.374) p= 0.387	-0.341 (0.317) p=0.283
	Age		-0.013 (0.015) p= 0.392	-0.001 (0.014) p= 0.926	-0.001 (0.014) p= 0.960	-0.002 (0.013) p=0.907	0.004 (0.011) p= 0.741
	Gender		1.514 (0.521) p= 0.004	0.951 (0.477) p= 0.048	0.922 (0.472) p= 0.052	0.856 (0.449) p= 0.059	0.765 (0.381) p 0.046
	Education		0.730 (0.382) p= 0.064	0.511 (0.354) p=0.151	0.327 (0.360) p= 0.366	0.495 (0.352) p= 0.162	-0.165 (0.081) p= 0.043
	Left-right placement			-0.582 (0.088) p=0.000	-0.541 (0.089) p= 0.000	-0.420 (0.089) p=0.000	0.478 (0.299) p= 0.112
	Generalized trust				0.280 (0.127) p= 0.029	0.317 (0.122) p= 0.010	0.059 (0.108) p=0.582
	Subjective cost					-0.278 (0.061) p= 0.000	-0.230 (0.052) p=0.000
	Environmental attitudes						0.775 (0.092) p= 0.000
	Adjusted R^2	-0.002	0.065	0.241	0.257	0.331	0.520
	Constant	6.053	2.957	6.149	4.683	4.894	0.621
	N=188						

Comparison	Variables	Model 1 coeff (SE) p-value	Model 2 coeff (SE) p-value	Model 3 coeff (SE) p-value	Model 4 coeff (SE) p-value	Model 5 coeff (SE) p-value	Model 6 coeff (SE) p-value
Direct: no-free-rider condition compared to free-rider condition	Beef Treatment	0.768 (0.486) p= 0.116	0.712 (0.473) p=0.134	0.639 (0.451) p= 0.158	0.632 (0.454) p= 0.166	0.432 (0.437) p=0.324	0.209 (0.416) p= 0.615
	Age		-0.030 (0.19) p= 0.111	-0.015 (0.018) p= 0.425	-0.014 (0.018) p=0.447	-0.006 (0.017) p= 0.749	-0.002 (0.017) p=0.885
	Gender		1.003 (0.550) p= 0.070	0.979 (0.524) p= 0.064	0.988 (0.366) p= 0.063	0.675 (0.511) p= 0.189	0.504 (0.848) p= 0.299
	Education		0.961 (0.365) p= 0.009	0.868 (0.348) p= 0.014	0.846 (0.366) p= 0.022	0.816 (0.351) p= 0.021	0.786 (0.331) p= 0.019
	Left-right placement			-0.403 (0.093) p= 0.000	-0.399 (0.096) p=0.000	-0.338 (0.093) p= 0.000	-0.165 (0.095) p=0.086
	Generalized trust				0.028(0.139) p= 0.842	0.061 (0.133) p= 0.650	0.025 (0.126) p= 0.844
	Subjective cost					-0.302 (0.74) p= 0.000	-0.273 (0.070) p= 0.000
	Environmental attitudes						0.518 (0.111) p= 0.000
	Adjusted R^2	0.008	0.077	0.161	0.157	0.227	0.311
	Constant	6.187	4.194	5.701	5.526	6.421	2.936
	N= 180						
	Fly Treatment	-0.051 (0.431) p= 0.906	-0.107 (0.428) p=0.803	-0.121 (0.403) p= 0.763	-0.139 (0.403) p= 0.730	-0.081 (0.351) p= 0.817	-0.057 (0.324) p= 0.860
	Age		0.031 (0.016) p= 0.051	0.041 (0.015) p= 0.006	0.042 (0.015) p=0.005	0.028 (0.013) p= 0.032	0.025 (0.012) p= 0.039
	Gender		0.976 (0.506) p= 0.055	0.649 (0.480) p= 0.178	0.642 (0.480) p= 0.183	0.551 (0.419) p= 0.190	0.285 (0.389) p= 0.465
	Education		0.180 (0.409) p= 0.660	0.117 (0.385) p= 0.761	0.061 (0.388) p= 0.874	0.051 (0.338) p= 0.880	-0.036 (0.313) p= 0.907
	Left-right placement			-0.452 (0.091) p= 0.000	-0.413 (0.097) p= 0.000	-0.279 (0.087) p=0.002	-0.139(0.084) p= 0.101
