Greening the Common Agricultural Policy – Insights from a field experiment in Lower Saxony, Germany*

Fabian Thomas[1] **Estelle Midler**[2] **Marianne Lefebvre**[3] **Stefanie Engel**[1]

[1] Address: Alexander von Humboldt-Professorship of Environmental Economics, Institute of Environmental Systems Research (IUSF), University of Osnabruck, Germany.

[2] Address: French Ministry of Agriculture, Policy Evaluation and Economic Analysis (BEAE), France.

[3] Address: University of Angers, Economics and Management Research Angers (GRANEM), France.

✉ Corresponding author: fabian.thomas@uni-osnabrueck.de

Abstract

This study investigates the behavioral economic underpinnings of the current policy approaches to integrate environmental objectives into the Common Agricultural Policy. We conduct an economic field experiment with farmers in the German state of Lower Saxony. We analyze the impact of the following policy design features on farmers' decisions to adopt environmentally-friendly agricultural practices: (i) framing of the policy: whether farmers perceive themselves as being part of the problem or the solution, (ii) degree of control: mandatory vs. voluntary policy (iii) framing of incentives as either losses or gains compared to the status-quo. All policy designs tested result in a significant increase in hectares conserved compared to a baseline scenario without policy. Also behavioral factors do significantly affect farmers' behavior at the individual level. Only framing is found to significantly affect policy effectiveness.

Keywords: Common Agricultural Policy, Agri-Environment Measures, Greening, Field Experiment

JEL Classifications: C93; D91; H20; Q00; Q18; Q58

* We thank Jetske Bouma, Ann-Kathrin Koessler, Bettina Matzdorf, Jens Rommel and Sophie Thoyer for their helpful comments on this project. For comments on the instructions we would like to thank researchers from the Joint Research Center and DG Agriculture from the European Commission. Without our practitioner partner, the Agricultural Chamber of Lower Saxony, this project would not have been possible. Financial support for this research was provided by the Alexander von Humboldt-Foundation.

1 Introduction

The agricultural sector is a major contributor to a wide range of environmental challenges including loss of ecosystem services (Foley et al. 2005). In the European Union (EU), overcoming these challenges became over time one of the main objectives of the Common Agricultural Policy (CAP) (EC 2013). Despite many CAP reforms, scholars and practitioners still point to the fact that many environmental indicators still show negative trends in the European Union (Henle et al. 2008) and doubt whether the current architecture of the CAP can effectively alter these trends (Pe'er et al. 2014; Matthews 2013). Many arguments in this debate come from standard economics (e.g. Czekaj et al. 2013; Vanni and Cardillo 2013), ecological (e.g. Pe'er et al. 2014) or institutional perspectives (e.g. Singh et al. 2014), whereas behavioral economic arguments remain underrepresented (Colen et al. 2015). However, it could be that behavioral factors are crucially linked to success or failure of the different policy instruments of the CAP toolbox and could thus help explain why success in terms of environmental achievements is still limited. For example, it has been shown that how a policy is framed can significantly alter the perception and reaction of the target group of this policy (Blasch 2015; Levin et al. 1998; Tversky and Kahneman 1981). Moreover, whether we perceive a policy as controlling or as supporting can make a difference in how responsive we are to the policy mechanisms (Falk and Kosfeld 2006; Frey and Stutzer 2006). Last but not least, cumulative prospect theory predicts that losses motivate behavior more than equal gains (Tversky and Kahneman 1991). From a policy perspective these considerations are important with respect to the future design of the CAP. Should behavioral factors interfere with different components of the current CAP, understanding how can help to decide which route to take in the future (EC 2017a, b). Experimental studies can provide a stronger basis for evidence-based policy making in the field of agriculture (Colen et al. 2015).

The aim of this study is to examine whether the behavioral aspects mentioned above play a role in the decision-making of farmers and thus affect environmental outcomes of different policy scenarios. With an economic field experiment, we investigate which overall framework of the CAP results in more environmental protection, and if and how behavioral factors are driving these outcomes. To this end, we invited farmers from the German federal state of Lower Saxony[1] to participate in an online experiment. In this two-staged decision experiment with real monetary incentives, farmers had to allocate a total amount of hectares between two types of agricultural practices (standard practices and a more environmentally-friendly alternative). In the first stage no policy mechanism was implemented, whereas in the second stage different policy scenarios were tested. These scenarios resembled different CAP scenarios and each one involved a unique combination of the three behavioral factors mentioned above: (i) framing of the policy: whether farmers perceive themselves as being part of the problem or the solution, (ii) degree of control: mandatory vs. voluntary policy (iii) incentive framed as a loss or a gain compared to the status-quo.

This experiment contributes to the limited and recent literature relying on incentivized economic field experiments with European farmers (Bougherara et al. 2017, Hermann et al. 2017, Meraner and Finger 2017, Vollmer et al. 2017). We managed to overcome the practical challenges associated with recruiting a large sample of farmers to take part in an experiment due to high transaction costs and limited contact data availability. The study is based on a unique dataset of 451 farmer representatives of the parent population of farmers in the German state of Lower Saxony.

The remainder of this article is structured as follows: Section two analyzes current CAP environmental policy in the light of behavioral economics' results. Section three presents the experimental research design. Sections four and five present and discuss the results.

2 Analysis of CAP environmental policy in the light of behavioral economics' results

We provide here background information on the progressive integration of environmental objectives into the CAP, and summarize the literature in behavioral economics likely to explain European farmers' reactions to this evolution of the agricultural policy.

[1] Located in the northwestern part of Germany and characterized by highly intensive agriculture.

2.1 The integration of environmental objectives into the CAP

The CAP was introduced in 1962 to provide food supply to European citizens by encouraging the attractiveness and modernization of the agricultural sector. The protection of the environment was only later added to the list of CAP objectives. In 1992, the so-called Agri-Environment Measures (AEM) were introduced. AEM resemble a government-funded payments for environmental services program (Sattler and Matzdorf 2013; Engel et al. 2008). Under these programs, farmers can voluntarily enroll for carrying out environmentally friendly farming practices and are compensated for their costs (EC 2005). Every Member State (MS) offers a catalogue of these measures ranging from relatively simple management prescriptions to highly targeted and result-oriented, complex bundles of practices. To be compatible with regulations from the World Trade Organization, the compensation for undertaking these measures can only cover the costs of the respective practices. However, due to the information asymmetries present, in practice regional averages are used as a proxy for the costs, leading to significant over- and under-compensation in the different cost-groups of farmers (Hanley et al. 2012).

