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Re-calibrating beliefs about peers: Direct impacts and cross-learning effects in agriculture*

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Abstract

We examine the influence of *perceived* social norms on the adoption by French farmers of eco-schemes (ES), a new type of direct monetary compensation provided by the EU Common Agricultural Policy to farmers who voluntarily adopt sustainable agricultural practices. Using a representative large scale web-survey, we show that French farmers hold inaccurate beliefs about their peers on various dimensions of the ES. Farmers are then randomly exposed to norm-based informational treatments where we vary the type of truthful information released about their peers. In addition to being able to assess the direct causal impact of the treatments, our between-subject design allows us to analyze *cross-learning effects*: providing information on the beliefs of peers may not only induce farmers to update their beliefs about their object of interest, but may also change their beliefs about other outcome variables. We demonstrate that norm-based informational treatments may modify: (i) farmers' personal opinion regarding the ES; (ii) farmers' beliefs about their peers regarding the ES; and (iii) that cross-learning effects may matter. While changes in beliefs are shown to be consistent with Bayesian-updating, we demonstrate that their causal effects may strongly depend upon the specific nature of the belief under consideration.

Keywords: Beliefs, Misperception, Informational treatment, Norms, Agriculture
JEL Codes: D81, D83, D84, C9, Q18

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1 Introduction

Launched in 1962, the EU's Common Agricultural Policy (CAP) is one of the world's largest agricultural policies and the EU's longest-prevailing one. The main objectives of the CAP are to support agriculture production and farmers' income while protecting the environment. Despite several important reforms, the CAP has been highly criticized over the years (Cullen et al., 2018). The lack of environmental ambition and the limited enrolment of farmers have been particularly documented (Pe'er et al., 2014, 2017).

Recent studies have thus highlighted the need to more consistently incorporate behavioral factors into the design of EU agri-environmental policies (Dessart et al., 2019; Schaub et al., 2023). Our study contributes to this literature by exploring the complex interplay between beliefs about peers and farmers' own adoption of eco-schemes (ES). These schemes are a new type of direct monetary compensation proposed by the 2023 CAP to farmers who voluntarily adopt environmentally-friendly practices. To address this issue, we implement a web survey on a large sample of French farmers (N=2,206). We find that French farmers hold inaccurate beliefs about their peers on various dimensions of ES. Then, we randomly expose farmers to different informational treatments in which we vary the type of (truthful) information about peers. The design of our intervention allows us to assess the *direct* causal impact of the treatments, but also the *cross-learning effects*: these effects arise from the fact that providing information on the beliefs of peers may not only induce farmers to update their beliefs about their object of interest, but also change their beliefs about other outcome variables (Haaland et al., 2023). To the best of our knowledge, our work is the first to causally assess by means of an informational experiment the role played by beliefs about peers on the adoption of policy instruments in agriculture, and to allow distinguishing direct effects of norm-based informational treatments from cross-learning effects.

The interest in beliefs about peers has gained in importance in recent years, in particular in the study of perceived prevailing social norms (see e.g., Bursztyn et al. 2020, d'Adda et al. 2020, Vriens et al. 2023, Angerer et al. 2024).[1] In the agricultural context, the assessment of the role of beliefs about peers is relevant, as evidenced by the literature that has emphasized the pivotal role of social norms for farmers, in particular as a driver for the adoption of new environmentally-friendly practices (Dessart et al., 2019; Schaub et al., 2023; Wuepper et al., 2023). A key insight from this literature is that farmers' decisions to adopt sustainable practices are influenced by their neighbours' behaviours or opinions (Bostian et al., 2020; Di Falco et al., 2020; Moritz et al., 2023; Wang et al., 2023). Central to these decisions is the dissemination of information through the observation of peer choices and social interactions, which highlights the crucial role of peer influence in shaping agricultural practices.

Although related, the focus of our work differs from previous literature, since we explore how beliefs about peers shape individual decision-making about ES, accounting for the fact that farmers may hold inaccurate beliefs regarding descriptive social norms. Our work then speaks more generally to the literature on the role of beliefs about peers, showing that people's perceptions about others play an important role in a variety of settings, including energy saving behavior (Jachimowicz et al., 2018), protest participation (Cantoni et al., 2019), COVID-19 vaccination (Vriens et al., 2023; Angerer et al., 2024), and women's participation in the job market (Bursztyn et al., 2020). This literature has

[1] Social norms are standards of behavior or "informal rules" (Bicchieri et al., 2023) people experience in their daily life. These standards of behavior are notably shaped by beliefs about the behavior of others (d'Adda et al., 2020).

been summarized in Bursztyn and Yang (2022), which provides a meta-analysis of the empirical literature that examines perceptions about others. They show that individual attitudes or behaviors strongly correlate with beliefs about peers.

A common view among researchers is that individuals tend to hold biased beliefs about others (Bursztyn and Yang, 2022).[2] One explanation is that individuals make inferences about the state of mind of others by imagining themselves as those other people and using their personal beliefs as an heuristic to impute the beliefs of others. However, due to anchoring and adjustment heuristics, individuals may insufficiently adjust when imputing the beliefs of others. The result is that many individuals may hold biased beliefs about others and, in particular, systematically *over-represent* the incidence of similar beliefs to their own, and systematically *underestimate* the incidence of contrasting beliefs. Different types of biased beliefs about others have been documented in the literature in psychology. Among them are the *false consensus effect* (Ross et al., 1977), which describes the tendency of people to overestimate the commonness of their personal beliefs or behaviors, and the *bias blind spot* (Pronin et al., 2002), which refers to people's unawareness of their personal judgmental biases. In relation to the false consensus effect, scholars describe a *pluralistic ignorance effect* (Prentice and Miller, 1996; Bicchieri and Fukui, 1999), where most individuals hold some beliefs but mistakenly assume that others do not. The overall finding of the psychology literature is that there is a general egocentric bias in the way individuals make judgments about the beliefs of others, particularly the beliefs of people whom they perceive as similar.

Since elicited beliefs about others often arise as a result of the existence of large biases, a recent literature has focused on proposing information-based methods to re-calibrate these beliefs, and to assess the causal impact of the re-calibration process on individual behaviors. To exogenously vary respondents' beliefs, different types of information have been provided, including quantitative information (e.g., official statistics based on census data), and qualitative anecdotes (e.g., stories, narratives). The sources for information may vary, but in experiments that aim to change beliefs about others, researchers tend to provide respondents with information about the views of others as measured in other prior surveys (Bursztyn et al., 2020; Haaland et al., 2023). The re-calibration of beliefs has taken place in various contexts and for various types of behaviors, including inflation expectations (Coibion et al., 2023), expectation about others' participation in protests (Cantoni et al., 2019), the intention of others to vaccinate (Vriens et al., 2023; Angerer et al., 2024), and other's energy conservation behaviours (Jachimowicz et al., 2018).

In this work, we focus on the role played by the *misperception* of others' beliefs on the intention to adopt and implement eco-schemes by French farmers, including the associated monetary compensation. ES are new policy instruments proposed in the 2023 reform of the EU CAP, but that had not yet been implemented at the time our survey was designed and realized (at the start of 2021). ES take the form of yearly payments to farmers who voluntarily enrol in agricultural activities that are in line with the EU's climate objectives, environmental protection, and the transition towards a sustainable food system. The aims of ES are first, to reward farmers who manage their land in a nature- and climate-friendly way, and second, to incentivize the adoption of specific farming practices that have higher environmental and animal welfare benefits (Guyomard et al., 2020).

The main goal of our experiment is therefore to isolate the causal effect of variations

[2]Political scientists have documented the presence of biased beliefs about others in a large range of empirical domains including preferences for territorial return, nuclear weapons policy and electoral reform (Shamir and Shamir, 1997), unilateral foreign policies (Todorov and Mandisodza, 2004), and political polarization (Levendusky and Malhotra, 2016). A few works have focused on beliefs about others in the context of environmental policies (Schuldt et al. 2019).

in beliefs about peer farmers' perceptions regarding ES. To do so, farmers have been randomly exposed to different informational treatments wherein we have communicated truthful information on peers' beliefs that are intended to shift another farmers' own behavior regarding ES. A challenge we face is that such information on peers' perception of ES must be available prior to conducting our experiment. To solve this issue, a few weeks before implementing our experiment, we conducted a web-survey on a different sample of French farmers in which we measured farmers' perceptions regarding several dimensions of ES (Ouvrard and Reynaud, 2024). This allows us to provide truthful information in our experiment regarding peers' perceptions of ES, potentially affecting their personal perceptions of ES.

A first contribution of our work is to demonstrate that French farmers hold biased beliefs about peers regarding ES, with a strong tendency to underestimate the proportion of peers considering that ES would be beneficial for the environment, as well as the proportion of peers wishing to adopt the ES on their farms. For beliefs on the proportion of peers considering that ES would be good for the environment, the average bias ranges between -15.30 and -15.48 percentage points, depending on the considered ES, and more than two-thirds of the respondents have a negative bias. For beliefs on the proportion of peers wishing to adopt the ES, the average bias ranges between -27.75 and -30.93 percentage points, and more than 85 percent of respondents have a negative bias. On the contrary, farmers overestimate the minimum subsidy necessary to incentivize their peers to adopt ES by 55.56 to 64.38 euros per hectare, depending on the specific ES considered.

Our second contribution is to show that using norm-based informational treatments, it is possible to re-calibrate the inaccurate beliefs of farmers that have significant impacts on their behaviors. For instance, being shown the truthful beliefs of peers regarding benefits for the environment increases the likelihood of reporting benefits for the environment by 8.7 to 10.1 percentage point, depending on the ES under consideration. However, we note that the impact of re-calibrating beliefs about others on farmers' behaviors crucially depends upon the individual's perception gap. Although changes in beliefs are shown to be consistent with Bayesian-updating, we demonstrate that their causal effects may strongly depend upon the nature of the belief being considered.

A last contribution of our work is to provide an experimental design to study *cross-learning* effects induced by the re-calibration of beliefs about others. A recurring issue in information provision experiments is that respondents may not only update beliefs about the object of interest (beliefs about peers), but at the same time change their beliefs about other variables (Coibion et al., 2023). The existence of cross-learning effects raises some methodological issues, in particular in identifying the impact on a specific outcome of interest of exposing respondents to some information provision (Haaland et al., 2023). We analyze cross-learning effects by implementing an original experiment with a between-subject design: the individual behaviors of farmers regarding ES are measured only after different groups have received some specific information, while one control group does not receive any information. Equipped with this experimental setting, we show that providing information on the share of peers believing that an ES leads to environmental benefits not only modifies the personal perceptions of farmers on environmental benefits to be expected from an ES, but also has a significant impact on farmers' own intention to adopt the ES (or not) and on the monetary compensation requested by farmers. From a policy perspective, we identify various channels to design informational interventions aimed at promoting the adoption of sustainable practices among farmers. These interventions can effectively contribute to achieving the environmental goals outlined in the EU CAP.

The reminder of the paper is organized as follows. In Section 2, we provide some gen-

eral information about the context of our study. Section 3 presents the survey experiment. In Section 4, we document the existence among French farmers of biased beliefs about peers regarding ES. Section 5 highlights our main results regarding the re-calibration of beliefs, and we derive some policy implications. We conclude in Section 6.

2 European agri-environmental policy and eco-schemes

With a budget of around €60 billion in 2020, the EU CAP accounts for 35 percent of the total budget of the EU. The CAP is structured around market measures (stabilization of agricultural markets, management of market crises), rural development measures to address the specific needs of rural areas, and farmers' income support. In 2020, farmers' income support represented more than 70 percent of total CAP expenses. While initially centred on supporting production, farm income and rural development, the CAP has progressively integrated policy instruments to protect the environment. From 2014 to 2020, around €100 billion have been spent on encouraging farmers to engage in sustainable farming (European Court of Auditors, 2021) with expenses representing one-fourth of the CAP budget. Despite several important reforms (in particular in 1999 and 2003), the CAP has been highly criticized (Cullen et al., 2018). The limited enrolment of farmers and a lack of environmental ambition have been of particular concern (Pe'er et al., 2017).

Agri-Environmental Compensation Measures (AECM) (which is a type of payment for ecosystem services) have played a crucial role within the CAP as a means to mitigate the adverse environmental impacts of agriculture. While the characteristics of these measures have evolved with various CAP reforms, participation by farmers in AECM has consistently remained voluntary, typically involving a multi-year commitment. These measures have primarily aimed to enhance biodiversity (such as through improved habitat management) and to improve water and soil quality, albeit with only limited success to date. When preparing the 2023 CAP reform, European authorities recognized that EU agriculture was unlikely to achieve the established environmental objectives, particularly in terms of biodiversity preservation and climate change mitigation. Consequently, there has been a pressing need to enhance CAP governance by implementing enforceable targets that would require reporting and monitoring to ensure effectiveness.

In 2019, the European Commission released the Green Deal, a package of policy initiatives aiming to set the EU on the path towards a "green transition", with the ultimate goal of achieving carbon neutrality by 2050.[3] The Green Deal introduced eco-schemes as new policy instruments that "should reward farmers for improved environmental and climate performance including managing and storing carbon in the soil, and improved nutrient management to improve water quality and reduce emissions". Compared to AECM, ES were presented as a more flexible solution to directly compensate farmers who voluntarily adopted environmentally-friendly practices (Guyomard et al., 2020). Indeed, while farmers had to comply with several conditions to be eligible to AECM (in terms of practices and commitment over some years), with ES, farmers could: (i) receive direct compensation when adopting a given pro-environmental practice; (ii) receive payments higher than their direct costs; and (iii) commit to ES on an annual basis. This improved flexibility was intended to foster farmers' enrollment rates. In addition, a particularity of ES was the possibility offered to EU countries to customize them to specific national needs.

At the time we implemented our survey (beginning of 2021), there was considerable debate about ES in France; specifically, the French government had not yet decided

[3]See https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2019:640:FIN

whether or not ES would be accessible to French farmers (Runge et al., 2022). Examples of possible ES that were discussed in the French agricultural policy arena included the maintenance of permanent grassland, crop diversity, land dedicated to ecological focus areas, and limiting animal density when increasing livestock levels (Guyomard et al., 2020). Based on these existing discussions and our understanding of the CAP reform in preparation, we decided to focus our survey on two dimensions relevant in the French context: (i) the conservation of land dedicated to biodiversity protection; and (ii) the reduction of the use of pesticides. Since these two dimensions had already been tackled by some AECM, considering them in our proposed ES was reasonable so as to limit the risk of random answers by farmers due to a lack of knowledge or understanding.

3 Survey experiment

We present the survey used to assess the role of beliefs about peers regarding ES, and the randomized experiment implemented to evaluate whether a norm-based intervention may modify a respondent's opinions and beliefs about their peers in relation to ES.

3.1 Structure of the survey

The survey consists of five blocks (see Appendix A):

Block 1: General information. The first block contains general questions on age, gender, education, location, etc.

Block 2: Eco-schemes. The second block refers to ES. We elicit farmer's personal opinions and beliefs about their peers regarding the benefits to be expected from implementing ES, their intention to adopt ES, and their willingness to pay for ES.

Block 3: Farm characteristics. In the third block, we collect additional data regarding farm characteristics (agricultural surface, type of agricultural activities, environmental certification, etc.).

Block 4: Agri-environmental measures. The fourth block is devoted to the past uptake of agri-environment-climate measures by farmers in the context of the EU Common Agricultural Policy (CAP).

Block 5: Psychological traits. In this block, we use psychometric tests to assess the individual personality traits of farmers, including risk preferences, openness, etc. The fifth block is not mandatory for respondents who may skip it.

3.2 Proposed ES

For our analysis, the most important block is the second, dedicated to ES. Since, at the time of the survey (beginning of 2021), discussions around ES had just begun in the context of the CAP reform, the second block started with some general background information on ES (see Appendix A). In particular, we explain to respondents that within the framework of the CAP reform, ES were envisaged to support farmers who engage in practices that are highly beneficial to the environment. We highlighted that although discussions on ES were still ongoing, it was likely that requirements for an ES would go beyond those of conditionality and that farmers would participate on a annual voluntary basis. In what follows, we briefly describe the two ES proposed to French farmers.

Ecological Focus Areas (EFA ES) EFA correspond to dedicated land that is not actively farmed in order to tackle biodiversity loss, which is one of the key negative

externalities caused by agriculture (Hasler et al., 2022). In order to be eligible for the Green direct payments, farmers holding more than 15 ha of arable land were required to set 5% of their land apart (2.5% under specific conditions). In the EFA ES proposed in the survey[4], we use a more ambitious land threshold: to be eligible for this ES, at least 7% of the total area of arable land must be allocated to EFA, without any exemption on the farmers' land size (the 15 ha of arable land is no longer relevant). Moreover, catch crops, nitrogen/nitrate-absorbing crops, and buffer zones are no longer considered to be EFA. Farmers are then told that they will receive a payment (in €/ha) on an annual basis if an EFA is implemented and these conditions are met.

Treatment Frequency Index (TFI ES) Despite the implementation of different reduction plans, the volume of pesticides used in French agriculture has been globally stable over the last decade (Kahindo and Blancard, 2022). To address this issue, in our survey we propose an ES based on a voluntary commitment by farmers to significantly reduce their Treatment Frequency Index (TFI).[5] The TFI is an indicator that reflects the intensity of the use of plant protection products. It is computed as the mean quantity of pesticides used per hectare, weighted by the ratio of the quantity used over the recommended one (which therefore depends on the types of pesticide used). With our TFI ES, a farmer receives a monetary payment (in €/ha) for all the surfaces having a TFI lower than 30% compared to the regional average. Farmers' enrollment is annual, with regular compliance checks of the TFI.

It should be noticed that the two ES we proposed in our survey in 2021 are aligned with ES that have effectively been implemented in France in 2023. Interestingly, the threshold of 7% of land held apart for biodiversity protection included in our EFA ES has been chosen as one possible way for French farmers to benefits from ES.[6] Moreover, since 2023, French farmers may also be eligible for ES through environmental certification; a process highly related to low TFI indexes.

3.3 Eliciting opinion and beliefs about peers regarding ES

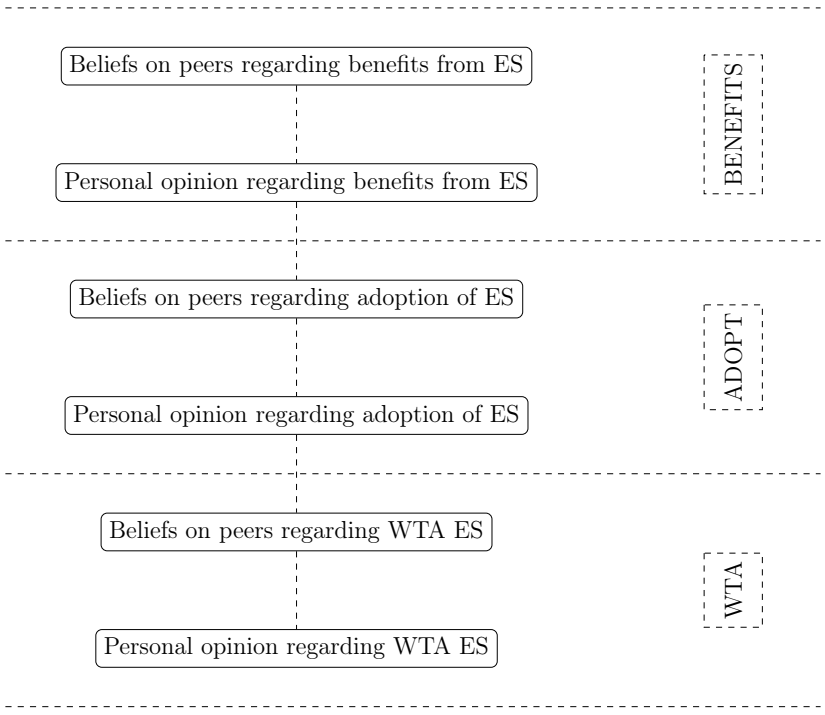
To elicit individual beliefs about ES, we use the introspection method that consists of asking farmers to report their beliefs without providing incentives (Charness et al., 2021). This method is widespread in surveys where incentives are difficult to implement, as is the case here. Since the introspection approach does not rely on effort-boosting extrinsic incentives, there is no guarantee that farmers will answer truthfully. While economists may express skepticism towards unincentivized methods, empirical studies have demonstrated that there is no conclusive evidence indicating that complex incentivized elicitation systematically outperforms introspection in experimental applications (Trautmann and van de Kuilen, 2015; Charness et al., 2021). Recent literature reviews on the design of experiments also provide little evidence that incentives matter for recovering the true underlying beliefs of respondents (Fuster and Zafar, 2023; Haaland et al., 2023). A problem of measurement error may occur if farmers deliberately bias their reports for strategic reasons. A particular concern could be that respondents may feel that they must answer in a specific socially-desirable way (social desirability bias). Given the context of our work

[4]The full name given to this ES was "Increasing ecological focus areas to preserve biodiversity".

[5]The full name given in the survey to this ES was "Reduced use of phytosanitary products to preserve aquatic ecosystems and human health".

[6]See https://agriculture.gouv.fr/les-paiements-directs-decouples

Figure 1: Structure of questions asked of farmers to elicit beliefs about ES



(the reform of the CAP), the use of a web-survey and the fact that we are working on a sample of farmers, we believe that the social desirability bias is limited in our study.

Figure 1 describes the sequence of questions asked for each ES. We elicit farmers' beliefs regarding three dimensions of ES: (i) the benefits to be expected from ES; (ii) the intention to adopt ES, and (iii) the willingness to accept (WTA) the ES. A rationale for considering the second dimension comes from the fact that the adoption of sustainable farming practices has been shown to correlate with the perception of environmental benefits (Beedell and Rehman, 1999; Ma et al., 2012; Schulz et al., 2014; Yeboah et al., 2015). Such a result is consistent with the Theory of Planned Behaviour, where perceived effectiveness may explain the acceptability of a particular behaviour (Ajzen, 1991). Ordering of the three parts in Figure 1 has been kept the same for all farmers, in particular since questions regarding WTA can only be asked once farmers have indicated that they are willing to adopt the ES.[7]

Block 2 of the survey starts with questions regarding environmental benefits to be expected from ES. We first focus on farmers' perceptions about their peers. We define peers as farmers located in the same administrative region of the respondent. Since some AECM of the CAP were already making reference to regional averages, farmers were compared to their peers, at this level. Moreover, the regional level is large enough (there are 13 regions in France) to allow us to abstract from the usual endogeneity issues due to using neighborhood variables. The selection bias which may exist when individuals choose their own peer group (Krishnan and Patnam, 2014) does not hold in our setting. More specifically, we use the following question to ask respondents to report their beliefs regarding the share of farmers in their region who they believe the proposed ES may be beneficial to the environment:[8]

[7]Ordering of benefits and adoption beliefs may be a concern due to a priming effect, but we expect this effect to be orthogonal to our treatment effects.

[8]In addition, farmers have been asked to report their beliefs on the share of farmers in their region

"*What percentage of farmers in your region believe that the proposed ES is beneficial to the environment?*".

Next, farmers have been asked to provide their personal opinion regarding the environmental benefits to be expected from implementing the proposed ES:

"*Do you think that the proposed ES is beneficial to the environment?*".

The second part of block 2 refers to the intention to adopt the proposed ES. Farmers have been asked to report their beliefs regarding the share of farmers in their region who would be ready to adopt the proposed ES:

"*Subject to receiving adequate financial support, in your opinion, what percentage of farmers in your region would be willing to implement this ES?*".

It is clear that the intention to adopt an ES depends on the monetary compensation provided to farmers. Since most of the French farmers have some experience in receiving CAP financial support, we expect them to be able to form reasonably precise expectations on CAP subsidies, and thus, also, on the adoption of ES by peers conditional on receiving these subsidies. We then elicit the own intention of farmers to adopt the proposed ES using the following question:

"*Subject to receiving adequate financial support, could you consider adopting this ES on your farm?*".

The third and last part of block 2 refers to farmers' WTA the proposed ES. To avoid anchoring or starting point biases, we use an open-ended WTA elicitation format. To elicit beliefs regarding the minimum subsidies that would induce peer farmers to adopt the proposed ES, we have used the following question:

"*Considering all costs involved in the ES but also the possible benefits, what is the minimum amount of money (€/ha) that would lead at least 50% of farmers in your region to implement this ES on their farms?*".

For simplicity reasons, we do not elicit the full distribution of beliefs on monetary compensations that may induce peer adoption. We focus on a particular point of the distribution; that is, on the minimum monetary compensation such that at least half of farmers located in the region of the respondent may adopt the proposed ES. Lastly, the own farmer's WTA ES has been elicited with the following question:

"*By considering all costs incurred by an ES for your farm but also benefits you could get from it, what is the minimum amount of subsidy (€/ ha) that would lead you to implement this measure on your farm?*".

