

# Re-calibrating Second-Order Beliefs: Results From a Randomized Experiment on French Farmers\*

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## Abstract

We assess the accuracy of French farmers in forming second-order beliefs (beliefs about other beliefs) about eco-schemes (ES), a new policy instrument under discussion in the 2023-27 reform of the EU Common Agricultural Policy. Using a randomized control experiment on a nationwide sample of French farmers, we demonstrate that French farmers hold biased second-order beliefs regarding ES with a strong tendency to underestimate the proportion of peers considering that ES would be good for the environment (average bias of -15.30 to -15.48 percentage points) and the proportion of peers wishing to adopt the ES on their farm (average bias of -27.75 to -30.93 percentage points). In line with previous results, farmers overestimate the minimum subsidy that lead farmers to adopt ES (by 55.56 to 64.38 €/ha depending upon the ES). Using informational treatments, we then re-calibrate second-order beliefs of farmers and we demonstrate that i) re-calibration of second-order beliefs in one dimension modifies second-order beliefs in another dimension, and ii) re-calibration of second-order beliefs modifies first-order beliefs (i.e., farmer's own beliefs).

**Keywords:** second-order beliefs, misperception, subjective expectations, experiments, 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. Initially centred on supporting production and farm income, the CAP has progressively integrated instruments to support the environment. With around €60 billions in 2020, the CAP accounts for 35% of the total budget of the EU. CAP actions are organized around market measures to deal with difficult market situations, rural development measures to address the specific needs of rural areas, and farmer's income support to ensure income stability, and remunerate farmers for environmentally friendly farming and delivering public services. In 2020, farmer's income support used to represent more than 70% of total CAP expenses. Despite several important reforms (in particular in 1999 and in 2003), the CAP has been highly criticized by EU farmers leading to low participation (ECA, 2011; Cullen et al., 2018) and, today, their support to the 2020 reform still under discussion remains limited.

Opinions of EU farmers on the CAP have been highly investigated. Evidence of lack of support relies in general on revealed preference studies (i.e., limited enrolment of farmers into programs including voluntary measures aiming at mitigating climate change, Pe'er et al. 2017) and on stated preference studies (i.e., direct assessment of farmer's support using surveys). Rather than assuming perfectly rational farmers, we adopt a more behavioral perspective by focusing on their beliefs, and in particular on their second-order beliefs (i.e., beliefs on beliefs of others). To the best of our knowledge, little attention has been paid to the role played by second-order beliefs of farmers on the CAP. This is surprising given the large literature which has shown that people's perceptions about others play an important role for a variety of settings (Bursztyn and Yang, 2021; Charness et al., 2021).

A rationale for a deep understanding of second-order beliefs comes from research in cognitive psychology showing that individuals make inferences about the mind state of others by imagining themselves as other people. This process is however imperfect: it is usually found that individuals insufficiently adjust when imputing the beliefs of others. The result is that many individuals tend to hold biased second-order beliefs and, in particular, systematically over-represent the incidence of similar beliefs to their own and systematically underestimate the incidence of contrasting belief.

The role played by accurate or inaccurate second-order beliefs for shaping individual

behaviors and opinions has been documented by scholars in different disciplines. Political scientists have documented the presence of biased second-order beliefs in a large range of empirical domains including public opinion (Shamir and Shamir, 1997; Todorov and Mandisodza, 2004), political opinions (Levendusky and Malhotra, 2016; Ahler, 2014) and opinion regarding environmental policies (Mildenberger and Tingley, 2019; Schuldt et al., 2019). Economists have also provided empirical evidence on the role played by biased second-order beliefs in particular on energy saving behaviors (Jachimowicz and Galinsky, 2018) or on gender access to job market (Bursztyn et al., 2020).

Here we propose to assess the accuracy of French farmers in forming second-order beliefs about eco-schemes (ES), a new policy instrument proposed in the reform of the EU CAP. Our work relies on a nationwide web-survey on more than three thousands French farmers. To elicit second-order beliefs about ES, we use the introspection method and ask to survey respondents their beliefs regarding others. By exposing respondents to different informational treatments with a randomized experiment, we then re-calibrate inaccurate second-order beliefs of farmers, and we explore the causal impact of this re-calibration on different dimensions of ES adoption.

Our first contribution is to demonstrate that French farmers hold biased second-order beliefs regarding ES with a strong tendency to underestimate the proportion of peers considering that ES would be good for the environment, as well as the proportion of peers wishing to adopt the ES on their farm. For second-order 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 upon the ES considered, and more than two-third of the respondents have a negative bias. For second-order beliefs on the proportion of peers wishing to adopt the ES on their farm, the average bias ranges between -27.75 and -30.93 percentage points, and more than 85 percent of respondents have a negative bias. Interestingly, farmers overestimate the minimum subsidy that would lead farmers to adopt ES (by 55.56 to 64.38 €/ha depending upon the ES). Our second contribution is to show that using informational treatments, it is possible to re-calibrate inaccurate second-order beliefs of farmers with significant impacts on their behaviors. We demonstrate in particular that i) re-calibration of second-order beliefs in one dimension modifies second-order beliefs in another dimension, and ii) re-calibration of second-order beliefs modifies first-order beliefs (i.e., farmer's own beliefs). For instance, being shown the true second-order beliefs regarding benefits for environment increases the likelihood

of reporting benefits for the environment by 8.7 to 10.1 percentage point depending upon the ES considered. We discuss the psychological mechanisms that could explain these results and we derive some policy implications.