In 2003, another step was made by increasing environmental conditionality of CAP payments with the cross-compliance regulation, which added basic requirements to be eligible for the subsidy program. The last reform of the CAP in 2013 further tightened this conditionality by introducing so-called "greening"-measures. 30% of the direct payments are now conditional on three environmental management practices (EU 2013). In its first implementation stage, farmers who did not comply lost a part of their direct payments proportional to the degree of non-compliance (i.e. both in terms of frequency and spatial extent). In the worst case, farmers could lose the entire greening premium. In the second implementation stage, a fine was introduced on top of that, further increasing the costs of non-compliance. The costs of fulfilling the greening requirement vary considerably among the different farm types, although for the majority of farmers they lie well below the premium paid (EC 2011).

The last CAP reform (2013) introduced a possibility of "modulation" for MS, i.e. a transfer of funds from the budget for direct payments ('pillar 1') to the budget for rural development programs ('pillar 2'). Up to 15% of pillar 1 budgets can be used to finance pillar 2 measures such as AEM. A member state can therefore reduce direct payments to provide more money for pillar 2 measures. This does not necessarily result in more money for an individual farmer, but in more funding for the AEM at the program level.

2.2 Insights from behavioral economics literature

A review of the relevant literature suggests that (at least) three behavioral factors could play a significant role in farmers' decision behavior. The effect of these behavioral factors have generally been observed in experimental games.

Framing of policy messages: being part of the problem or the solution

Several studies have demonstrated that human behavior can be affected by the framing of a decision context (Levin et al. 1998; Tversky and Kahneman 1981). In our context, this could imply that policy impacts could be affected by whether farmers perceive themselves as being part of a problem or part of a solution to societal problems. Individuals might experience a positive feeling of "warm glow" when doing something good and thus derive a positive utility from respective actions (Andreoni 1995). A positive framing of a decision situation could make more salient to the decision-maker the opportunity for such a utility gain. It has been shown that some farmers have strong pro-environmental preferences (Beedell and Rehman 2000). These could be candidates for the warm glow-effect and thus react stronger in a positively framed context. Another strand of the literature emphasizes the effects of a negative framing. Feelings of "green guilt" could be the reason for more cooperative behaviors in negatively framed scenarios (Kotchen 2009). Decision-makers dislike these negative emotions ("guilt aversion") and adjust their decisions accordingly (Brañas-Garza et al. 2013; Dufwenberg et al. 2011). Willingness to cooperate has been extensively analyzed using experimental games such as public good ones, including some studies focusing on the impact of framing. Experimental evidence based on decontextualized public good games is mixed: some studies show that the framing has no effect (Meier 2006; Rutte et al. 1987), whereas many other articles report positive (Sonnemans et al. 1998; Park 2000; Willinger and Ziegelmeyer 1999) or negative (McCusker and Carnevale 1995; Fleishman 1988; Brewer and Kramer

1986) effects on contributions for either positive or negative framings[2]. This suggests that the effect of framing is highly context-dependent, i.e. it is not clear a priori whether framing matters at all and if so, in which direction a specific frame alters behavior (Cornelissen and Werner 2014). In Germany, agriculture has a rather negative image for the general public. This negative frame could trigger the farmers' need to undertake actions in order to improve their public image (Weible et al. 2016). A negative frame in the experiment could remind farmers of that fact and encourage them to also undertake these actions in the game.

Degree of control: voluntary vs. mandatory policy

The second, potentially relevant behavioral effect is the impact of perceived control, i.e. whether farmers perceive a policy instrument as an attempt by the government to control or to support individual decisions (Frey and Stutzer 2006). Controlling people can crowd-out intrinsic motivations and thus lead to ambiguous policy results (Rode et al. 2015; Bowles and Polanía-Reyes 2012). People who are "control averse" are highly reluctant when it comes to obeying rules and might sometimes even bear the costs of being non-compliant to send a signal of protest (Vollan 2008). This effect is further amplified if people do not agree with the policy objectives or think that instrument choice was inappropriate (Winter and May 2001).

One can think of several reasons why farmers could be thought of as being relatively control averse. First, farmers have a strong community and a relatively closed set of values that determines their self-identity (Rodriguez et al. 2009; Burton and Wilson 2006; Burton 2004). Thus, these values are steadily reinforced by their peers and other views are not easily accepted (Burton et al. 2008). Second, there is a constant struggle between farmers and the authorities over "who is right" when it comes to what works in conservation, how measures should be timed and similar issues (Winter and May 2011). Third, the negative public image of farmers, combined with the bad economic situation on many farms, might further amplify feelings of reactance and protest among farmers.

---

[2] It may be that this literature overview is blurred due to publication bias, i.e. no-effect results being systematically under-published.

When they were was introduced in the CAP, payments for voluntary AEM *on top* of existing direct payments may have been perceived as supportive: not only income is preserved or increased but also farmers can decide voluntarily to engage into AEM, therefore broadening their choice set. But several elements of recent CAP reforms or proposals for the future could be perceived as controlling. Especially the introduction of the green payment could be perceived as a means of control because it prescribes specific farming practices (which may reduce profitability) with a threat of sanctions.

Framing incentives: losses or gains compared to the status-quo

The third domain is that of perceived gains and losses, i.e. whether farmers perceive the net outcome of a policy to impact positively or negatively his or her revenue compared to the status-quo. Cumulative prospect theory predicts that losses motivate behavior more than equal gains (Tversky and Kahneman 1991). This phenomenon has been called loss aversion and is larger when people feel ownership of the good, due to an "endowment effect" or "status quo bias" (Kahneman et al. 1991; Samuelson and Zeckhauser 1988; Thaler 1980). The perception of gains or losses depends on a reference point, which can not only be initial endowments but also prior experiences with similar measures (Koszegi and Rabin 2006). Given that most of current farmers have always been receiving CAP payments, these payments are certainly perceived as an initial endowment. Furthermore, previous studies have shown that farmers are prone to loss aversion when confronted with lottery choices in laboratory experiments (Bougherara et al. 2017).

All this evidence suggests there are at least two elements of the current CAP that could impact farmers' decision-making given their potential impact on farmers' perception of gains or losses compared to the previous CAP. First, with greening, loss averse farmers might fear losing (part of) their direct payments and therefore change their decisions in order to comply with the greening requirements and get the green payment. Second, with the modulation of funds from pillar 1 to pillar 2, farmers may perceive a loss in their total payments since individual AEM payment per hectare are not increased to cover for the loss in direct payments. Indeed, AEM payments are calculated such as compensating implementation costs but does not aim at supporting income.

Analysis of CAP environmental policy reform proposals at the light of behavioral economics' results

Considering possible future trajectories of the CAP, the evidence presented so far suggests that behavioral factors may well influence policy outcomes related to the adoption of environmentally-friendly practices. Should the direct payments be kept, but the greening be tightened, loss averse farmers could react in a desirable way, whereas control averse farmers might not. The overall effect then depends on the relative strength of these individual effects and on the distribution of warm glow, control and loss aversion among the farmer population. On the other hand, should the direct payments be phased out and the second pillar receive much more attention, control averse farmers may positively react to this shift towards more voluntary measures. On top of these possible effects, one should also consider how the framing of a future CAP might mediate or strengthen these reactions.

