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Discussion Paper

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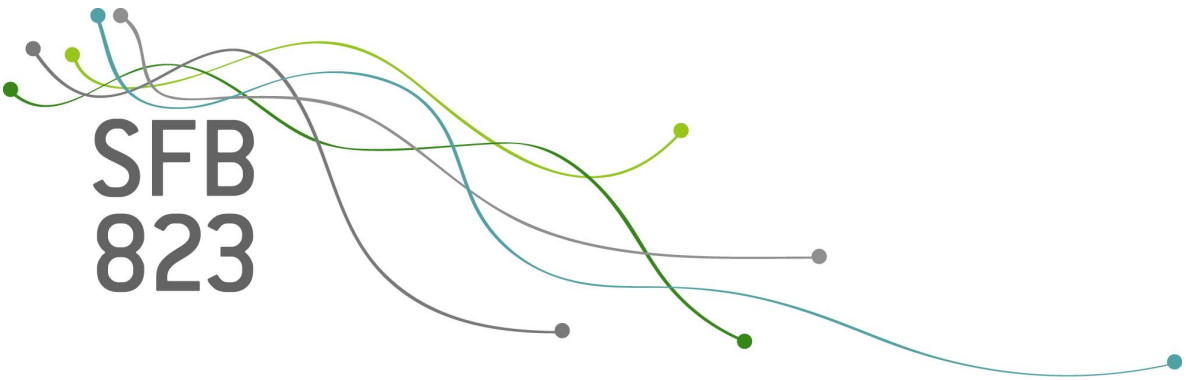

Pro-environmental Behavior as a Means of Self-Signaling: Theory and Evidence

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Abstract

Recent research indicates that pro-environmental behavior may be driven by concerns about one's moral identity. Using identification with the environmentalist movement *Fridays for Future*, this paper develops and empirically tests a straightforward model of self-signaling. We assume that pro-environmental behavior, here taking the train rather than the plane for a journey, serves as a means of self-signaling. On the basis of a large-scale survey experiment with revealed preferences, we find evidence that respondents who receive an identity

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prime in the form of a reminder of their previously stated attitude towards *Fridays for Future* are more likely to behave in line with the movement's moral principles in that they take the train. Our explanation of this outcome is that individuals attempt to avoid cognitive dissonance by choosing the more environmentally benign alternative. Our results suggest that pro-environmental behavior may be enhanced by appealing to an individual's self-image so that costly interventions that are designed to convince subjects of new moral principles may be unnecessary.

JEL classifications: D81, D91.

Keywords: Pro-social behavior, moral identity, cognitive dissonance, self-signaling.

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1 Introduction

Standard economic theory assumes that individual behavior is driven by preferences over outcomes and the resulting material utility. Recent research, however, has highlighted the role of identity in decision-making, as well as its utility implications, called affective utility. In a pioneering article, Akerlof and Kranton (2000) were the first to introduce the notion of identity as an additional ingredient of economic theory. These authors include the affective utility associated with identity-confirming actions, such as pro-environmental or, more generally, pro-social behavior, into the utility function (Akerlof and Kranton, 2000).[1]

In a related article, Bénabou and Tirole (2011) develop a model in which former actions, such as taking the train or the plane for a journey, serve as a means of self-signaling, that is, as a signal about one's moral identity to oneself. Core features of their model are that (i) individuals are not fully aware of their true moral identity, which they infer from their past actions, and (ii) that they derive affective utility from having a positive self-image. Therefore, a key assumption of the model of Bénabou and Tirole (2011) is that when deciding upon an action, in addition to material utility, an individual also takes into account the affective utility that results from the implications that an action has for the self-image.

[1]The notion of identity is defined as "a person's self-image as well as her assigned categories" (Akerlof and Kranton, 2000). Self-image is a psychological concept denominating an individual's "[...] view or concept of oneself. [It] is a crucial aspect of an individual's personality that can determine [...] a sense of general well-being" (American Psychological Association, 2021).

Adding to this strand of research, this paper follows Bénabou and Tirole (2011) and develops a straightforward model of self-signaling that we test experimentally using the identification with the environmentalist movement *Fridays for Future*. Acting pro-environmentally, which is captured in the experiment by taking the train rather than the plane for a journey, is hypothesized to be a means of self-signaling. In a large-scale survey, in which an experiment with revealed preferences was embedded, nearly 6,000 German household heads had to decide on whether they would prefer to win a voucher for a train ride or for a flight, which was won by one out of 50 participants.

Half of the sample was randomly assigned to a treatment group, whose subjects were reminded of their previously stated attitude towards *Fridays for Future* immediately before making their trip decision. These subjects were then asked to actively confirm or revoke this attitude. Following the experimental literature that has used priming to disentangle the impact of identity on behavior from preferences over outcomes, this reminder served as an identity prime that temporarily increases the salience of pro-environmental identity – for an overview on priming in economics, see Cohn and Maréchal (2016).

Our empirical findings indicate that subjects of the treatment group, who were reminded of their previously stated attitude towards *Fridays for Future*, are more likely to choose the train than those of the control group, who did not receive such a reminder. A possible explanation of this outcome is that subjects of the treatment group attempt to avoid cogni-

tive dissonance by choosing the more environmentally benign alternative. Cognitive dissonance typically arises from inconsistencies between an individual's behavior and her self-image (Aronson, 1969). If, for example, an individual considers herself to be an honest person, she will experience cognitive dissonance while lying.

We further find that individuals who are less secure about their support of *Fridays for Future* are more likely to opt for the environmentally benign transport mode. Our results suggest that pro-environmental behavior may be enhanced by appealing to an individual's self-image so that costly interventions that are designed to convince subjects of new moral principles, such as large-scale information campaigns , are not necessarily required.

The remainder of this paper is structured as follows: The next section provides a literature review, while Section 3 introduces our theoretical model. The experimental design and hypotheses are explained in Section 4. Section 5 provides a detailed description of our data, while Section 6 presents the empirical results. A suite of robustness checks is reported in Section 7. The last section summarizes and concludes.

2 Literature Review

Related to the work of Bodner and Prelec (2003) and Bénabou and Tirole (2004, 2006, 2011), in which individuals infer their identity from past be-

havior, our analysis is embedded in the rich behavioral economics literature on identity, self-signaling, and cognitive dissonance, with the latter two concepts originating from social psychology.[2] The economic implications of cognitive dissonance were first analyzed in the seminal paper of Akerlof and Dickens (1982), who introduced the notion that individuals have preferences over their beliefs about the state of the world, but can modify these beliefs to a certain extent.