The remainder of the paper is organized as follows. In Section 2 we briefly review the literature on second-order beliefs. Section 3 presents our empirical approach. Section 4 exposes our main results and we derive some policy implication in Section 5.

## 2 Re-calibrating second-order beliefs

### 2.1 Rationale for considering second-order beliefs

A growing body of literature has emphasized the need to focus not only on what people believe, but also on what they believe others believe. Much of this literature draws from research in cognitive psychology, which has long focused on how individuals make inferences about the mind states of others.

A common view among psychologists is that individuals make inferences about the mind state of others by imagining themselves as other people (simulation view), and that individuals use their own beliefs as a heuristic to impute the beliefs of others. Since individuals have some intuitive sense that other people are different than themselves, they will often modify this imputation as a function of perceived differences between themselves and “the others”. However, due to anchoring and adjustment heuristic, individuals may insufficiently adjust when imputing the beliefs of others. The result is that many individuals may hold biased second-order beliefs and in particular systematically over-represent the incidence of similar beliefs to their own and systematically underestimate the incidence of contrasting beliefs.

Different type of biased second-order beliefs have been documented in the literature in psychology. Among them is the “false consensus effect” (Ross et al., 1977), which describes the tendency of people to overestimate the commonness of their own beliefs or behaviors, and the “bias blind spot” (Pronin et al., 2002), which refers to people’s unawareness of their own 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 belief but mistakenly assume that others do not. The overall finding of the literature in psychology is that there is a general egocentric bias in the way individuals make judgments about the beliefs of others, particular the beliefs of people

who they perceive as similar. Inaccuracy of second-order beliefs may be a concern since second-order beliefs are involved in many important decisions.

## 2.2 Empirical evidence of the role played by second-order beliefs

The role played by accurate or inaccurate second-order beliefs for shaping individual behaviors and opinions has been documented by scholars in different disciplines (in particular in political sciences and in economics).

Political scientists have documented the presence of biased second-order beliefs in a large range of empirical domains. Adopting a public opinion research perspective in Israel, [Shamir and Shamir \(1997\)](#) demonstrate the existence of pluralistic ignorance across issue domains, including preferences for territorial return, nuclear weapons policy and electoral reform. In similar research, [Todorov and Mandisodza \(2004\)](#) find that the US citizens overestimate public support for unilateral foreign policies. [Levendusky and Malhotra \(2016\)](#) have demonstrated that Americans perceive more partisan polarization than exists in reality, a phenomenon American politics scholars have described as false polarization. Related research suggests that the public perceives ideological partisans as more extreme than they are in reality ([Ahler, 2014](#)). A few works have focused on second-order beliefs and environmental policies. Drawing from six opinion surveys of mass publics, political elites and intellectual elites in the United States and in China, [Mildenberger and Tingley \(2019\)](#) demonstrate that all classes of political actors have second-order beliefs characterized by egocentric bias and global underestimation of pro-climate positions. Working on China, [Schuldt et al. \(2019\)](#) demonstrate that second-order beliefs, particularly strongly predicted individual-level environmental policy support (coal-to-gas policy), over-and-above key demographic variables and first-order environmental beliefs.

Economists have also been involved in providing empirical evidence on the role played by biased second-order beliefs in different context. In the United States context, [Jachimowicz and Galinsky \(2018\)](#) show that second-order normative beliefs are better predictors for energy saving behaviors than first-order personal beliefs. [Bursztyn et al. \(2020\)](#) provide evidence that the vast majority of young married men in Saudi Arabia privately support women working outside the home, while they substantially underestimate the level of support by other similar men.

## 2.3 Measuring and re-calibrating second-order beliefs

Charness et al. (2021) provide an extensive review of methods used to elicit beliefs. These methods range from simple methods (introspection i.e., simply asking people for their beliefs, frequency-guess, interval-guess) to more extensive and complex methods that satisfy desirable theoretical properties (outcome matching-choose, probability matching-choose, scoring rules, incentivized elicitation methods).<sup>1</sup>

Since elicited second-order beliefs have often come to the conclusion of the persistence of large bias, a recent literature has focused on proposing methods to re-calibrate second-order. Bursztyn and Yang (2021) has recently provided a meta-analysis of this literature. Re-calibration of second-order beliefs has taken place in various contexts and for various types of behaviors. After establishing the predictive effect of second-order normative beliefs on energy conservation, Jachimowicz and Galinsky (2018) subsequently conducted an experimental study that manipulated second-order normative beliefs to provide causal evidence.