3 Research Design

The research design used in the present study can be classified as a framed lab-in-the-field economic experiment with a non-standard (professional) subject pool. "Framed" here means that the participants did not make an abstract decision, but one that resembles, to some degree, a real-world decision in their professional setting. The subject pool is "non-standard" because the participants were not students, but real farmers from the German federal state of Lower Saxony. Professional participants are argued to increase external validity especially in cases of framed experiments (Henrich et al. 2010; Carpenter et al. 2005). The experiment was administered online[3] and the farmers participated using their computer at home. During the experiment it was possible to earn points which were later exchanged to Euros at a known exchange rate. Given these two characteristics, the experiment is classified as "lab in the field".

3.1 Experimental design

The experimental design, which was pre-tested[4] before the real implementation, resulted in a set of experimental instructions that can be found in the supplementary material.

---

[3] The experiment was programmed in "SoPHIE – Software Platform for Human Interaction Experiments" (Hendriks 2012).

[4] The pre-test was organized by the Agricultural Chamber and had 11 participants in total. Those consisted of full- and part-time farmers, Chamber employees and farmers in training.

The main part of the experiment consisted of two stages. In the first stage, each participant played a baseline scenario. This baseline scenario resembles a CAP without any environmental component in it (CAP prior to 1992): if a farmer chooses to farm with the environmentally friendly alternative, he or she has to bear the costs. In the second stage, each participant was randomly allocated to one of six different policy scenarios (see Table 1). Each of the six treatments represented a unique combination of the three behavioral aspects discussed above and thus resembled a specific policy scenario[5]. To ensure incentive compatibility, one of the two decisions was randomly chosen to be payoff-relevant.

Table 1: Overview of treatment scenarios.

Treatment	**Policy message framing**	**Degree of control**	**Incentive framing**	**Policy Scenario**	**N**
T1	0	0	0	AEM	76
T2	0	0	1	AEM and modulation	75
T3	0	1	1	Greening	78
T4	1	0	0	AEM with neg. frame	76
T5	1	0	1	AEM, modulation, neg. frame	75
T6	1	1	1	Greening with neg. frame	71

Policy message framing: 0 positive, 1 negative; Degree of control: 0 voluntary, 1 mandatory; Incentive framing: 0 no loss, 1 loss

In both stages, the decision to be made consisted of the allocation of a total of 120 hectares[6] between two agricultural practices: practice A and a more environmentally-friendly alternative practice B. Practice B was costlier than practice A, and farmers could choose whatever split they liked (but only integer numbers were accepted).

The allocation decision resulted in a number of points that were determined by a payoff function. In the baseline scenario, the payoff function was specified in the following way (see Table 2 for parameters' description and values):

[5] A few possible combinations of behavioral factors were left out: for example, greening without a loss. It is an unlikely policy scenario as this would imply even more funds in pillar 1 that would then be made conditional on the greening measures.

[6] Average arable land per farm in Lower Saxony is ≈ 60 hectares. However, during the pre-test farmers commented that there is no such farm in reality and we switched to the average arable land per *arable farm* of ≈ 120 hectares (see results section).

$$\pi_i = I + L^A(p + d) + L^B(p + d - c)$$

To increase external validity, the corresponding average values from Lower Saxony were used. Farmers were only shown the parameterized payoff-functions (see experimental instructions in the supplementary material).

Table 2: Overview of parameters.

Parameter	Description	Value [Unit]
$\mathbf{L^A}$	Hectares farmed according to (conventional) practice A (participant choice)	0-120 [ha]
$\mathbf{L^B}$	Hectares farmed according to (environmentally-friendly) practice B (participant choice)	0-120 [ha]
I	Farm income from other sources than arable farming	15.000 [points]
p	Profit contribution per hectare from arable farming, equals to the contribution margin per hectare minus fixed costs such as rents	150 [points/ha]
d	Direct subsidy payment per hectare	325 [points/ha]
b	Reduced subsidy, with b = d – g	240 [points/ha]
c	Additional costs of practice B (compared to practice A) per hectare	85 [points/ha]
g	Green payment	85 [points/ha]

The first policy scenario resembles a situation where a new voluntary program such as AEM is introduced. There is no loss of direct payments compared to the baseline, and engaging in farming practice B is completely voluntary. As only difference to the baseline, AEM payments are introduced that are paid for each hectare farmed according to practice B. The payoff function is thus modified in the following way:

$$\pi_i = I + L^A(p + d) + L^B(p + d - c + g)$$

In the second scenario the situation is similar to the first scenario with the only difference that direct payments are reduced to finance the AEM program (modulation between pillar 1 and pillar 2). This way, the participants incur a loss compared to the baseline. The payoff function is modified in the following way:

$$\pi_i = I + L^A(p + b) + L^B(p + b - c + g),$$

where $b = d - g$.

In the third scenario the situation changes more fundamentally. Here, it is mandatory to farm all hectares according to practice B, should the participant want to receive the green payment. That is, farmers receive no green payment if they don't farm their total land area with practices B; while in the other scenarios it was possible to put only part of the land in practice B and still receive the green premium for this area. In scenario 3, the green payment is again taken from the direct payments. This scenario is alike to the "greening" of the CAP with a strict conditionality: should a farmer decide to farm any hectares according to practice A, he or she will not receive any green payments. In other words, compliance with practice B is compulsory on all farmland. The payoff function for scenario 3 is:

$$\pi_i = \begin{cases} \mathrm{I} + L^B(\mathrm{p} + \mathrm{b} - \mathrm{c} + \mathrm{g}) \; if \; L^B = L^{total} \\ \mathrm{I} + \; L^A(\mathrm{p} + \mathrm{b}) + L^B(\mathrm{p} + \mathrm{b} - \mathrm{c}) \; if \; L^B < L^{total} \end{cases}$$

The first three scenarios also all share a common positive framing, which sees the farmer as a part of the solution to societal problems. This is conveyed in the instructions as follows: "By engaging in farming practice B you make a positive contribution towards overcoming societal challenges by stabilizing the climate, and by preserving biodiversity and water quality."

By contrast, scenarios four, five and six share a negative framing, which marks the farmers as being responsible for societal problems. Subjects participating in these scenarios read: "By engaging in farming practice A you cause harm to society by contributing to climate change, and by reducing biodiversity and water quality."

In all the other aspects besides the framing, scenario four resembles scenario one, scenario five resembles scenario two and scenario six resembles scenario three.

This main part of the experiment was accompanied by two questionnaires. Before the baseline decision, participant's loss aversion parameter θ was elicited with an un-incentivized procedure following Wang et al. (2017). After the main experiment, participants filled out a standard questionnaire on socio-demographic and farm characteristics. Additionally, Likert-scale preference proxies were used to elicit proxies for control aversion, green guilt, environmental preferences and warm glow incidence (see experimental instructions in the supplementary material).