By inducing cognitive dissonance as a centerpiece of our analysis, we build on numerous other experimental studies that attempt to provoke cognitive dissonance among participants. For example, in a large-scale field experiment among the customers of the UK's leading renewable energy supplier, Gosnell (2018) causes cognitive dissonance by appealing to the customers' identity as a conscious consumer. Her results indicate that, in general, dissonance-inducing messaging increases the willingness to switch from paper to online billing. This result is in line with our finding that the likelihood of choosing the more environmentally benign alternative in form of the train is increased by the induction of cognitive dissonance.

Other empirical studies have provided support for pro-social behavior as a means of self-signaling. For instance, analyzing choices in modified dictator games, Dana et al. (2007), Grossman (2014), Grossman and Van Der Weele (2017), and Matthey and Regner (2011) show that subjects who make selfish choices tend to avoid information on whether their decision

[2]See Bem (1972) on self-perception theory, which is the basis of self-signaling, and Festinger (1962) on cognitive dissonance.

harms the other player – a result that is perfectly in line with self-signaling theory: Information ignorance facilitates the maintenance of a positive self-image while choosing the allocation that yields larger material utility.

In a similar study by Tonin and Vlassopoulos (2013), participants make three consecutive decisions to allocate an endowment between themselves and either the experimenter or a charity. One of these decisions is randomly chosen to be implemented. At the end of the experiment, subjects are given the opportunity to opt out of the donation and keep the entire endowment to themselves. Although this allocation had been feasible from the very beginning, a substantial fraction of subjects choose to opt out. This result implies that allocations comprising positive donations were not purely motivated by preferences over outcomes but served to self-signal altruism, at least partially.

Gneezy et al. (2012) and Dubé et al. (2017) find evidence for self-signaling in field settings where a consumption good is bundled with a donation to a charity. By contrast, the experimental results by Grossman (2015) support a model of social signaling, but provide little evidence for self-signaling. Our study adds to this literature by investigating self-signaling in a setting in which subjects have to choose between two travel modes, where taking the plane is socially more harmful, but yields larger material utility than an environmentally benign train ride.

3 Theoretical Model

To theoretically analyze how self-signaling influences the decision between a pro-social and a selfish action, we now develop a straightforward two-period model, thereby following the theory of moral behavior of Bénabou and Tirole (2011). It is based on a general model of identity in which people care about "who they are" and infer their identity from past actions. Our model is grounded in the theory of cognitive dissonance, because individuals have an incentive to choose an action that is in line with their desired self-view, just to avoid discrepancies between their actions and their self-image. Otherwise, such a discrepancy would lead to cognitive dissonance. Another central element of our model is that individuals are uncertain about their moral identity, i. e. the strength of their moral concerns, and take their prior actions as signals to make inferences about their true identity.

3.1 Model Setup

In our two-period model (see Figure 1), at $t = 0$, individuals choose between a selfish and a pro-social action $a \in \{S, P\}$, where S designates the selfish and P the pro-social action for which it is common knowledge that it is socially preferable. Individuals derive material utility $U(a)$ from action a and affective utility $V(\hat{v})$ from their self-image $\hat{v}$ on their true identity v. The affective utility $V(\hat{v})$ results from the individuals' intention to "be true to myself" in their decisions, to "maintain my integrity", to "not

betray my values", to "be able to look at myself in the mirror", etc. (Bénabou and Tirole, 2011).

It is assumed that $U(S) > U(P)$ and, hence, rational individuals would choose $a = S$ if moral concerns and considerations about the self-image play no role at all, that is, if $V = 0$. In contrast, given that action P is socially preferable, a purely altruistic individual would always choose P.

At t = 0, individuals are uncertain about their true moral identity v, that is, whether they are selfish or altruistic. For the sake of simplicity, it is assumed that there are only two types of individuals that differ with respect to the strength of their moral concerns, indicated by $v \in \{v_L, v_H\}$ with $v_H > v_L > 0$. While not knowing their true type v, at t = 0, individuals hold an a-priori belief about their identity v, that is, they either believe to be of the high-moral type v_H or of the low-moral type v_L. Due to the uncertainty about their moral identity v, individuals take their prior actions as signals to make inferences about their true identity v. There is extensive empirical evidence that both people judge themselves by their actions and many decisions are shaped by a concern to achieve or maintain a desirable self-view (Bénabou and Tirole, 2011).

Self-inference Assumption: At $t = 1$, individuals are aware of their true identity v only with probability λ. In contrast, with probability $1 - \lambda$, individuals are unaware of their true identity v, but instead infer their true type from past behavior and actions. $1 - \lambda$ may therefore be thought of as the degree of *malleability of the self-image through actions* (Bénabou and Tirole, 2011), reflecting the possibility that the motivation for deeds may,

for instance, be forgotten or repressed.

Hence, according to the Self-inference Assumption, at $t = 1$, an individual's self-image $\hat{v}$ equals the true type v with probability λ, but with probability $1 - \lambda$ the true type v has to be inferred from past actions:

$$\hat{v} = \begin{cases} v & \text{with probability } \lambda, \\ \hat{v}(a) & \text{with probability } 1 - \lambda, \end{cases} \tag{1}$$

where $\hat{v}(a)$ denotes the self-image derived from past action a. To rule out the polar case that the self-image $\hat{v}$ equals the true type v with probability 100%, we assume that $0 \leq \lambda < 1$.

If an individual has chosen the pro-social option P, she will consider herself to be of the high-moral type v_H and if she has acted selfishly by choosing action S, she will think of herself as the low-moral type v_L:

$$\hat{v}(P) = v_H > v_L = \hat{v}(S). \tag{2}$$

In short, the chosen action a serves as a means of self-signaling, that is, as a signal of one's true identity v in that it leads to the self-image $\hat{v}(a)$.