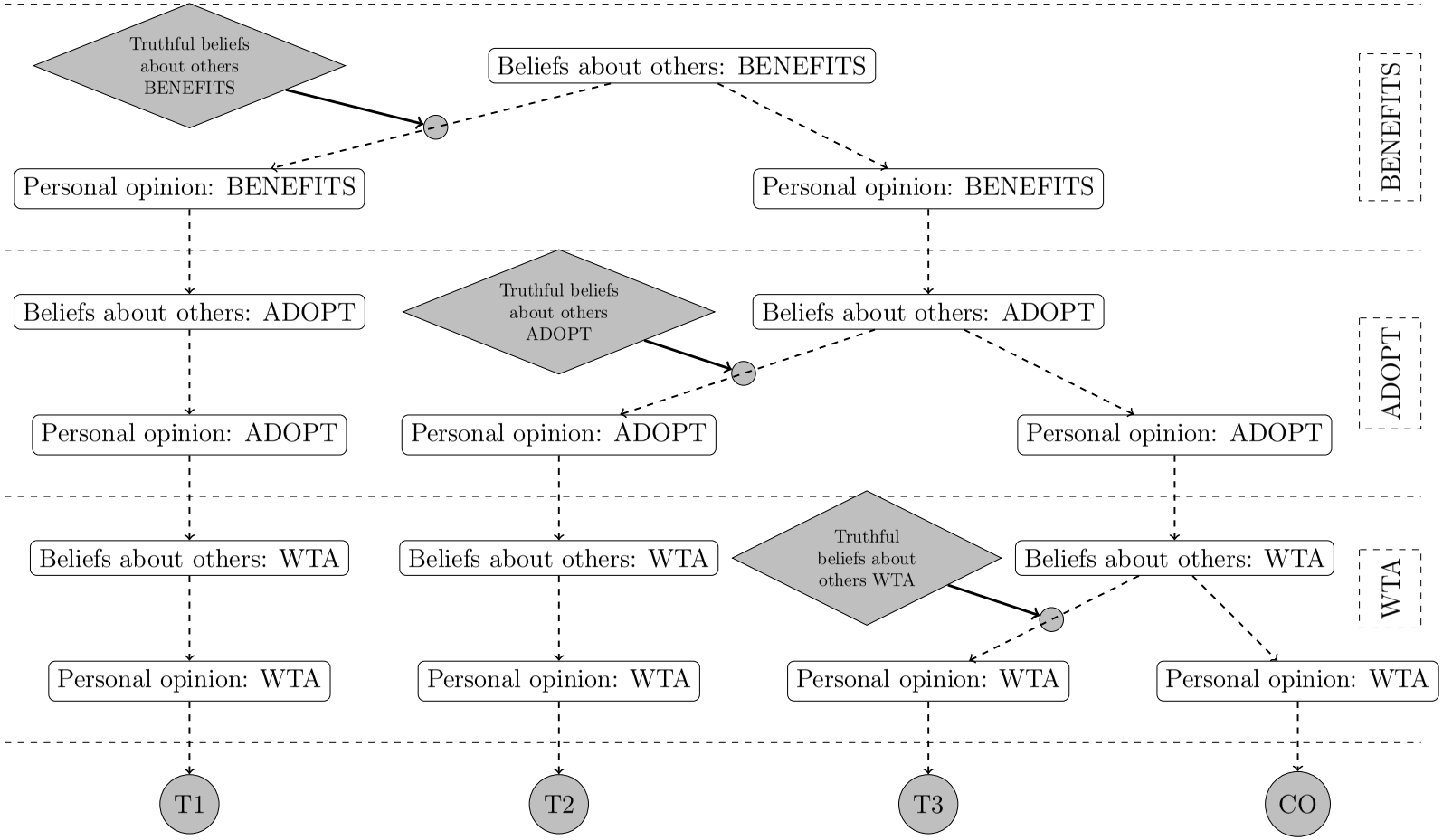
Notice that this last question has been asked only to respondents having reported that they were considering adopting this ES on their farm.

3.4 Informational treatments to re-calibrate beliefs about others

We use informational treatments to re-calibrate misperceptions about others, and to study the effect of providing respondents with (truthful) information about others on their personal opinions and behaviour.

who believe that ES may also provide benefits to society and to the wider population (see Appendix A).

Figure 2: Re-calibrating beliefs about other farmers with informational treatments



Although a within-subject design is known to be more powerful for studying heterogeneity in belief formation, we propose here a between-subject design, where farmers randomly assigned to different groups receive different kinds of informational treatments regarding their beliefs about others (see Figure 2). At the end of the first block of the survey, respondents have been randomly assigned to one of three information treatments (T1, T2 or T3), or to the control group. This design choice is motivated by two main reasons. First, since a within-subject design entails the elicitation of a belief twice (once before the information provision and once afterwards), it may raise some experimenter demand effects (Fuster and Zafar 2023). Moreover, it may cause some fatigue for farmers since the questionnaire is longer, therefore increasing the risk of attrition. More importantly, our between-subject design allows us to shed light on the *cross-learning* effects: providing information on the beliefs of peers may not only induce farmers to update their beliefs about their object of interest, but also change their beliefs regarding other outcome variables (Haaland et al., 2023).

Different sources of information can be used to build the true information displayed to respondents, including quantitative information (e.g., official statistics based on census data), and qualitative anecdotes (e.g., stories, narratives). Here we use the results of Ouvrard and Reynaud (2024) who conducted a prior web-survey on a different sample of 1,143 French farmers a few weeks before the current survey.[9]

In the prior-survey, farmers have been asked the same questions regarding ES but without being exposed to any informational treatment. The true information presented to farmers exposed to informational treatment corresponds to the regional means of the personal opinion of farmers measured in the prior-survey (i.e., to the objective descriptive norm). A rationale for exposing farmers to the objective descriptive norm comes from the fact that when taking decisions in a novel context, farmers may lack a clear understanding of how they *should* behave (i.e., the injunctive norm). In this case, the descriptive norm can serve as a powerful behavioral guide (Cialdini, 2007). Of course, the belief updating process depends on how credible the information provided to farmers is perceived by them to be (Haaland et al., 2023). In terms of INRAE, a public research institute well-known by French farmers, this is the way to ensure that the information-based treatment is "credible enough".

In T1, we provide to farmers additional truthful information on the proportion of farmers in their region who have declared that the ES may provide benefits for the environment (i.e., the objective descriptive norm). We focus on environmental benefits, since recent evidence has emphasized that perceived environmental benefits are a key determinant of individuals' willingness to accept public policies (Dechezleprêtre et al., 2022; Douenne and Fabre, 2022). To minimize concerns about demand effects, information provided to farmers was short and neutrally framed (Haaland et al., 2023).[10] Farmers in T1 are shown the following sentence:

> *"You have just indicated that you think that X% of farmers in your region (Y) think the measure is beneficial for the environment. In fact, a recent INRAE*

[9] Ouvrard and Reynaud (2024)'s work explores the patterns of misperception about peer farmers regarding ES using data from the *prior-survey*, and shows in particular that misperceptions correlate with personal opinion and behaviors of farmers. However, since Ouvrard and Reynaud (2024)'s work remains purely descriptive, no causal inference between misperception about peers and personal opinion and behaviors of farmers can be made.

[10] Recently Kuang and Bicchieri (2024) have indeed shown that individual compliance behaviors can be strongly affected by the way norms are presented to people.

study showed that Z% of farmers in your region (Y) think that this measure is beneficial for the environment".

X and Y were based on information reported by each farmer when answering previous questions. The crucial element of T1 is to expose farmers to the objective descriptive norm Z (i.e., to the true percentage of peer farmers located in his/her region considering that this measure is beneficial for the environment), and computed thanks to the prior survey.

In T2, farmers are provided with (truthful) information about the percentage of peer farmers intending to adopt the proposed ES, conditional on receiving adequate monetary compensation. In T2, farmers are shown the following sentence:

"You have just indicated that you think that X% of farmers in your region (Y) would be willing to adopt this measure. In fact, a recent INRAE study showed that Z% of farmers in your region (Y) would be willing to adopt this measure."

Again X and Y were based on information reported by each farmer when answering previous questions, whereas Z was based on regional means of their own intention to adopt ES as measured in the prior survey.

In T3, we provide to farmers (truthful) information about the minimum subsidies required by peer farmers to implement ES. In T3, farmers are shown the following sentence:

"You have just indicated that, for you, the minimum aid that would lead at least 50% of farmers in your region (Y) to implement this measure should be X€/ha. In fact, a recent study by INRAE showed that at least 50% of farmers in your region (Y) would implement this measure if the subsidy was Z€/ha."

In T3, X and Y are based on farmers' previous answers to the survey, whereas Z is computed using the responses of farmers collected in the prior survey.

Lastly, no additional (truthful) information about peers is provided to farmers in the control group (CO). Regional data used to re-calibrate farmers' beliefs in the three treatments are presented in Appendix B.

3.5 Identifying causal effects of informational treatments

Since the truthful information on beliefs about others is provided to farmers *before* asking them to report their personal opinion regarding ES, we can then assess the *direct effect* of re-calibrating beliefs about others for a particular dimension (benefits, adoption, WTA) on the corresponding personal opinion of farmers.

Finding a difference in terms of the share of farmers who do believe that adopting an ES may lead to environmental benefits should only be imputable for the information-based re-calibration treatment. This difference is observed between those farmers who *are exposed* to the truthful regional share of farmers sharing this view (T1) and farmers who are *not exposed* to this information or to any other informational treatment (T2, T3 and CO), Similarly, finding a difference in terms of the share of farmers intending to adopt an ES should only be imputable for the information-based re-calibration treatment. Again, this difference is observed between farmers who *are exposed* to the truthful regional share of farmers intending to adopt (T2) and those farmers who are *not exposed* to this

Table 1: Causal effects of informational treatments on outcome variables

Treatment	Information provided in treated group	Outcome variable	Extended control group
Direct effects: beliefs about others → personal opinion (same dimension)			
T1	beliefs about others benefits	personal opinion benefits (0,1)	T2, T3, CO
T2	beliefs about others adoption	personal opinion adoption (0,1)	T3, CO
T3	beliefs about others WTA	personal opinion WTA (€/ha)	CO
Cross-learning effects: beliefs about others → personal opinion (other dimension)			
T1	beliefs about others benefits	personal opinion adoption (0,1)	T3, CO
T1	beliefs about others benefits	personal opinion WTA (€/ha)	CO
T2	beliefs about others adoption	personal opinion WTA (€/ha)	CO
Cross-learning effects: beliefs about others → beliefs about others (other dimension)			
T1	beliefs about others benefits	beliefs about others adoption (%)	T2, T3, CO
T1	beliefs about others benefits	beliefs about others WTA (€/ha)	T3, CO
T2	beliefs about others adoption	beliefs about others WTA (€/ha)	T3, CO

information, or to any other informational treatment (T3 and CO). Lastly, any difference in terms of the average WTA ES between farmers who *are exposed* to the truthful regional average WTA (T3) and those farmers who are *not exposed* to this information (CO) should only be imputable for the information-based re-calibration treatment.

Our particular design also allow us to identify two types of *cross-learning* effects. First, we may identify the causal effects of showing the truthful information regarding beliefs about others in terms of a particular dimension (such as benefits, adoption, and WTA) on the personal opinion of farmers for another dimension (see the second part in Table 1). Finding a difference in terms of intention to adopt an ES between farmers in T1 (i.e., farmers exposed to truthful information about peers regarding benefits to be expected from ES) and farmers in T3 and CO (i.e., farmers not exposed to any informational treatment) should be only imputable for the information-based re-calibration treatment. Similarly, our design allows us to identify the causal effect of information on peers presented in T1 and T2 on the personal opinion of farmers regarding the WTA to implement an ES.

Second, our design also allows us to identify the presence of another type of *cross-learning* effect: we can establish the causal effect of re-calibrating beliefs about others in one dimension on beliefs about others in another dimension (see the third part in Table 1). Such an effect is *a priory* plausible. For instance, a farmer exposed to the true share of peer farmers indicating their intention to adopt an ES may update his/her beliefs regarding their peers' WTA this ES. Finding a difference in terms of beliefs about peers regarding the adoption of ES between farmers in T1 (exposed to true beliefs about peers regarding benefits to be expected from ES) and farmers in T2, T3 and CO (not exposed to any informational treatment) should be imputable for the information-based re-calibration of beliefs about peers regarding benefits to be expected from ES. Similarly, our design allows us to identify the causal effect of being exposed to information about peers in T1 and T2 in relation to the beliefs about peers regarding their WTA an ES.

3.6 Data collection

The data collection relies on an online survey designed with the platform LimeSurvey (version 2.5). The study has been approved by the Institutional Review Board of the Toulouse School of Economics (TSE), and has been pre-registered on the AEA RCT Registry (ID AEARCTR-0007020).[11] In accordance with the General Data Protection Regulation of the European Union, a consent page was included in the study informing respondents that they are free to participate in, or, on the contrary, to leave the survey at any time (see Appendix A).

We contracted with the pool company BVA[12] to attain access to a large database of information on French farmers. Using an online survey with French farmers is relevant since 79 percent of farmers used internet in 2016.[13] Following a pre-test of the online survey on a sample of 2,000 farmers, invitations to the final survey were sent by email from 19 February to 26 March 2021 to 59,000 French farmers. The link for the questionnaire was sent to farmers along with an introductory e-mail explaining that the study had been designed by the French Institute for Agricultural Research (INRAE), (see Appendix A).

A total of 3,676 farmers followed the link provided in the invitation email, which represents about 6.2 percent of the initial sample. Among the 3,676 farmers who connected to our survey, 3,614 completed the first block and 2,997 provided an answer to the first question of the second block dedicated to ES. A total of 617 farmers dropped out between the end of block 1 and the completion of the first question in block 2 (a dropout rate equal to 17.07 percent). Although this dropout of respondents is not surprising, there may be an issue of self-selection of farmers since the beginning of block 2 was devoted to explaining to farmers the context of the last CAP reform, with a specific focus on ES. There may be a concern if farmers who have decided to drop out from the survey share some specific characteristics. To explore this issue, we estimated a Logit model to predict dropout between the end of block 1 and the completion of the first question in block 2. With the exception of gender and education level, none of our observable variables are significant to explain the dropout rates between the end of block 1 and the completion of the first question in block 2.[14] Finally, 2,206 farmers completed the survey (the last block of the survey was not mandatory to complete).

We present farmers' individual characteristics in Appendix D (see Table D.1). We also conduct balancing tests to compare farmers' individual characteristics between treatments in Table D.2. We do not detect any statistically significant difference between treatments, except for farmers' locations (at the 5% level). Therefore, and abstracting from location, our sample remains well balanced in terms of observables between treatments.

4 Evidence of biased beliefs about peers regarding ES

In this section, we analyze farmers' personal opinions and beliefs about peers regarding benefits to be expected from the ES, the intention to adopt ES, and their willingness to accept the ES. We demonstrate that farmers do hold inaccurate beliefs regarding their peers, and we investigate the patterns of these misperceptions.

[11] https://doi.org/10.1257/rct.7020-1.0

[12] https://www.bva-group.com/

[13] See https://agriculture.gouv.fr/infographie-les-chiffres-cles-de-lagriculture-connectee

[14] Results are available from authors upon request.

4.1 Defining and measuring misperceptions about others

In order to show that farmers have biased perceptions about others regarding ES, we require two key pieces of information: (i) a measure of farmers' beliefs about their peers regarding ES; and (ii) a truthful measure (the observed distribution of farmers' personal opinions in our case) that we can compare with their beliefs about their peers.

To measure farmers' beliefs about their peers (i.e., the perceived descriptive norms), we rely on the set of questions presented in Figure 1. We denote $belief_{ir}(y_j)$ the beliefs about peers regarding outcome y_j (environmental benefits from ES, the intention to adopt ES, and WTA for ES) for farmer i located in region r. For the truthful measure (i.e., the objective descriptive norms), we rely on the self-reported opinions of farmers. We denote $personal_{ir}(y_j)$ the personal opinion of farmer i located in region r regarding outcome y_j. For a given outcome, we then compute the regional average of farmers' personal opinions, which we consider in our setting as the truthful regional information. The truthful regional information for outcome y_j in region r is denoted $personal_r(y_j)$.

These two items of information allow us to measure the *perception gap* (Cortés et al., 2022). Formally, we define perception gaps about others as follows:

$$PG_{ir}(y_j) = belief_{ir}(y_j) - personal_r(y_j), \tag{1}$$

where $PG_{ir}(y_j)$ is farmer i's perception gap in region r regarding outcome y_j (j denotes either perceived environmental benefits, the intention to adopt, or the WTA). The perception gap is negative (resp. positive) if farmers underestimate (resp. overestimate) their peers' opinions. If farmers are perfectly informed about the beliefs of other farmers regarding ES, their beliefs about others exactly match the observed distribution of their personal opinions regarding ES, and the perception gap is null.

For each ES, Table 2 reports farmers' beliefs about their peers, truthful information (the average of farmers' personal opinions), as well as the associated perception gaps. Results are based on the extended control group samples only; that is, on farmers who have not been shown any information regarding the true beliefs of their peers when answering the different survey questions.

Table 2: Farmers' beliefs, personal opinions and perception gaps regarding ES

	Benefits env.			Adopt			WTA		
	Beliefs peers	Personal opinion	Gap	Beliefs peers	Personal opinion	Gap	Beliefs peers	Personal opinion	Gap
	%	%	%	%	%	%	€	€	€
ES EFA	37.69	51.31	-13.61***	36.12	66.40	-30.28***	443.76	385.36	58.40***
ES TFI	45.61	59.30	-13.69***	36.96	62.45	-25.49***	395.10	339.48	55.61***

For the EFA and TFI ES, this table presents the average of farmers' beliefs about their peers, the average truthful information (average of farmers' personal opinions), as well as the average perception gaps for the three dimensions of ES (existence of environmental benefits, the intention to adopt, and WTA). Descriptive statistics are based on extended control groups; that is, on farmers who have not been exposed to an information-based treatment before answering the different questions of the survey (CO, T2 and T3 for environmental benefits, CO and T3 for the intention to adopt, and CO for the WTA). Farmers believe that 37.69% of their peers consider that ES EFA may deliver environmental benefits, whereas the true percentage is 51.61%. The resulting average perception gap is -13.61%.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ (Paired T-test)

4.2 Personal opinion of farmers regarding ES

We first focus on farmers' personal opinions presented in Table 2. A majority of farmers consider that the proposed ES may generate environmental benefits (51.31 and 59.30 percent for the EFA and TFI ES, respectively). In the regional analysis conducted in Appendix E, we document a considerable heterogeneity across French regions. The percentage of farmers indicating that the EFA ES may deliver benefits for the environment varies from 40 percent in the Centre-Val de Loire region to 61 percent in the Bourgogne-Franche-Comté region. For the TFI ES, the percentage varies from 45 percent in the Île-de-France region to 69 percent in Normandie. This indicates that farmers have accounted for their local context when providing their opinion on environmental benefits to be expected from ES, with low environmental benefits being associated with intensive agricultural regions producing field crops (such as Centre-Val de Loire, and Île-de-France).

We also show that intention to adopt the ES is high (66.40 percent of farmers report that they intend to adopt the EFA ES and 62.45 percent of them intend to adopt the TFI ES), with the average WTA for the ES equal to €385.36/ha and €339.48/ha for the EFA and TFI ES, respectively. Interestingly, the elicited WTA are consistent with the existing rules for AECM payments in the CAP.[15] Moreover, since setting aside some agricultural land for environmental purposes is known to be more costly for farmers than reducing the use of pesticides (as proposed in the ES TFI), it is not surprising to find a higher WTA for the EFA ES. Regional disparities regarding the intention to adopt ES and WTA ES are also documented in Appendix E.

To get a sense of the accuracy of the elicited personal opinion of farmers regarding ES, in Appendix F, we conduct a series of tests to demonstrate the existence of some expected associations between farmers' personal opinions regarding ES and some of their relevant characteristic and past behaviours. The signs of these associations are in line with our prior expectations.

4.3 Beliefs about peers and perception gaps regarding ES

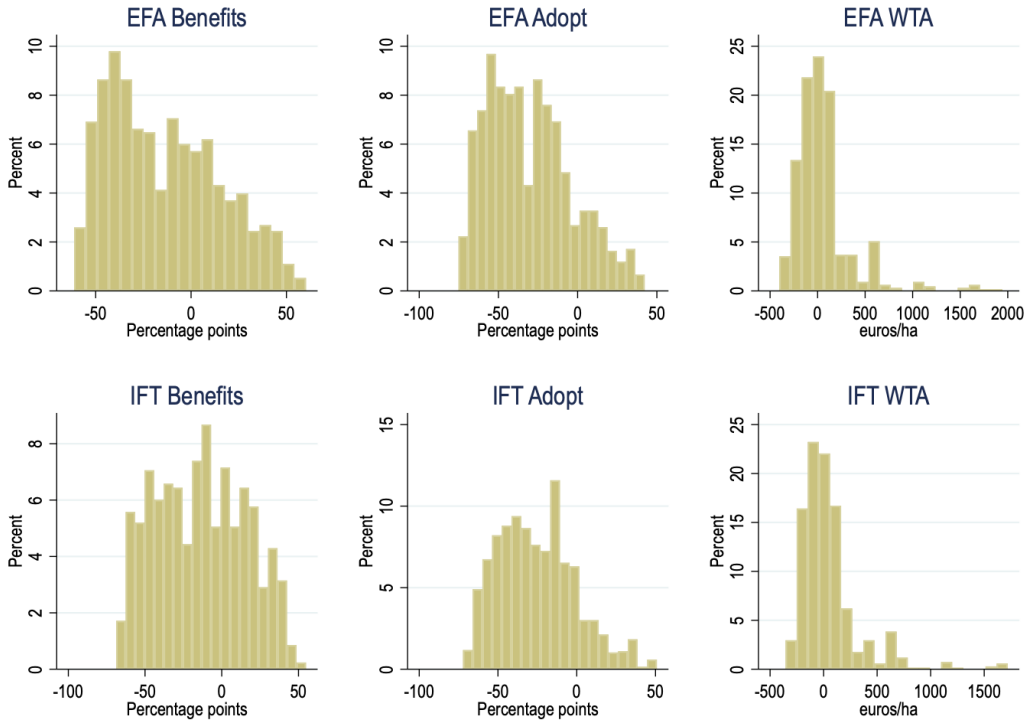
We now show that biased beliefs are widely represented among French farmers. This will be the main rationale for proposing that farmers re-calibrate their personal beliefs about their peers.

Table 2 documents that farmers systematically under-estimate the proportion of their peers who believe that the two ES may benefit the environment (they believe that 37.69 and 45.61 percent of their peers consider that, respectively, the EFA and TFI ES may benefit the environment), and who may adopt them (they believe that 36.12 and 36.96 percent of their peers may adopt the EFA and TFI ES, respectively). On the contrary, farmers systematically over-estimate their peers' WTA to implement the ES.

Conducting paired T-tests, we detect a significant perception gap at the 1% level for both the perceived environmental benefits and the intention to adopt. The perception gaps are important in levels, representing -13.61 and -13.69 percentage points for environmental benefits to be expected from the EFA and TFI ES, respectively, to -30.28 and -25.49 percentage points for the intention to adopt the EFA and TFI ES, respectively. For the WTA, the average perception gaps for the EFA and TFI ES are €58.40/ha and €55.61/ha, representing 15.15 and 16.38 percent, respectively. In Appendix E, we show that perception gaps are substantial in size and widespread throughout all French regions.

[15] Annex I of Regulation (EU) no. 1698/2005 and Annex II of Regulation (EU) no. 1305/2013 indeed stipulate that AECM annual payments may not exceed €600/ha for annual crops, €900/ha for specialized perennial crops and €450 €/ha for other land uses.

Figure 3: Distribution of perception gaps for ES EFA and TFI



To further characterize farmers' misperceptions, we plot in Figure 3 the distribution (in France) of farmers' perception gaps about environmental benefits, the intention to adopt and the WTA for each ES. In line with the existing literature, we find that misperceptions about others are very asymmetric, beliefs being disproportionately concentrated on one side relative to the truth (Bursztyn and Yang, 2022). In particular, 69.71 and 66.95 percent of respondents express a negative perception gap regarding the environmental benefits of the EFA and TFI ES, respectively. The percentage of farmers with negative gaps increases to 85.32 and 86.88 percent for the intention to adopt the EFA and TFI ES. Lastly, 64.34 and 61.98 percent of respondents express a positive perception gap regarding the WTA to implement the EFA and TFI ES, respectively.