3.2 Theoretical predictions and hypotheses

In the baseline scenario, the profit maximizing solution is not to farm with the costlier environmentally-friendly practices, i.e. to choose $L^B = 0$. For the policy scenarios, the profit maximizing solution depends on the level of the green payment. For our study, we set g equal to c as AEM regulations state that only income forgone is subsidized. Moreover, while compliance with greening in reality appears to be far less costly than the green payment in the period 2014-2020, if greening requirements are reinforced in the future, the costs of the greening measures could rise (Pe'er et al. 2017). When the green payment is equal to the cost of compliance, there are multiple equilibria in the policy treatments. In T1, T2, T4 and T5, any value for L^B between 0 and 120 would be consistent with payoff-maximization. In T3 and T6, the mandatory scenarios, only corner solutions are consistent with payoff-maximization, i.e., $L^B = 0$ or $L^B = 120$, because intermediate values would imply higher costs but bring no gain.

To guide the analysis of the experimental results, the following research hypotheses were formulated based on the literature on behavioral economics and the theoretical predictions:

Impact of environmental policy mechanisms (treatment effect):

> **H1a: When a policy mechanism is present**, the average amount of hectares farmed according to practice B will be significantly higher than in the baseline.

This is because policy treatments compensate for the costs of adopting activity B, while the baseline scenario does not. However, note that under the policy treatments, payoff-maximizing farmers are indifferent between activity A and B. Thus, in deciding which activity to choose under the policy treatments, farmers' preferences can take a role. We expect:

H1b: Farmers with stronger environmental preferences will, on average, respond more strongly to policy intervention (i.e. exhibit a greater positive change in hectares farmed according to practice B from the baseline to the treatment decision) than farmers with lower environmental preferences.

Impact of policy framing:

It is not clear what the global effect of the policy message is, given that it may depend on the extent and distribution of "green guilt" and "warm glow" type of farmers in our sample. Therefore, a hypothesis on the average effect of framing is not formulated. However, various hypotheses on the determinants of farmer behavior can be formulated:

H2a: In the positive framing condition, individuals who are more sensitive to the "warm glow" effect will, on average, respond more strongly to policy intervention (i.e. exhibit a greater positive change in hectares farmed according to practice B from the baseline to the treatment decision) than individuals who are less sensitive to it.

H2b: In the negative framing condition, individuals who are more sensitive to the "green guilt" effect will, on average, respond more strongly to policy intervention (i.e. exhibit a greater positive change in hectares farmed according to practice B from the baseline to the treatment decision) than individuals who are less sensitive to it.

Impact of voluntary vs. mandatory policy:

The global effect of imposing a mandatory environmental regulation is ambiguous: it could either lead to more people obeying the law or – if control aversion is highly prevalent – more people showing protest behavior and farming less hectares according to practice B. This leads to the following hypothesis:

H3: In the mandatory condition, individuals who are more control averse will, on average, respond less strongly to policy intervention (i.e. exhibit a smaller positive change in hectares farmed according to practice B from the baseline to the treatment decision) than individuals who are less control averse.

Impact of losses vs. gains:

It is not clear what the global effect of the perception of losses and gains is, because it depends strongly on the prevalence of loss aversion amongst the farmers. The hypothesis is as follows:

H4: In the loss condition, individuals who are more loss averse will, on average, respond more strongly to policy intervention (i.e. exhibit a higher positive change in hectares farmed according to practice B from the baseline to the treatment decision) than individuals who are less averse to losses.

3.3 Sampling and representativeness

To recruit the participants, 15.000 invitation letters were sent to a subsample of Lower Saxonian famers. The subsample was randomly selected from all the farmers that are subject to the greening regulations[7]. To avoid leakage via communication among participants, the participating farmers were given a time window of 2 weeks to participate in the experiment. Due to financial restrictions the maximum number of participants was capped at 450, and due to a very high response rate, the experiment was closed after 3 days[8]. Average payoffs to the farmers were 44.6€ which were sent to the farmers with a voucher card[9].

To check for the external validity of the experiment, the sample population is compared to the general population of Lower Saxonian farmers. A high similarity in the observed characteristics of the two populations can be interpreted as a confirmation that the sampling procedure worked well. Table 3 gives an overview of several observable characteristics. Participating farmers are slightly younger than the German average farmer (46 vs. 53 years), which could be due to a higher affinity of the younger farmers to the internet and thus a higher willingness to participate in online studies. About 14% of the participants are female, which is lower than the share of female workers in the Lower Saxonian agricultural sector. The average values for the share of full-time farmers, the average farm size as well as the share of farmers participating in AEM are quite similar to the parent population. The average amount of permanent pastures is only slightly lower than the Lower Saxonian average.

[7] Very small farms and organic farmers are exempted from the greening regulations.
[8] Until the closing date we measured a response rate of 8% and a dropout rate of 25%.
[9] The card can be used for paying online as well as in a number of local stores, gas stations etc.

Table 3: Comparison of observable characteristics of the experimental sample with the farmer population.

	Participants [a]	Parent population [a]
Avg. age	46.6 years	53 years [b]
Female	14 %	38 % [b]
Fulltime	64.1 %	66.8 % [b]
Avg. farm size	91.0 ha	89.6 ha [b]
Avg. arable land	N/A	66.9 ha [b] / 121.7 ha [b]
AEM participation	36.4 %	34.1 % [b]
Avg. permanent pastures	15.8 ha	20.1 ha [b]

a: Sample size in the experiment is N = 451. Lower Saxony has approx. 39.500 famers. However, farmers from adjacent federal states can have arable land in Lower Saxony and therefore appear in the Chamber's database, which was used for invitations. The actual parent population thus has N = 40.178. Participants were asked for their postal codes in the experiment and it was therefore possible to check for non-Lower Saxonian farmers (N = 2). There is no reason to believe that those two farmers are systematically different especially because they are also partly farming in Lower Saxony. The two observations were thus *not* excluded from the analysis.

b: Data sources and more detailed explanations are listed in supplementary material.

4 Results

4.1 Data analysis

To check whether the randomization to treatments worked correctly, the distribution of all variables elicited was tested for similarity between the six treatment groups with a Mann Whitney U / Wilcoxon Rank-Sum test. The tests show that most of the variables are evenly distributed across the treatment groups (see supplementary material for details). Confidence in the randomization procedure can be further increased by comparing the baseline decisions of the participants, as their distribution should be the same for all treatments (Diagram 1). This is confirmed both with a pairwise Mann Whitney U / Wilcoxon Rank-Sum test (see supplementary material) and a Kruskal-Wallis equality-of-populations rank test ($p = 0.5804$).