# 3 Material and method

## 3.1 Study registration and ethics

Given that data collection relies on an online survey, designed with the platform LimeSurvey (version 2.5), the study has been evaluated and approved by the Toulouse School of Economics (TSE) Ethic Committee, and pre-registered on the AEA RCT Registry (ID AEARCTR-0007020)<sup>2</sup>. In addition, a consent page in the study informed respondents that, in accordance with the General Data Protection Regulation of the European Union, they were free to participate or on contrary to leave the survey, see Appendix A.

## 3.2 Survey

### 3.2.1 Data collection

We contracted with the pool company BVA (<https://www.bva-group.com/>) to get an access to a large database of French farmers. The use of an online survey with French

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<sup>1</sup>We don't aim at presenting here merits and drawbacks associated to each method. The interested reader may refer to Charness et al. (2021) for a detailed review.

<sup>2</sup><https://doi.org/10.1257/rct.7020-1.0>

farmers is relevant since 71% of them had an internet connection in 2012 (according to the French National Institute of Statistics and Economic Studies, INSEE). Following a pretest of the online survey on a sample of 2 000 farmers, invitations to the survey were sent by email from February 19<sup>th</sup> to March 26<sup>th</sup> 2021 to 59,000 farmers. The link for the questionnaire was sent to farmers with an introductory e-mail explaining that the study was designed by the French Institute for Agricultural Research (INRAE), see Appendix A. Although 59 000 invitation emails were sent, we do not know exactly how many farmers actually received and read our invitation email. A total of 3,676 farmers followed the link provided in the invitation email, which represent about 6.2% of the initial sample.

### 3.2.2 Structure of the survey

The survey consists of five blocks:

*Block 1: General information.* The first block contains questions on age, gender, educational attainment, location, etc..

*Block 2: Eco-schemes.* The second block refers to ES. We elicit farmer's beliefs regarding the benefits to be expected from implementing ES, adoption rate by peers and willingness to pay.

*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 adoption of agri-environment-climate measures by farmers they were allow to subscribe to in the context of the EU Common Agricultural Policy (CAP). The collected information covers the period 2015-2020.

*Block 5: Psychological traits.* The fifth block is not mandatory for respondents who have the possibility to skip it. In this block, we use different psychometric test to assess individual personality traits of farmers including risk preference, openness, etc.

A list of questions asked to farmers in the five different blocks is provided in Appendix A. For our analysis, the most important block is the second one dedicated to eco-schemes (ES). Since, at the time of the survey, ES have just started to be discussed in the context of the CAP reform, block 2 started with some general background information on ES, see Appendix B. 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 mentioned that although discussions on ES were still in progress, it was likely that requirements for an ES would go beyond those of conditionally and that farmers would participate on an annual voluntary basis.

### 3.3 Eliciting farmer’s beliefs regarding eco-schemes

We consider two ES : i) ES EFA “Increasing Ecological Focus Areas” and ii) ES FTI “Reduce use of phytosanitary products to preserve aquatic ecosystems and human health”. A complete description of the two ES is provided in Appendix B. With ES EFA, a farmer who commits to allocate at least 7% of the total area of arable land to EFA gets a payment in compensation (€ per ha). With ES TFI, a farmer commits to reduce his Treatment Frequency Index<sup>3</sup>: for all plots enrolled in this ES, the TFI must be less than or equal to the regional average - 30%. A farmer subscribing to the TFI ES is compensated by a payment (€ per ha).

Different methods are available to elicit beliefs about ES (Charness et al., 2021). We use here the introspection approach which consists simply in asking to survey respondents their beliefs regarding others without any reward for the accuracy of their report. This method is widespread in surveys, where incentives are difficult to implement as it is the case here.<sup>4</sup>

Figure 1 describes the sequence of questions asked for each ES. We focus first on farmer’s beliefs regarding the benefits to be expected from implementing a particular ES.<sup>5</sup> Respondents have been first asked to report their beliefs regarding the share of farmers in their region who believe that the proposed ES may provide benefits for the society, for farmers located in their region and for the environment (second-order beliefs). To elicit beliefs about others regarding benefits we use the three following questions (see

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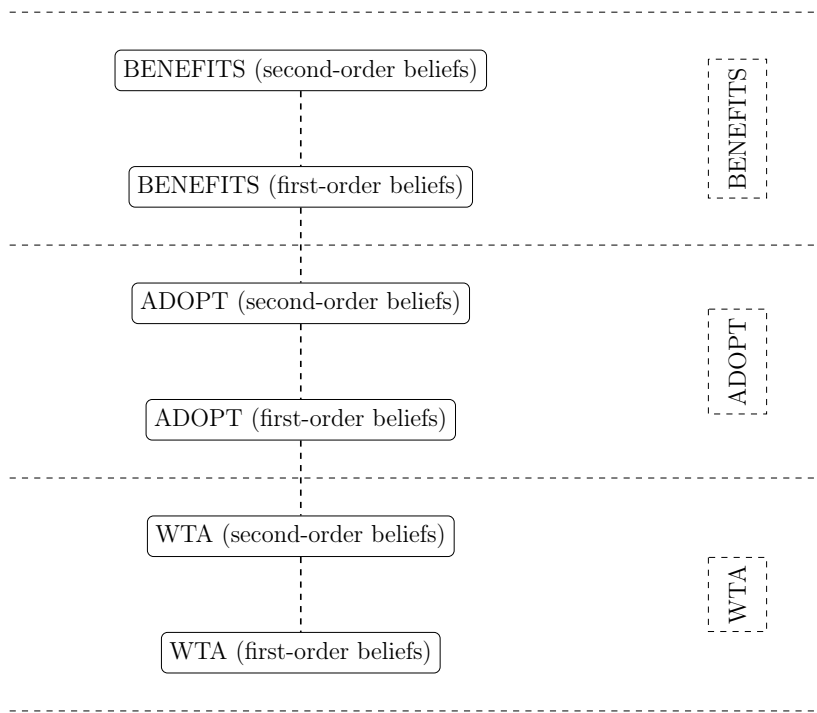
<sup>3</sup>The TFI is an indicator that reflects the intensity of the use of plant protection products.