Result 1: Perception gaps are large, asymmetric, and widespread among farmers. In particular, farmers underestimate their peers' beliefs about environmental benefits and their intention to adopt regarding the two ES. On the contrary, they overestimate their peers' WTA for implementing the ES.

These descriptive results are in line with the existing literature, and in particular with Bursztyn and Yang (2022), who reports that "misperceptions about others are asymmetrically distributed, and such asymmetry is large in magnitude".

There may however be some concerns with our results if the biases we report are simply due to: (i) noises when respondents report their perceptions about others; and (ii) farmers' strategic behaviors when responding to the survey. We believe that some specific patterns of the perception gaps rule out these possible explanations. First, the patterns of perception gaps that we have described (in particular, the large proportion of farmers with strong negative biases) suggest that symmetric noises may be unable to account for

the observed misperceptions. In addition, we show in Appendix H that perception gaps are associated with some attitudes and characteristics of farmers, which suggests that the elicited misperceptions are not random and, on the contrary, capture some meaningful variations across respondents.

Second, we believe that perception gaps are unlikely due to the strategic behaviors of respondents when responding to the survey. To elicit farmers' beliefs, we have used the introspection approach, which involves asking respondents about their beliefs regarding others without any reward for the accuracy of their response. Since this method is not truth-telling incentive compatible, respondents may not report their personal beliefs, especially if they have strategic motivations for doing so. However, recent evidence in the literature has emphasized that introspection methods do not under-perform compared to more elaborate methods of eliciting beliefs (Trautmann and van de Kuilen, 2015; Charness et al., 2021). We also expect limited effects from the strategic behaviors of farmers, since we explicitly mention at the beginning of the survey that the study was carried out by INRAE (a public research institute in France, well-known by farmers), and that it was only for research purposes.

On the contrary, there are several psychological biases that may provide predictions consistent with some patterns of the perception gaps we have found (in particular, asymmetry). Among them is the *theory of stereotypes*, where beliefs are systematically shifted towards the direction that are more representative in the tail likelihood (Bordalo et al., 2019; Coffman et al., 2023). Other possible mechanisms at play are the *false consensus effect* (Ross et al., 1977), which corresponds to people tending to overestimate the commonness of their personal beliefs or behaviors; and the *bias blind spot effect* (Pronin et al., 2002), which refers to a person's unawareness of their personal judgmental biases.

5 Effects of re-calibrating beliefs about peers

The biases we have documented on farmers' beliefs about their peers regarding ES suggest a potential role for information provision to correct these misperceptions. In this section, we report the effects of information-based treatments on different outcomes of interest.

5.1 Direct effects of informational treatments

We now document that providing truthful information on beliefs about peers may modify farmers' personal opinions regarding perceived environmental benefits of the ES, the intention to adopt the ES, and the associated WTA to adopt.

Table 3 reports the average treatment effects. We also split farmers into sub-samples depending on their perception gap; that is, on the difference between beliefs about others and the true information about peers (only shown to farmers in the treated groups). The perception gap categories starts from beliefs about others below the true regional average by more than 50% ("more than 50% below"), and moves to beliefs about others above the true regional average by more than 50% ("more than 50% above"). The proposed categories therefore allow us to assess the heterogeneous effects of the informational treatments depending on the magnitude of farmers' perception gaps.

Table 3 reveals that the average impacts of the information-based treatments on farmers' personal opinion regarding ES are not consistent across outcome variables (perceived environmental benefits, intention to adopt, and WTA). The average share of farmers indicating that the EFA ES provides some benefits to the environment increases from 51.31 percent without treatment to 58.49 percent for farmers exposed to the true share of peers

Table 3: Direct effects of treatments on opinions and behaviors of farmers

Sample	EFA ES			TFI ES		
	Treated	Extended Control	T-test	Treated	Extended Control	T-test
Average percentage of farmers considering that an ES provides environmental benefits						
	T1	T2,T3,CO		T1	T2,T3,CO	
Full sample	58.50%	51.32%	-3.23***	66.97%	59.31%	-3.54***
By perception gap						
more 50% below	25.90%	18.73%	-2.47**	31.94%	23.57%	-2.47**
50% to 25% below	61.36%	46.36%	-1.93*	72.83%	59.70%	-2.26**
25% to 0% below	80.00%	64.45%	-2.44**	79.33%	70.08%	-2.15**
0% to 25% above	78.64%	73.46%	-1.03	90.91%	84.07%	-1.59
25% to 50% above	83.56%	80.61%	-0.55	88.41%	89.39%	0.23
more 50% above	90.00%	91.10%	0.31	96.30%	92.79%	-0.93
Average percentage of farmers intending to adopt an ES						
	T2	T3,CO		T2	T3,CO	
Full Sample	64.62%	66.41%	0.79	63.88%	62.46%	-0.61
By perception gap						
more 50% below	46.43%	47.99%	0.45	40.40%	38.85	-0.39
50% to 25% below	69.32%	75.00%	1.00	61.03%	71.86%	2.21**
25% to 0% below	81.29%	82.35%	0.26	77.50%	80.14%	0.65
0% to 25% above	88.89%	90.48%	0.33	84.15%	88.64%	0.94
25% to 50% above	96.77%	93.42%	-0.68	94.12%	83.33%	-1.52
more 50% above	79.17%	85.25%	0.67	70.83%	76.32%	0.54
Average minimum subsidy (€/ha) inducing farmers to adopt an ES						
	T3	CO		T3	CO	
Full Sample	449.14	446.06	-0.19	382.93	386.92	0.29
By perception gap						
more 50% below	277.49	166.76	-5.75***	193.40	145.42	-2.81***
50% to 25% below	326.78	280.98	-3.72***	282.85	233.48	-5.33***
25% to 0% below	406.21	358.24	-3.17***	331.78	305.58	-3.14***
0% to 25% above	449.46	442.49	-0.38	381.15	386.79	0.55
25% to 50% above	502.00	555.45	2.26**	448.73	491.61	3.36***
more 50% above	841.60	956.99	1.78*	658.62	825.19	3.15***

This table provides an analysis of the effect of the three information-based treatments on corresponding farmers' opinions, depending upon their perceived beliefs relative to the true information from peers provided in the treatment groups (perception gap). Treated farmers correspond to those who are exposed to the true regional information regarding the share of peers believing that an ES provides environmental benefits (T1), the share of peers wishing to adopt the proposed ES (T2), and the minimum subsidy, such as 50%, of peers willing to adopt an ES (T3). ***, ** and *: difference between treated and control is significant at 1, 5 and 10%.

believing that this ES provides environmental benefits (p-value < 0.01). A similar result is found for the TFI ES, with the average share varying from 59.31 to 66.97 percent (p-value < 0.01). On the contrary, the average share of farmers indicating a positive intention to adopt an ES is unaffected when they are shown the true regional information regarding the percentage of peers wishing to adopt the proposed ES (T2). Similarly, the average minimum subsidy resulting in adoption of an ES by 50% of peers is unaffected by being shown the true regional information regarding the minimum subsidy, such as 50% of peers willing to adopt an ES.

A possible explanation for the absence of significant effects of T2 and T3 on the corresponding personal opinions of farmers could be that the impact of re-calibrating beliefs about others differs depending upon individual perception gaps. If farmers with subjective beliefs about others below the true average update their personal opinion upward, while farmers with subjective beliefs about others above the true average update their personal opinion in the opposite direction (downward), the average total impact of the informational treatments may then not be significant.

We explore further this issue in Table 3 by splitting farmers in sub-samples depending upon their perception gap. The percentage of farmers considering that the EFA ES provides environmental benefits is significantly higher for farmers exposed to T1 (true information about peers regarding environmental benefits from EFA ES), but only for farmers presenting negative beliefs perception gaps. The magnitude of the impact of T1 is high. For instance, 61.36 percent of farmers underestimating by 25% to 50% the share of peers who consider that EFA ES may provide environmental benefits, declare themselves that the EFA ES may provide environmental benefits when they are exposed to T1, whereas the percentage drops to 46.36 percent for farmers belonging to the extended control group. We document a similar effect of T1 when considering the TFI ES. Overall, farmers who learn that their peers are more optimistic regarding the environmental benefits of ES than they thought they were (negative perception gap) seem to update their beliefs upwards, which increases their own likelihood of perceiving environmental benefits (positive treatment effect).

The results we obtain for the minimum subsidy incentivizing farmers to adopt an ES are particularly informative to better understand the belief-updating processes used by farmers. It appears that most farmers exposed to T3 revise their personal opinions, however the magnitude of this process depends upon the sign of the perception gap. The minimum subsidy requested by a farmer to implement an ES (either EFA or TFI) increases for farmers who learn with treatment T3 that their peers request a higher subsidy than they thought (negative perception gap: <50%, [50%,25%], [25%, 0%]). On the contrary, the minimum subsidy requested by a farmer to implement an ES (either EFA or TFI) decreases for farmers who learn with treatment T3 that their peers request a lower subsidy than they thought (positive perception gap: [25%,50%], >50%). These empirical facts are consistent with a Bayesian updating process in which farmers revise their personal perceptions using information about their peers.

We complement our statistical analyses by estimating econometric models that aim to quantify the influence of our informational treatments on the outcome variable of interests (personal opinion of farmers regarding ES). We first consider an homogeneous treatment model of the form:

$$personal_i(y_j) = \sum_{k=1}^{K} \{\alpha_k \times I\{i \in PG(y_j)_k\} + \beta \times I\{i \in T_t\} + \epsilon_i \quad (2)$$

where i denotes the respondent, the dependent variable is the personal opinion of farmers

for the outcome variable of interest y_j, $I\{i \in PG(y_j)_k\}$ is an indicator variable if respondent i belongs to class k of the perception gap for outcome variable y_j, $I\{i \in T_t\}$ is an indicator variable if respondent i belongs to the informational treatment $t \in \{1, 2, 3\}$, and ϵ is an error term. This homogeneous treatment model is consistent with Bayesian updating in which respondents form their personal perceptions as a combination of their beliefs about others (embedded in the perception gap) and from the signals they receive (conveyed by the informational treatment).

The homogeneous treatment model however assumes that the Bayesian updating process is the same for all respondents, and in particular that it is unrelated to individual perception gaps. We relax this assumption by considering an heterogeneous treatment model of the form:

$$personal_i(y_j) = \sum_{k=1}^{K} \{\alpha_k \times I\{i \in PG(y_j)_k\}\} + \sum_{k=1}^{K} \{\beta_k \times I\{i \in PG(y_j)_k\} \times I\{i \in T_t\} + \epsilon_i \quad (3)$$

which allows the coefficient of the treatment to vary depending on the class of perception gap to which a respondent belongs. In Equation (3), the coefficients $\beta'_k s$, which capture the extent of belief updating toward the provided signal among respondents in the treatment group, are usually interpreted as *learning rates* (Haaland et al., 2023).

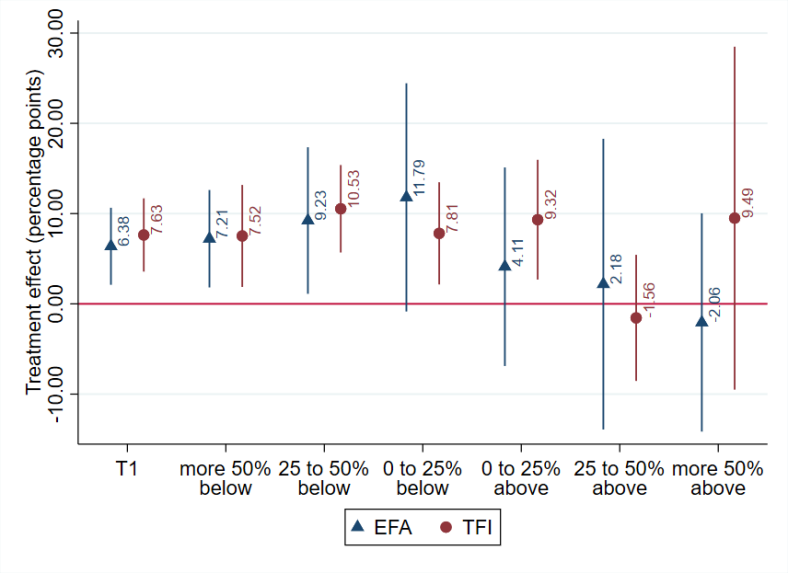
This heterogeneous analysis by belief perception gap is particularly important as it is often viewed as evidence that the observed treatment effects are driven by genuine changes in beliefs and not by confounding factors such as priming (Haaland et al., 2023). Since treated farmers with beliefs about others below the truth are expected to update their personal perceptions upward, we expect positive $\beta'_k s$ for them. On the contrary, negative $\beta'_k s$ are expected for respondents with positive perception gaps. The informational signal transmitted by our treatment to farmers having a perception gap around zero is limited. For these farmers, we do not expect to find significant $\beta'_k s$. Different psychological mechanisms may explain this type of belief updating process. For instance, farmers may seek to conform to the norm if they believe that others will conform to it as well, as is the case in models of normative expectations (Sugden, 2000). In that case, displaying the true beliefs of peers may allow farmers to build more accurate subjective beliefs about others.

We estimate the homogeneous and the heterogeneous treatment effect models by including regional fixed effects. Since the two first outcome variables are binary (the existence of environmental benefits to be expected from ES and the intention to adopt the ES), we estimate Probit models. For the WTA, OLS have been estimated. In the heterogeneous treatment model, we have split farmers into six sub-samples, depending on the perception gap; that is, based on the difference between individual beliefs about others and the true regional average (shown to farmers in the treated group).

We start our analysis by focusing on the direct effect of showing to farmers the true share of peers believing that ES provide environmental benefits (T1) on farmers' personal opinion regarding environmental benefits. Estimates of the homogeneous treatment effect and the heterogeneous treatment effect models are provided in Appendix I in Table I.1. We provide in Figure 4 the effect of T1 on the probability of a farmer indicating that the EFA and TFI ES provide environmental benefits.

In the homogeneous treatment effect model, the information-based treatment increases the probability of a farmer considering that the ES will provide environmental benefits by 6.38 and 7.63 percentage points for the EFA and TFI ES, respectively. The increase in probability is significant in magnitude given that in the control group 51.32 and 59.31 percent of farmers declare that the proposed ES provides environmental benefits for the

Figure 4: Effect of T1 on personal opinion of farmers regarding ES environmental benefits



This figure reports the effect (in percentage points) of being exposed to the true share of peers believing that ES provide environmental benefits (T1) on the probability of a farmer indicating that the ES provides environmental benefits. Treatment effects come from Probit regressions of the outcome variable (the probability for a farmer to indicate that the ES provides environmental benefits). Confidence intervals and point estimates are provided for the homogeneous treatment model ("T1") and for the heterogeneous treatment model for which interaction terms between T1 and perception gap classes are reported (from "more than 50% below" to "more than 50% above"). The treated group (T1) is compared to the extended control group (T2, T3,CO). 95% confidence intervals are reported.

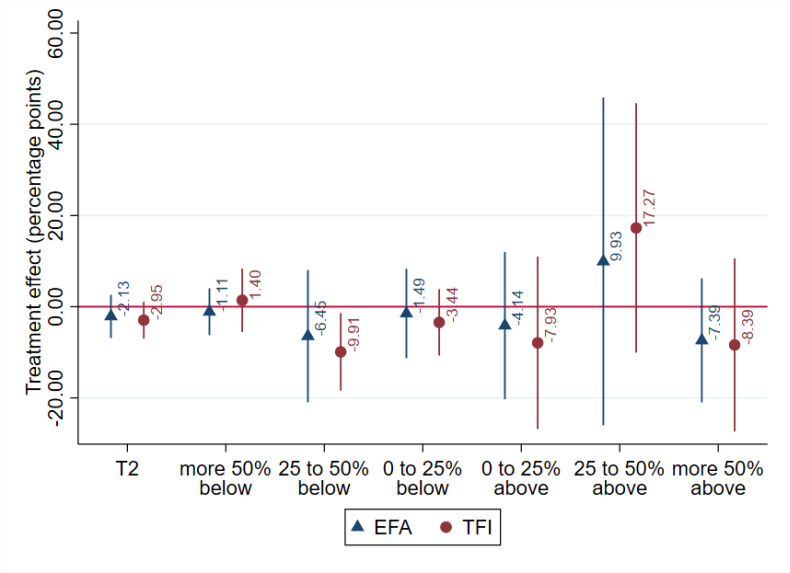
EFA and TFI ES, respectively.

We also explore in Figure 4 whether the treatment effect depends upon the magnitude and the size of the belief perception gap (heterogeneous treatment effect model). We find a very asymmetric treatment effect, with the impact of T1 crucially depending upon the fact that farmers hold negative or positive belief perception gaps. More precisely, farmers who learn that their peers are more optimistic regarding environmental benefits of ES than they thought (negative perception gap), update their beliefs upwards. This then increases their own likelihood of perceiving environmental benefits (positive treatment effect). The magnitude of the treatment effect can be high, up to 10.53 percentage points for the TFI ES and for the belief perception gap category "25 to 50% below". On the contrary, no significant effect of T1 is found for farmers holding a positive perception gap: farmers who learn that their peers are less optimistic than they thought regarding the environmental benefits of ES do not modify their own perception of environmental benefits to be expected from the ES.

Regarding environmental benefits to be expected from ES, farmers then tend to *asymmetrically* update their beliefs: when exposed to the true information on peers, only farmers presenting a negative perception gap update their prior beliefs. We may relate this result to the literature showing that people do not process information in the same way when they receive *good* news or *bad* news (Eil and Rao, 2011). Holding a negative perception bias may be considered by farmers as good news, since it means that farmers have been too pessimistic regarding the environmental perception of their peers.

We now turn to the direct effect of showing to farmers the true share of peers wishing

Figure 5: Effect of T2 on farmers' intention to adopt ES

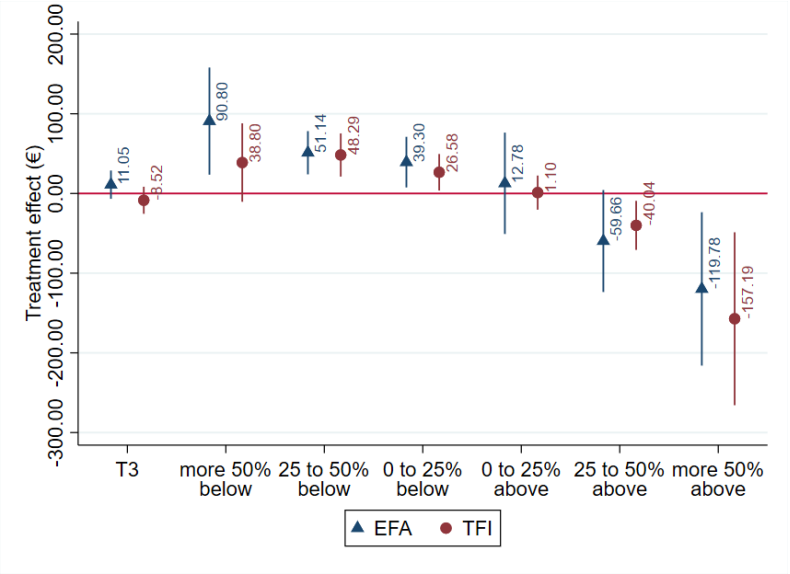


This figure reports the effect (in percentage points) of being exposed to the true share of peers wishing to adopt an ES (T2) on farmers' own intention to adopt ES. Treatment effects come from Probit regressions of the outcome variable (the probability of a farmer indicating that he/she may adopt ES). Confidence intervals and point estimates are provided for the homogeneous treatment model ("T2") and for the heterogeneous treatment model, for which interaction terms between T2 and perception gap classes are reported (from "more than 50% below" to "more than 50% above"). The treated group (T2) is compared to the extended control group (T3,CO). 95% confidence intervals are reported.

to adopt an ES (T2) on farmers' own intention to adopt the ES. Estimates of the homogeneous treatment effect and the heterogeneous treatment effect models are provided in Appendix I in Table I.2. Figure 5 presents the effects of T2 on the probability of a farmer indicating that he/she may adopt the proposed ES. Considering the homogeneous treatment effect model, we do not find any statistically significant average treatment effect for either of the ES. The heterogeneous treatment effect model leads to the same conclusion, even for respondents presenting large perception gaps (except for farmers with a perception gap belonging to the class "25 to 50% below") for the TFI ES. Our results indicate that information provided in T2 (adoption of ES by peers) does not lead farmers to start a belief-updating process, as information on peers is not perceived as relevant by farmers in their own decisions to adopt ES.

Lastly, in Figure 6, we consider the impact of informing farmers about the true subsidy requested by their peers to adopt an ES (T3) on farmers' own WTA (estimates of the homogeneous treatment effect and the heterogeneous treatment effect models are provided in Appendix I in Table I.3). Similarly to treatment T2, we do not find any statistically significant average treatment effect using the homogeneous treatment effect model, either for the EFA ES or for the TFI ES. However, the results by class of the perception gap are particularly informative in understanding the belief-updating processes used by farmers. We indeed find that treatment T3 has a significant effect on almost all farmers presenting a perception gap (either positive or negative). Farmers with beliefs about others below the true regional average update their own WTA upward, whereas farmers with beliefs about others above the true regional average update it in the opposite direction (downward). Moreover the larger the belief perception gap (in absolute value), the larger the treatment

Figure 6: Effect of T3 on subsidy requested by farmers to adopt ES



This figure reports the effect (in €) of being exposed to the true average subsidy requested by peers to adopt an ES (T3) on farmers' own willingness to accept an ES. Treatment effects come from OLS regressions of the outcome variable (subsidy requested to adopt ES). Confidence intervals and point estimates are provided for the homogeneous treatment model ("T3") and for the heterogeneous treatment model, for which interaction terms between T3 and perception gap classes are reported (from "more than 50% below" to "more then 50% above"). The treated group (T3) is compared to the extended control group (CO). 95% confidence intervals are reported.

effect.

For farmers holding negative perception gaps, the largest treatment effect is found for farmers holding beliefs about others more than 50% above the true regional average. These farmers are predicted to reduce their own WTA by -119.78 and -157.19 €/ha for the EFA ES and the TFI ES, respectively, when exposed to treatment T3. On the contrary, farmers holding negative perception gaps are predicted to increase their WTA once exposed to the true regional average of peers' WTA.

Although we cannot formally test whether or not farmers are fully rational Bayesian updaters, our analysis per perception gap reveals a belief-updating process consistent with Bayesian updating. In particular, the informational treatment T3 significantly reduces the disagreement (variance) expressed by farmers on the subsidy that would cause them to adopt the proposed ES. The standard deviations for the subsidy requesting to adopt an ES are respectively 313.0 and 264.4 for the EFA and TFI ES in the extended control group, and only 229.1 and 171.6 in the group of farmers exposed to treatment T3.

Result 2: Information-based treatments on beliefs about peers may modify farmers' personal opinions and behaviors, depending upon the considered domain and on the individual belief perception gap. When considering the perception of environmental benefits, we find that farmers tend to *asymmetrically* update their beliefs: when exposed to the true information on peers, only farmers presenting a negative perception gap update their prior beliefs. For WTA, the belief-updating process is consistent with Bayesian updating.

We have documented that both farmers' personal perceptions of the environmental

benefits of ES and WTA for ES are significantly impacted by the direct effects of the norm-based informational treatments (T1 and T3). However, contrary to our expectations, the intention to adopt an ES remains largely unchanged when farmers are exposed to the true norm regarding the adoption of ES by peers (T2). A possible explanation for this result could be that the content of an informational treatment may strongly matter, and thus induce a behavioral change (Kuang and Bicchieri, 2024). This is in line with Armantier et al. (2016), who show that households may update their inflation expectations, but only when they are provided certain kinds of inflation-relevant information. Another explanation could be that the malleability of perceived social norms may depend upon the context. In that case, farmers may then be selective in changing their personal opinion depending upon the context. In the context of the COVID-19 pandemic, Andrighetto et al. (2024) have analyzed how social norms may adjust depending upon disease intensity. In line with our finding, they show that some social norms may be strengthened (e.g., hand washing), whereas other behaviours may exhibit resilience and remain largely unchanged (e.g., social norms governing daily lives).

5.2 Cross-learning effects of informational treatments

It has been documented that respondents exposed to information provision may not only update their beliefs about the object of interest, but also update their beliefs about other outcome variables (Haaland et al., 2023). In this section, we explore the existence of such *cross-learning effects*.