When deciding on which action to take, in addition to material utility U, individuals are supossed to take into account the affective utility V:

$$V(\hat{v}) \equiv s\hat{v}, \text{with } s > 0, \frac{\partial V}{\partial \hat{v}} > 0, \tag{3}$$

where the affective utility V depends on the self-image $\hat{v}$ that an individual

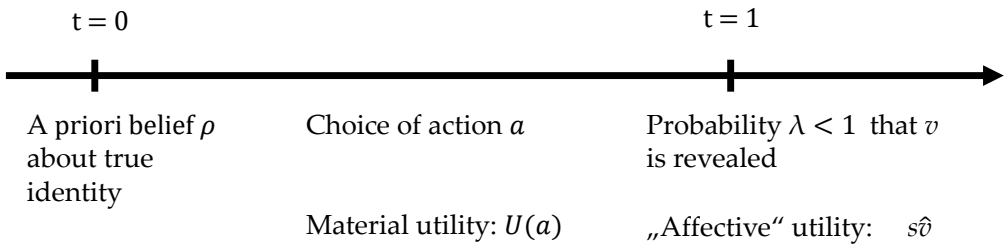

Figure 1: *Timing of our two-period model*

has at $t = 1$ and s measures the importance of the self-image $\hat{v}$ for affective utility. s depends on the individual's awareness of identity considerations and is assumed to be situation-dependent, that is, it can be varied exogenously, for instance, by increasing the salience of social categories through priming, as it is done in our experiment with the reminder on the attitude towards the *Fridays for Future* movement. Note that if self-image were to be completely irrelevant and, hence, $s = 0$, affective utility V would vanish. To rule out this extreme case, we assume $s > 0$.

Denoting total intertemporal utility by W, W is given by

$$W(a) \equiv E[U(a) + V(\hat{v})], \tag{4}$$

where the expectation is taken with respect to the distribution $(\lambda, 1 - \lambda)$ of self-image $\hat{v} \in \{v, \hat{v}(a)\}$ and hence

$$W(a) = U(a) + \lambda V(v) + (1 - \lambda)V(\hat{v}(a)). \tag{5}$$

3.2 Behavior

At $t = 0$, a rational individual solves the intertemporal utility maximization problem

$$max_a W(a) \tag{6}$$

by comparing $W(S)$ and $W(P)$. The difference in intertemporal utility W between choosing action P and S yields the incentive I to behave pro-socially:

$$\begin{aligned} I &\equiv W(P) - W(S) \\ &= U(P) + \lambda V(v) + (1-\lambda)V(\hat{v}(P)) - [U(S) + \lambda V(v) + (1-\lambda)V(\hat{v}(S))] \\ &= U(P) - U(S) + (1-\lambda)s[v_H - v_L]. \end{aligned} \tag{7}$$

It becomes evident from this expression that individuals are more likely to behave pro-socially the larger the material utility $U(P)$ from the pro-social action P is. Furthermore, from expression (7), the following two propositions can be derived.

Proposition 1: An individual is more likely to behave pro-socially

(a) the more important her self-image is for her affective utility V, that is, the larger s is, and

(b) the more malleable her self-image is, that is, the larger $1 - \lambda$.

Proof: From expression (7) follows that (a) $\frac{\partial I}{\partial s} = (1-\lambda)[v_H - v_L] > 0$ and (b) $\frac{\partial I}{\partial (1-\lambda)} = s[v_H - v_L] > 0$, as $v_H > v_L, s > 0$, and $\lambda < 1$.

Proposition 2: An increase in an individual's importance s of her self-image implies a particularly strong incentive to behave pro-socially for those individuals with a highly malleable self-image, that is, when $1-\lambda$ is large.

Proof: $\frac{\partial^2 I}{\partial s \partial(1-\lambda)} = v_H - v_L > 0$, as as $v_H > v_L$.

Both propositions point to the role of former actions as a signal for individuals to infer their moral identity: First, the more important self-image is for affective utility, that is, the larger s, the more important it is to signal a high-moral identity v_H by behaving pro-socially (Proposition 1 (a)). Second, the greater the malleability of one's self-image, that is, the larger $1-\lambda$, the more important it is to send a positive signal by behaving pro-socially (Proposition 1 (b)). Third, according to Proposition 2, a high malleability of one's self-image is reinforced by an increase in its importance, leading to particularly strong incentives to behave pro-socially.

4 Experimental Design and Hypotheses

Drawing on an incentivized survey experiment conducted in Germany in late 2019, we apply the theoretical model presented in the previous section to the context of pro-environmental behavior and individuals' identification with the environmentalist movement *Fridays for Future*. In a discrete choice task, respondents had to decide on whether they would prefer to win a voucher worth 40 euros either for a flight or for a railway trip, the

latter of which is more environmentally benign and, hence, socially preferred.[3] One out of 50 survey participants was randomly selected to win such a voucher.

For many trips, the plane is frequently the faster and more convenient option than the train and, hence, taking the plane corresponds to activity S of our theoretical model, which is associated with the larger material utility. Recently, though, because of its high emissions of greenhouse gases, flying has been discredited by an anti-flying movement that is spearheaded by *Fridays for Future*. The anti-flying agenda is particularly pushed by Greta Thunberg, the central figure of *Fridays for Future*, who received enormous attention from the media for avoiding a flight to the UN climate summit in New York in 2019. Instead, for environmental reasons, even for the very long trip from Europe to the USA, she took the boat. At other instances, she preferred taking the train (CNN, 2019; Spiegel, 2019). Accordingly, traveling by train is the option that is conceived in our experiment to correspond to the socially preferable activity P of our theoretical model.

At the beginning of the survey, we elicited the respondents' general attitude towards the *Fridays for Future* protests by asking the following question: "Currently, in many cities students are protesting for more climate protection every Friday both during and outside school hours. What is your attitude towards these so-called *Fridays for Future* protests?". Respondents answered on a 5-point Likert scale, indicating the degree of

[3]The voucher was valid either for the German Railways (*Deutsche Bahn*) or the website of Flightgift, where flights from a large variety of airlines can be booked.

support for the protests – for the response options, see Question A13 in the appendix.

Later in the survey, half of the sample was randomly assigned to the treatment group, for which the salience of the self-image was increased through an identity prime: Immediately before deciding upon the type of voucher, either for a train or plane trip, subjects of the treatment group were reminded of their previously stated general attitude towards *Fridays for Future* and were asked to confirm or revoke this attitude. Conditional on their previously stated attitude, subjects of the treatment group were asked: "Would you agree that, overall, you don't support/have a neutral attitude towards/support the *Fridays for Future* movement?".

While the control group did not receive any such questions, nor any other additional information, the treatment was designed to arouse cognitive dissonance, that is, to raise the respondents' awareness about the inner conflict between the morally appropriate behavior, i.e. taking the train, and the more convenient choice of taking the plane. Given this experimental design, from Proposition 1 (a), we now derive the following hypothesis:

Hypothesis 1: Subjects of the treatment group, for which the treatment of reminding respondents about their attitude towards *Fridays for Future* protests should increase the importance s of the self-image, are more likely to choose the train than subjects of the control group.

Our theoretical model further predicts that respondents who are less

sure about their true identity, in formal terms, for which $1 - \lambda$ is larger than for others, are more likely to behave pro-socially – see Proposition 1(b). Following from Proposition 2, these respondents will also react more strongly to the treatment, which increases the importance s of the self-image.