<sup>4</sup>The choice of the method for eliciting beliefs is highly context-dependent. Although economists are often skeptical about unincentivized methods, Charness et al. (2021) indicate in their recent review of the literature on belief measurement that “Overall, our view is that there is no reliable evidence that complex incentivized elicitation systematically outperforms introspection in experimental applications. Since introspection is also much cheaper, simpler, and faster, it seems preferable in common experimental applications.”

<sup>5</sup>Previous studies have demonstrated that beliefs about the environmental benefits of some sustainable farming practices (i.e., filter strips, sustainable hedge management and payment-for-environmental-services programmes) is correlated with adoption (Beedell and Rehman, 1999; Ma et al., 2012; Yeboah et al., 2015).



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



Appendix B):

- What percentage of farmers in your region believe that the proposed ES is beneficial to the society as a whole?
- What percentage of farmers in your region believe that the proposed ES is beneficial to the population in your region?
- What percentage of farmers in your region believe that the proposed ES is beneficial to the environment?

Then respondents have been asked to provide their own opinion regarding the benefits of the ES for the society, for farmers located in their region and for the environment (first-order beliefs):

- Do you think that the proposed ES is beneficial to the society as a whole?
- Do you think that the proposed ES is beneficial to the population in your region?
- Do you think that the proposed ES is beneficial to the environment?

Then we focus on adoption of the proposed ES. Farmers have been first asked to report their beliefs regarding the share of farmers in their region who would be ready to adopt the proposed ES (second-order beliefs):

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

Then respondents have been asked if they would be ready to adopt the proposed ES (first-order beliefs):

- Subject to receiving an adequate financial support, could you consider adopting this ES on your farm?

Finally, we focus on eliciting the minimum subsidies that would lead farmers to adopt the proposed ES. Respondents have been first asked their belief regarding the minimum subsidies that would lead 50% of farmers in their region to implement the ES (second-order beliefs):

- 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?

Lastly, respondents have been asked the minimum subsidies that would lead them to implement the ES (first-order beliefs):

- Subject to receiving adequate financial support, could you consider adopting this measure on your farm?

Notice that this last question has been asked only to respondents having reported that they were not considering adopting this ES on their farm conditionally to receiving an adequate financial support.

### **3.4 Re-calibrating beliefs of farmers**

The typical design to re-calibrate misperceptions about others is to provide respondents with (truthful) information about others, the rationale of this intervention being that people tend to have biased or insufficient information regarding others ([Bursztyn and Yang, 2021](#)).



Here we use a randomized control trial (RCT) to re-calibrate second-order beliefs, and to assess how re-calibration impacts first-order beliefs.

At the end of the first block of the survey, respondents have been randomly assigned by the web-survey platform to one of three treatments (T1, T2 or T3), or to a control group. In T1, we provide to respondents an additional (truthful) information about ES benefits perceived by other farmers (true second-order beliefs): we communicate to farmers the true proportion of farmers in his/her region who have declared that the ES may provide benefits for the society, for farmers located in their region and for the environment. This information is based on the results of an internet survey conducted on a sample of 1 559 French farmers a few weeks before the current survey, see Appendix G. In T2, farmers are provided with (truthful) information about adoption of ES by peers (true second-order beliefs): farmers are informed about the true share of farmers in their region who wish to adopt a particular ES. Again, this information is based on the results of the internet survey conducted a few weeks before the current one, see Appendix G. In T3, we provide to farmers a (truthful) information about the minimum subsidies required by peer farmers to implement ES (true second-order beliefs): farmers are informed about the average willingness to accept of farmers located in their region see Appendix G. Lastly, no additional (truthful) information about peers is provided to farmers in the control group.

A particular feature of our belief re-calibration procedure is that the truthful information is provided *after* having asked farmers to report their beliefs about others but *before* asking to report the personal opinion of each farmer. We then allow the information treatment to have heterogeneous effects depending on subjects' prior beliefs (and the positions of such prior beliefs relative to the information provided).