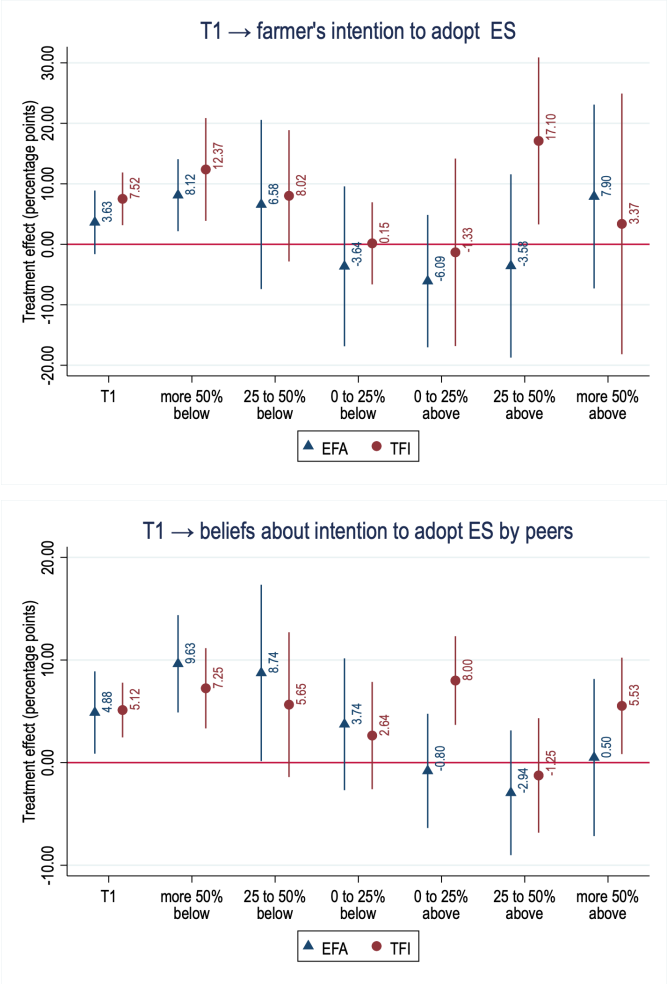
5.2.1 Cross-learning effects of T1 on adoption of ES

We first analyze the effects of showing to farmers the true share of peers believing that an ES provides environmental benefits on farmers' intention to adopt the ES, and on beliefs about others regarding the intention to adopt the ES. For beliefs about others, we estimate models similar to those represented by Equations (2) and (3).

Figure 7 presents our results regarding the effects of treatment T1 on farmers' intention to adopt the ES. We document a statistically significant positive average treatment effect for the TFI ES. Being shown the true share of peers believing that the TFI ES may provide environmental benefits increases the probability for a farmer to adopt the proposed ES by 7.52 percentage.

Whereas we have previously found that being shown the true share of peers wishing to adopt an ES has no significant impact on farmers' intention to adopt an ES, correcting a misperception of beliefs regarding environmental benefits to be expected from the ES influences, in this case, the intention to adopt the ES. Analyzing results by belief perception gap reveals that the significant average treatment effect obtained using the homogeneous treatment effect model is essentially driven by farmers presenting the largest negative belief perception gap (+8.12 and +12.37 percentage points for the EFA and TFI ES, respectively).

Figure 7: Cross-learning effects of T1 on adoption of ES



This figure reports the effect (in percentage points) of being exposed to the true share of peers believing that an ES provides environmental benefits (T1) on farmers' own intention to adopt the ES and on beliefs about intention to adopt the ES by their peers. Treatment effects come from Probit regressions for own intention to adopt and from OLS for beliefs about intention to adopt the ES by peers. Confidence intervals and point estimates are provided for the homogeneous treatment model ("T1") and for the heterogeneous treatment model, for which interaction terms between T1 and perception gap classes are reported (from "more than 50% below" to "more than 50% above"). The treated group (T1) is compared to the extended control group (T3,CO). 95% confidence intervals are reported.

To understand possible channels explaining this result, we examine in Figure 7 the effects of treatment T1 on beliefs about intention to adopt the ES by peers. Considering first the homogeneous treatment effect model, we find a statistically significant positive treatment effect of treatment T1 for both ES. Being shown the true share of peers believing that an ES may provide environmental benefits increases farmers' beliefs regarding the percentage of peers willing to implement an ES by 4.88 and 5.12 percentage points for the EFA and TFI ES, respectively. Re-calibrating beliefs about peers regarding the environmental benefits from ES induces a Bayesian updating process for beliefs regarding peers' intention to adopt the ES. Again, the positive average treatment effect is essentially driven by farmers presenting large negative belief perception gaps.

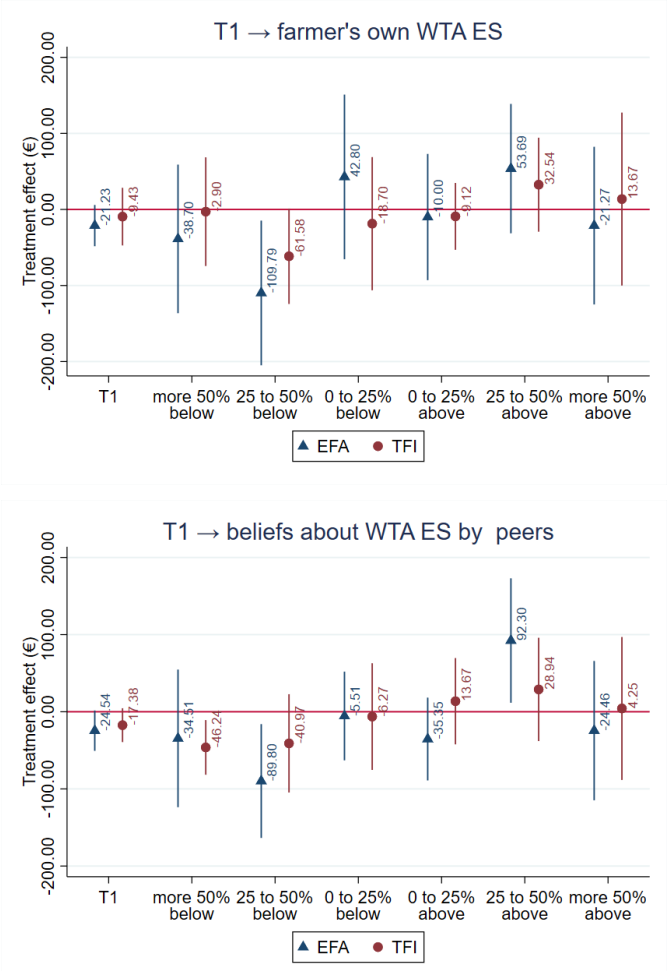
These results call for the implementation of information-based policies using peers' perceptions of the environmental benefits of ES. On the contrary, information-based poli-

cies that consist of providing the true beliefs of peers regarding the adoption of ES are predicted to be ineffective to induce ES adoption.

5.2.2 Cross-learning effects of T1 on subsidy to implement ES

Next, we analyze the effects of showing to farmers the true share of peers believing that an ES provides environmental benefits (T1) on the WTA to implement the ES. In Figure 8, we consider the impact of displaying to farmers the true share of peers believing that an ES provides environmental benefits (T1) on farmers' own WTA (estimates of the homogeneous treatment effect and the heterogeneous treatment effect models are provided in Table I.5 in Appendix I).

Figure 8: Cross-learning effects of T1 on WTA ES



This figure reports the effect (in percentage points) of being exposed to the true share of peers believing that an ES provides environmental benefits (T1) on farmers' WTA and on beliefs about peers' WTA. Treatment effects come from OLS estimations, and point estimates are provided for the homogeneous treatment model ("T1") and for the heterogeneous treatment model for which interaction terms between T1 and perception gap classes are reported (from "more than 50% below" to "more than 50% above"). The treated group (T1) is compared to the extended control group (CO). 95% confidence intervals are reported.

We do not find any statistically significant average treatment effects for either the EFA ES or for the TFI ES. Analyzing results by belief perception gap reveals that for the EFA ES, farmers with a large negative belief perception gap (between 25 to 50% below the truth regional average) react to treatment T1 by requesting a lower subsidy (-100.79€/ha for the EFA ES, and -61.58€/ha at a 10% significance level only for the TFI ES).

In Figure 8, we also consider the impact of displaying to farmers the true share of peers believing that an ES provides environmental benefits (T1) on farmers' beliefs regarding the WTA to implement an ES by peers. We find a statistically significant negative average treatment effect for the EFA ES (-24.54€/ha): being informed about the true share of peers believing that an ES provides environmental benefits induces respondents to update downward their beliefs regarding the subsidy requested by peers. This downward belief updating process is essentially driven by respondents presenting large negative belief perception gaps.

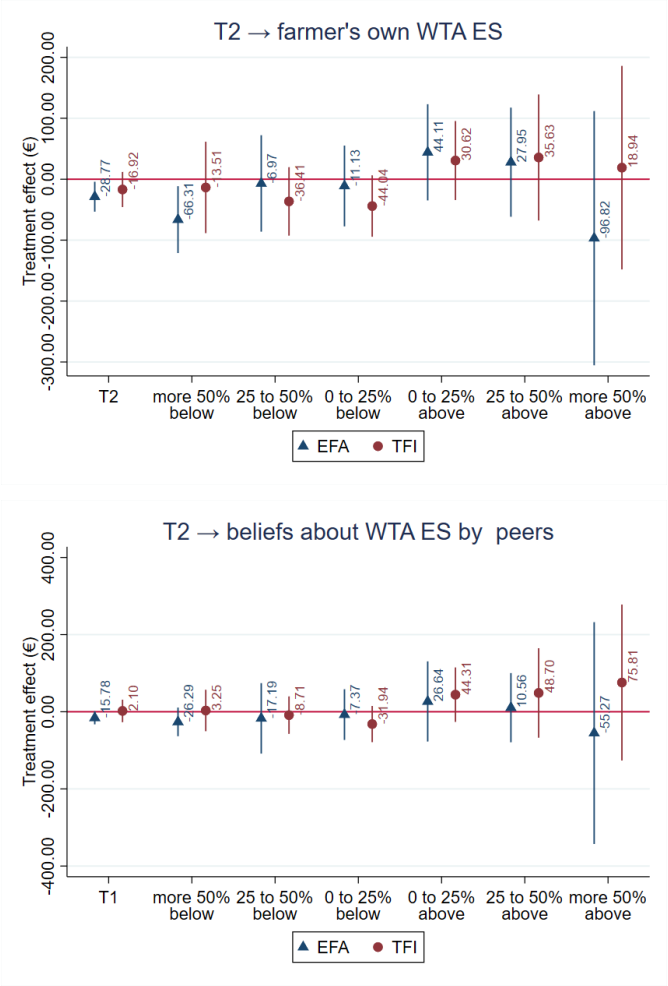
5.2.3 Cross-learning effects of T2 on subsidy to implement ES

Finally, we analyze the effects of showing to farmers the true share of peers wishing to adopt an ES on the subsidy requested by farmers to adopt an ES, and on farmers' beliefs regarding the subsidy inducing other farmers to adopt ES.

In Figure 9, we consider the impact of displaying to farmers the true share of peers wishing to adopt an ES (T2) on farmers' own WTA to implement an ES. Farmers who have been exposed to the true share of peers wishing to adopt the ES EFA request on average a lower subsidy to implement it, the decrease of the requested subsidy being -26.77€/ha. Analyzing results by belief perception gap reveals that for the ES EFA, farmers with a large negative belief perception gap (more than 50% below the truth regional mean) react to T2 by requesting a lower subsidy ($-$ 66.31€/ha).

Regarding the impact of displaying to farmers the true share of peers wishing to adopt an ES (T2) on farmers' beliefs regarding the WTA to implement an ES by peers, we do not find any statistically significant impact.

Figure 9: Cross-learning effects of T2 on WTA ES



This figure reports the effect (in percentage points) of being exposed to the true share of peers wishing to adopt an ES (T2) on farmers' WTA to implement an ES and on beliefs about the WTA expressed by peers. Treatment effects come from Probit regressions for own intention to adopt and from OLS for beliefs about intention to adopt ES by peers. Confidence intervals and point estimates are provided for the homogeneous treatment model ("T2") and for the heterogeneous treatment model, for which interaction terms between T2 and perception gap classes are reported (from "more than 50% below" to "more than 50% above"). The treated group (T1) is compared to the extended control group (CO). 95% confidence intervals are reported.

5.2.4 Summary of findings for cross-learning effects

Result 3: We document the existence of *cross-learning* effects. In particular, we find evidence that being shown the true share of farmers believing that the ES may provide environmental benefits induces farmers to update their beliefs regarding their peers' intention to adopt the ES, which in turn has a significant positive impact on their own intention to adopt an ES (for the TFI ES only).

The existence of *cross-learning* effects however depends upon the type of belief and the context. This reflects the complex interplay between farmers' personal opinions and their beliefs about their peers.

5.3 Robustness checks

The direct and indirect effects of our informational treatments have been obtained without controlling for observable characteristics of farmers. As a robustness analysis, we have re-estimated our econometric models controlling for some observed characteristics of farmers (in particular, gender, age, education level, risk aversion, location in the EU Natura 2000 zone, income, organic farming, and environmental labels).[16] Results are reported in Appendix J.

The direct effects we obtain controlling for observable characteristics of farmers are qualitatively similar to those obtained in the main analysis. We find that only farmers with a negative perception gap update their beliefs when exposed to true information regarding environmental benefits. Second, there is no effect on farmers' intention to adopt when providing them with true information regarding their peers' intention to adopt. Third, when farmers are exposed to the true subsidy asked by their peers, they increase (decrease) their WTA when their beliefs are below (above) the true WTA.

Turning to cross-learning effects, we find that providing farmers with the true share of peers believing that an ES provides environmental benefits (T1) has the same effect on other dimensions, as in the main analyses. In particular, we again document: (i) a positive effect on perceived intention to adopt by peers and own intention to adopt (mainly for farmers who hold a negative belief perception gap); and (ii) a negative effect on perceived WTA by peers and own WTA (mainly for farmers who hold a large negative belief perception gap). Considering the effect of providing farmers with the true share of peers wishing to adopt the ES (T2), again, we do not detect any strong effect on the perceived WTA by peers, while we do detect a negative significant effect on the own WTA, but only for the EFA ES and for farmers with a large negative belief perception gap.

5.4 Falsification tests

The sequential structure of the survey can be used to conduct a series of falsification tests. Since some outcome variables have been measured *before* implementing some treatments, they should not be affected by these treatments. For instance, farmers in T3 have been exposed to the true subsidy requested by their peers *after* having provided their own intention to adopt and their personal opinion regarding environmental benefits to be expected from ES. Therefore, T3 should have no impact either on farmers' own intention to adopt or on farmers' personal opinions regarding environmental benefits (sub-samples of farmers not affected by T1 and T2). The results of the falsification tests are presented in Appendix K. In almost all cases, we do not find any significant impacts of the treatments, as expected.

6 Conclusion

We have assessed the accuracy of French farmers in forming beliefs about their peers regarding eco-schemes (ES), a new policy instrument proposed in the reform of the EU CAP. Our work relies on a nationwide large scale web-survey of more than 3,000 French farmers. Our first contribution is to demonstrate that French farmers hold biased beliefs about their peers regarding the ES. We show that perception gaps are substantial in size and widespread throughout all French regions. More specifically, farmers have a strong tendency to underestimate the proportion of peers who consider that the ES may

[16] We detail the different control variables used in the additional analyses in Appendix C.

provide environmental benefits, as well as the proportion of peers wishing to adopt the ES. For beliefs on the proportion of peers who consider that the ES would be good for the environment, the average bias represents between -15.30 and -15.48 percentage points, depending upon the considered ES. For beliefs on the proportion of peers wishing to adopt an ES, the average bias represents between -27.75 and -30.93 percentage points, and more than 85 percent of farmers have a negative bias. Additionally, farmers overestimate the minimum subsidy necessary to incentivize their peers to adopt an ES by 55.56 to 64.38 euros per hectare, depending on the specific ES under consideration

Since previous works have shown that the descriptive norm can serve as a powerful behavioral guide (Cialdini, 2007), we have exposed respondents to different norm-based informational treatments using a randomized experiment setting. We have then explored the impact of the re-calibration of beliefs about peers on different dimensions related to ES adoption. Our second contribution is to show that using these informational treatments, it is possible to re-calibrate any inaccurate beliefs of farmers with significant impacts on their own behavior. We document that the impact of re-calibrating beliefs about others on farmers' behaviors crucially depends upon the individual's perception gap. In terms of the perception of environmental benefits of the ES, only the farmers who present a negative perception gap will update their prior beliefs after being exposed to the true information on peers. Access to high-quality information may then not necessarily lead to true-belief formation for all farmers, in particular since there is a wide range of cognitive, social and other factors influencing the formation of false beliefs (Ecker et al., 2022).

Our design allows us to assess both the causal *direct effect* of treatments, but also *cross-learning effects*. These effects arise from the fact that providing information on the beliefs of peers may not only induce farmers to update their personal beliefs about the object of interest, but also to change their beliefs about other outcome variables. We have shown that the *direct effect* of our informational treatments depends upon the *type* of belief. Being shown the truthful beliefs of peers regarding benefits for the environment increases the likelihood of reporting benefits for the environment by 8.7 to 10.1 percentage points, depending upon the ES considered. However, contrary to our expectations, the intention to adopt an ES remains largely unchanged when farmers are exposed to the true norm regarding the adoption of ES by peers. A plausible explanation for this result could be that the malleability of perceived social norms may depend upon the context. We have also documented the presence of *cross-learning effects*. Providing information on the share of peers who believe that an ES leads to environmental benefits has been shown to modify farmers' intentions to adopt the ES along with the subsidy requested for its adoption, plus farmers' beliefs about their peers for these two dimensions. Our results are in line with previous studies showing that farmers who believe that sustainable practices promoted by the CAP yield no ecological benefits are more likely to opt out of these schemes than those who believe in their benefits (Schulz et al., 2014).

The fact that farmers have biased beliefs about their peers regarding CAP policy instruments, and that this misperception impacts on their personal attitudes, offers a new explanation for the low uptake of voluntary measures proposed in the CAP to European farmers for the protection of biodiversity losses or the mitigation of climate change (Pe'er et al., 2017). Since we have experimentally demonstrated that individual support for pro-environmental policies increases after farmers have updated their beliefs about their peers, policy-makers may have an interest in focusing more closely on these types of beliefs as an important factor in making the CAP "greener". Furthermore, future research could invest more in understanding an individual's beliefs about their peers, as a way to modify individual attitudes and behaviors.

Although our results are useful in understanding the process of the voluntary adoption of policy instruments by farmers, using our framework to predict adoption rates should be considered with caution, for two main reasons. First, our treatments have made the information regarding peers' true beliefs very salient (for example, in respondents' everyday lives, it is not clear that they would pay so much attention to this type of information). Second, in our setting, farmers did not have the possibility of choosing the type of information they were exposed to. It is likely that the exogenous information we have provided to farmers may differ from the information that they would normally acquire themselves through their social networks or through a motivated information selection updating. In the context of electricity consumption, Allcott and Kessler (2019) indeed show that 34 percent of customers would prefer not to receive any information about their peers, even if this information was provided free-of-charge. Moreover, Castagnetti and Schmacker (2022) show in a lab experiment that subjects may sort themselves into information structures that allow them to maintain their motivated beliefs. Adoption rates may then depend upon how exogenous information is provided to farmers, and information that is endogenously acquired, interact and affect the updating of personal beliefs.

Continued research efforts aimed at advancing our understanding of belief re-calibration processes remain essential. Longitudinal studies, experimental methodologies, and interdisciplinary approaches are required to uncover the underlying mechanisms and boundary conditions of belief re-calibration. Such efforts may be pivotal in facilitating the design and implementation of tailored interventions that have enduring effects. Additionally, fostering collaborative efforts among researchers, policymakers, and practitioners may be crucial for effectively translating research insights into practical applications.

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A Survey

–Translated from French to English–

A.1 Invitation email received by farmers

Dear farmer,

We are researchers from INRAE and we are carrying out a study that may allow to adjust the CAP aids, as far as possible.

This survey is an opportunity to give your opinion on an important issue that will affect you in the coming years.

This survey is organized in 5 parts and lasts about 20 minutes. Your answers will be anonymous and they will be used for research purposes, only (C4EAU project).

Participation in this survey is voluntary. Do you agree to take this survey?

- Yes, I agree to answer
- No, I refuse to participate

As a farmer and main stakeholder, your opinion on these issues is important to us. We thank you in advance for your responses.

A.2 Survey questions

Thank you for taking part in our survey. If you do not have time to answer all the questions at once, you can save your answers and resume later from where you left off by clicking on "Finish later". In this first part, we will ask some general information about you.

Block 1: General information

A1 How old are you? [Years]

A2 Are you? [Man; Women]

A3 What is your level of education? [No diploma or CEP (certificate of primary school); College certificate; CAP, BEP or other diploma of this level ; Baccalaureate, professional certificate or other diploma of this level; Higher education from Baccalaureate +2 to Baccalaureate +4 (BTS, DEUG, license, master 1, etc.); Higher education Baccalaureate +5 and more (engineer, master 2, doctorate, etc.); Other]

A4 In which region is located your farm?

A5 How many years have you been on your farm? [Years]

Block 2: Eco-schemes

Introduction script common to both ES in the survey

Within the framework of the CAP reform under discussion, new measures are considered to support farmers who engage in practices that are highly beneficial to the environment. These new measures are called "eco-schemes".

Discussions on the eco-schemes available to French farmers are still in progress, but it is likely that:

1- The requirements in an eco-regime will have to go beyond those of conditionality;

2- Member States will have to propose one or more eco-schemes;

3- Farmers will be able to participate on a voluntary basis;

4- Subscription to eco-schemes will be annual.

In what follows, we will propose two possible eco-schemes. For each one, we will ask you to answer some questions in order to better understand the conditions that would lead you to implement them on your farm.

Script to describe ES "Increasing Ecological Focus Areas"

ECO-SCHEME "Increasing 'ecological focus areas to preserve biodiversity".

<u>The context</u>

One way to preserve and enhance biodiversity (pollinating insects, birds, etc.) is to set aside part of the land to constitute an ecological focus area (EFA) (fallow land, areas planted with short rotation crops, areas bearing catch crops or with plant cover, etc.).

Until now, one of the conditions for a farmer to receive the green payment was to set aside at least 5% of the arable land as an EFA, except for:

- farms with less than or equal to 15 ha of arable land;
- farms with more than 75% of their arable land in temporary grassland and/or fallow and/or leguminous crops;
- farms with more than 75% of their arable land in grass (permanent and temporary grassland) and/or rice;

<u>Proposed measure</u>

As part of the 2020 CAP reform, the voluntary establishment of EFA would be directly remunerated but subject to new conditions:

- At least 7% of the total area of arable land must be allocated to EFA;
- Catch crops, nitrogen/nitrate-absorbing crops, buffer zones are no longer EFA;
- No derogation possible for particular farms:

. end of the minimum threshold of 15 ha of arable land;

. end of exemptions for farms with temporary grassland and/or fallow land and/or leguminous crops or in grass.

You are paid (in €/ha) if an EFA is implemented and if these conditions are met. The commitment is annual (no commitment over several years).

Script to describe ES "Reduce use of phytosanitary products to preserve aquatic ecosystems and human health"

ECO-SCHEME "Reduce use of phytosanitary products to preserve aquatic ecosystems and human health".

The context

Limiting the use of phytosanitary products is an issue both for the preservation of aquatic ecosystems and for human health.

Regulatory measures, some of them being linked to the cross-compliance of CAP subsidies, already exist (prohibition of use in case of strong wind, respect of the pre-harvest period and the re-entry period, etc.), but they have not succeeded in achieving the objectives of environmental and health preservation set by the French authorities.

A new measure is therefore considered based on a voluntary commitment to significantly reduce the Treatment Frequency Index (TFI). The TFI is an indicator that reflects the intensity of the use of plant protection products. It is expressed in number of reference doses per hectare applied to a plot during a crop year.

Proposed measure

The proposed measure consists of voluntarily implementing technical itineraries with TFI that are 30 percent lower than the regional average (based on the last five years). The conditions to access this measure are:

- For all your plots enrolled in this measure: the TFI must be less than or equal to the regional average - 30%.

- For all your plots not enrolled in this measure: the TFI must not be higher than the regional average + 20%.

You will receive a payment (in €/ha) for all the surfaces with an TFI lower than 30% to the regional average. The commitment is annual (no commitment over several years) and compliance checks of the TFI is based on information in the recording book on your farm.