To construct a measure of insecurity about the own moral identity, we exploit the answers to a series of questions with respect to the respondents' opinion on various aspects of the *Fridays for Future* movement, such as skipping classes for protests, climate policy as a question of intergenerational justice, and the importance of protests relative to students' own environmental behavior. Respondents who are very sure about their support for *Fridays for Future* should consistently express positive attitudes towards the movement in all these aspects.

Hence, to measure respondents' insecurity about these aspects, we took the standard deviation of a respondent's answer to Question A13, which elicited the overall attitude towards *Fridays for Future*, as well as to Question A14, and then standardized this insecurity measure – for details, see Question A13 and A14 and the description of the construction of this measure in appendix A.2, as well as Table 3 in the subsequent section. Due to this standardization, we are able to interpret the corresponding regression coefficient in terms of standard deviations of insecurity.

Based on this insecurity measure, we are now able to formulate two additional hypotheses that correspond to Proposition 1 (b) and Proposition 2, respectively:

Hypothesis 2: Corresponding to a larger malleability, $1 - \lambda$ in our theoretical model, respondents who are more insecure about their true moral identity, and whose answers to questions about various aspects of *Fridays for Future* display more variance, are more likely to choose the train.

Hypothesis 3: In line with Proposition 2, the treatment effect of the reminder with respect to the attitude towards *Fridays for Future*, which raises the importance s of the self-image, should be stronger for respondents who are more insecure about their true moral identity and, hence, whose answers to the questions about various aspects of *Fridays for Future* display more variance.

5 Data

Our analysis relies on data collected by the survey institute *forsa*. *forsa* maintains a panel of about 80,000 members, being representative of the German-speaking population – for more information on *forsa's* household panel, see http://www.forsa.com. The survey was addressed to household heads, defined as those individuals who are responsible for the household's financial decisions. Data collection is based on a state-of-the-art tool that allows panelists to fill out the questionnaire using either a television or the internet. The survey could be interrupted and resumed at any time. Respondents in our survey tend to be older, wealthier, and more educated than the average of the German population (see Table A1 in the appendix). This implies that the results of our study are only valid for this particular

sample and cannot be extrapolated to the entire German population.

The survey period spanned from October 16 to November 6, 2019. 6,549 household heads were recruited to fill in the questionnaire. Out of these, 553 dropped out prior to the experiment or refused to participate in it and 48 did not provide their attitude towards the *Fridays for Future* protests, such that the sample size for the experiment amounts to 5,948 respondents. Dropout rates hardly differ between treatment and control group, implying that selection bias is not an issue.

The summary statistics, reported in Tables 2 and 3, indicate that randomization was successful. Socio-economic characteristics, distance to the nearest airport, pro-environmentalist attitude, and attitudes towards *Fridays for Future* are very similar for the treatment and control group. Only minor differences emerge for the gender composition and the frequency of traveling by plane.

Figure 2 illustrates the relationship between the respondents' insecurity about their attitude towards *Fridays for Future* and their past travel behavior by presenting the density of the insecurity measure for both respondents who indicated to never take the plane and those who fly at least sometimes. The figure shows that the group with subjects who never fly is less sure about their attitude towards *Fridays for Future* than the opposite group.

Furthermore, a t test reveals that the mean values of insecurity between the two groups are statistically different at the 1% significance level. This

Table 2: Means of Socio-demographic Characteristics across Treatment and Control Groups, as well as the Whole Sample

	Whole sample	Treatment group	Control group	t statistics
Female	0.418	0.407	0.428	1.587
Age	56.3	56.3	56.3	0.119
At least technical college	0.327	0.330	0.325	-0.407
Employed	0.516	0.507	0.525	1.337
Children < 14 years in household	0.151	0.154	0.148	-0.588
Distance to nearest airport in km	34.2	34.1	34.3	0.331
Flyers	0.696	0.685	0.706	1.736
Environmentalist attitude	3.647	3.653	3.641	-0.497
Inclination towards Green party	0.192	0.187	0.198	1.038
Area of residence:				
Urban area	0.359	0.365	0.353	-0.927
Peri-urban area	0.432	0.427	0.436	0.690
Rural area	0.209	0.208	0.210	0.253
Type of nearest airport:				
Large airport	0.710	0.705	0.715	0.861
Medium airport	0.290	0.295	0.285	-0.861
Household size:				
1 person	0.269	0.274	0.264	-0.851
2 persons	0.473	0.465	0.481	1.236
3 persons	0.136	0.137	0.135	-0.188
4 persons	0.090	0.090	0.091	0.242
$\geq$ 5 persons	0.031	0.035	0.028	-1.404
Net household income:				
Income $<$ 1,200 Euro	0.076	0.079	0.073	-0.881
Income 1,200 - 2,700 Euro	0.361	0.371	0.350	-1.512
Income 2,700 - 4,200 Euro	0.337	0.331	0.343	0.898
Income $\geq$ 4,200	0.226	0.219	0.234	1.280

Note: t statistics for testing the equality of means across treatment and control groups are reported in the last column.

Table 3: Means of various Attitudes towards the Fridays for Future Movement across Treatment and Control Group

	Whole Sample	Treatment group	Control group	t statistics
Insecurity about attitude towards *Fridays for Future*	0.004	0.008	-0.000	-0.322
Attitude towards Fridays for Future:				
Negative attitude	0.309	0.306	0.311	0.381
Neutral attitude	0.233	0.238	0.229	-0.820
Positive attitude	0.458	0.456	0.460	0.342
Pupils should protest only in free time:				
disagree	0.274	0.269	0.279	0.892
neutral	0.083	0.082	0.084	0.227
agree	0.643	0.649	0.637	-0.961
OK to skip classes:				
disagree	0.490	0.484	0.497	0.962
neutral	0.097	0.097	0.098	0.095
agree	0.412	0.419	0.406	-1.034
Question of intergenerational justice:				
disagree	0.144	0.140	0.147	0.791
neutral	0.111	0.112	0.110	-0.212
agree	0.745	0.748	0.743	-0.484
Pupils should rather change their own behavior:				
disagree	0.286	0.288	0.285	-0.296
neutral	0.146	0.146	0.147	0.073
agree	0.567	0.566	0.569	0.218

Note: t statistics for testing the equality of means across treatment and control groups are reported in last column.

finding is in line with Proposition 1 (b): Subjects who are less secure about their true identity are more likely to exhibit identity-confirming behavior, that is, they are more likely to choose the more environmentally friendly means of transport.