## 4 Results

### 4.1 Sample description

As previously mentioned, 3,676 farmers followed the link provided in the invitation email (about 6.2% 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 (see Table C.1). 617 farmers dropped out between the end of block 1 and the completion of the first question in block 2 (dropout rate equal to 17.07%). 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 (see Appendix A). There may be a concern if farmers who have decided not to continue the survey have some specific characteristics. We explore this issue in Appendix C. The main characteristic of farmers explaining dropout is farmers education achievement: highly educated farmers are less likely to dropout.

Table 1 presents some basics descriptive statistics on farmers having completed the survey. Although we are not claiming that our sample is representative of the population of farmers at the France level, for a comparison purpose we also report statistics obtained in 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 explained that the average farm agricultural area is more than twice the agricultural in 2020 agricultural census (143.6 ha compared to 69 ha). The regional distribution of farms appears relatively similar in both sample, 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.

## **4.2 Analyzing second-order beliefs of farmers**

As discussed previously, misperceptions about others has been highly documented in the existing literature for a great variety of settings: across societies, individuals widely misperceive what others think, what others do, and even who others are (Bursztyn and Yang, 2021). We start the empirical analysis by documenting the fact that misperception about others is widely represented among French farmers. This will be the main rationale for proposing to re-calibrate second-order beliefs of farmers.

### **4.2.1 Defining and measuring misperception about others**

If farmers were perfectly informed about the beliefs of other respondents, their subjective second-order beliefs would exactly match the observed distribution of first-order beliefs. Two pieces of information are then needed to establish that farmers have biased perceptions of other beliefs about ES: i) a measure of beliefs about others beliefs regarding ES (second-order beliefs) and ii) a truthful measure of beliefs regarding ES (observed distribution of first-order beliefs).

Table 1: Characteristics of farmers in the survey and in the French 2020 agricultural Census

	<b>Survey</b>	<b>2020 Ag. Census</b>
Organic farming	14.60%	12.1%
Other quality labels	25.55%	27.3%
Short supply chains	24.75%	23.1%
60 years and more	16.89%	25.4%
Agricultural area	143.6 ha	69 ha
Farm type		
-Arable and permanent crops	48.88%	51.8%
-Animal production	15.90%	37.3%
-Mixed production	35.21%	10.4%
Number of farms (%)		
-Auvergne-Rhône-Alpes	204(8.29%)	48454(12.44%)
-Bourgogne-Franche-Comté	164(6.66%)	23632(6.07%)
-Bretagne	131(5.32%)	26335(6.76%)
-Centre-Val de Loire	229(9.30%)	19916(5.11%)
-Corse	0(0%)	2943(0.76%)
-Grand Est	342(13.89%)	40970(10.52%)
-Hauts-de-France	261(10.60%)	23472(6.03%)
-Île-de-France	88(3.57%)	4425(1.14%)
-Normandie	151(6.13%)	26510(6.81%)
-Nouvelle-Aquitaine	375(15.23%)	64125(16.46%)
-Occitanie	273(11.09%)	64266(16.50%)
-Pays de la Loire	191(7.76%)	26394(6.78%)
-Provence-Alpes-Côte d'Azur	53(2.15%)	18025(4.63%)

Organic farming: Organic certified farm or under conversion to organic farming. Other quality labels: Label Rouge, Protected Designation of Origin (AOC or AOP), Protected Geographical Indication (IGP), Spécialité Traditionnelle Garantie (STG). Short supply chains: direct selling to final customers (with or without intermediary). 60 years and more: Respondent is 60 years old, or more. Agricultural area: used agricultural area in ha. Arable and permanent crops: arable systems, permanent crops horticulture. Animal production: dairy cattle, beef and mixed cattle, sheep, goats and mixed grazing livestock, pigs, poultry and mixed pigs/poultry. Mixed production: mixed livestock. Number of farms: number and percentage of farms per region.

As previously discussed, we use the introspection method for both pieces of information and directly ask for beliefs. There is no guarantee that farmers will reveal true subjective measures of beliefs about other beliefs and their own beliefs, in particular since the introspection approach does not rely on effort-boosting extrinsic incentives. Farmers may also deliberately bias their reports for strategic reasons or simply to boost their image. Both our measure of beliefs about other beliefs and of truthful beliefs regarding ES may then be subject to measurement errors. [Charness et al. \(2021\)](#) reports however that introspection seems to do as well as rather complex incentivized methods.