To measure whether the differences across treatments are significant, we again rely on non-parametric tests. We compare the distribution of changes in hectares farmed according to practice B from baseline to treatment in the different treatment groups (pairwise Mann Whitney U / Wilcoxon Rank-Sum test) and check whether the amount of hectares farmed according to practice B in the policy scenarios is significantly different from the baseline (Wilcoxon Matched-Pairs Signed-Ranks test). The test results can be found in the supplementary material. The within-subject treatment effect, i.e. the effect of the policy mechanisms on the adoption of environmentally-friendly practices is highly significant in all treatment groups (Prob > |z| = 0.00). The distribution of changes in hectares in B from baseline to treatment is similar in all cases.[10]

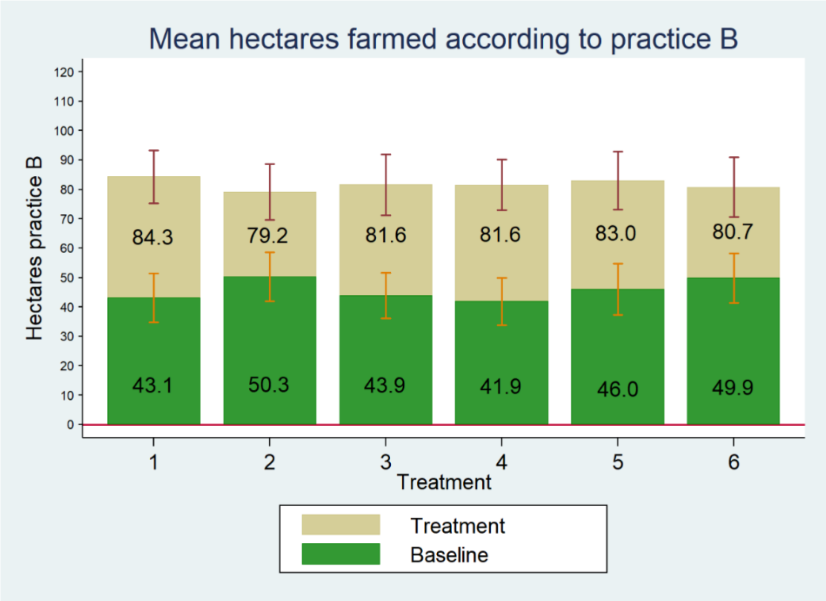

Diagram 1: Mean hectares farmed according to practice B.

To find out what motivated farmers' decisions to adopt environmentally-friendly practices, an econometric model was estimated (Table 4). The Model is an OLS estimation to explain the difference in hectares farmed according to practice B in the baseline and in the policy treatment (a measure of the policy impact). The dependent variable was obtained by subtracting the amount of hectares farmed according to practice B in the baseline from the amount of hectares in B in the treatment. The independent variables include socio-demographic and farm characteristics, dummy variables for the three dimensions of the treatment conditions (loss, mandatory and negative frame), behavioral proxies, as well as several interaction effects in line with our specific hypotheses. To guide the interpretation of results, a second model was run to explain the hectares farmed according to practice B in the baseline. To account for the

---

[10] We observe a difference between T1 and T2. However, including a dummy variable in the regression we later run to check whether introducing a loss in a positively framed scenario with voluntary protection has a significant impact did not confirm this result, so that we classify it as a spurious correlation.

nature of the data (decision space was limited between 0 and 120), we decided to use a random effects Tobit model. The model results of the Tobit model can be found in the supplementary material.

Table 4: Results of the OLS regression model.

Variable	Model Coefficient [a]:	Standard Error
Age	- 0.53 ***	0.17
Female	5.01	5.66
Fulltime	3.87	4.65
Education [b]	4.16 **	1.86
Farm Size	0.03 *	.016
No Livestock	16.65 ***	4.30
Diversifier [c]	2.01	4.20
Loss	- 0.78	15.07
Mandatory	17.29	12.86
Negative Frame	23.27 *	13.60
Environmental Consciousness	2.35	2.47
Environmental Responsibility	- 1.75	2.64
Loss Aversion	- 1.01	3.14
Control Aversion	2.93	2.03
Green Guilt	- 0.80	2.16
Warm Glow	2.86	2.56
Loss x Loss Aversion	- 2.23	3.94
Mandatory x Control Aversion	- 3.22	3.47
Negative Frame x Green Guilt	- 0.05	3.28
Positive Frame x Warm Glow	6.34 *	3.54
Constant	2.54	21.47
R^2	0.12	
N	451	

a: *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

b: For the regression this variable was coded in an increasing manner from 0 (Elementary School) to 4 (A-Level)

c: Diversifiers means the participant indicated at least two further sources of income besides arable farming and animal husbandry (e.g. agri-tourism, photovoltaic, forest)

4.2 Hypotheses testing

In the sections hereafter, results are discussed following the hypotheses formulated in the preceding section.

Impact of environmental policy mechanisms (treatment effect) – Hypothesis 1a and 1b:

The average amount of hectares farmed under B in the policy scenarios is 81.75 ha (68.13% of total hectares, see also Diagram 1), which is significantly higher than in the baseline for all treatment groups (Prob > |z| = 0.00 in all treatments). The average change in hectares from baseline to treatment was 35.98 ha (mean treatment effect). Our results thus support Hypothesis 1a.

The OLS regression analysis does not indicate an impact of environmental preferences on the strength of the policy impact, so that we have to reject Hypothesis 1b (see Table 4). But the model results suggest a minor negative effect of age and a slightly stronger positive effect of education on the difference in hectares conserved between the baseline and the treatment scenarios. That is, young and educated farmers are more responsive to the policy treatments. Moreover, farmers with livestock react more negatively to the policy treatment, compared to farmers with no livestock. We provide potential explanations in the discussion section.

Impact of policy framing - *Hypothesis 2a and 2b:*

The OLS model reveals that a negative framing is significantly correlated with a greater change in hectares conserved between the baseline and the treatment (see Table 4). Moreover, results confirm the effect of warm glow in the positive framing condition (Hypothesis 2a). Indeed, farmers experiencing stronger feelings of warm glow when conserving the environment respond more strongly to a positive framing than individuals with lower values of warm glow. However, the effect of green guilt in the negative framing condition (Hypothesis 2b), cannot be supported with the results obtained: the specific interaction term is not significant in the OLS model.

Impact of voluntary vs. mandatory policy - *Hypothesis 3:*

The interaction term of control aversion and the mandatory treatment condition is insignificant. Thus, we do not find evidence that control averse individuals exhibit a smaller change in hectares conserved from the baseline to the treatment decision if faced with a mandatory condition, compared to less control averse individuals. Hypothesis 3 is thus not be supported by the results of the OLS model.

Impact of losses vs. gains - Hypothesis 4:

The OLS regression analysis yields a statistically non-significant interaction term of loss aversion and the loss condition, indicating that loss averse individuals do not react more strongly in the loss condition (see Table 4). This leads us to a rejection of Hypothesis 4. There is also no general effect of loss aversion.