Script used for asking questions regarding each ES

B1 In your opinion, what percentage of farmers in your area think that such a measure is beneficial for society as a whole? [%]

B2 In your opinion, what percentage of farmers in your region think that such a measure is beneficial for the population of your region? [%]

B3 In your opinion, what percentage of farmers in your area think that such a measure is beneficial for the environment? [%]

B4 (T1) You have just indicated that, for you, X% of farmers in your region (*Name Region*) think that the measure is beneficial for the environment. In fact, a recent INRAE study showed that Y% of farmers in your region (*Name Region*) believe that this measure is beneficial for the environment. Do you think this measure is beneficial for society as a whole? [Yes ; No ; I do not know]

B4 (not T1) Do you think this measure is beneficial for society as a whole? [Yes ; No ; I do not know]

B5 (T1) You have just indicated that, for you, X% of farmers in your region (*Name Region*) think that the measure is beneficial for the environment. In fact, a recent INRAE study showed that Y% of farmers in your region (*Name Region*) believe that this measure is beneficial for the environment. Do you think this measure is beneficial for the population of your region? [Yes ; No ; I do not know]

B5 (not T1) Do you think that this measure is beneficial for the population of your region? [Yes ; No ; I do not know]

B6 (T1) You have just indicated that, for you, X% of farmers in your region (*Name Region*) think that the measure is beneficial for the environment. In fact, a recent INRAE study showed that Y% of farmers in your region (*Name Region*) believe that this measure is beneficial for the environment. Do you think this measure is beneficial for the environment? [Yes ; No ; I do not know]

B6 (not T1) Do you think this measure is beneficial for the environment? [Yes ; No ; I do not know]

B7 Subject to receiving adequate financial aid, in your opinion what percentage of farmers in your region would be willing to implement this measure? [%]

B8 (T2) You have just indicated that, for you, X% of farmers in your region (*Name Region*) would be willing to adopt this measure. In fact, a recent INRAE study showed that Y% of farmers in your region (*Name Region*) would be willing to adopt this measure. Subject to receiving adequate support/financial assistance, could you consider adopting this measure on your farm? [Yes ; No ; I do not know]

B8 (not T2) Subject to receiving adequate support/financial assistance, could you consider adopting this measure on your farm? [Yes ; No ; I do not know]

B9 Considering all the costs associated to this measure, as well as the benefits you could derive from, what minimum amount of aid (€/ha) would lead that at least 50% of the farmers in your region implement this measure on their farm? [€/ha]

B10 (T3) You have just indicated that, for you, the minimum aid that would lead at least 50% of farmers in your region (*Name Region*) to implement this measure should be X€/ha. In fact, a recent study by INRAE showed that at least 50% of the farmers in your region (*Name Region*) would implement this measure if the aid was Y€/ha. What would be, in this case, the minimum aid that would lead you to implement this measure on your farm?

B10 (not T3) What would be, in this case, the minimum aid that would lead you to implement this measure on your farm?

Block 3: Farm characteristics

C1 What is the main orientation of your farm? [Polyculture and polybreeding; Field crops ; Market gardening and horticulture; Viticulture; Fruits and other perennial crops; Cattle - milk, breeding and/or meat; Sheep, goats and other herbivores; Pigs, poultry; Other]

C2 Did you irrigate at least once during the 2019-2020 campaign? [Yes ; No]

C3 What is the usable agricultural area (UAA) of your farm, in ha? [Ha]

C4 Is your farm, or part of your farm, located in a Natura 2000 area? [Yes ; No ; I do not know]

C5 Is your farm, or part of your farm, located in a nitrate vulnerable zone (as defined by the Water Framework Directive)? [Yes ; No ; I do not know]

C6 What was your net operating income for the year 2020? [Less than €15,000; Between €15,000 and less than €30,000; Between €30,000 and less than €45,000; Between €45,000 and less than €60,000; More than €60,000; I do not wish to answer]

C7 Is the farm certified, or in conversion to, organic farming according to the official Organic Agriculture specifications, for all or part of its productions? [Yes ; No ; I do not know]

C8 (If yes in C7). Is the operation conducted entirely in organic farming? (all the surface is certified or in conversion to organic farming or all the animals are raised in organic farming or in conversion)

C9 Are any of your products affected by any of the following quality label? (Answer yes whether the quality label is applied to the product leaving your farm or whether it is awarded afterwards). Red Label / Controlled or Protected Designation of Origin (AOC or AOP) / Protected Geographical Indication (PGI) / Traditional Specialty Guaranteed (TSG). [Yes ; No]

C10 Is the farm involved in another quality approach or another environmental approach, for all or part of its production, appart from agri-environmental measures (AEM) of the CAP? Please specify the procedure(s) in which your farm is involved. Biodynamic agriculture (Démeter, Biodyvin, etc.) / Nature and Progress / Level 1 environmental certification (compliance with conditionality and carrying out an assessment of the farm) / Level 2 environmental certification (compliance with a reference system comprising 16 requirements) / High Environmental Value Certification (HVE) / Economic and Environmental Interest Group (GIEE) / Dephy Farm / Other quality or environmental approach, excluding agro-environmental measures (labels such as farm, mountain or countryside product, Terra Vitis, Global Gap, retail quality sector, Agriconfiance, Bleu Blanc Coeur, etc.)/ None of these approaches / Other. [Yes ; No]

C11 For some of your products, do you use a short food supply chain (direct sale to the consumer or sale to the consumer with an intermediary)? [Yes ; No]

C12 Are you involved in one or more of the following farmer collectives? A group for exchanging experiences and results, or collective training (GEDA, GVA, CETA, Civam, GAB, group led by the chamber of agriculture or other organization - excluding dairy control) / Membership of a cooperative for agricultural equipment sharing (CUMA) / An agricultural work bank or a formalized self-help group / None of these collectives. [Yes ; No]

C13 Do you have a smart water meter? [Yes ; No ; I do not know]

C14 (If yes to C13) Why do you use a smart water meter? [I did not have the choice; The purchase of this meter was subsidized; I think this technology can help me better manage my farm; This technology is useful for better managing my water consumption; This decision is the result of a collective decision (at the level of an ASA, a group of farmers, etc.); Other]

C15 (If yes to C13) Would you recommend this technology to other farmers in your area? [Yes; No; I do not know]

C16 (If no to C13) Why don't you have a smart water meter? [I am against this technology; This technology is too expensive; I don't have a water meter on my farm; This technology is not useful to help me better manage my farm; I changed my mechanical water meter less than 5 years ago; Other]

C17 Smart water meters make it possible to receive useful information on one's own water consumption and allow better territorial management of water resources. If an eco-scheme were set up in France to encourage farmers to adopt a smart water meter for their farm, and subject to receiving the appropriate financial aid, could you consider installing one on your farm? ? [Yes; No; I do not know]

C18 Do you belong to an environmental association or do you participate in outdoor activities (such as hiking, hunting, fishing, etc.)? [Yes; No; I do not know]

C19 Which statement would best suit your situation? [I know most of the people who live in my neighborhood; I know many people who live in my neighborhood; I know a few people who live in my neighborhood, but most of them are strangers to me; I don't know the people who live in my neighborhood]

C20 There are often differences between people who live in the same place. Where I live (choose the answer that best describes your situation). [People look a lot alike; People look a bit alike; The people are neither more nor less different than elsewhere; People are rather different from each other; People are very different from each other]

C21 To what extent do you agree with the following statements? [Totally agree; Agree; Neutral; Disagree; Totally disagree]

- The opinions of my family members are helpful in helping me to manage my farm
- My friends' opinions are helpful in helping me manage my farm
- The opinions of farmers in my neighborhood are useful to help me manage my farm
- The opinions of representatives of the agricultural profession (chamber of agriculture, cooperative) are useful to help me manage my farm;

- The opinions of representatives of local state services (DREAL, DDTM, etc.) are useful to help me manage my farm
- The opinions of environmental protection associations are useful to help me manage my farm

Block 4: Agri-environmental measures

This fourth part focuses on the agro-environmental and climate measures (AECM) that you may have implemented between 2015 and 2020 on your farm.

D1 During the 2015-2020 period, did you benefit from one or more system AECM? [Yes; No; I do not know]

D2 (If yes to D1) Select the AECM system(s) from which you benefited over the period 2015-2020. [AECM system - Field Crops; AECM system - Field crops adapted for intermediate zones; AECM system- Grassland and Pastoral Systems; AECM system- "Herbivorous" livestock mixed cropping systems; AECM system- "Monogastric" livestock polyculture systems; Other]

D3 During the 2015-2020 period, did you benefit from one or more "localized" AECM? [Yes; No; I do not know]

D4 (If yes to D3) Select the localized AECM(s) from which you benefited over the period 2015-2020. ["COVER": Soil cover and maintenance of covers; "GRASS": Management and maintenance of fodder surfaces; "LINEA": Maintenance of hedges, trees, groves, embankments, riparian forests; "ENVIRONMENT": Maintenance and management of remarkable environments; "OPEN": Opening and management of abandonment environments; "PHYTO": Reduction or absence of phytosanitary treatments; Other]

D5 During the 2015-2020 period, did you benefit from one or more AECM for the protection of genetic resources? [Yes; No; I do not know]

D6 (If yes to D5) Select the AECM(s) for the protection of genetic resources you benefited over the period 2015-2020. [Yes; No; I do not know]

- AECM protection of endangered breeds (PRM)
- AECM preservation of plant resources (PRV)
- AECM improvement of the pollinating potential of honeybees for the preservation of biodiversity (API)
- Other

D7 During the period 2015-2020, did you receive aid for the conversion or maintenance of organic farming?

D8 (If yes to D7) Select the aid(s) you received over the period 2015-2020 [Yes; No; I do not know]

- Support for conversion to organic farming
- Help to maintain organic farming

- Other

D9 Between 2015 and 2020, did you receive the green payment for your farm? [Yes; No; I do not know]

D10 (If not D1 AND D3 AND D5 AND D7) Can you tell us the reason(s) that led you not to subscribe to any AECM over the 2015-2020 period? [Technical reasons related to the characteristics of my farm; Financial reasons (insufficient financial aid); Administrative reasons (e.g. heaviness or complexity of application files); Lack of information on the measures; Because I don't trust the institutions that finance and manage aids; Because the commitment period of 5 years was too long; Other]

D11 (If yes to D1 OR D3 OR D5 OR D7) Can you tell us the reason(s) that led you to subscribe to at least one AECM over the 2015-2020 period? [Environmental sensitivity; Perception of the expectations of society or citizens; Local dynamics in favor of the environment; Level of financial aids; Opinions of your relatives; The fact that other farmers have already adopted a similar measure; Other]

D12 (If yes to D1 OR D3 OR D5 OR D7) Can you tell us if you agree or disagree with the following statements? [Totally disagree; Disagree; Indifferent; Somewhat agree; Totally agree]

- My participation in an AECM has a positive impact on the environment
- My participation in an AECM encourages other farmers to get involved
- Knowing that by adopting a AECM I am contributing to the preservation of the environment gives me real satisfaction

Block 5: Farmer psychological traits

E1 In the exercise of your professional activity, are you a person who takes risks or who, on the contrary, tries to limit them as much as possible [0 to 10] (0 being "I try not to take any risks" and 10 being "I am completely ready to take risks").

E2 Did you subscribe during the 2019-2020 campaign? [Yes; No; I do not know]

- A climate risk crop insurance
- An insurance covering crop production value

E3 Can you indicate your opinion regarding the following statements? [Totally disagree; Disagree; Neutral; Agree; Totally agree]

- I don't like to rely on other farmers in my area
- What happens to me is of my own making
- I like to act independently and take matters into my own hands
- I try to live my life independently of other farmers in my area as much as possible
- I mainly depend on myself, rarely on other farmers in my area
- Faced with a difficult personal problem, it is better to decide for yourself what to do, than to follow the advice of other farmers in your area

E4 Can you indicate your opinion regarding the following statements? [Totally disagree; Disagree; Neutral; Agree; Totally agree]

- Being different is important to me
- I intentionally do things to differentiate myself from other farmers in my area
- I am a unique individual
- I am different from other farmers in my area
- I chose to grow/raise other things than the farmers in my area
- My hobbies are different from those of other farmers in my area

E5 Can you indicate your opinion regarding the following statements? [Totally disagree; Disagree; Neutral; Agree; Totally agree]

- When taking decisions, it is important for me to consider the effects my decisions may have on other farmers in my area
- When taking decisions, it is important for me to consider the needs of other farmers in my sector
- When taking decisions, it is important for me to consider the feelings of other farmers in my sector
- If I decided to change my crop/breeding, one of my main concerns would be how this change would affect other farmers in my area
- If I decided to retire, one of my main concerns would be how my retirement would affect other farmers in my area
- If I decided to change town/region, one of my main concerns would be how this change would affect other farmers in my area

[Questions E3, E4 and E5 are partly adapted from Singelis et al. (1995)]

E6 Do you agree, or disagree, with the statement - we need more equality and justice even if it means less freedom for the individual? [Not agree at all; Tend to disagree; Indifferent; Somewhat agree; Totally agree]

E7 In the following list, what are for you the three most important values? (3 responses maximum) [Peace; Human rights; Respect for human life; The democracy; The Law; Individual freedom; Legality; Tolerance; Solidarity, Support for others; Personal development; Respect of other cultures; Religion; None of these values; I do not know]

E8 You will find a number of statements that may or may not apply to you. For example, do you accept to be someone who enjoys spending time with others? Indicate the extent to which you agree or disagree with this statement using the following scale: 1) Strongly disagree; 2) Disagree; 3) Neither approve nor disapprove; 4) Agree; 5) Strongly agree.

- Is creative, full of original ideas
- Interested in many subjects
- Is ingenious, a big head
- Has a great imagination

– Is inventive
– Appreciates artistic and aesthetic pursuits
– Prefers simple, routine work
– Likes to think and play with ideas
– Has little interest in anything artistic
– Has good knowledge of art, music or literature

B Data used to re-calibrate farmers' beliefs

To re-calibrate beliefs about others, we provide respondents with (truthful) information about other farmers in their region (see Table B.1). The (truthful) information is computed using data from a web-survey (*prior-survey*) conducted a few weeks before the current one (from January 27th to February 2021), on a sample of 1,143 French farmers (different from the current sample). In the *prior-survey*, the same ES have been proposed with similar questions regarding benefits from ES, intention to adopt the ES and willingness to accept ES. Ouvrard and Reynaud (2024) provides a description and an analysis of the data collected in the *prior-survey*.

Table B.1: Truthful information on peers used in the informational treatments

	EFA			TFI		
Region	Benefits	Adopt	WTA	Benefits	Adopt	WTA
	(%)	(%)	€/ha	(%)	(%)	€/ha
Auvergne-Rhône-Alpes	55	58	402	69	63	342
Bourgogne-Franche-Comté	46	59	379	55	58	304
Bretagne	44	56	471	68	61	310
Centre-Val de Loire	39	61	380	52	50	365
Grand Est	57	63	428	62	57	339
Hauts-de-France	49	55	541	52	55	386
Île-de-France	37	44	428	52	42	343
Normandie	47	56	409	55	57	350
Nouvelle-Aquitaine	44	64	386	53	57	354
Occitanie	48	62	330	60	61	314
Pays de la Loire	49	66	341	63	68	287
Provence-Alpes-Côte d'Azur	61	72	420	72	76	454
Observations	1,266	1,195	864	1,260	1,179	873

The (truthful) information is based on the *prior-survey* conducted from January 27th to February 5th 2021 (Ouvrard and Reynaud, 2024). *Benefits:* percentage of farmers in a region considering that the proposed ES will generate some benefits for the environment. *Adopt:* percentage of farmers in a region who declare that they will adopt the ES subject to receiving an adequate monetary compensation. *WTA:* regional willingness to accept an ES, i.e., monetary compensation such as 50% of farmers in a region adopt the proposed ES.

Individual answers from the *prior-survey* have been used to compute regional means displayed to the treated respondents in the final survey (treatments T1, T2 and T3). More specifically, treated respondents are shown the percentage of farmers in their region who consider that ES will generate some benefits for the environment (T1), the percentage of farmers in their region who declare that they will adopt the ES subject to receiving adequate monetary compensations (T2), and the average monetary compensation such as half of farmers may adopt the proposed ES (T3).

Table B.1 reveals that truthful information varies significantly from one French region to another. For instance, if only 37% of farmers located in the Île-de-France region believe that the EFA ES will generate environmental benefits, this percentage reaches 61% in Provence-Alpes-Côtes d'Azur. Regional disparities are also documented for the TFI ES, and for beliefs about others regarding adoption of ES and WTA. These findings reflect the need to account for regional heterogeneity in beliefs about others when implementing informational treatments.

There may be a concern with the re-calibration of beliefs if the regional averages in

the *prior-survey* differ from individual beliefs in the ES survey. Indeed, if this is the case, farmers may be shown regional averages which may have nothing to do with the true averages. This may raise some credibility issues for respondents regarding the regional averages, with potentially an impact on the process of belief updating. We do not notice any strong difference between the regional averages in the *prior-survey* and in the ES survey (control group). The correlation at the regional level is positive and significant (from 0.15 for beliefs on benefits for the EFA ES to 0.61 for beliefs on adoption of the TFI ES). The regional averages computed from the *prior-survey* and displayed to ES survey respondents in T1, T2 and T3 can then be considered as relevant and accurate.

C Control variables

We describe here the different control variables considered in the appendices.

Socio-demographic variables: *Age* (age of respondent in years, continuous variable), *Age40* (variable equal to 1 if respondent is less than 40 years old), *Age60* (variable equal to 1 if respondent is more than 60 years old), *Female* (variable equal to 1 if respondent is a female), *Net income > 60,000€* (variable equal to 1 if respondent's net annual income is larger than 60,000€), *Net income < 15,000€* (variable equal to 1 if respondent's net annual income is lower than 15,000€), *Risk averse* (variable equal to 1 if respondent answered 4 or less to question E1), *Risk lover* (variable equal to 1 if respondent answered 6 or more to question E1), *University diploma* (variable equal to 1 if respondent holds a university diploma).

Farm characteristics: *AECM* (variable equal to 1 if the farmer is engaged into AECM or receives subsidies for organic farming), *Agricultural area* (continuous variable that indicates the agricultural area in ha), *Farming experience* (continuous variable that indicates the number of years as a farmer), *Farm type* (categorical variable that indicates the farm orientation), *Natura 2000* (variable equal to 1 if the farmer is located in a Natura 2000 zone), *Nitrate zone* (variable equal to 1 if the farmer is located in a vulnerable zone to nitrates), *Organic farming* (variable equal to 1 for organic farming), *Quality label* (variable equal to 1 if the farm is certified with a quality label), *Short food supply chain* (variable equal to 1 if farm products are sold within short food supply chains).

Network characteristics: *Associative affiliation* (variable equal to 1 if the farmer participates to an environmental association), *Collective association* (variable equal to 1 if the farmer participates to a professional collective association), *Neighborhood familiarity* (variable equal to 1 if the farmer thinks he/she is familiar with his/her neighbors), *Neighborhood similarity* (variable equal to 1 if the farmer thinks he/she is similar to his/her neighbors).

D Farmers' characteristics and balancing tests

D.1 Descriptive statistics

Table D.1: Characteristics of farmers (survey and 2020 French agricultural Census)

	Our survey	Ag. Census 2020
Organic farming	14.60%	12.1%
Quality label	25.55%	27.3%
Short food supply chain	24.75%	23.1%
Age60	16.89%	25.4%
Agricultural area	143.6 ha	69.0 ha
Farm type		
-Arable and permanent crops	48.88%	51.8%
-Animal production	15.90%	37.3%
-Mixed production	35.21%	10.4%
Distribution of farms per region		
-Auvergne-Rhône-Alpes	8.29%	12.44%
-Bourgogne-Franche-Comté	6.66%	6.07%
-Bretagne	5.32%	6.76%
-Centre-Val de Loire	9.30%	5.11%
-Corse	0.00%	0.76%
-Grand Est	13.89%	10.52%
-Hauts-de-France	10.60%	6.03%
-Île-de-France	3.57%	1.14%
-Normandie	6.13%	6.81%
-Nouvelle-Aquitaine	15.23%	16.46%
-Occitanie	11.09%	16.50%
-Pays de la Loire	7.76%	6.78%
-Provence-Alpes-Côte d'Azur	2.15%	4.63%

Table D.1 presents some basics descriptive statistics on farmers having completed the survey. Although we do not claim that our sample is representative of the population of farmers at the France level, for a comparison purpose, we also report statistics derived from the last agricultural census (year 2020).

Organic farming is slightly over-represented in our sample. Compared to the 2020 agricultural census, farmers are less involved into animal production, which can explain that the average farm agricultural area is more than twice the agricultural area in the 2020 agricultural census (143.6 ha compared to 69 ha).

The regional distribution of farms appears relatively similar in both samples, except for regions Centre-Val de Loire and Hauts-de-France which are over-represented in our survey, and for region Occitanie which is under-represented in our survey.

D.2 Balancing tests for control and treated groups

Table D.2: Balancing tests for control and treated groups

	Control	T1	T2	T3	Test
Organic farming	14.33%	15.35%	14.43%	14.33%	χ^2 test $p\text{-}value = 0.950$
Quality label	24.48%	25.17%	27.21%	25.40%	χ^2 test $p\text{-}value = 0.730$
Short food supply chain	24.24%	25.47%	26.88%	22.56%	χ^2 test $p\text{-}value = 0.345$
Age60	17.40%	15.28%	16.54%	18.33%	χ^2 test $p\text{-}value = 0.348$
Female	11.82%	13.97%	12.57%	14.64%	χ^2 test $p\text{-}value = 0.261$
Agricultural area	140.73	145.69	145.84	142.45	Kruskal–Wallis $p\text{-}value = 0.722$
Farm type					
Arable and permanent crops	48.65%	50.25%	48.76%	47.94%	χ^2 test
Animal production	16.06%	15.91%	16.47%	15.19%	$p\text{-}value = 0.957$
Mixed production	35.29%	33.84%	34.76%	36.87%	
Distribution of farms per region					
Auvergne-Rhône-Alpes	7.40%	7.80%	8.06%	7.68%	
Bourgogne-Franche-Comté	7.51%	6.58%	5.15%	6.48%	
Bretagne	5.44%	4.68%	6.49%	6.26%	
Centre-Val de Loire	9.36%	7.58%	11.09%	8.12%	
Corse	0%	0%	0%	0%	
Grand Est	12.84%	13.15%	15.57%	13.72%	χ^2 test
Hauts-de-France	10.66%	13.60%	9.07%	10.87%	$p\text{-}value = 0.033$
Île-de-France	3.81%	2.79%	2.58%	5.16%	
Normandie	6.86%	6.69%	6.27%	5.93%	
Nouvelle-Aquitaine	16.97%	14.72%	15.12%	15.37%	
Occitanie	10.77%	11.71%	9.52%	10.54%	
Pays de la Loire	6.64%	8.81%	8.51%	6.92%	
Provence-Alpes-Côte d'Azur	1.74%	1.90%	2.58%	2.96%	

E Regional analysis of farmers' opinions and beliefs

We analyze farmers' opinions, beliefs and perception gaps, per region, regarding environmental benefits, intention to adopt and WTA for the EFA and TFI ES (Tables E.1 and E.2).

First, regional variations in terms of beliefs about peers are documented. For instance, in region Ile-de-France farmers report that, on average, they believe that 30.1% and 36.0% of their peers consider that the proposed ES (EFA and TFI, respectively) may lead to environmental benefits. The corresponding percentages increase to 42.9% and 50.4% in region Occitanie.

Second, and as emphasized in the main text, farmers underestimate the share of peer farmers who believe that the ES have positive environmental benefits, as well as those who are willing to adopt them. In Appendix G, we further show that these perception gaps are concentrated on one side relative to the truth (i.e., misperceptions are asymmetric and downwards biased). The average perception gap for perceived environmental benefits is -13.61 percentage points for the EFA ES, and -13.69 for the TFI ES. Regional effects are found, with the average perception gap for the EFA ES varying from -5.5 percentage points in the region Provence-Alpes-Côte d'Azur to -22.7 percentage points in the Auvergne-Rhône-Alpes region, and from -6.9 percentage points in the region Bretagne to -19.4 percentage points in the Provence-Alpes-Côte-d'Azur region for the TFI ES.

The magnitude of perception gaps is even stronger regarding the intention to adopt, ranging from -25.5 percentage points for the TFI ES to -30.28 percentage points for the EFA ES. Again, regional effects are found with the average perception gap for the EFA ES varying from -22.2 percentage points in the Hauts-de-France region to -42.2 percentage points in the Provence-Alpes-Côte d'Azur region, and from -18.6 percentage points in the Hauts-de-France region to -31.6 percentage points in the Bretagne region for the TFI ES.