Not least, our data reveals that supporting the *Fridays for Future* movement is strongly correlated with other indicators of subjects' environmen-

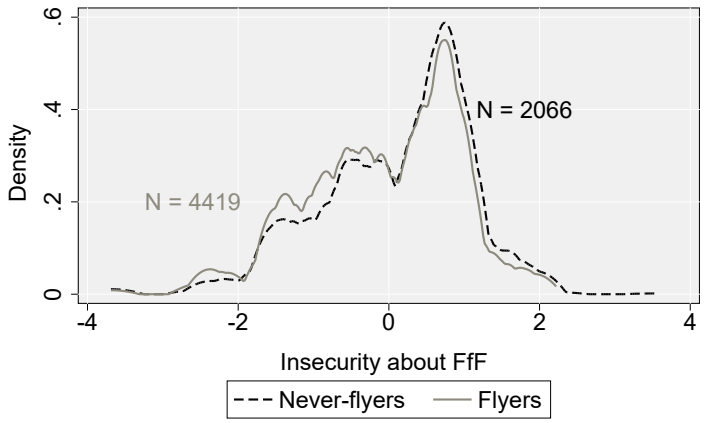

Figure 2: *Insecurity about the attitude towards Fridays for Future by flying behavior*

tal attitudes. For instance, Figure A1 presented in the appendix illustrates that respondents who have a positive attitude towards *Fridays for Future* are more likely to score higher on a scale measuring general pro-environmentalist attitude than other respondents. It is likewise not surprising that *Fridays for Future* supporters are more inclined towards the Green party (Figure A2) than non-supporters.

6 Empirical Results

Claiming that subjects of the treatment group are more likely to choose the train than subjects of the control group, Hypothesis 1 can be easily tested on the basis of a t test on the difference between the shares of train users across treatment and control group, as the assignment to these experimen-

tal groups was random.

6.1 Shares of Respondents who Choose to Travel by Train

Relative to the control group, the figures reported in Table 4 indicate that the share of respondents who opt for the train is significantly higher in the treatment group, whose subjects were asked to confirm or revoke their previously stated attitude towards *Fridays for Future* immediately before making their traveling decision. Overall, with a share of 79.1% of train users in the treatment group (see last row of Table 4), the difference to the control group amounts to 3.9 percentage points and is statistically significant at the 1% significance level, thereby confirming Hypothesis 1.

Table 4: *Shares of Respondents who Choose to Travel by Train*

Attitude towards	Treatment group		Control group		Difference between
Fridays for Future	# Obs.	Share	# Obs.	Share	treatment and control group
Negative attitude	918	0.743	918	0.664	0.078**
Neutral attitude	712	0.754	675	0.751	0.003
Positive attitude	1,366	0.843	1,359	0.813	0.030*
Total	2,996	0.791	2,952	0.753	0.039**

Note: * and ** denote statistical significance at the 5% and the 1% level, respectively.

Focusing on those participants who indicated a positive attitude towards *Fridays for Future*, in line with our expectation, we find that the share of train users in the treatment group is 3.0 percentage points higher than for the control group, whereas for those with a neutral attitude towards

Fridays for Future, the respective difference is virtually vanishing. In contrast, as can be seen from the last column of Table 4, the treatment effect doubles for those participants who had stated a negative attitude towards the *Fridays for Future* movement.

At first glance, the strong treatment effect for participants with a negative a-priori attitude towards *Fridays for Future* may appear puzzling. Nonetheless, this result seems plausible, as it is in line with the theories of moral balancing (Nisan and Horenczyk, 1990) and conscience accounting (Gneezy et al., 2014). According to these theories, individuals balance moral and immoral actions against each other, trying to maintain a satisfactory moral self-image (Ploner and Regner, 2013).[4] In other words, individuals are more likely to behave morally right after having violated a social norm and vice versa.

As the public debate in Germany was dominated in the survey year 2019 by climate politics, and *Fridays for Future* received a lot of media coverage, expressing a negative attitude towards the movement may be interpreted as a violation of a social norm. When subjects of the treatment group are reminded of their violation of the social norm by previously stating a negative attitude towards *Fridays for Future*, respondents may feel guilty and may try to compensate the feeling of guilt by choosing the morally superior alternative for traveling, that is, the train.

[4]The theory of moral balancing has been confirmed in numerous empirical studies – see e. g. Nisan and Horenczyk (1990), Monin and Miller (2001), Ploner and Regner (2013), Gneezy et al. (2014), as well as Blanken et al. (2015) for a meta-analysis.

6.2 Linear Probability Model Estimation Results

To analyze the relationship between the insecurity about one's attitude towards *Fridays for Future* and the likelihood of opting for the train, we estimate a linear probability model (LPM), the results of which are reported in Table 5. For starters, it bears noting that the results of the first specification, which merely includes the attitude and treatment dummies, as well as the corresponding interaction terms, exactly mimic the shares of those participants who choose the train – see Table 4. For instance, adding the estimates on the coefficients of the treatment dummy and its interaction term with positive attitude, 0.003 and 0.027, respectively, yields precisely the difference of 0.03 between the treatment and the control group for those who indicated a positive attitude towards Fridays for Future (Table 4). While such results reconfirm the validity of Hypothesis 1, it is also of note that the coefficient estimates for the treatment dummy and its interaction terms with attitude towards *Fridays for Future* are jointly significant in all specifications.

With respect to Hypothesis 2, which presumes that respondents who are less secure about their attitudes towards the movement are more likely to opt for the train, we find that our insecurity measure is uncorrelated with travel mode choice. Yet, when interacted with an indicator of having stated an overall positive attitude, the interaction term turns out to be positive and statistically significant. This outcome is not surprising, as only individuals who view themselves as supporters of the *Fridays for Future* movement tend to confirm this identity by choosing an action that is in

Table 5: *Results of a Linear Probability Model (LPM) on the Likelihood to Choose the Train*

	(1)		(2)		(3)	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Positive attitude	0.062**	(0.020)	0.070**	(0.024)	0.092**	(0.028)
Negative attitude	-0.087**	(0.023)	-0.056*	(0.028)	-0.053	(0.031)
Treatment	0.003	(0.023)	0.017	(0.026)	0.045	(0.029)
Insecurity	-	-	-0.016	(0.015)	-0.014	(0.017)
Treatment * Positive attitude	0.027	(0.027)	0.008	(0.031)	-0.030	(0.035)
Treatment * Negative attitude	0.075*	(0.031)	0.055	(0.036)	0.042	(0.040)
Insecurity * Positive attitude	-	-	0.038*	(0.016)	0.037*	(0.018)
Insecurity * Negative attitude	-	-	-0.030	(0.019)	-0.025	(0.021)
Insecurity * Treatment	-	-	0.019	(0.013)	0.012	(0.015)
Constant	0.751**	(0.017)	0.739**	(0.021)	0.679**	(0.049)
Gender	No		No		Yes	
Age	No		No		Yes	
College degree	No		No		Yes	
Employed	No		No		Yes	
Income	No		No		Yes	
Household size	No		No		Yes	
Children	No		No		Yes	
Urban/rural	No		No		Yes	
Distance to airport	No		No		Yes	
Airport type	No		No		Yes	
Observations	5,948		5,936		4,728	
Adjusted R^2	0.019		0.022		0.059	