6 Discussion and conclusion

The discussion of the results and the broader implications of this research are divided into the following parts: first, the results of the experiment are critically assessed and put into context. After that, the broader policy implications are discussed. We also provide a reflection on the method used and the limitations of this study. Several future avenues of research are suggested.

Regarding the results of this study, it is first of all striking that, in general, farmers were willing to protect the environment even if this comes at a cost to them. This is evident through the positive average number of hectares farmed according to practice B in the baseline. A possible explanation could be the prevalence of pro-environmental preferences in the farmer population, which has also been documented by rural sociologists (Beedell and Rehmann 2000). The Tobit model used to explain the hectares farmed according to practice B in the baseline confirms an impact of environmental responsibility, though only a weakly significant one (see supplementary material).

Turning to the impact of the policy treatments, an effect of both education and animal husbandry is visible. Pure arable farms without livestock and better educated farmers react significantly stronger to the policy mechanisms. The Tobit model used to explain the baseline decision shows exactly the opposite result. In the baseline, more educated farmers and those without livestock farm significantly less hectares (see supplementary material). It seems that more educated farmers are not willing to act environmentally friendly in the absence of economic incentives, what makes them also more receptive to the policy mechanisms. Similarly, the result that livestock farmers are less responsive to policy treatments may be due to the fact that livestock farmers already chose significantly higher levels of B in the baseline, so have less room for adjustment in response to economic incentives, or that farmers without livestock are more insistent on requiring economic incentives in order to act pro-environmentally. That pure arable farms without livestock farm less hectares in an environmentally friendlier way in the baseline could be due to two explanations. First, livestock farmers in Lower Saxony are under high public pressure (Weible et al. 2016). Second, for farmers without livestock, arable farming is their main source of income and they are more dependent on the profit generated with their cropping choices. Lastly, we also find that older farmers are less responsive to the policy mechanism. This may be due to them being more conservative and having a stronger identity as a producer (Burton and Wilson 2006).

Interestingly, although control aversion does not seem to have a general impact on policy responsiveness, it matters for the baseline decision. In the Tobit model, more control averse farmers farmed significantly less hectares according to practice B. This may be because farmers either see the study itself as a threat, because the results could be used to justify more control in the future (the baseline is the first opportunity to express concerns), or they may perceive the baseline scenario as suggesting to be environmentally friendly. In both cases, control averse individuals could be particularly reluctant to adopt the environmentally friendly practice in the absence of economic incentives.

Turning to the general effects of the policy treatments, it is first of all interesting to see that they do not seem to differ much in their ability to steer behavior. On average they were all equally effective in increasing hectares farmed according to practice B. Moreover, it should be emphasized that the two "greening" treatments (T3 and T6) were not able to increase hectares to 120, although here it was mandatory to farm with practice B on all hectares if wanting to receive the green premium. This can be explained by the fact that mere compensation of costs makes farmers indifferent between adopting and not adopting the environmentally-friendly practice. With respect to the impact of framing, our results suggest that negative framing increases farmers' responsiveness to policy intervention, compared to positive framing. Also, farmers who experience stronger warm glow from acting pro-environmentally are more responsive to a positive framing. Modulation, i.e. the perceived losses, does not seem to affect policy responsiveness, nor does this effect significantly differ for loss averse farmers. Linking agri-environmental payments to a full conversion of all land (our 'mandatory' treatment) does not affect behavior significantly neither.

In terms of policy implications, our results that modulation and area requirements do not affect adoption of environmentally-friendly practices could be interpreted as supporting the idea to shift funds from pillar 1 into pillar 2. If pillar 2 is designed appropriately, this can increase policy cost-effectiveness (Armsworth et al. 2012) and seems to do no harm in terms of policy efficiency. Of the three behavioral dimensions of policy design considered in this study, the only one that appears to matter in our results in terms of policy effectiveness is framing. Our analysis suggests that, in general, the current negative framing prevalent in the public debate actually helps to promote policy effectiveness. When faced with such framing and offered incentive payments compensating opportunity costs, farmers are more responsive to such a policy compared to the case of a positive framing. However, for farmers with a strong warm glow effect, positive framing can increase these farmers' responsiveness to incentive payments. Thus, which framing is more appropriate depends on the target farmer population and it could be promising to target different types of framing to different types of farmers.

Although overall aggregate outcomes of the different policy scenarios seem to be similar, this does not necessarily mean that the behavioral mechanisms at work are also similar. The total effect cannot be generalized because it depends on the composition of the farmer population in terms of behavioral types. For farmers in Lower Saxony, instrument choice (e.g. AEM vs. greening) seems to be a second-order problem, because all mechanisms were equally effective in this setting. None of the potential policy designs achieve full conversion to environmentally more friendly activities. This is in line with the theoretical prediction that policies that compensate just the opportunity costs lead farmers to be indifferent between adopting the more environmentally-friendly activities and not doing so. In practice, many farmers appear to prefer a mix of practices, also as a way to diversify their portfolio in order to manage risk. Interestingly, this is true even when payments are made conditional on full adoption (in our setting: 120 hectares farmed according to practice B). Although in this case, it is theoretically payoff-maximizing to convert either all or no land to the environmentally friendlier practice, many farmers (T3: 35%, T6: 48%) in our sample accepted a loss of part of their direct payment by still choosing a mix of practices.

An analysis of the entries from an open text field for general remarks by farmers suggests that many of them chose to split hectares in the treatments because this is "how they've always farmed their lands". Instead of discussing instrument choice it could thus be more promising to try to reinforce environmental preferences and especially feelings of environmental responsibility in the farmer population. This could potentially be done with information campaigns (Schahn and Holzer 1990), nudging campaigns (Barnes et al. 2013), or more integrative approaches that directly involve farmers, their knowledge and skills, for the purpose of nature conservation (Bellec et al. 2012).

This study furthermore showed that it is possible to use experimental economic methodology for projects in the domain of agriculture and that it is possible to guide evidence-based policy with the results. Both sampling and randomization worked well and the response rate was much higher than anticipated. Thus farmers seem to be willing to participate in experimental studies, and this was also voiced often in the open text fields for general remarks.

Turning to the limitations of the study, it may be that that some differences across treatments were too subtle to be effective in an online experiment and in a between-subject setting. It could also be that parts of the framing were still too abstract for many, especially older farmers. The reduction of decision complexity (e.g. no cross compliance element, perfect monitoring and enforcement, abstract greening, direct modulation) however, was a necessary step to create a sound experimental design. Another issue could be an "adaptation bias" on the side of the farmers (Viceisza, 2016). According to Viceisza (ibid), adaptation bias leads to artificial behavior of the subjects if they have unrealistic expectations about how the experiment might inform subsequent policy-making. It was evident from general remarks of the farmers that several of them had such unrealistic expectations.