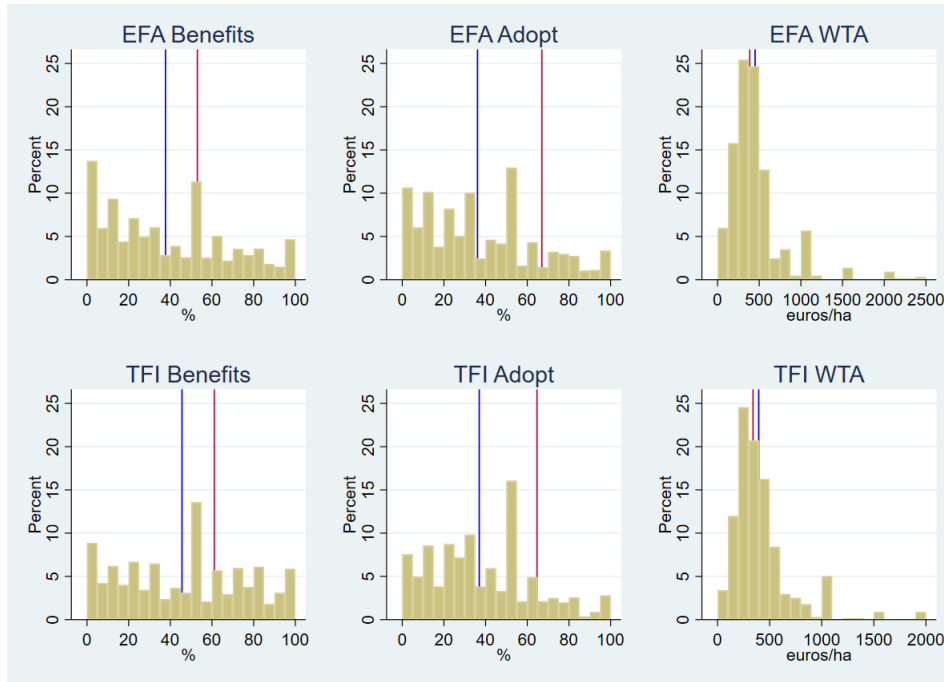
To measure second-order beliefs (beliefs about beliefs of other farmers), we rely on a set of questions presented in [Figure 1](#). Respondents have been asked to directly report their beliefs regarding other farmer beliefs for several dimensions of ES (benefits to be expected, adoption, willingness to accept). We also need a truthful measure of first-order beliefs (the own perception of farmers) about ES. Observing directly the individual perception of farmers is impossible since ES have not already been implemented at the time of the survey. We then rely on self-reported perceptions and opinions of farmers. We use questions on first-order beliefs (see [Figure 1](#)). Respondents have been asked to report their own opinion regarding the benefits to be expected from ES, the possibility to adopt the proposed ES and the willingness to accept ES. Based on individual answers provided by farmers to these question, we have computed regional means which will be considered in our setting as the truthful regional information.

#### **4.2.2 Evidence of biased second-order beliefs of farmers**

[Figure 3](#) provides in the first column the distribution of second-order beliefs for the percentage of farmers who consider that implementing ES EFA and TFI will result in benefits for environment (second-order beliefs on *Benefits*). Column 2 provides the distribution of second-order beliefs regarding the percentage of farmers ready to adopt ES subject to receiving adequate monetary subsidies (second-order beliefs on *Adopt*). Lastly, column 3 in [Figure 3](#) represents the distribution of second-order beliefs regarding the minimal monetary subsidy required to implement ES (second-order beliefs on *WTA*). In [Figure 3](#), the difference between the two vertical lines (blue and red) represents a measure of the misperception of second-order beliefs (bias).

To complement the results on second-order beliefs presented in [Figure 3](#), we provide in [Table 2](#) some summary statistics on bias for second-order beliefs of farmers, both for

Figure 3: Distribution of second-order beliefs on *Benefits*, *Adopt* and *WTA* for ES EFA and ES TFI



Histograms give the distribution of the second-order beliefs on *Benefits*, *Adopt* and *WTA* for ES EFA and ES TFI. The blue line represents the regional means for the second order-beliefs. The red line represents the regional mean for the observed distribution of first-order beliefs.

ES EFA and ES TFI.

*Result: Misperceptions of second-order beliefs are large and widespread among farmers. Farmers underestimate second-order beliefs regarding environmental benefits, adoption of ES and WTA for implementing ES.*

Farmers underestimate second-order beliefs, and the negative biases are large. Regarding second-order beliefs for environmental benefits of ES, the average bias for benefits represent -15.30 percentage points for ES EFA, and -15.48 percentage points for ES FTI. Notice that the absolute value of the bias represents 28.26 percentage points for ES EFA, and 27.71 percentage points for ES TFI. Biases are even greater regarding second-order beliefs on adoption of ES, -36.93 percentage points for ES EFA and -27.75 for FTI. The absolute value of the bias represents 35.62 percentage points for ES EFA, and 31.92 percentage points for ES TFI. Since farmers underestimate the second-order beliefs for



Table 2: Summary statistics on farmer’s bias for second-order beliefs

	Mean	Median	Std. Dev	Respondents with bias<0
ECO-SCHEME ECOLOGICAL FOCUS AREA (EFA)				
Bias for second-order beliefs <i>Benefits</i>	-15.30%	-20.00%	29.22	69.46%
Bias for second-order beliefs <i>Adopt</i>	-30.93%	-35.08%	26.67	85.25%
Bias for second-order beliefs <i>WTA</i>	64.38 €/ha	-1.00 €/ha	330.75	51.15%
ECO-SCHEME TREATMENT FREQUENCY INDEX (TFI)				
Bias for second-order beliefs <i>Benefits</i>	-15.48%	-14.76%	29.36	66.95%
Bias for second-order beliefs <i>Adopt</i>	-27.75%	-30.27%	24.53	86.88%
Bias for second-order beliefs <i>WTA</i>	55.56 €/ha	-7.25 €/ha	286.231	52.51%