Note: * and ** denote significance at the 5%, and 1% level, respectively. The reference category is neutral attitude towards Friday for Future.

line with its demands. In detail, for respondents who have expressed a positive attitude towards *Fridays for Future*, a one-standard-deviation increase in the insecurity about this attitude is associated with a 3.7 to 3.8

percentage points higher probability of choosing the train than respondents with a neutral attitude (Table 5), thereby supporting Hypothesis 2.

With respect to Hypothesis 3, claiming that respondents who are more insecure about their attitude towards *Fridays for Future* react more strongly to the treatment, we find an interaction term of the treatment dummy and our insecurity measure that is positive, yet not different from zero in statistical terms. Thus, Hypothesis 3 is not supported.

Taken together, our results provide support for the interpretation of pro-environmental behavior as a means of self-signaling: First, the more an individual cares about her self-image, here because its salience was increased through the identity prime, the more likely she is to act in line with the values corresponding to her desired self-image, thus reducing cognitive dissonance. Second, the more uncertain an individual is about her support for the values in question, the more likely she is to reassure herself of this identity by choosing a pro-environmental action.

7 Robustness Checks

The fact that students skip classes to attend *Fridays for Future* protests is highly controversial and might play an important role for both the respondents' attitude towards the movement and for the security with respect to their attitude. In a robustness check, we therefore use items (a) and (b) of Question A14 to exclude respondents from the analysis who gener-

ally support the *Fridays for Future* movement, but are opposed to skipping classes.

With respect to Hypothesis 1, claiming that subjects of the treatment group are more likely to choose the train than subjects of the control group, the results are robust to this reduction in the sample size, which decreases by about 1000 observations. The treatment effect of the identity prime increases to 4.6 percentage points in total (last column of Table 6), rather than 3.9 points as reported in Table 4, and to 4.8 percentage points for respondents with a positive attitude towards *Fridays for Future* .

Table 6: *Shares of Respondents who Choose to Travel by Train when excluding Respondents who Support Fridays for Future, but Oppose Skipping Classes for Protests*

Attitude towards	Treatment group		Control group		Difference between
Fridays for Future	# Obs.	Share	# Obs.	Share	treatment and control group
Negative attitude	918	0.743	918	0.664	0.078**
Neutral attitude	712	0.754	675	0.751	0.003
Positive attitude	846	0.863	871	1	0.048**
Total	2,476	0.787	2,464	0.741	0.046**

Note: * and ** denote significance at the 5% and 1% level, respectively.

For this subset of respondents, we have also re-estimated the linear-probability model the results of which are presented in Table 7. These results are quite similar to those presented in Table 5. A notable exception is that the interaction term between insecurity and the indicator of having stated an overall positive attitude towards the movement decreases in magnitude and becomes statistically insignificant (Table 7). This suggests that the positive correlation between our insecurity measure and the pref-

erence for the train is mainly driven by respondents who support *Fridays for Future*, but do not like the aspect of skipping classes for protests.

Table 7: *Results of a LPM on the Likelihood to Choose the Train when excluding Respondents who Support Fridays for Future, but Oppose Skipping Classes for Protests*

	(1)		(2)		(3)	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Positive attitude	0.064**	(0.021)	0.073**	(0.026)	0.109**	(0.030)
Negative attitude	-0.087**	(0.023)	-0.059*	(0.028)	-0.052	(0.032)
Treatment	0.003	(0.023)	0.014	(0.027)	0.043	(0.030)
Insecurity	-	-	-0.014	(0.016)	-0.013	(0.018)
Treatment * Positive attitude	0.045	(0.029)	0.029	(0.035)	-0.017	(0.039)
Treatment * Negative attitude	0.075*	(0.031)	0.060	(0.037)	0.047	(0.041)
Insecurity * Positive attitude	-	-	0.020	(0.018)	0.017	(0.020)
Insecurity * Negative attitude	-	-	-0.030	(0.019)	-0.024	(0.021)
Insecurity * Treatment	-	-	0.015	(0.015)	0.008	(0.017)
Constant	0.751**	(0.017)	0.741**	(0.022)	0.630**	(0.054)
Gender	No		No		Yes	
Age	No		No		Yes	
College degree	No		No		Yes	
Employed	No		No		Yes	
Income	No		No		Yes	
Household size	No		No		Yes	
Children	No		No		Yes	
Urban/rural	No		No		Yes	
Distance to airport	No		No		Yes	
Airport type	No		No		Yes	
Observations	4940		4928		3922	
Adjusted R^2	0.022		0.023		0.063	

Note: * and ** denote significance at the 5% and 1% level, respectively. The reference category is a neutral attitude towards *Fridays for Future*. The treatment dummy and its interaction with attitude towards *Fridays for Future* are jointly significant in all specifications.

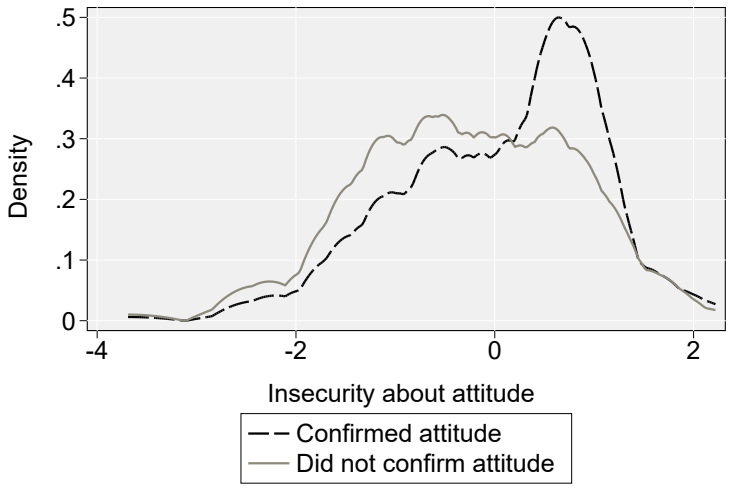

Figure 3: *Insecurity about the attitude towards Fridays for Future by answer to the treatment question with which subjects either confirmed their attitude towards Fridays for Future or not.*

Finally, we take a closer look at the relationship between whether subjects of the treatment group confirm their previously stated attitude towards *Fridays for Future* and their insecurity about their attitude. Figure 3 illustrates that respondents who are less sure about their attitude towards the *Fridays for Future* movement are more likely to confirm their attitude when answering the treatment question, being consistent with our Hypothesis 2: Respondents who are less sure about their attitude are more likely to confirm it – either verbally or through identity-confirming behavior.