	Generalized trust				0.128 (0.118) p= 0.278	0.080 (0.103) p= 0.436	-0.055 (0.098) p= 0.576
	Subjective cost					-0.428 (0.057) p=0.000	-0.396 (0.053) p= 0.000
	Environmental attitudes						0.514 (0.091) p= 0.000
	Adjusted R^2	-0.005	0.013	0.129	0.130	0.338	0.366
	Constant	6.934	3.490	5.676	4.837	6.844	6.246
	N= 185						
	Drive Treatment	0.739 (0.454) p= 0.105	0.684 (0.448) p=0.129	0.893 (0.421) p=0.035	0.886 (0.408) p= 0.031	0.876 (0.398) p= 0.029	0.617 (0.345) p=0.075
	Age		-0.003 (0.016) p=0.876	0.002 (0.015) p= 0.881	-0.003 (0.015) p= 0.850	-0.002 (0.015) p= 0.913	-0.004 (0.013) p=0.727
	Gender		1.258 (0.502) p=0.013	1.003 (0.472) p= 0.035	0.964 (0.458) p= 0.037	0.952 (0.447) p=0.035	0.824 (0.386) p= 0.034
	Education		0.836 (0.397) p=0.037	0.533 (0.375) p= 0.157	0.199 (0.375) p= 0.596	0.195 (0.353) p= 0.594	0.070 (0.316) p= 0.826
	Left-right placement			-0.464 (0.087) p=0.000	-0.381 (0.087) p=0.000	-0.341 (0.086) p= 0.000	-0.115 (0.080) p= 0.152
	Generalized trust				0.452 (0.127) p=0.000	0.483 (0.125) p= 0.000	0.251 (0.111) p=0.025
	Subjective cost					-0.199 (0.063) p=0.002	-0.192 (0.054) p= 0.001
	Environmental attitudes						0.716 (0.091) p= 0.000
	Adjusted R^2	0.009	0.055	0.177	0.228	0.265	0.453
	Constant	6.404	2.703	5.653	3.743	4.200	1.215
	N=185						

Comparison	Variables	Model 1 coeff (SE) p-value	Model 2 coeff (SE) p-value	Model 3 coeff (SE) p-value	Model 4 coeff (SE) p-value	Model 5 coeff (SE) p-value	Model 6 coeff (SE) p-value
Indirect:	Beef Treatment	0.532 (0.547) p=0.332	0.510 (0.503) p= 0.312	0.422 (0.473) p=0.373	0.416 (0.470) p= 0.377	0.341 (0.460) p= 0.460	0.266 (0.390) p= 0.496
no-free-rider	Age		-0.032 (0.018) p= 0.080	-0.017 (0.017) p= 0.330	-0.020 (0.017) p= 0.239	-0.017 (0.017) p= 0.314	-0.008 (0.014) p= 0.563
condition	Gender		2.323 (0.574) p= 0.000	1.679 (0.554) p=0.003	1.588 (0.554) p=0.005	1.357 (0.546) p= 0.014	1.502 (0.463) p= 0.001
compared to	Education		1.721 (0.462) p=0.000	1.331 (0.441) p= 0.003	1.212 (0.444) p= 0.007	1.147 (0.434) p= 0.009	0.635 (0.373) p= 0.090
control	Left-right placement			-0.533 (0.106) p=0.000	-0.488 (0.109) p= 0.000	-0.436 (0.108) p= 0.000	-0.138 (0.098) p= 0.158
condition	Generalized trust				0.249 (0.147) p=0.093	0.248 (0.144) p= 0.087	0.033 (0.124) p= 0.789
	Subjective cost					-0.225 (0.073) p= 0.002	-0.111 (0.063) p= 0.079
	Environmental attitudes						0.945 (0.112) p=0.000
	Adjusted R^2	0.000	0.154	0.254	0.261	0.295	0.494
	Constant	5.326	-0.362	3.206	2.040	3.053	-2.354
	N=188						
	Fly Treatment	-0.090 (0.547) p= 0.870	-0.205 (0.559) p= 0.714	-0.302 (0.514) p= 0.558	-0.311 (0.507) p= 0.540	-0.303 (0.500) p= 0.545	-0.073 (0.440) p= 0.868