Third, farmers overestimate the WTA asked by their peers to implement the two ES. The average perception gap for WTA is 55.36€/ha for the EFA ES, and 59.43€/ha for the TFI ES. Strong regional effects are again documented, with the average perception gap for the EFA ES varying from -14€/ha in the Centre-Val de Loire region to 172.7€/ha in the Hauts-de-France region, and from -41.1€/ha in the Provence-Alpes-Côte-d'Azur region to 116.5€/ha in the Pays de la Loire region for the TFI ES.

Table E.1: Farmers' opinions, beliefs and perception gaps for the EFA ES, per region

Region	**Benefits env.**			**Adopt**			**WTA**		
	Farmers' personal opinion	Beliefs about peers	Perception gap	Farmers' personal opinion	Beliefs about peers	Perception gap	Farmers' personal opinion	Beliefs about peers	Perception gap
France	51	37.57	-13.61	0.66	36.23	-30.28	446.06	437.49	55.36
Auvergne-Rhône-Alpes	53	39.39	-13.88	0.71	37.95	-33.94	429.43	395.62	75.84
Bourgogne-Franche-Comté	61	37.17	-22.70	0.68	38.92	-30.03	400.63	409.93	48.32
Bretagne	57	38.43	-17.22	0.71	36.82	-33.66	451.87	451.50	147.42
Centre-Val de Loire	40	31.29	-7.74	0.65	32.42	-32.78	460.21	448.71	-13.98
Grand Est	51	37.47	-15.12	0.65	34.06	-30.36	473.20	464.34	90.77
Hauts-de-France	47	34.93	-12.04	0.58	35.30	-22.17	545.23	552.55	172.68
Ile-de-France	40	30.05	-9.25	0.61	29.73	-30.35	706.50	599.34	-63.54
Normandie	57	39.15	-17.20	0.66	36.10	-28.51	452.13	438.44	50.54
Nouvelle-Aquitaine	52	38.61	-13.16	0.67	36.21	-31.80	413.07	393.33	-6.11
Occitanie	59	42.88	-16.26	0.75	44.64	-31.17	371.85	381.09	49.07
Pays de la Loire	47	39.30	-8.29	0.57	33.40	-23.78	393.69	367.44	55.11
Provence-Alpes-Côte d'Azur	44	38.54	-5.46	0.76	35.67	-42.17	341.73	426.14	87.58

Table E.2: Farmers' opinions, beliefs and perception gaps for the TFI ES, per region

Region	**Benefits env.**			**Adopt**			**WTA**		
	Farmers' personal opinion	Beliefs about peers	Perception gap	Farmers' personal opinion	Beliefs about peers	Perception gap	Farmers' personal opinion	Beliefs about peers	Perception gap
France	0.59	45.52	-13.69	0.62	38.29	-25.49	386.92	396.08	59.43
Auvergne-Rhône-Alpes	0.61	48.30	-13.47	0.65	41.95	-26.40	389.05	397.48	66.80
Bourgogne-Franche-Comté	0.67	46.61	-18.40	0.64	39.47	-26.58	356.50	371.42	63.88
Bretagne	0.57	49.49	-6.89	0.71	40.89	-31.58	376.28	378.40	91.28
Centre-Val de Loire	0.47	38.04	-8.79	0.54	32.38	-22.27	395.12	404.70	68.78
Grand Est	0.59	43.52	-15.82	0.66	37.16	-30.13	358.97	379.34	70.61
Hauts-de-France	0.56	42.50	-12.59	0.53	35.36	-18.55	434.89	465.99	70.04
Ile-de-France	0.45	36.03	-8.77	0.49	30.87	-18.97	550.16	490.74	51.17
Normandie	0.69	50.10	-17.59	0.66	37.44	-26.94	443.20	437.58	51.81
Nouvelle-Aquitaine	0.60	44.94	-15.12	0.62	37.63	-25.08	409.79	393.98	47.10
Occitanie	0.67	50.41	-17.17	0.72	43.76	-29.80	382.08	364.25	11.85
Pays de la Loire	0.58	49.67	-8.62	0.60	41.90	-19.56	252.08	328.62	116.53
Provence-Alpes-Côte d'Azur	0.68	49.55	-19.35	0.66	42.96	-28.28	272.00	363.56	-41.12

F Association between farmers' personal opinion regarding ES and their characteristics and past behaviours

We report in Tables F.1-F.3 tests to compare farmers' personal opinions regarding perceived environmental benefits, adoption and WTA for the ES depending on their characteristics (gender, age, farming experience and university diploma) and their past behaviours (participation to short food supply chain, whether or not the farm is certified with a quality label, participation to an environmental association, past participation to AECM, and the adoption of organic farming).

Overall, the results are as expected. Regarding farmers' characteristics, the most robust result is related to education: farmers with an university diploma more often consider adopting the two proposed ES. Regarding farmers' past behaviours, past participation to AECM and the adoption of organic farming are associated with a higher likelihood to perceive environmental benefits and to adopt the ES, and a lower WTA.

Table F.1: Farmers' opinions regarding environmental benefits of ES depending upon their characteristics and past behaviours

		EFA ES		TFI ES	
		Yes (%)	p-value χ^2 test	Yes (%)	p-value χ^2 test
Farmers' characteristics					
Gender	*Female*	56.03	0.127	63.64	0.155
	Male	50.72		58.76	
Age40	*Yes*	53.79	0.263	59.90	0.786
	No	50.70		59.16	
Farming experience	*Less than 15 years*	54.74	0.043	59.97	0.691
	More than 15 years	49.86		59.02	
University diploma	*Yes*	52.34	0.304	58.96	0.693
	No	50.06		59.82	
Farmers' past behaviours					
Short food supply chain	*Yes*	58.50	< 0.01	62.47	0.268
	No	49.78		59.54	
Quality label	*Yes*	53.37	0.168	62.31	0.040
	No	50.19		57.65	
Associative affiliation	*Yes*	53.78	0.188	60.82	0.705
	No	50.67		59.94	
AECM	*Yes*	60.00	< 0.01	67.69	< 0.01
	No	49.61		58.36	
Organic farming	*Yes*	71.91	< 0.01	75.28	< 0.01
	No	48.56		57.73	

Table F.2: Farmers' opinions regarding adoption of ES depending upon their characteristics and past behaviours

		EFA ES		TFI ES	
		Yes (%)	p-value χ^2 test	Yes (%)	p-value χ^2 test
Farmers' characteristics					
Gender	*Female*	71.72	0.151	66.23	0.311
	Male	65.76		61.99	
Age40	*Yes*	69.12	0.289	66.43	0.126
	No	65.71		61.44	
Farming experience	*Less than 15 years*	68.66	0.253	62.89	0.828
	More than 15 years	65.43		62.27	
University diploma	*Yes*	68.47	0.072	66.06	< 0.01
	No	63.73		57.69	
Farmers' past behaviours					
Short food supply chain	*Yes*	71.23	0.059	66.44	0.135
	No	62.27		61.61	
Quality label	*Yes*	66.67	0.882	65.02	0.145
	No	66.27		61.02	
Associative affiliation	*Yes*	70.83	< 0.01	64.68	0.182
	No	63.48		60.96	
AECM	*Yes*	78.02	< 0.01	74.36	< 0.01
	No	63.39		58.80	
Organic farming	*Yes*	77.22	< 0.01	70.56	0.018
	No	64.78		61.34	

Table F.3: Farmers' opinions regarding WTA for ES depending upon their characteristics and past behaviours

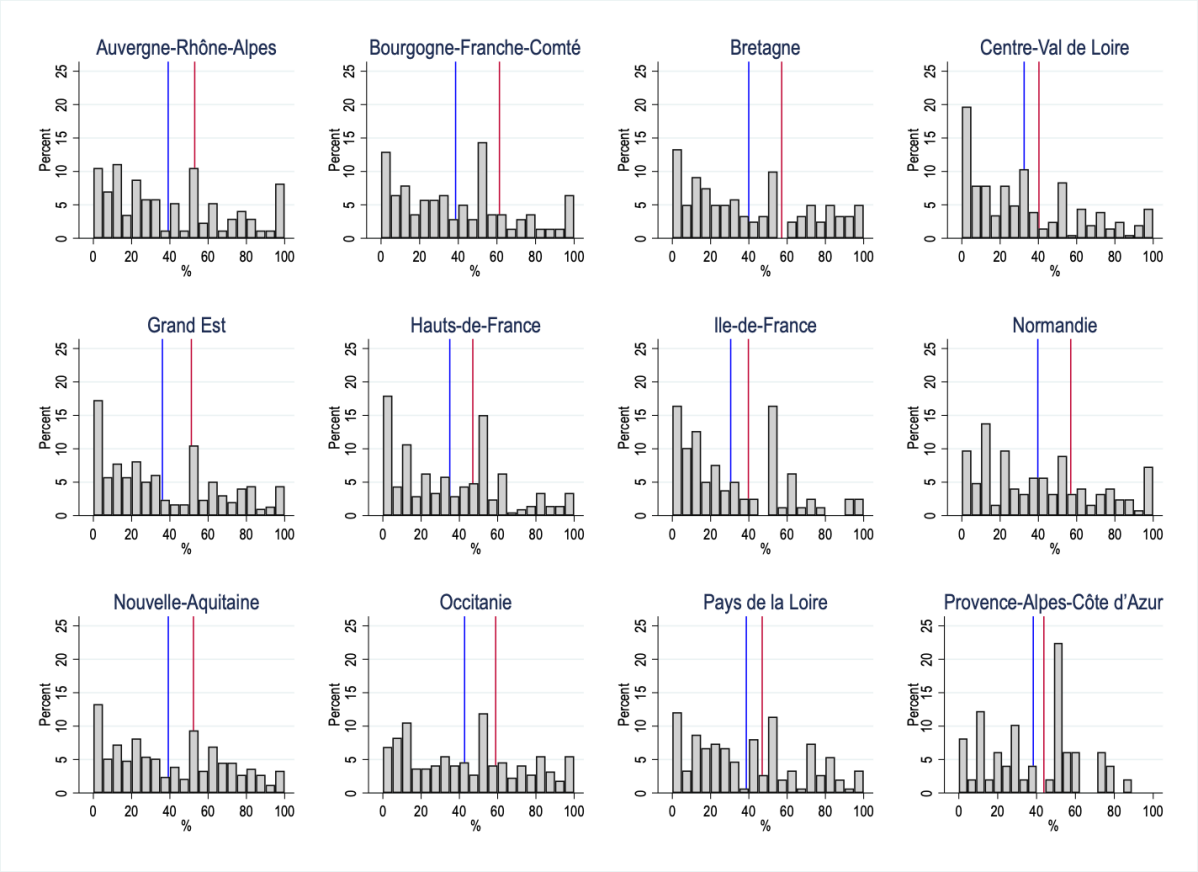
		EFA ES		TFI ES	
		WTA (in €/ha)	t-test	WTA (in €/ha)	t-test
Farmers' characteristics					
Gender	*Female*	406.17	1.039	412.23	-0.800
	Male	451.06		383.68	
Age40	*Yes*	429.06	0.632	386.16	0.034
	No	450.41		387.11	
Farming experience	*Less than 15 years*	437.67	0.415	414.00	-1.569*
	More than 15 years	449.85		375.32	
University diploma	*Yes*	454.95	-0.758	372.96	1.398*
	No	434.10		404.78	
Farmers' past behaviours					
Short food supply chain	*Yes*	448.22	-0.038	396.45	-0.550
	No	447.00		381.32	
Quality label	*Yes*	478.94	-1.910*	387.33	-0.029
	No	425.65		386.67	
Associative affiliation	*Yes*	475.80	-1.767**	404.68	-1.418*
	No	426.11		370.42	
AECM	*Yes*	432.38	0.623	341.21	2.032**
	No	453.03		398.93	
Organic farming	*Yes*	307.14	4.188***	300.35	2.898***
	No	469.34		398.68	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

G Misperception about peers by French region

G.1 Misperception about peers regarding perceived environmental benefits of the ES per French region

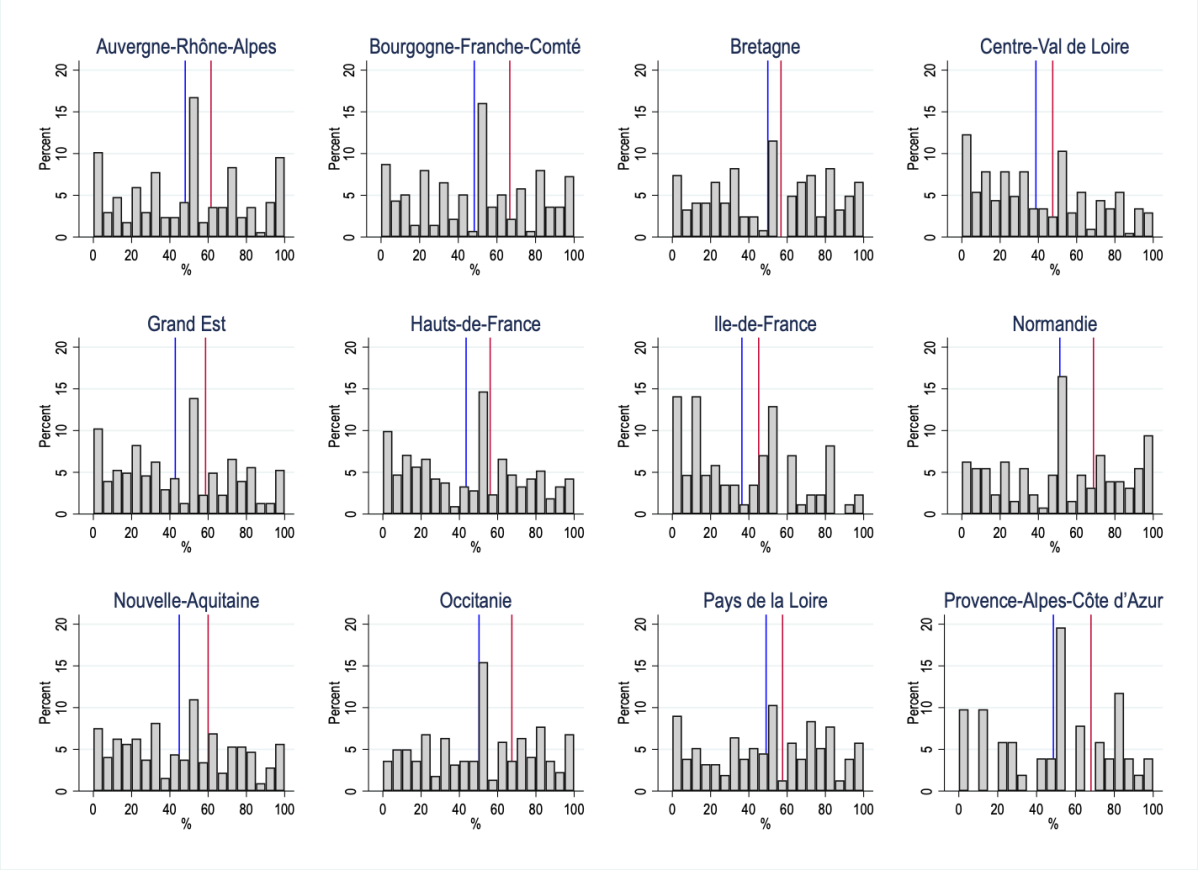
Figure G.1: Distribution of beliefs about peers regarding perceived environmental benefits of the EFA ES



Histograms provide, in each region, the distribution of beliefs about the percentage of peer farmers who think that the EFA ES will provide environmental benefits. The blue line represents the regional averages for the beliefs about peers. The red line represents the regional average for the observed distribution of farmers' personal opinion. Farmers in T1 are excluded.

Figures G.1 and G.2 provide the distribution of beliefs about peers regarding perceived environmental benefits associated with, respectively, the EFA and TFI ES (i.e., farmers' beliefs regarding the share of peers who believe that the corresponding ES provides environmental benefits). For each of the 12 French regions, the difference between the two vertical lines (blue and red) represents a measure of the misperception regarding environmental benefits of ES for environment. The main result from Figures G.1-G.2 is that whatever the region and the ES considered, French farmers misperceive the share of their peers who believe that implementing the ES will generate positive environmental benefits.

Figure G.2: Distribution of beliefs about peers regarding perceived environmental benefits of the TFI ES

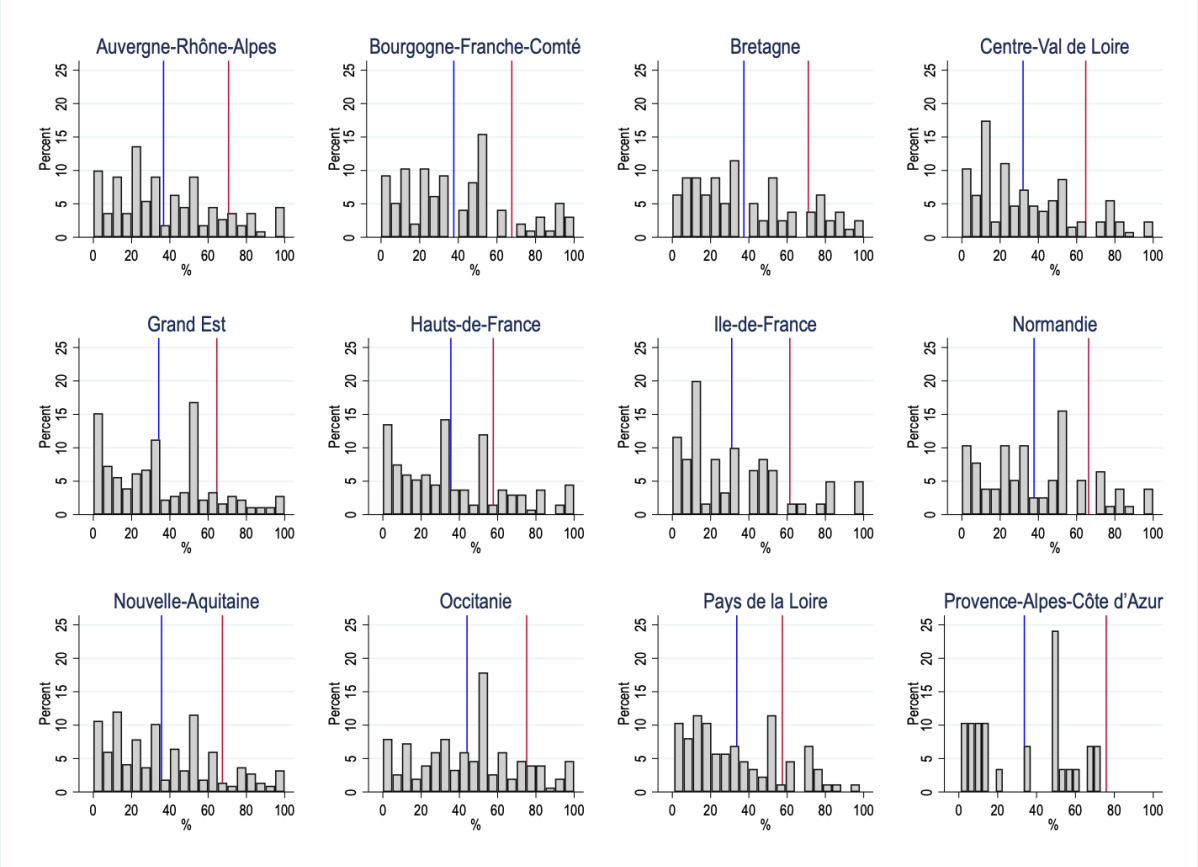


Histograms provide, in each region, the distribution of beliefs about the percentage of peer farmers who think that the TFI ES will provide environmental benefits. The blue line represents the regional averages for the beliefs about peers. The red line represents the regional average for the observed distribution of farmers' personal opinion. Farmers in T1 are excluded.

G.2 Misperception about peers regarding the adoption of ES per French region

We now document that farmers misperceive the adoption of ES by their peers. We restrict our sample to respondents in T3 and in the control group, i.e., to respondents who have not been shown any information regarding peers before answering the two questions regarding the adoption of ES.

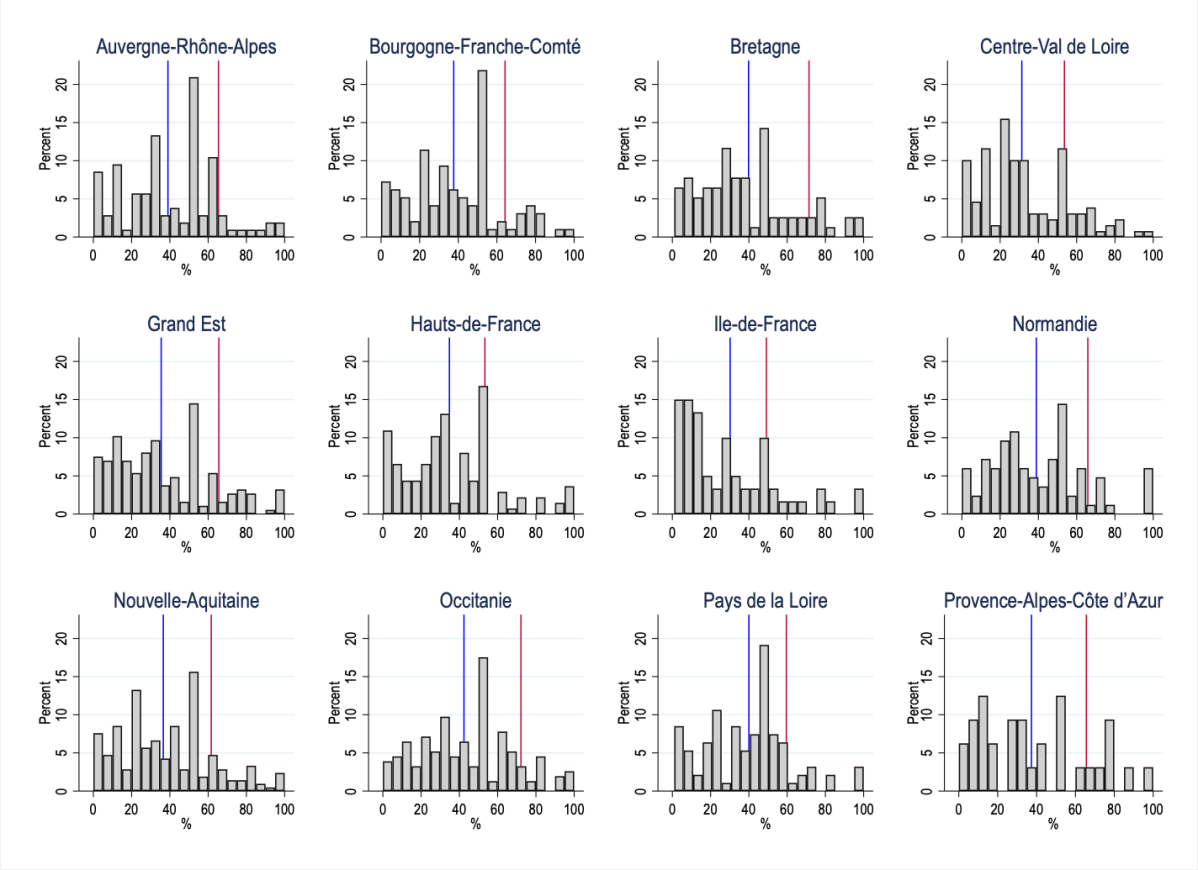
Figure G.3: Distribution of beliefs about peers regarding the intention to adopt the EFA ES subject to receiving adequate monetary subsidies



Histograms give in each region the distribution of beliefs regarding the percentage of peer farmers ready to adopt the EFA ES subject to receiving adequate monetary subsidies. The blue line represents the regional averages for the beliefs. The red line represents the regional average for the observed distribution of farmers' own intention to adopt. Farmers in T1 and T2 are excluded.

Figures G.3 and G.4 provide the distribution of farmers' beliefs regarding the share of peer farmers in a region ready to adopt, respectively, the EFA and TFI ES subject to receiving adequate monetary subsidies. Overall, Figures G.3-G.4 reveal that whatever the region and the ES considered, French farmers have biased beliefs regarding the intention to adopt the ES by their peers. The bias is substantial and negative: French farmers underestimate adoption of ES by their peers by 28 to 30 percentage points, on average.