8 Summary and Conclusion

Ever since the notion of identity has been introduced into economic theory in a seminal paper by Akerlof and Kranton (2000), numerous experimental studies have demonstrated its impact on behavior (Cohn and Maréchal, 2016). Assuming that individuals are not necessarily aware of their own moral identity, but may infer it from their past behavior, the literature on the economics of identity has been complemented by models of self-signaling (Bénabou and Tirole, 2004, 2006, 2011; Bodner and Prelec, 2003).

In this article, we have developed a straightforward theoretical model of self-signaling from which we have derived three hypotheses that have been empirically tested on the basis of an incentivized experiment. It was embedded in a large-scale survey, in which nearly 6,000 German household heads had to decide on whether they would prefer to win a voucher for a train ride or for a flight. Acting pro-environmentally, in the experiment by taking the train rather than the plane for a journey, is hypothesized to be a means of self-signaling.

Exploiting the information about the identification with the environmentalist movement *Fridays for Future*, half of the sample was randomly assigned to a treatment group, whose subjects were reminded of their previously stated attitude towards *Fridays for Future* immediately before making their trip decision and were asked to actively confirm or revoke this attitude. Following the experimental literature that has used priming to disentangle the impact of identity on behavior from preferences over

outcomes, this reminder served as an identity prime that temporarily increases the salience of pro-environmental identity.

We find that, first, respondents who care more about their self-image because they received a reminder of their previously stated attitude towards the *Fridays for Future* movement are significantly more likely to choose the environmentally benign transport mode, here the train rather than the plane, than respondents who do not receive a reminder. Second, respondents who are less secure about their true moral identity, evidenced by a larger variance in their answers to questions about various aspects of *Fridays for Future*, are more likely to reassure themselves of their pro-environmental identity by choosing the train.

Taken together, our results provide support for the interpretation of pro-environmental behavior as a means of self-signaling: First, the more an individual cares about her self-image, here because its salience was increased through an identity prime, the more likely she is to act in line with the values corresponding to her desired self-image, thus reducing cognitive dissonance. Second, the more uncertain an individual is about her support for the values in question, the more likely she is to reassure herself of this identity by choosing a pro-environmental action. In the end, our empirical results suggest that to increase pro-environmental or, more generally, pro-social behavior, it may be sufficient to appeal to an individual's self-image so that costly interventions, such as information campaigns, which are designed to convince individuals of new moral principles, may be unnecessary.

A Appendix

A.1 Relevant Survey Questions (Translated from German)

A. General

Question A12: How often do you travel by plane?

- More than 5 times per year
- 3 to 5 times per year
- Once or twice per year
- Less than once per year
- Never
- Don't know/No answer

Question A13: Currently, students in many cities are protesting for more climate protection every Friday during and outside school hours. What is your attitude towards these so-called "Fridays for Future" protests?

- (1) I don't like them at all
- (2) I don't like them
- (3) neither in favor nor I don't like them
- (4) I'm in favor
- (5) I'm totally in favor
- Don't know/No answer

Question A14: Please indicate the extent to which you agree with the following statements about the "Fridays for Future" protests.

Items (randomized):

a. Students have the right to protest for climate protection. However, this should not be done during school hours, but during their free time.

b. Students have the right to protest for climate protection during school hours as well. Otherwise, they would not get the necessary attention from politicians and the public.

c. The protests have an important political function. In this way, the students show that the children's future also depends on the climate policy decisions of today's adults and is thus a question of intergenerational justice.

d. The importance of the protests is overrated. Behavioral changes of the students for climate protection would be more important and effective.

Scale:

- fully agree
- rather agree
- neither agree nor disagree
- rather disagree
- totally disagree
- don't know / no answer

KOMP. Experiment

Question KOMP1: Do you plan to take a private trip within the next year using either the train or the plane? (Note: Please do not consider a trip where you would take a car (either as a driver or passenger) or a bus).

- Yes
- No
- Don't know/ No answer

If respondent is in the treatment group FfF:
Question KOMP2: *Filtering into different groups depending on answer to Question A13.*
For participants who answered Question A13 with 1 or 2.

Would you agree that, overall, you do not support the "Fridays for Future" movement?

- Yes
- No
- Don't know/ No answer

For participants who answered Question A13 with 3.
Would you agree that, overall, you have a neutral attitude towards the "Fridays for Future" movement?

- Yes
- No
- Don't know/ No answer

For participants who answered Question A13 with 4 or 5.
Would you agree that, overall, you support the "Fridays for Future" movement?

- Yes
- No
- Don't know/ No answer

If KOMP1 = Yes
In the following, you can win a travel voucher worth 40 euros for your upcoming trip. The winners will be selected randomly. One out of 50 respondents will receive a voucher. You can choose whether you would prefer to receive a flight voucher or a rail voucher for your trip, should you be one of the winners. Flight vouchers can be redeemed via the Flightgift website with more than 300 different airlines, while rail vouchers can be redeemed with *Deutsche Bahn AG*.

If KOMP1 = No
Imagine that you are planning to take a private trip using either the train or the

plane. In the following, you can win a travel voucher worth 40 euros for your upcoming trip. The winners will be selected randomly. One out of 50 respondents will receive a voucher. You can choose whether you would prefer to receive a flight voucher or a rail voucher for your trip, should you be one of the winners. Flight vouchers can be redeemed via the Flightgift website with more than 300 different airlines, while rail vouchers can be redeemed with *Deutsche Bahn AG*.

For everyone:
Question KOMP3: If you are among the winners, which voucher do you choose?

- Flight voucher worth 40 euros
- Train voucher worth 40 euros

PV: Psychological Control Variables

The order of questions in this section was randomized
Now we would like to ask you some more questions about the environment in general.