	Age		0.012 (0.020) p= 0.560	0.022 (0.019) p= 0.244	0.018 (0.018) p= 0.333	0.017 (0.018) p= 0.364	0.028 (0.016) p= 0.084
	Gender		-0.252 (0.640) p= 0.695	-0.551 (0.591) p= 0.352	-0.672 (0.584) p=0.251	-0.926 (0.587) p= 0.116	-0.969 (0.515) p= 0.062
	Education		0.636 (0.501) p= 0.206	0.324 (0.464) p= 0.486	0.061 (0.469) p= 0.896	0.237 (0.469) p= 0.614	-0.234 (0.417) p= 0.575
	Left-right placement			-0.591 (0.104) p= 0.000	-0.521 (0.106) p= 0.000	-0.500 (0.105) p= 0.000	-0.186 (0.102) p= 0.069
	Generalized trust				0.389 (0.156) p= 0.013	0.342 (0.155) p= 0.029	0.235 (0.137) p= 0.088
	Subjective cost					-0.168 (0.072) p= 0.020	-0.156 (0.063) p= 0.015
	Environmental attitudes						0.861 (0.120) p= 0.000
	Adjusted R^2	-0.006	-0.010	0.146	0.171	0.192	0.378
	Constant	6.674	4.675	8.505	6.769	7.558	2.305
	N=178						
	Drive Treatment	0.503 (0.539) p= 0.352	0.345 (0.530) p= 0.515	0.367 (0.480) p= 0.446	0.321 (0.459) p= 0.486	0.342 (0.457) p= 0.455	0.499 (0.407) p= 0.221
	Age		-0.025 (0.020) p= 0.209	-0.007 (0.018) p= 0.707	-0.006 (0.017) p= 0.722	-0.007 (0.017) p= 0.705	-0.003 (0.015) p= 0.821
	Gender		1.244 (0.610) p= 0.043	1.074 (0.553) p= 0.054	1.101 (0.529) p= 0.039	1.100 (0.527) p= 0.038	0.827 (0.469) p= 0.080
	Education		0.766 (0.402) p= 0.059	0.517 (0.367) p= 0.161	0.416 (0.352) p= 0.239	0.443 (0.350) p= 0.208	0.513 (0.311) p= 0.101
	Left-right placement			-0.646 (0.102) p= 0.000	-0.503 (0.103) p= 0.000	-0.470 (0.105) p= 0.000	-0.179 (0.102) p= 0.080
	Generalized trust				0.614 (0.145) p= 0.000	0.651 (0.146) p= 0.000	0.302 (0.139) p= 0.031
	Subjective cost					-0.113 (0.068) p= 0.099	-0.029 (0.062) p= 0.644
	Environmental attitudes						0.816 (0.117) p= 0.000
	Adjusted R^2	-0.001	0.055	0.223	0.290	0.297	0.446
	Constant	5.138	3.039	6.204	1.790	1.768	-2.687
	N=188						

Comparison	Variables	Model 1 coeff (SE) p-value	Model 2 coeff (SE) p-value	Model 3 coeff (SE) p-value	Model 4 coeff (SE) p-value	Model 5 coeff (SE) p-value	Model 6 coeff (SE) p-value
Indirect: control condition compared to free-rider condition	Beef Treatment	-0.360 (0.537) p= 0.504	-0.230 (0.497) p= 0.644	-0.358 (0.467) p= 0.445	-0.390 (0.469) p=0.407	-0.355 (0.448) p= 0.429	-0.436 (0.396) p= 0.272
	Age		-0.036 (0.018) p=0.052	-0.012 (0.018) p= 0.512	-0.015 (0.018) p= 0.418	0.000 (0.018) p= 0.985	0.007 (0.016) p= 0.648
	Gender		1.686 (0.555) p=0.003	0.833 (0.548) p= 0.130	0.771 (0.554) p= 0.166	0.368 (0.537) p= 0.494	0.412 (0.474) p= 0.386
	Education		1.844 (0.468) 0.000	1.221 (0.456) p=0.008	1.166 (0.462) p= 0.013	1.120 (0.441) p= 0.012	1.024 (0.390) p= 0.009
	Left-right placement			-0.569 (0.114) p=0.000	-0.551 (0.116) p=0.000	-0.515 (0.111) p= 0.000	-0.217 (0.107) p= 0.044
	Generalized trust				0.123 (0.150) p= 0.415	0.126 (0.143) p= 0.380	0.086 (0.127) p= 0.500