Given these limitations, it is important to pursue follow-up research that tries to better understand the mechanisms of farmers' decision making. Especially with respect to control aversion it seems likely that this behavioral dimension also interacts with the given monitoring and sanctioning regime (Shimshack 2014). Also, should the European Commission concretize their vision for the future CAP, other scenarios, probably interacting with further behavioral domains, could be tested. The experimental *ex ante* evaluation of European agricultural policies is still in its infancy and therefore more studies are needed to better understand what works in the lab and in the field and why. Clearly, more empirical evidence on treatment effects and prevalence of behavioral biases in the farmer population is needed to be able to effectively guide policy-making.

7 References

Andreoni, J. (1995). Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving. *The Economic Journal* 100(401): 464-477.

Armsworth, P.R., Acs, S., Dallimer, M., Gaston, K.J., Hanley, N. and Wilson, P. (2012). The cost of policy simplification in conservation incentive programs. *Ecology Letters* 15: 406-414.

Barnes, A.P., Toma, L., Willock, J. and Hall, C. (2013). Comparing a '*budge*' to a '*nudge*': Farmer responses to voluntary and compulsory compliance in a water quality management regime. *Journal of Rural Studies* 32: 448-459.

Beedell, J. and Rehman, T. (2000). Using social-psychology models to understand farmers' conservation behavior. *Journal of Rural Studies* 16(1): 117-127.

Blasch, J. (2015). Doing Good or Undoing Harm – Framing Voluntary Contributions to Climate Change Mitigation. Working Paper, ETH Zurich, Zurich.

Bougherara, D., Gassmann, X., Piet, L. and Reynaud, A. (2017). Structural estimation of farmers' risk and ambiguity preferences: a field experiment. *European Review of Agricultural Economics* 44(5): 782-808.

Bowles, S. and Polanía-Reyes, S. (2012). Economic Incentives and Social Preferences: Substitutes or Complements? *Journal of Economic Literature* 50(2): 368-425.

Brañas-Garza, P., Bucheli, M., Espinosa, M.P. and García-Muñoz, T. (2013). Moral Cleansing and Moral Licenses: Experimental Evidence. *Economics and Philosophy* 29: 199-212.

Brewer, M.B. and Kramer, R.M. (1986). Choice behavior in social dilemmas: Effects of social identity, group size, and decision framing. *Journal of Personality and Social Psychology* 50(3): 543-549.

Burton, R.J.F. (2004). Seeing through the „good farmer's" eyes: Towards developing an understanding of the social symbolic value of "productivist" behavior. *Sociologia Ruralis* 44(2): 195-215.

Burton, R.J.F. and Wilson, G.A. (2006). Injecting social psychology theory into conceptualizations of agricultural agency: Towards a post-productivist farmer self-identity? Journal of Rural Studies 22(1): 95-115.

Burton, R.J.F., Kuczera, C. and Schwarz, G. (2008). Exploring Farmers' Cultural Resistance to Voluntary Agri-environmental Schemes. *Sociologia Ruralis* 48(1): 16-37.

Carpenter, J.P., Burks, S. and Verhoogen, E. (2005). Comparing Students to Workers: The Effects of Social Framing on Behavior in Distribution Games. *Research in Experimental Economics* 10: 261-290.

Colen, L., Gomez y Paloma, S., Latacz-Lohmann, U., Lefebvre, M., Préget, R. and Thoyer, S. (2015). (How) can economic experiments inform EU agricultural policy? JRC Science and Policy Report EUR 27496. Joint Research Centre of the European Commission, Seville, Spain.

Cornelissen, J.P. and Werner, M.D. (2014). Putting Framing in Perspective: A Review of Framing and Frame Analysis across the Management and Organizational Literature. *Academy of Management Annals* 8(1): 181-235.

Czekaj, S., Majewski, E. and Was, A. (2013). The impact of the "greening" of the Common Agricultural Policy on the Financial Situation of Polish Farms. *Applied Studies in Agribusiness and Commerce* 2013(2-3): 49-55.

Dufwenberg, M., Gächter, S. and Henning-Schmidt, H. (2011). The framing of games and the psychology of play. *Games and Economic Behavior* 73: 459-478.

EC – European Commission (2005). Agri-Environment Measures. Overview on General Principles, Types of Measures, and Application. EC, Brussels.

EC – European Commission (2011). CAP Towards 2020 Impact Assessment: Greening – Results of Partial Analysis on Farm Income using FADN. EC, Brussels.

EC – European Commission (2013). Overview of CAP Reform 2014-2020. *Agricultural Policy Perspectives Brief* No. 5/December 2013, EC, Brussels.

EC – European Commission (2017a). Modernizing and Simplifying the CAP. Background Document: Economic challenges facing EU agriculture. EC, Brussels.

EC – European Commission (2017b). Modernizing and Simplifying the CAP. Background Document: Climate and Environmental challenges facing EU agriculture and rural areas. EC, Brussels.

Engel, S., Pagiola, S. and Wunder, S. (2008). Designing payments for environmental services in theory and practice: An overview of the issues. *Ecological Economics* 65: 663-674.

EU – European Union (2013). Regulation (EU) No. 1307/2013 of the European Parliament and of the Council of 17 December 2013 establishing rules for direct payments to farmers under support schemes within the framework of the Common Agricultural Policy and repealing Council Regulation (EC) No. 637/2008 and Council Regulation (EC) No. 73/2009. EU, Brussels.

Falk, A. and Kosfeld, M. (2006). The Hidden Costs of Control. *The American Economic Review* 96(5): 1611-1630.

Fleishman, J.A. (1988). The Effects of Decision Framing and Others' Behavior on Cooperation in a Social Dilemma. *Journal of Conflict Resolution* 32(1): 162-180.

Foley, J.A., DeFries, R., Asner, G.P., Barford, C., Bonan, G., Carpenter, S.R., Chapin, F.S., Coe, M.T., Daily, G.C., Gibbs, H.K., Helkowski, J.H., Holloway, T., Howard, E.A., Kucharik, C.J., Monfreda, C., Patz, J.A., Prentice, I.C., Ramankutty, N. and Snyder, P.K. (2005). Global Consequences of Land Use. *Science* 309: 570-574.

Frey, B.S. and Stutzer, A. (2006). Environmental Morale and Motivation. *CREMA Working Paper* No. 2006-17, Basel.

Hanley, N., Banerjee, S., Lennox, G.D. and Armsworth, P.R. (2012). How should we incentivize private landowners to 'produce' more biodiversity? *Oxford Review of Economic Policy* 28(1): 93-113.

Hendriks, A. (2012). SoPHIE – Software Platform for Human Interaction Experiments. University of Osnabrück, Working Paper, Osnabrück.

Henle, K., Alard, D., Clitherow, J., Cobb, P., Firbank, L., Kull, T., McCracken, D., Moritz, R.F.A., Niemelä, J., Rebane, M., Wascher, D., Watt, A. and Young, J. (2008). Identifying and managing the conflicts between agriculture and biodiversity conservation in Europe – A review. *Agriculture, Ecosystems and Environment* 124: 60-71.