Question PV3:
To what extent do you personally agree with the following statements?
Items (randomized):

a. I am worried when I think about the environmental conditions our children and grandchildren will probably have to live in.

b. There are natural limits to growth that our industrialized world has long since reached or exceeded.

c. Environmental protection should be a priority for Germany, even if it interferes with economic growth.

d. In order to preserve our natural livelihoods, we must all be willing to limit our standard of living.

SOE. Socioeconomic Characteristics

Finally, please answer a few questions about yourself. Your data will be treated absolutely confidentially in accordance with the data protection regulations.

Question SO2: What is your highest vocational training or (technical) college degree?

- No degree
- Apprenticeship or vocational internship of at least 12 months
- Vocational preparation year
- Apprenticeship, vocational training in the dual system
- Preparatory service for the intermediate civil service in public administration
- Vocational qualification from a vocational school/college, completion of a 1-year school in the healthcare sector
- 2- or 3-year school of health care
- Technical college degree (master craftsman, technician or equivalent degree)
- Vocational academy, technical academy
- Degree from a university of applied sciences
- University of applied sciences degree, also engineering degree
- Degree from a university, scientific college, art college
- Doctorate
- No answer

Question SOE3: Which of the following applies to you? Please select only one answer option.

- I am employed or working (incl. trainees, persons on parental leave or partial retirement)
- I am a pupil
- I am a student
- I am a pensioner or retiree

- I live from income from capital assets, renting or leasing
- I receive maintenance/allowances from my spouse, partner, parents, relatives or other persons - including persons from outside the household.
- I am a housewife/ husband or take care of children and/or persons in need of care.
- I receive unemployment benefit I
- I receive unemployment benefit II or social benefits (Hartz IV benefits)
- I receive social welfare or basic income support in old age or in case of reduced earning capacity
- None of the above options applies to me
- No answer

Question SOE6: What is the total monthly net income of your household? This is the sum of wages, salaries, income from self-employment, or pensions after deduction of taxes and social security contributions. Please also include income from public assistance, income from renting, leasing, housing allowance, child benefit and other income.

- less than 700 Euro
- 700 to less than 1,200 Euro
- 1,200 to less than 1,700 Euro
- 1,700 to less than 2,200 Euro
- 2,200 to less than 2,700 Euro
- 2,700 to less than 3,200 Euro
- 3,200 to less than 3,700 Euro
- 3,700 to less than 4,200 Euro
- 4,200 to less than 4,700 Euro
- 4,700 to less than 5,200 Euro
- 5,200 to less than 5,700 Euro
- 5,700 Euro and more
- No answer

Question SOE8: In Germany, many people tend to vote for a particular political party for a long time, although they also vote for different parties from time to time. How about you: Are you - in general - inclined toward a particular party? And if so, which one?

- CDU / CSU
- SPD
- AfD
- FDP
- The Left Party
- Bündnis 90 / The Greens
- Another party
- No party
- Don't know / no answer

A.2 Insecurity Measure

Question A13 elicited respondents' general attitude towards *Fridays for Future* and Question A14 asked for their agreement with four different statements about the movement. We coded the answers to all these items on a 5-point Likert scale, such that higher values on the scale imply stronger approval of the movement. The measure on the insecurity of a respondent's attitude towards *Fridays for Future* was then calculated as follows: First, we took the standard deviation of an individual's answers to all items of Questions A13 and A14 to obtain a variable measuring the heterogeneity of the respondent's attitude towards different aspects of the movement. Second, we standardized the obtained variable by subtracting its mean value across all respondents and dividing by its standard deviation. Thus, we obtain a standardized insecurity measure, enabling us to interpret the corresponding regression coefficients in terms of standard deviations of

insecurity.

A.3 Figures

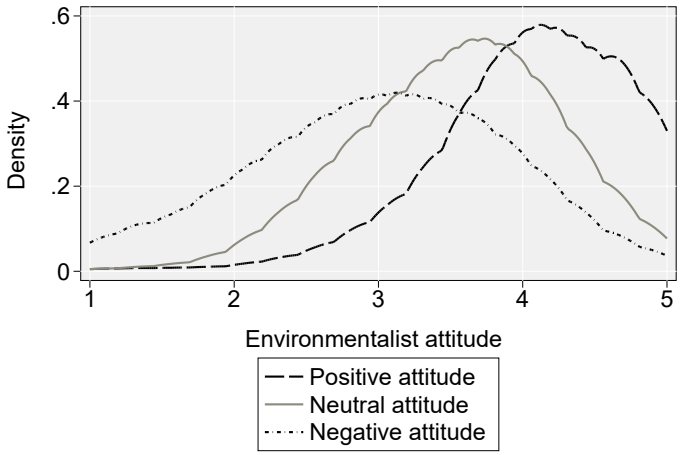

Figure A1: *General Pro-environmentalist Attitude by Attitude towards Fridays for Future*

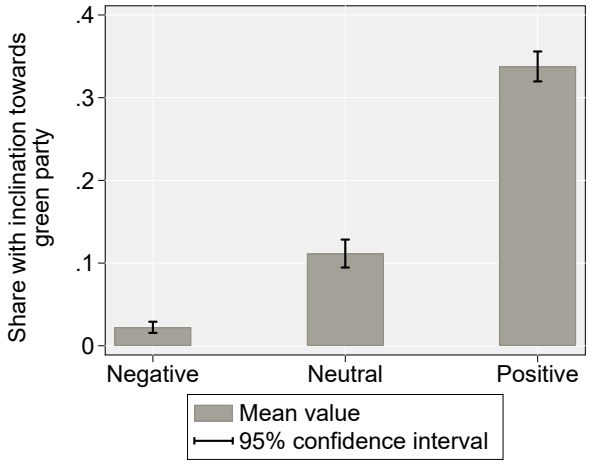

Figure A2: *Inclination towards Green Party by Attitude towards Fridays for Future*

A.4 Tables

Table A1: Comparison of the Sample with the German Population

	Sample	Germany (2019)
Female	0.418	0.505
At least technical college	0.327	0.281
Employed	0.516	0.519
Age:		
$<$ 25 years	0.021	0.240
25 - 35 years	0.093	0.127
35 - 45 years	0.130	0.126
45 - 55 years	0.182	0.149
55 - 65 years	0.226	0.150
$\geq$ 65 years	0.348	0.209
Household size:		
1 person	0.269	0.423
2 persons	0.473	0.332
3 persons	0.136	0.119
4 persons	0.090	0.091
$\geq$ 5 persons	0.031	0.035
Net household income:		
Income $<$ 1700 euros	0.182	0.305
Income 1700 - 3200 euros	0.375	0.361
Income $\geq$ 3200 euros	0.443	0.334

Data for the German population is drawn from (Destatis, 2020).

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