	Subjective cost					-0.325 (0.076) p= 0.000	-0.225 (0.069) p= 0.001
	Environmental attitudes						0.795 (0.113) p= 0.000
	Adjusted R^2	-0.003	0.143	0.246	0.244	0.312	0.463
	Constant	5.326	0.355	4.450	3.985	4.964	-1.491
	N= 182						
	Fly Treatment	-0.545 (0.483) p= 0.261	-0.423 (0.484) p= 0.383	-0.229 (0.444) p= 0.607	-0.226 (0.446) p= 0.612	-0.066 (0.440) p= 0.882	-0.118 (0.408) p= 0.772
	Age		0.009 (0.016) p= 0.601	0.024 (0.015) p= 0.125	0.023 (0.015) p= 0.132	0.024 (0.015) p= 0.105	0.024 (0.014) p= 0.087
	Gender		-0.081 (0.528) p= 0.878	-0.346 (0.489) p= 0.481	-0.342 (0.490) p= 0.487	-0.441 (0.482) p= 0.361	-0.420 (0.446) p= 0.348
	Education		1.291 (0.450) p= 0.005	0.840 (0.419) p= 0.046	0.816 (0.427) p= 0.057	1.060 (0.426) p= 0.014	0.634 (0.402) p= 0.117
	Left-right placement			-0.540 (0.090) p= 0.000	-0.531 (0.095) p= 0.000	-0.488 (0.094) p= 0.000	-0.199 (0.102) p= 0.052
	Generalized trust				0.045 (0.143) p= 0.755	0.068 (0.141) p= 0.629	0.099 (0.130) p= 0.447
	Subjective cost					-0.196 (0.067) p= 0.004	-0.196 (0.062) p= 0.002
	Environmental attitudes						0.658 (0.120) p= 0.000
	Adjusted R^2	0.001	0.030	0.187	0.183	0.216	0.327
	Constant	6.674	2.674	6.498	6.248	0.066	0.118
	N=185						
	Drive Treatment	0.228 (0.540) p= 0.673	0.082 (0.526) p= 0.876	0.494 (0.470) p= 0.295	0.415 (0.464) p= 0.372	0.424 (0.461) p= 0.360	0.067 (0.423) p= 0.875
	Age		-0.016 (0.018) p= 0.385	0.001 (0.016) p= 0.929	-0.004 (0.016) p= 0.826	-0.002 (0.016) p= 0.913	-0.003 (0.015) p= 0.818
	Gender		1.458 (0.643) p= 0.025	0.718 (0.581) p= 0.218	0.666 (0.572) p= 0.246	0.659 (0.567) p= 0.247	0.801 (0.516) p= 0.123
	Education		0.950 (0.392) p= 0.016	0.721 (0.349) p= 0.040	0.658 (0.345) p= 0.058	0.548 (0.227) p= 0.017	0.320 (0.210) p= 0.129
	Left-right placement			-0.694 (0.099) p= 0.000	-0.627 (0.101) p= 0.000	-0.607 (0.104) p= 0.000	-0.298 (0.107) p= 0.006
	Generalized trust				0.364 (0.143) p= 0.012	0.369 (0.147) p= 0.013	0.147 (0.138) p= 0.289
	Subjective cost					-0.065 (0.070) p= 0.357	-0.005 (0.065) p= 0.937
	Environmental attitudes						0.753 (0.123) p= 0.000
	Adjusted R^2	-0.005	0.057	0.257	0.279	0.289	0.412
	Constant	5.138	1.775	5.877	3.755	3.320	-0.713
	N=185						

Comparison	Variables	Model 1 coeff (SE) p-value	Model 2 coeff (SE) p-value	Model 3 coeff (SE) p-value	Model 4 coeff (SE) p-value	Model 5 coeff (SE) p-value	Model 6 coeff (SE) p-value
Indirect: no-free-rider condition compared to free-rider condition	Beef Treatment	0.173 (0.529) p=0.745	0.281 (0.497) p= 0.573	0.126 (0.478) p= 0.792	0.032 (0.475) p= 0.947	-0.047 (0.646) p= 0.919	-0.161 (0.437) p= 0.714
	Age		-0.004 (0.020) p= 0.846	0.0008 (0.019) p= 0.996	-0.004 (0.019) p= 0.852	0.002 (0.019) p= 0.896	0.006 (0.017) p= 0.750