Henrich, J., Heine, S.J. and Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences* 33: 61-135.

Hermann, D., Sauthoff, S. and Mußhoff, O. (2017). Ex-ante evaluation of policy measures to enhance carbon sequestration in agricultural soils. *Ecological Economics* 140: 241-250.

Kahneman, D., Knetsch, J.L. and Thaler, R.H. (1991): Anomalies – The Endowment Effect, Loss Aversion, and the Status Quo Bias. *Journal of Economic Perspectives* 5(1): 193-206.

Koszegi, B. and Rabin, M. (2006). A Model of Reference-Dependent Preferences. *The Quarterly Journal of Economics* CXXI(4): 1133-1165.

Kotchen, M.M. (2009). Offsetting Green Guilt. *Stanford Social Innovation Review* 7(2): 26-31.

Le Bellec, F., Rajaud, A., Ozier-Lafontaine, H., Bockstaller, C. and Malezieux, E. (2012). Evidence for farmers' active involvement in co-designing citrus cropping systems using an improved participatory method. *Agronomy for Sustainable Development* 32(3): 703-714.

Levin, I.P., Schneider, S.L. and Gaeth, G.J. (1998). All Frames Are Not Created Equal: A Typology and Critical Analysis of Framing Effects. *Organizational Behavior and Human Decision Processes* 76(2): 149-188.

Matthews, A. (2013). Greening CAP Payments – A Missed Opportunity? The Institute of International and European Affairs (IIEA), Dublin.

McCusker, C. and Carnevale, P.J. (1995). Framing in Resource Dilemmas – Loss Aversion and the Moderating Effect of Sanctions. *Organizational Behavior and Human Decision Processes* 61(2): 190-201.

Meier, S. (2006). Does Framing Matter for Conditional Cooperation? Evidence from a Natural Field Experiment. *Contributions to Economic Analysis and Policy* 5(2).

Meraner, M. and Finger, R. (2017). Data on German farmers risk preference, perception and management strategies. *Data in Brief* 15: 102-105.

Park, E.-S. (2000). Warm-glow versus cold-prickle: a further experimental study of framing effects on free-riding. *Journal of Economic Behavior and Organization* 43(4): 405-421.

Pe'er, G., Dicks, L.V., Visconti, P., Arlettaz, R., Báldi, A., Benton, T.G., Collins, S., Dieterich, M., Gregory, R.D., Hartig, F., Henle, K., Hobson, P.R., Kleijn, D., Neumann, R.K., Robijns, T., Schmidt, J., Shwartz, A., Sutherland, W.J., Turbé, A., Wulf, F. and Scott, A.V. (2014). EU agricultural reform fails on biodiversity. *Science* 344(6188): 1090-1092.

Pe'er, G., Zinngrebe, Y., Hauck, J., Schindler, S., Dittrich, A., Zingg, S., Tscharntke, T., Oppermann, R., Sutcliffe, L.M.E., Sirami, C., Schmidt, J., Hoyer, C., Schleyer, C. and Lakner, S. (2017). Adding Some Green to the Greening: Improving the EU's Ecological Focus Areas for Biodiversity and Farmers. *Conservation Letters* 10(5): 517-530.

Rode, J., Gómez-Baggethun, E. and Krause, T. (2015). Motivation crowding by economic incentives in conservation policy: A review of the empirical evidence. *Ecological Economics* 117: 270-282.

Rodriguez, J.M., Molnar, J.J., Fazio, R.A., Sydnor, E. and Lowe, M.L. (2009). Barriers to adoption of sustainable agricultural practices: Change agent perspectives. *Renewable Agriculture and Food Systems* 24(1): 60-71.

Rutte, C.G., Wilke, H.A.M. and Messick, D.M. (1987). The effects of framing social dilemmas as give-some or take-some games. *British Journal of Social Psychology* 26: 103-108.

Samuelson, W. and Zeckhauser, R. (1988). Status Quo Bias in Decision Making. *Journal of Risk and Uncertainty* 1: 7-59.

Sattler, C. and Matzdorf, B. (2013). PES in a nutshell: From definitions and origins to PES in practice – Approaches, design process and innovative aspects. *Ecosystem Services* 6: 2-11.

Schahn, J. and Holzer, E. (1990). Studies of Individual Environmental Concern – The Role of Knowledge, Gender, and Background Variables. *Environment and Behavior* 22(6): 767-786.

Shimshack, J.P. (2014). The Economics of Environmental Monitoring and Enforcement. *Annual Review of Resource Economics* 6(1): 339-360.

Singh, M., Marchis, A. and Capri, E. (2014). Greening, new frontiers for research and employment in the agro-food sector. *Science of the Total Environment* 472: 437-443.

Sonnemans, J., Schram, A. and Offerman, T. (1998). Public good provision and public bad prevention: The effect of framing. *Journal of Economic Behavior and Organization* 34: 143-161.

Thaler, R. (1980). Toward a Positive Theory of Consumer Choice. *Journal of Economic Behavior and Organization* 1: 39-60.

Tversky, A. and Kahneman, D. (1981). The Framing of Decisions and the Psychology of Choice. *Science* 211: 453-458.

Tversky, A. and Kahneman, D. (1991). Loss Aversion in Riskless Choice: A Reference-Dependent Model. *The Quarterly Journal of Economics* 106(4): 1039-1061.

Vanni, F. and Cardillo, C. (2013). The effects of CAP greening on Italian agriculture. *International Agricultural Policy* 3(3): 7-21.

Viceisza, A.C.G. (2016). Creating a Lab in the Field: Economics Experiments for Policymaking. *Journal of Economic Surveys* 30(5): 835-854.

Vollan, B. (2008). Socio-ecological explanations for crowding-out effects from economic field experiments in southern Africa. *Ecological Economics* 67(4): 560-573.

Vollmer, E., Hermann, D. and Mußhoff, O. (2017). Is the risk attitude measured with the Holt and Laury task reflected in farmers‘ production risk? *European Review of Agricultural Economics* 44(3): 399-424.

Wang, M., Rieger, M.O. and Hens, T. (2017). The Impact of Culture on Loss Aversion. *Journal of Behavioral Decision Making* 30(2): 270-281.

Weible, D., Christoph-Schulz, I., Salamon, P. and Zander, K. (2016). Citizens' perception of modern pig production in Germany: a mixed-method research approach. *British Food Journal* 118(8): 2014-2032.

Willinger, M. and Ziegelmeyer, A. (1999). Framing and cooperation in public good games: an experiment with an interior solution. Economics Letters 65(3): 323-328.

Winter, S.C. and May, P.J. (2001). Motivation for compliance with environmental regulations. *Journal of Policy Analysis and Management* 20(4): 675-698.