Figure G.4: Distribution of beliefs about peers regarding the intention to adopt the TFI ES subject to receiving adequate monetary subsidies

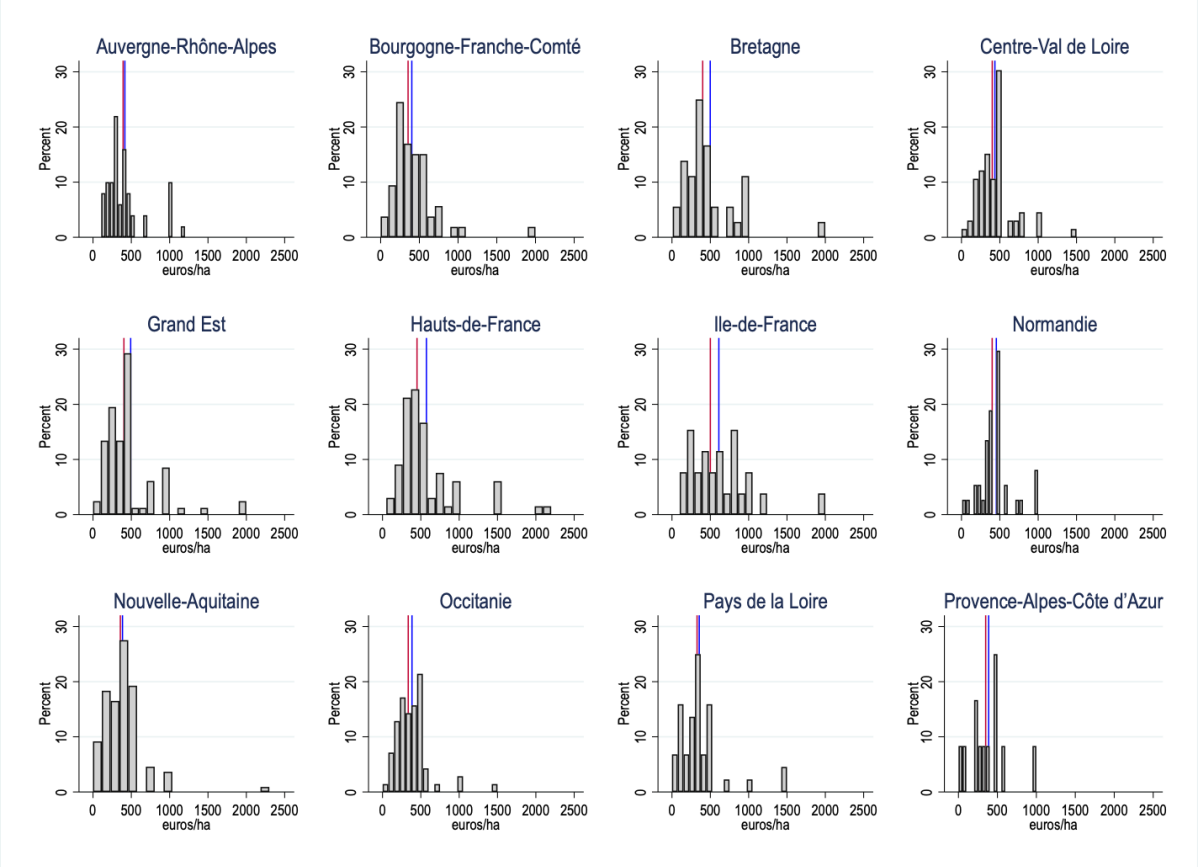


Histograms give in each region the distribution of beliefs regarding the percentage of peer farmers ready to adopt the TFI ES subject to receiving adequate monetary subsidies. The blue line represents the regional averages for the beliefs. The red line represents the regional average for the observed distribution of farmers' own intention to adopt. Farmers in T1 and T2 are excluded.

G.3 Misperception about peers regarding the WTA expressed to implement the ES per French region

We now focus on farmers' misperceptions of the WTA expressed by their peers to implement the ES. We restrict our sample to respondents in the control group, i.e., to respondents who have not been shown any information regarding peers before answering the two questions regarding WTA ES.

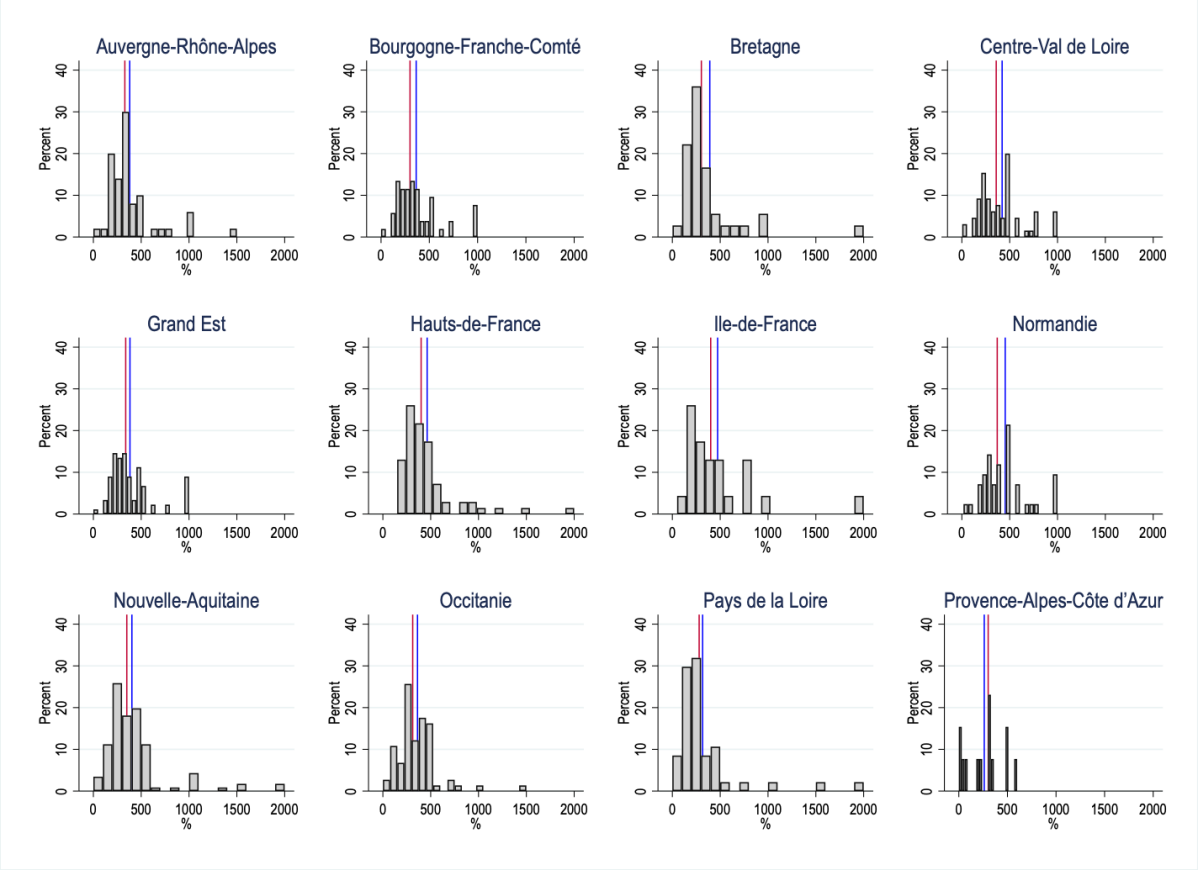
Figure G.5: Distribution of beliefs regarding the willingness to accept (WTA) the EFA ES



Histograms give in each region the distribution of beliefs regarding the WTA for the EFA ES. The blue line represents the regional averages of farmers' beliefs. The red line represents the regional average for the observed distribution of farmers' expressed WTA. Farmers in T1, T2 and T3 are excluded.

Figures G.5 and G.6 provide the distribution of beliefs regarding the WTA for, respectively, the EFA and TFI ES. The main result is that, in most regions, farmers overestimate the WTA required by their peer farmers to implement the ES by, on average 55€ per ha (with heterogeneity between regions and considered ES).

Figure G.6: Distribution of beliefs regarding the willingness to accept (WTA) the TFI ES



Histograms give in each region the distribution of beliefs regarding the WTA for the TFI ES. The blue line represents the regional averages of farmers' beliefs. The red line represents the regional average for the observed distribution of farmers' expressed WTA. Farmers in T1, T2 and T3 are excluded.

H Association between misperceptions and farmers' characteristics

To further understand the mechanisms that may plausibly explain farmers' misperceptions, we conduct T-tests to compare the main characteristics of farmers with upward and downward biased beliefs. The results are reported in Tables H.1 and H.2.

We first consider a set of variables related to farmers' socio-demographics: gender, age, experience in years, and university diploma. Second, we consider a set of variables related to the farm: surface (in ha), net income, whether or not the farm is certified with a quality label, whether or not the farm is converted into organic farming, whether or not farmers are engaged into AECM or receive subsidies for organic farming, whether or not farm products are sold to short food circuits, participation to professional collective association, participation to environmental associations, location in a Natura 2000 area, and location in a vulnerable zone to nitrates. Finally, we consider variables related to farmers' neighborhood: whether or not they think they are familiar with their neighbors, and whether or not they think they are similar to their neighbors.

Overall, we observe that farmers' age and experience in years are systematically associated with farmers' misperceptions with the EFA ES, but not with the TFI ES. We find that farmers holding positive perception gaps regarding environmental benefits of ES and adoption rates by peers tend to be younger compared to those holding negative biases. On the contrary, farmers with a positive perception gap regarding WTA ES tend to be older. The contribution of age to explain perception gaps has been documented in the existing literature in social psychology (Rudolph et al., 2021), this association being explained by generational differences, media consumption habits or participation to social networks. We also document a strong association between perception gaps and organic farming. For ES EFA, 18% of farmers with a positive perception gap on environmental benefits are involved in organic farming whereas this percentage drops to 13% when considering farmers with a negative perception gaps. Results are very similar when considering the perception gaps regarding adoption by peers: 19% of farmers with a positive perception gap on adoption by peers are involved in organic farming compared to 13% of farmers with a negative perception gaps. It is then not surprising to find that 20% of farmers with a negative perception gap for WTA are engaged in organic farming compared to only 8% holding negative perception gaps. We document similar associations when considering the TFI ES.

Table H.1: Comparison of farmers' characteristics depending on misperceived beliefs about peers (EFA ES)

	Beliefs about Benefits			Beliefs about Adoption			Beliefs about WTA		
	Bias ≥ 0	Bias<0	T-test	Bias ≥ 0	Bias<0	T-test	Bias ≥ 0	Bias<0	T-test
Female	0.14	0.10	2.459**	0.13	0.11	1.024	0.10	0.11	-0.568
Age	48.81	49.97	-2.526**	47.26	49.99	-3.573***	50.62	49.01	2.118**
Farming experience	21.24	23.51	-4.409***	19.91	23.21	-3.802***	24.35	21.95	2.750***
University diploma	0.57	0.56	0.732	0.59	0.57	0.543	0.55	0.56	-0.215
Agricultural area	139.61	146.40	-1.298	151.01	142.08	1.045	138.88	142.40	-0.437
Net income $> 60,000$€	0.10	0.10	-0.178	0.10	0.10	0.063	0.07	0.09	-0.742
Net income $< 15,000$€	0.42	0.41	0.550	0.42	0.42	-0.074	0.46	0.42	0.993
Quality label	0.26	0.25	0.419	0.21	0.26	-1.498	0.24	0.24	-0.030
Organic farming	0.18	0.13	3.006***	0.19	0.13	2.083**	0.08	0.20	-4.471***
AECM	0.36	0.28	3.397***	0.33	0.31	0.449	0.26	0.38	-3.299***
Short food supply chain	0.26	0.24	1.281	0.24	0.23	0.322	0.22	0.26	-1.169
Collective affiliation	0.71	0.69	0.709	0.69	0.69	0.141	0.67	0.71	-0.904
Associative affiliation	0.43	0.43	0.036	0.45	0.42	0.899	0.45	0.41	0.981
Natura 2000	0.15	0.19	-1.698*	0.19	0.18	0.222	0.18	0.18	0.021
Nitrate zone	0.54	0.63	-3.679***	0.55	0.61	-1.632	0.63	0.60	0.606
Neighborhood familiarity	0.55	0.56	-0.427	0.60	0.53	1.721*	0.57	0.56	0.323
Neighborhood similarity	0.05	0.05	-0.315	0.03	0.05	-0.778	0.04	0.06	-1.049

The column Bias ≥ 0 (resp. ≤ 0) corresponds to a positive (resp. negative) perception bias. For categorical variables, this column indicates the share of farmers who express a positive (resp. negative) perception bias. For instance, 14% of female express a positive perception gap regarding perceived environmental benefits of the EFA ES. For continuous variables, this column indicates the average for the considered variable for farmers expressing a positive (resp. negative) perception gap. For instance, among farmers who express a positive perception bias regarding perceived environmental benefits for the EFA ES, the average farming experience is 21.24 years.

Table H.2: Comparison of farmers' characteristics depending on misperceived beliefs about peers (ES TFI)

	Beliefs about Benefits			Beliefs about Adoption			Beliefs about WTA		
	Bias $\geq$0	Bias<0	T-test	Bias $\geq$0	Bias<0	T-test	Bias $\geq$0	Bias<0	T-test
Female	0.12	0.11	0.767	0.12	0.11	0.615	0.11	0.10	0.072
Age	49.04	50.14	-2.448**	49.16	49.77	-0.791	50.03	49.68	0.468
Farming experience	21.89	23.52	-3.229***	21.84	23.01	-1.333	23.46	22.86	0.687
University diploma	0.55	0.57	-0.905	0.59	0.57	0.558	0.54	0.55	-0.498
Agricultural area	139.10	147.13	-1.577	134.87	144.82	-1.143	140.12	141.40	-0.159
Net income $> 60,000$€	0.12	0.09	1.828*	0.15	0.09	2.163**	0.06	0.10	-1.677*
Net income $< 15,000$€	0.40	0.42	-0.694	0.41	0.42	-0.181	0.46	0.42	1.095
Quality label	0.26	0.25	0.572	0.23	0.25	-0.634	0.24	0.24	-0.166
Organic farming	0.17	0.13	2.838***	0.19	0.14	1.924*	0.09	0.19	-3.361***
AECM	0.33	0.28	2.062**	0.35	0.31	1.148	0.25	0.38	-3.453***
Short food supply chain	0.25	0.24	0.472	0.28	0.23	1.406	0.23	0.25	-0.595
Collective affiliation	0.68	0.71	-1.400	0.66	0.69	-0.762	0.67	0.71	-0.999
Associative affiliation	0.44	0.42	0.562	0.41	0.42	-0.225	0.43	0.43	-0.195
Natura 2000	0.16	0.18	-0.907	0.23	0.17	1.788*	0.19	0.17	0.626
Nitrate zone	0.55	0.63	-3.476***	0.54	0.62	-1.854*	0.59	0.64	-1.298
Neighborhood familiarity	0.54	0.57	-1.040	0.59	0.54	1.203	0.53	0.60	-1.777*
Neighborhood similarity	0.06	0.04	1.082	0.04	0.04	-0.286	0.06	0.04	1.093

The column Bias ≥ 0 (resp. ≤ 0) corresponds to a positive (resp. negative) perception bias. For categorical variables, this column indicates the share of farmers who express a positive (resp. negative) perception bias. For instance, 12% of female express a positive perception gap regarding perceived environmental benefits of the EFA ES. For continuous variables, this column indicates the average for the considered variable for farmers expressing a positive (resp. negative) perception gap. For instance, among farmers who express a positive perception bias regarding perceived environmental benefits for the EFA ES, the average farming experience is 21.89 years.

I Effects of treatments on outcome variables

We present in this Appendix the detailed results of the estimations reported in the main text.

I.1 Direct effects of informational treatments

Table I.1: Direct effects of T1 (marginal effects)

	Homogeneous model		Heterogeneous model	
	EFA	FTI	EFA	FTI
T1	0.064***	0.076***		
	(0.022)	(0.021)		
T1 × More 50% below			0.072***	0.075***
			(0.028)	(0.029)
T1 × 25 to 50% below			0.092**	0.105***
			(0.041)	(0.025)
T1 × 0 to 25% below			0.118*	0.078***
			(0.064)	(0.029)
T1 × 0 to 25% above			0.041	0.093***
			(0.056)	(0.034)
T1 × 25 to 50% above			0.022	-0.016
			(0.082)	(0.036)
T1 × More 50% above			-0.021	0.095
			(0.062)	(0.097)
More 50% below	-0.200***	-0.148***	-0.201***	-0.147***
	(0.009)	(0.012)	(0.009)	(0.014)
25 to 50% below	0.059***	0.120***	0.052***	0.113***
	(0.010)	(0.012)	(0.016)	(0.013)
0 to 25% below	0.172***	0.204***	0.160***	0.203***
	(0.030)	(0.016)	(0.027)	(0.014)
0 to 25% above	0.219***	0.331***	0.225***	0.327***
	(0.018)	(0.017)	(0.027)	(0.019)
25 to 50% above	0.303***	0.379***	0.313***	0.397***
	(0.026)	(0.032)	(0.024)	(0.037)
More 50% above	0.439***	0.483***	0.455***	0.479***
	(0.029)	(0.034)	(0.037)	(0.024)
Observations	2715	2716	2715	2716
Log-likelohood	-1371.107	-1369.098	-1346.015	-1344.719

We estimate, for each ES, Probit models to explain the probability, for a farmer, to indicate that the ES provides environmental benefits. Although not reported, we include regions fixed effects. Standard errors, in parentheses, are clustered at the regional level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table I.2: Direct effects of T2 (marginal effects)

	Homogeneous model		Heterogeneous model	
	EFA	FTI	EFA	FTI
T2	-0.021	-0.030		
	(0.024)	(0.021)		
T2 × More 50% below			-0.011	0.014
			(0.026)	(0.036)
T2 × 25 to 50% below			-0.064	-0.099**
			(0.074)	(0.043)
T2 × 0 to 25% below			-0.015	-0.034
			(0.050)	(0.037)
T2 × 0 to 25% above			-0.041	-0.079
			(0.082)	(0.096)
T2 × 25 to 50% above			0.099	0.173
			(0.183)	(0.139)
T2 × More 50% above			-0.074	-0.084
			(0.069)	(0.097)
More 50% below	-0.025**	-0.076***	-0.027***	-0.087***
	(0.011)	(0.008)	(0.010)	(0.014)
25 to 50% below	0.197***	0.171***	0.212***	0.195***
	(0.026)	(0.014)	(0.039)	(0.024)
0 to 25% below	0.287***	0.271***	0.286***	0.271***
	(0.016)	(0.018)	(0.021)	(0.024)
0 to 25% above	0.408***	0.390***	0.417***	0.409***
	(0.036)	(0.033)	(0.038)	(0.058)
25 to 50% above	0.510***	0.377***	0.482***	0.320***
	(0.041)	(0.051)	(0.051)	(0.060)
More 50% above	0.323***	0.272***	0.341***	0.289***
	(0.050)	(0.039)	(0.047)	(0.044)
Observations	1969	1982	1969	1982
Log-likelihood	-1102.972	-1102.119	-1127.022	-1123.148

We estimate, for each ES, Probit models to explain the probability, for a farmer, to indicate that he/she would adopt the corresponding ES. Although not reported, we include regions fixed effects. Standard errors, in parentheses, are clustered at the regional level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table I.3: Direct effects of T3

	Homogeneous model		Heterogeneous model	
	EFA	FTI	EFA	FTI
T3	11.050	-8.525		
	(8.061)	(7.718)		
T3 × More 50% below			90.803**	38.796
			(30.547)	(22.358)
T3 × 25 to 50% below			51.144***	48.293***
			(12.315)	(12.295)
T3 × 0 to 25% below			39.301**	26.575**
			(14.420)	(10.411)
T3 × 0 to 25% above			12.780	1.099
			(28.885)	(9.724)
T3 × 25 to 50% above			-59.661*	-40.037**
			(29.065)	(13.973)
T3 × More 50% above			-119.781**	-157.194***
			(43.708)	(49.294)
More 50% below	236.856***	196.595***	198.659***	175.904***
	(21.629)	(10.511)	(20.100)	(14.404)
25 to 50% below	312.953***	276.587***	292.764***	250.719***
	(10.374)	(7.051)	(11.649)	(8.450)
0 to 25% below	419.045***	351.422***	401.212***	333.259***
	(6.494)	(6.011)	(5.853)	(5.541)
0 to 25% above	496.020***	408.146***	493.030***	401.396***
	(6.045)	(6.519)	(19.382)	(6.505)
25 to 50% above	594.205***	494.221***	620.962***	510.546***
	(16.845)	(5.430)	(26.249)	(13.600)
More 50% above	936.233***	783.903***	992.046***	849.459***
	(50.981)	(37.110)	(57.160)	(46.309)
Observations	1075	1077	1075	1077
R^2	0.894	0.903	0.897	0.908

We estimate, for each ES, OLS models to explain the requested WTA by farmers to implement the corresponding ES. Although not reported, we include regions fixed effects. Standard errors, in parentheses, are clustered at the regional level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

I.2 Cross-learning effects of informational treatments

I.2.1 Cross-learning effect of T1 on adoption of ES

Table I.4: Cross-learning effect of T1 on adoption of ES (marginal effects)

	Own intention to adopt				Belief on peers' intention to adopt			
	Homogeneous model		Heterogeneous model		Homogeneous model		Heterogeneous model	
	EFA	FTI	EFA	FTI	EFA	FTI	EFA	FTI
T1	0.04		0.08***		4.88**	5.12***		
	(0.03)		(0.02)		(1.82)	(1.21)		
T1 × More 50% below		0.08***		0.12***			9.63***	7.25***
		(0.03)		(0.04)			(2.15)	(1.78)
T1 × 25 to 50% below		0.07		0.08			8.74**	5.65
		(0.07)		(0.06)			(3.90)	(3.21)
T1 × 0 to 25% below		-0.04		0.00			3.74	2.64
		(0.07)		(0.03)			(2.92)	(2.37)
T1 × 0 to 25% above		-0.06		-0.01			-0.80	8.00***
		(0.06)		(0.08)			(2.53)	(1.96)
T1 × 25 to 50% above		-0.04		0.17**			-2.94	-1.25
		(0.08)		(0.07)			(2.76)	(2.53)
T1 × More 50% above		0.08		0.03			0.50	5.53**
		(0.08)		(0.11)			(3.48)	(2.13)
More 50% below	-0.01	-0.02*	-0.07***	-0.08***	26.01***	27.37***	24.56***	26.60***
	(0.01)	(0.01)	(0.01)	(0.02)	(1.28)	(0.75)	(1.15)	(0.78)
25 to 50% below	0.22***	0.21***	0.15***	0.15***	37.76***	39.23***	36.38***	38.90***
	(0.04)	(0.03)	(0.03)	(0.03)	(1.28)	(1.19)	(1.78)	(1.13)
0 to 25% below	0.20***	0.22***	0.20***	0.23***	42.66***	49.16***	43.03***	49.95***
	(0.04)	(0.05)	(0.01)	(0.02)	(1.05)	(1.05)	(1.41)	(1.25)
0 to 25% above	0.26***	0.30***	0.34***	0.37***	47.48***	51.80***	49.58***	50.67***
	(0.03)	(0.03)	(0.02)	(0.04)	(0.89)	(1.00)	(1.16)	(1.16)
25 to 50% above	0.32***	0.34***	0.33***	0.31***	51.73***	53.63***	54.58***	55.39***
	(0.02)	(0.03)	(0.04)	(0.04)	(1.08)	(1.48)	(1.23)	(1.69)
More 50% above	0.41***	0.39***	0.36***	0.37***	57.96***	57.93***	59.17***	57.69***
	(0.02)	(0.03)	(0.03)	(0.04)	(1.24)	(1.66)	(1.33)	(1.70)
Observations	1956	1956	1990	1990	1992	2016	1992	2016
R^2					0.75	0.79	0.75	0.79
Log-likelihood	-1094.788	-1090.830	-1104.503	-1100.273				

In columns 1 to 4, we estimate, for each ES, Probit models to explain the probability, for a farmer, to indicate that he/she would adopt the corresponding ES. In columns 5 to 8, we estimate, for each ES, Probit models to explain the probability, for a farmer, to indicate that he/she believes that his/her peer farmers, in the same region, would adopt the corresponding ES. Although not reported, we include regions fixed effects. Standard errors, in parentheses, are clustered at the regional level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