	Gender		1.534 (0.550) p=0.006	1.224 (0.532) p= 0.023	1.017 (0.536) p= 0.60	0.639 (0.536) p= 0.235	0.629 (0.504) p= 0.214
	Education		1.828 (0.451) p= 0.000	1.581 (0.436) p= 0.000	1.425 (0.438) p= 0.001	1.377 (0.427) p= 0.002	1.165 (0.404) p= 0.004
	Left-right placement			-0.448 (0.111) p= 0.000	-0.405 (0.112) p= 0.000	-0.439 (0.109) p= 0.000	-0.234 (0.111) p= 0.037
	Generalized trust				0.322 (0.152) p= 0.035	0.297 (0.148) p= 0.047	0.167 (0.142) p= 0.241
	Subjective cost					-0.244 (0.078) p= 0.002	-0.146 (0.076) p= 0.057
	Environmental attitudes						0.677 (0.141) p= 0.000
	Adjusted R^2	-0.005	0.114	0.187	0.203	0.242	0.330
	Constant	5.859	-1.036	2.034	0.741	2.385	-1.706
	N= 178						
	Fly Treatment	-0.634 (0.475) p= 0.184	-0.642 (0.479) p= 0.182	-0.557 (0.440) p= 0.207	-0.550 (0.440) p= 0.214	-0.387 (0.436) p= 0.376	-0.268 (0.399) p= 0.502
	Age		0.013 (0.016) p= 0.440	0.033 (0.015) p= 0.032	0.032 (0.015) p= 0.041	0.036 (0.015) p= 0.021	0.041 (0.014) p= 0.004
	Gender		-0.119 (0.592) p= 0.841	-0.300 (0.544) p= 0.582	-0.292 (0.545) p= 0.593	-0.411 (0.537) p= 0.445	-0.369 (0.490) p= 0.452
	Education		-0.192 (0.490) p= 0.696	-0.675 (0.457) p= 0.141	-0.726 (0.465) p= 0.121	-0.672 (0.457) p= 0.143	-0.927 (0.419) p= 0.028
	Left-right placement			-0.567 (0.096) p= 0.000	-0.552 (0.099) p= 0.000	-0.537 (0.098) p=0.000	-0.232 (0.102) p= 0.024
	Generalized trust				0.086 (0.140) p= 0.541	0.057 (0.138) p= 0.678	0.023 (0.126) p= 0.853
	Subjective cost					-0.179 (0.064) p= 0.006	-0.129 (0.059) p= 0.030
	Environmental attitudes						0.679 (0.112) p= 0.000
	Adjusted R^2	0.004	-0.007	0.152	0.149	0.181	0.317
	Constant	7.219	7.138	10.358	9.933	10.376	5.300
	N= 185						
	Drive Treatment	0.731 (0.540) p= 0.177	0.468 (0.535) p= 0.383	0.947 (0.473) p= 0.047	0.795 (0.447) p= 0.077	0.835 (0.448) p= 0.064	0.493 (0.420) p= 0.243
	Age		-0.016 (0.019) p= 0.410	0.001 (0.017) p= 0.964	-0.008 (0.016) p= 0.619	-0.010 (0.016) p= 0.546	-0.008 (0.015) p= 0.576
	Gender		0.645 (0.612) p= 0.294	0.346 (0.538) p= 0.521	0.364 (0.507) p= 0.474	0.313 (0.509) p= 0.539	0.598 (0.475) p= 0.210
	Education		1.119 (0.400) p= 0.006	0.866 (0.352) p= 0.015	0.569 (0.337) p= 0.093	0.557 (0.337) p= 0.101	0.526 (0.312) p= 0.094
	Left-right placement			-0.748 (0.102) p= 0.000	-0.615 (0.100) p= 0.000	-0.583 (0.104) p= 0.000	-0.235 (0.116) p= 0.045
	Generalized trust				0.623 (0.129) p= 0.000	0.635 (0.130) p= 0.000	0.402 (0.127) p= 0.002
	Subjective cost					-0.073 (0.072) p= 0.307	0.005 (0.068) p= 0.938
	Environmental attitudes						0.748 (0.138) p= 0.000
	Adjusted R^2	0.005	0.056	0.275	0.357	0.357	0.448
	Constant	4.910	2.255	5.768	2.536	2.819	-2.217
	N=181						