This table provides some summary statistics (mean, median, standard deviation, percentage of respondent with negative bias) on farmer’s bias for second-order beliefs on environmental benefits of ES, on adoption rate of ES and on the willingness to accept ES.

environmental benefits of ES and for adoption of ES, it is not surprising to see that they overestimate second-order beliefs regarding WTA ES: by 64.38 €/ha and 55.56 €/ha for ES EFA and FTI, respectively. The bias for WTA is substantial in size. For ES EFA, the bias represents 14.30% of the mean second-order beliefs for WTA (450.06 €/ ha). For ES TFI, the bias represents 14.06% of the mean second-order beliefs for WTA (395.09 €/ ha). One possible interpretation of this finding could be that farmers tend to underestimate individual support by peer for pro-environment agricultural policies.<sup>6</sup> One consequence of underestimating peer support for pro-environment agricultural policies is that farmers overestimate the amount of subsidies that would lead peer farmers to implement ES.

*Result: Misperceptions about second-order beliefs are very asymmetric, namely, beliefs are disproportionately concentrated on one side relative to the truth (for second-order beliefs on environmental benefits and on adoption of ES, but not for second-order beliefs on WTA ES).*

<sup>6</sup>This would be in line with [Mildenberger and Tingley \(2019\)](#) who have shown that second-order climate beliefs in the United States and China are characterized by a global underestimation of pro-climate opinions.

The asymmetry of the distribution for second-order beliefs appears clearly in Figure 3. As shown in Table 2, 69.46% and 66.95% of farmers have negative biased second-order beliefs regarding benefits from ES EFA and TFI, respectively. The percentages reach 85.25% and 86.86% for second-order beliefs regarding benefits from ES EFA and TFI. Our results are in line with Bursztyn and Yang (2021) who report that “misperceptions about others are asymmetrically distributed, and such asymmetry is large in magnitude”.

### 4.2.3 Misperception about second-order beliefs regarding ES per region

We document that the misperception of second-order beliefs regarding ES is present in all French regions. A detailed analysis of regional heterogeneity can be found in Appendix D, and we present here only the main results.

*Result: Misperception of second-order beliefs regarding ES is widely spread in all French region.*

*Second-order beliefs regarding Benefits* Farmers have biased second-order beliefs regarding the fact that the ES EFA generates benefits for the environment. This is the case for all French regions. The average bias varies from -8.80% for the Centre-Val de Loire region to -20.79% to the Normandie region (the average bias for France being -15.30%). We also find that farmers have biased second-order beliefs regarding the fact that the ES TFI generates benefits for the environment. This is the case for all French regions. The average bias varies from -10.12% for the Centre-Val de Loire region to -22.84% for the Provence-Alpes-Côte d’Azur the Normandie region (the average bias for France is -15.48%).

*Second-order beliefs regarding Adopt* In all regions, farmers have biased second-order beliefs regarding the percentage of peers ready to adopt ES EFA. The average bias is -30.93% and it varies from -26.80% for Ile-de-France to -43.53% to Provence-Alpes-Côte d’Azur. Farmers have biased second-order beliefs regarding adoption of ES IFT by peers. This is the case for all French regions, the average bias being -27.75%. The average bias varies from -16.60% for the Ile-de-France region to -39.11% for the Provence-Alpes-Côte d’Azur region. Whatever the region and the ES considered, French farmers have biased second-order beliefs regarding adoption of ES by peers. The bias is substantial and

negative: French farmers underestimate second-order beliefs regarding adoption of ES by peers by 28 to 30% on average.

*Second-order beliefs regarding WTA* In all regions, farmers have biased second-order beliefs regarding WTA for ES EFA. The average second-order beliefs regarding WTA ES for EFA is equal to €450.06/ha whereas true average WTA is €386.11/ha, which corresponds to an average bias of is 64.38/ha, varying from €22.94/ha for Auvergne-Rhône-Alpes to 111.46/ha for Île-de-France. In all regions, farmers have biased second-order beliefs regarding WTA for ES FTI. The average second-order beliefs regarding WTA for ES FTI is equal to €395.10/ha whereas true average WTA is €340.52/ha which corresponds to an average bias of is €55.56/ha, varying from €-40.61/ha for Provence-Alpes-Côte d'Azur (the only French region where second-order beliefs are below true WTA) to €88.28/ha for Bretagne.

Whatever the region and the ES considered, French farmers have biased second-order beliefs regarding WTA for ES. The bias is substantial and positive (at the exception of Provence-Alpes-Côte d'Azur for FTI): French farmers overestimate the monetary compensation required by peers to implement ES by amount of €55 to 64 per ha on average.

#### **4.2.4 Association between misperception of second-order beliefs and characteristics of farmers**

To go one step further into the understanding of the possible mechanisms that may explain the misperception of second-order beliefs, we use T-tests in Appendix E to compare the mean characteristics of farmers with upward and downward biased second-order beliefs.