I.2.2 Cross-learning effect of T1 on the WTA to implement ES

Table I.5: Cross-learning effect of T1 on the WTA to implement ES

	Own WTA to adopt				Belief on peers' WTA to adopt			
	Homogeneous model		Heterogeneous model		Homogeneous model		Heterogeneous model	
	EFA	FTI	EFA	FTI	EFA	FTI	EFA	FTI
T1	-21.23	-9.43			-24.54*	-17.38		
	(12.32)	(17.21)			(11.88)	(9.97)		
T1 × More 50% below			-38.70	-2.90			-34.51	-46.24**
			(44.39)	(32.46)			(40.53)	(16.09)
T1 × 25 to 50% below			-109.79**	-61.58*			-89.80**	-40.97
			(43.22)	(28.49)			(33.52)	(28.94)
T1 × 0 to 25% below			42.80	-18.70			-5.51	-6.27
			(49.18)	(39.77)			(26.12)	(31.41)
T1 × 0 to 25% above			-10.00	-9.12			-35.35	13.67
			(37.70)	(19.96)			(24.40)	(25.41)
T1 × 25 to 50% above			53.69	32.54			92.30**	28.94
			(38.65)	(28.07)			(36.65)	(30.43)
T1 × More 50% above			-21.27	13.67			-24.46	4.25
			(47.09)	(51.66)			(41.02)	(42.10)
More 50% below	531.08***	455.52***	542.70***	452.70***	499.89***	466.89***	506.66***	480.24***
	(15.35)	(15.03)	(30.99)	(16.35)	(16.36)	(12.70)	(28.54)	(18.78)
25 to 50% below	382.45***	345.77***	435.61***	371.64***	379.44***	335.99***	418.97***	347.63***
	(16.94)	(20.19)	(34.90)	(17.60)	(23.39)	(15.70)	(34.13)	(17.04)
0 to 25% below	360.47***	361.21***	330.62***	366.34***	345.09***	356.84***	337.58***	351.08***
	(26.55)	(21.57)	(21.20)	(31.46)	(16.90)	(17.05)	(17.44)	(27.89)
0 to 25% above	385.27***	324.75***	382.89***	325.15***	381.89***	338.69***	390.31***	322.28***
	(15.80)	(16.79)	(16.26)	(17.29)	(17.68)	(18.72)	(14.23)	(19.79)
25 to 50% above	356.58***	336.98***	317.68***	316.65***	346.75***	348.08***	283.20***	326.05***
	(24.24)	(22.52)	(40.91)	(27.65)	(22.55)	(18.05)	(28.70)	(23.10)
More 50% above	382.42***	328.45***	385.25***	319.42***	397.68***	351.01***	399.71***	341.46***
	(19.68)	(26.38)	(31.86)	(27.04)	(17.09)	(20.64)	(28.82)	(27.19)
Observations	1071	1077	1071	1077	1292	1319	1292	1319
R^2	0.69	0.68	0.69	0.68	0.68	0.66	0.68	0.66

In columns 1 to 4, we estimate, for each ES, OLS models to explain the WTA requested by farmers to implement the corresponding ES.
In columns 5 to 8, we estimate, for each ES, OLS models to explain the WTA that farmers believe their peer farmers, in the same region, would request to implement the corresponding ES. Although not reported, we include regions fixed effects.
Standard errors, in parentheses, are clustered at the regional level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

I.2.3 Cross-learning effect of T2 on the WTA to implement ES

Table I.6: Cross-learning effect of T2 on the WTA to implement ES

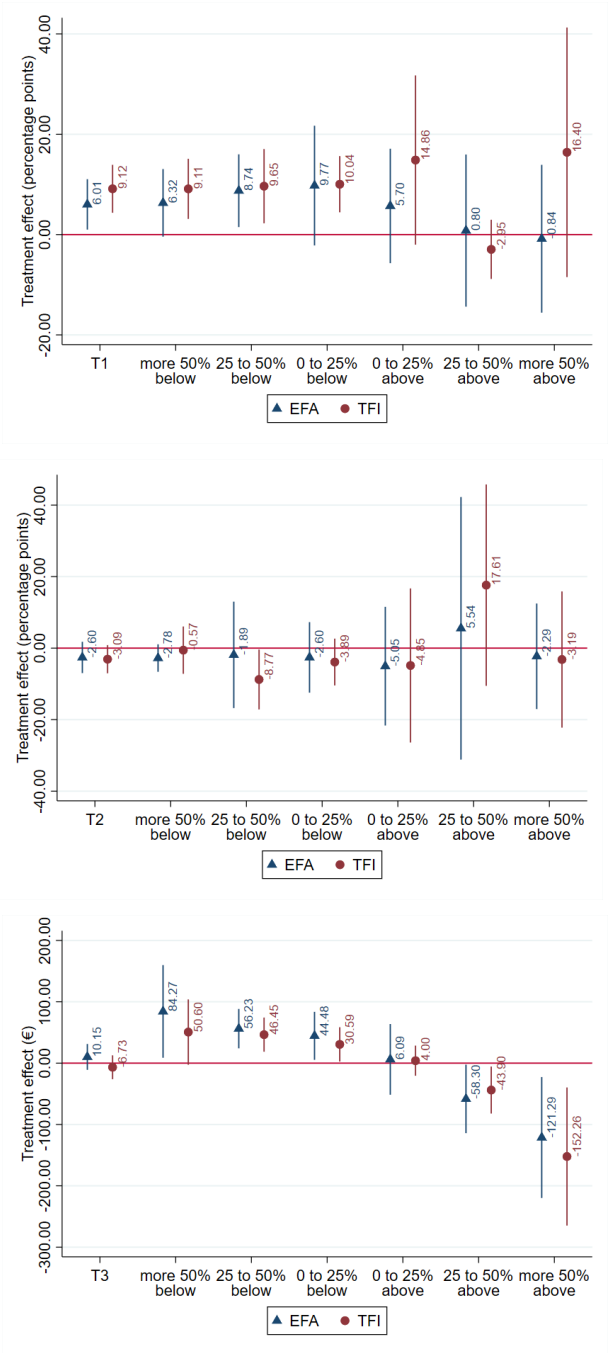
	Own WTA to adopt				Belief on peers' WTA to adopt			
	Homogeneous model		Heterogeneous model		Homogeneous model		Heterogeneous model	
	EFA	FTI	EFA	FTI	EFA	FTI	EFA	FTI
T2	-28.77**	-16.92			-15.78*	2.10		
	(11.15)	(13.09)			(7.69)	(13.25)		
T2 × More 50% below			-66.31**	-13.51			-26.29	3.25
			(24.93)	(34.09)			(16.89)	(24.41)
T2 × 25 to 50% below			-6.97	-36.41			-17.19	-8.71
			(35.95)	(25.53)			(41.48)	(22.07)
T2 × 0 to 25% below			-11.13	-44.04*			-7.37	-31.94
			(30.14)	(22.89)			(29.86)	(21.31)
T2 × 0 to 25% above			44.11	30.62			26.64	44.31
			(35.85)	(29.45)			(47.21)	(32.07)
T2 × 25 to 50% above			27.95	35.63			10.56	48.70
			(40.69)	(47.01)			(40.74)	(52.70)
T2 × More 50% above			-96.82	18.94			-55.27	75.81
			(94.77)	(75.89)			(130.63)	(91.82)
More 50% below	493.65***	432.78***	512.93***	429.83***	490.73***	449.56***	496.49***	446.80***
	(13.07)	(12.18)	(19.43)	(19.51)	(12.96)	(8.23)	(17.58)	(11.29)
25 to 50% below	385.94***	348.45***	376.39***	356.55***	380.13***	334.72***	381.46***	337.92***
	(19.55)	(14.01)	(26.83)	(20.49)	(16.71)	(15.93)	(26.55)	(20.11)
0 to 25% below	399.66***	349.36***	390.97***	362.52***	385.31***	327.20***	381.36***	343.74***
	(8.08)	(11.79)	(19.16)	(16.52)	(11.60)	(13.99)	(23.70)	(16.03)
0 to 25% above	375.41***	332.92***	336.60***	302.46***	371.75***	315.36***	349.47***	286.76***
	(20.76)	(18.62)	(28.13)	(28.80)	(11.66)	(19.91)	(30.40)	(21.58)
25 to 50% above	367.44***	360.17***	340.71***	333.11***	335.23***	347.93***	323.28***	322.54***
	(39.30)	(23.22)	(52.44)	(31.92)	(26.02)	(26.18)	(41.63)	(33.50)
More 50% above	429.18***	473.83***	457.17***	456.83***	428.46***	460.65***	446.22***	423.47***
	(44.45)	(54.14)	(79.84)	(69.71)	(43.59)	(50.18)	(72.72)	(58.39)
Observations	1058	1062	1058	1062	1304	1311	1304	1311
R^2	0.72	0.74	0.72	0.74	0.70	0.70	0.70	0.70

In columns 1 to 4, we estimate, for each ES, OLS models to explain the WTA requested by farmers to implement the corresponding ES.
In columns 5 to 8, we estimate, for each ES, OLS models to explain the WTA that farmers believe their peer farmers, in the same region, would request to implement the corresponding ES. Although not reported, we include regions fixed effects.
Standard errors, in parentheses, are clustered at the regional level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

J Robustness checks

J.1 Direct effects with controls

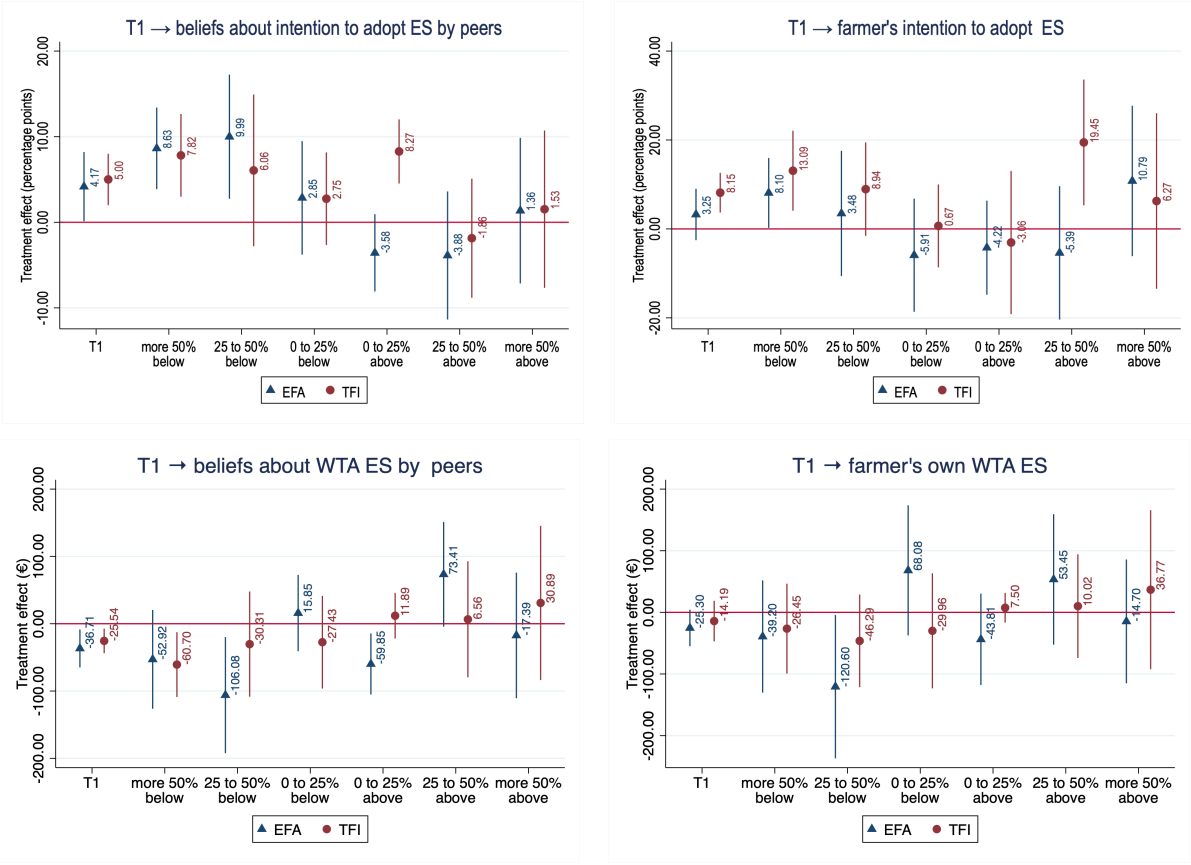
Figure J.1: Direct effects of treatments controlling for farmer's characteristics



This figure reports the direct effects (in percentage points) of being exposed to T1 (first graph), T2 (second graph) and T3 (third graph) on the corresponding personal opinion of farmers. Control variables: gender, age, education level, risk aversion, location in EU Natura 2000 zone, income, organic farm, other environmental label. Confidence intervals and point estimates are provided for the homogeneous treatment model ("T1, T2, T3") and for the heterogeneous treatment model for which interaction terms between treatments and perception gap classes are reported (from "more 50% below" to "more 50% above"). Treated groups are compared to the extended control groups. 95% confidence intervals are reported.

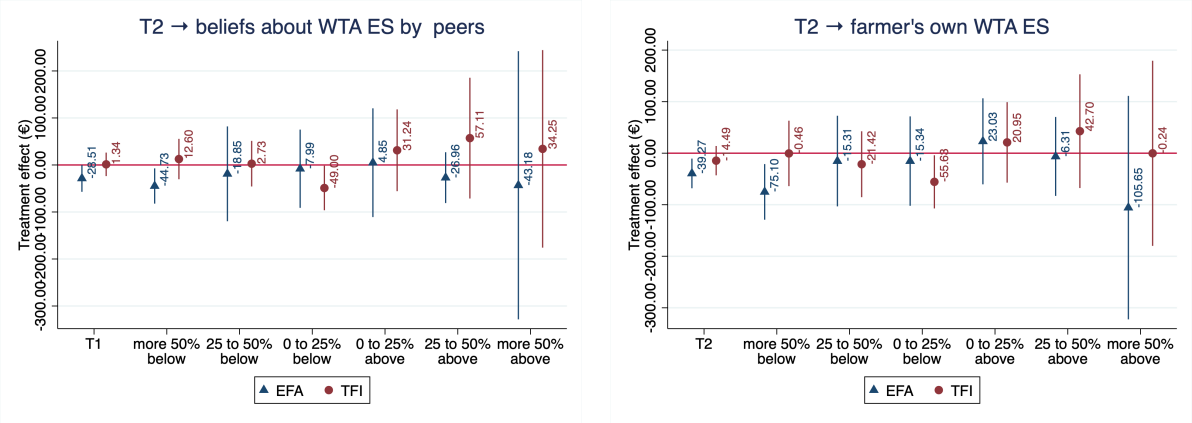
J.2 Cross-learning effects with controls

Figure J.2: Indirect effects of T1 on adoption and WTA controlling for farmer's characteristic



This figure reports the cross-learning effects (in percentage points) of being exposed to T1 on adoption and WTA (beliefs about peers and personal opinion in both cases). Control variables: gender, age, education level, risk aversion, location in EU Natura 2000 zone, income, organic farm, other environmental label. Confidence intervals and point estimates are provided for the homogeneous treatment model ("T1, T2, T3") and for the heterogeneous treatment model for which interaction terms between treatments and perception gap classes are reported (from "more 50% below" to "more 50% above"). Treated groups are compared to the extended control groups. 95% confidence intervals are reported.

Figure J.3: Indirect effects of T2 on WTA controlling for farmer's characteristic



This figure reports the cross-learning effects (in percentage points) of being exposed to T1 on adoption and WTA (beliefs about peers and personal opinion in both cases). Control variables: gender, age, education level, risk aversion, location in EU Natura 2000 zone, income, organic farm, other environmental label. Confidence intervals and point estimates are provided for the homogeneous treatment model ("T1, T2, T3") and for the heterogeneous treatment model for which interaction terms between treatments and perception gap classes are reported (from "more 50% below" to "more 50% above"). Treated groups are compared to the extended control groups. 95% confidence intervals are reported.

K Falsification tests

Since some outcome variables have been measured *before* implementing some treatments, they should not be affected by these treatments. The sequential structure of the survey provides then a way to conduct a series of falsification tests.

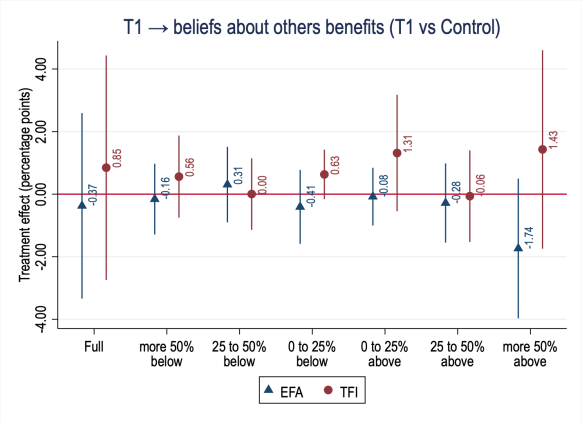
Table K.1: Definition outcome variables for falsification tests

Treatment	Information provided in treated group	Control group	Outcome variables that should not be affected by treatments
T1	"True" beliefs about others benefits	CO	Beliefs about others benefits
T2	"True" beliefs about others adoption	CO	Beliefs about others benefits
T2	"True" beliefs about others adoption	CO	Personal opinion benefits (0,1)
T2	"True" beliefs about others adoption	CO	Beliefs about others adoption
T3	"True" beliefs about others WTA	CO	Beliefs about others benefits
T3	"True" beliefs about others WTA	CO	Personal opinion benefits (0,1)
T3	"True" beliefs about others WTA	CO	Beliefs about others adoption
T3	"True" beliefs about others WTA	CO	Personal opinion adoption (0,1)
T3	"True" beliefs about others WTA	CO	Beliefs about others WTA (€/ha)

Since farmers in T1, T2 and T3 have been asked to report their beliefs regarding environmental benefits to be expected from ES by peers *before* being exposed to any kind of "true" information regarding peers, this outcome variable should not be impacted by our informational treatments. Similarly, we do not expect any impact of T2 and T3 on the own intention to adopt ES since farmers belonging to these treatments have reported their own intention to adopt the proposed ES *before* being exposed to any kind of "true" information regarding peers. For the same reason, the beliefs about others regarding adoption of ES should not been affected by T2 or by T3, and the personal opinion regarding adoption and the beliefs about others WTA should not been affected by T3.

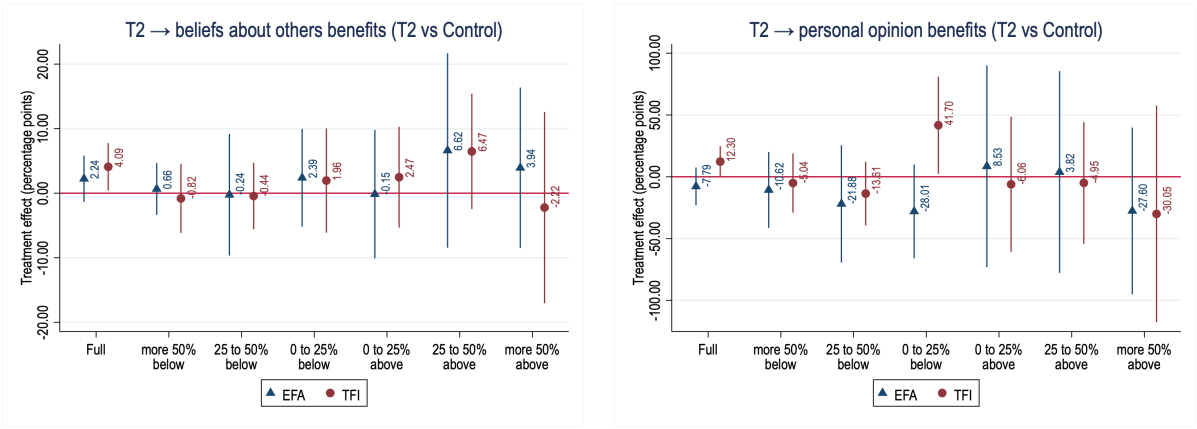
The results of the falsification tests are presented in Figures K.1-K.3. As expected, there is no significant impacts of T1, T2 and T3 on beliefs regarding environmental benefits to be expected from ES by peers, both considering the homogeneous and the heterogeneous treatment models (at the exception of T2 for the TFI ES in the homogeneous treatment model). For the other outcome variables, we do not find any significant effect of neither of T2 or T3 (again at the exception of the TFI ES in the homogeneous treatment model).

Figure K.1: Results of falsification tests for T1



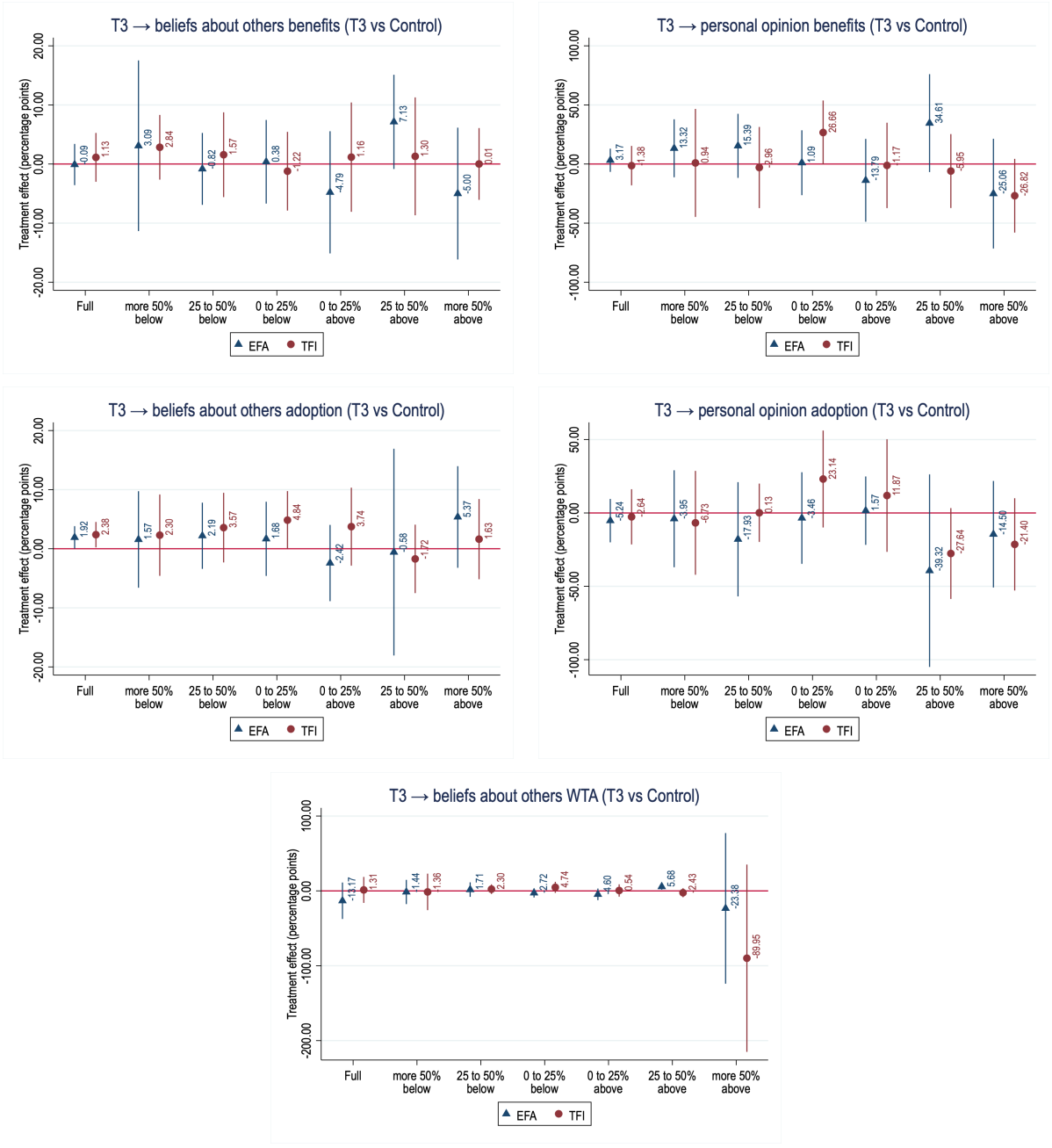
This figure reports the effects (in percentage points) of being exposed to T1 on beliefs about peers regarding environmental benefits from ES. 95% confidence intervals and point estimates are provided for the homogeneous treatment model ("Full") and for the heterogeneous treatment model for which interaction terms between treatments and perception gap classes are reported. T1 compared to the control group.

Figure K.2: Results of falsification tests for T2



This figure reports the effects (in percentage points) of being exposed to T2 on beliefs about peers and personal opinion regarding environmental benefits from ES. 95% confidence intervals and point estimates are provided for homogeneous treatment model ("Full") and for heterogeneous treatment models for which interaction terms between treatments and perception gap classes are reported. T2 compared to control.

Figure K.3: Results of falsification tests for T3



This figure reports the effects (in percentage points) of being exposed to T3 on beliefs about peers and personal opinion regarding environmental benefits from ES, on beliefs about peers and personal opinion regarding intention to adopt ES, and on beliefs about peers regarding WTA ES. 95% confidence intervals and point estimates are provided for the homogeneous treatment model ("Full") and for the heterogeneous treatment model for which interaction terms between treatments and perception gap classes are reported. T3 compared to the control group.