*Result: Misperception of second-order beliefs regarding ES is associated with behaviors, attitudes and characteristics of farmers*

*Association with second-order beliefs regarding environmental benefits.* Farmers who underestimate the share of peers who believe that the proposed ES will provide environmental benefits tend to be older with a higher proportion of male (EFA only). Concerning farm's characteristics, respondent who underestimate the share of peers who believe that ES EFA or TFI will lead to environmental benefits have larger agricultural areas and, more importantly, are less involved into eco-friendly activities (organic farming, direct supply to final customers). This pattern is consistent with the presence of a projection

bias. Being located in some special areas (EU Natura 2000, nitrate vulnerable zones) also plays a role. The proportion of farmers located in these zones is significantly higher among farmers who underestimate the share of peers who believe that ES EFA or TFI will lead to environmental benefits. Concerning farmer’s preferences, no clear differences are found, except that the proportion of respondents with a high level of individualism is higher among farmers who underestimate beliefs on environmental benefits (ES EFA only). On contrary, the proportion of respondents with a high level of collectivism is lower among farmers who underestimate beliefs on environmental benefits (ES TFI only). It then appears that individualism and collectivism play a role. The intensity of social interactions appears to be different in both groups. The proportion of farmers who declare that they don’t know their neighbors is significantly higher for respondents who underestimate beliefs on environmental benefits.

*Association with second-order beliefs regarding adoption of ES* The T-tests presented in Appendix E reveal that farmers who underestimate or overestimate the share of peers willing to adopt the proposed ES differ only for a limited number of observable characteristics (age, organic farming, neighbor knowledge for ES EFA; and gender, organic farming, direct supply to final consumers, EU Natura 2000, nitrate vulnerable zones for ES FTI). Interestingly, we observe some differences regarding risk preferences for ES FTI: in the group of farmers who underestimate the share of peers willing to adopt the proposed ES, the proportion of risk-averse farmers is greater and the proportion of risk-lover farmers is lower.

*Association with second-order beliefs regarding WTA ES* Being located in some special areas (EU Natura 2000, nitrate vulnerable zones) also plays a role. The proportion of farmers located in a EU Natura 2000 zone is significantly lower among farmers who underestimate second-order beliefs regarding WTA ES. On contrary, the proportion of farmers located in a nitrate vulnerable zone is significantly lower among farmers who underestimate second-order beliefs regarding WTA ES. In the group of respondents who underestimate the minimum subsidy requested by peers to implement ES, the proportion of risk-averse farmers is greater and the proportion of risk-lover farmers is lower.

#### **4.2.5 Explaining biased second-order beliefs of farmers**

We have documented that French farmers have biased second-order beliefs. There are several possible explanations, the most common being i) measurement errors, ii) strategic

answers of respondents and iii) psychological biases.

*Result: Misperception of second-order beliefs regarding ES are not measurement errors. Misperception of second-order beliefs regarding ES are unlikely due to strategic behaviors of respondents when responding to the survey. The patterns of misperceptions of second-order beliefs regarding ES are consistent with some well-known psychological biases.*

First, the elicited misperceptions may simply be noises when respondents report their perceptions about others. We believe that some specific patterns of misperceptions rule out this possible explanation. There are two main arguments that support our claim. First, the patterns of misperceptions that we have described (in particular the large proportion of respondents with strong negative biases) suggest that symmetric noises are unable to account for the observed misperceptions. Second, we have shown that misperception about second-order beliefs are associated with some attitudes and characteristics of respondents, which suggests that the elicited misperceptions are not random and, on the contrary, may capture some meaningful variations across people. Our findings are in line with what has been recently reported by [Bursztyn and Yang \(2021\)](#).

Second, we believe that misperception of second-order beliefs regarding ES are unlikely due to strategic behaviors of respondents when responding to the survey. To elicit second-order beliefs of farmers, we have used the introspection approach which consists in asking to survey respondents their beliefs regarding others without any reward for the accuracy of their report. Since the introspection method is not truth-telling incentive compatible, respondents may not report their own beliefs, especially if they have strategic motivations for doing so. In their review of the approaches that have been used to measure beliefs ([Charness et al., 2021](#)) mention however that “Overall, our view is that there is no reliable evidence that complex incentivized elicitation systematically outperforms introspection in experimental applications”.<sup>7</sup>

Third, different psychological biases have been found to be relevant to explain such deviations between second-order beliefs and observed distribution of first-order beliefs. Among them is the false consensus effect [Ross et al. \(1977\)](#), which corresponds to the fact that people tend to overestimate the commonness of their own beliefs or behaviors, and

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<sup>7</sup>[\(Charness et al., 2021\)](#) conclude that eliciting beliefs with or without incentives leads to possible biases.

the bias blind spot (Pronin et al., 2002), which refers to people’s unawareness of their own judgmental biases.

### 4.3 Re-calibrating second-order beliefs

We now assess whether or not re-calibrating second-order beliefs modifies subjective beliefs of farmers.

#### 4.3.1 Effect of re-calibrating second-order beliefs in one dimension on second-order beliefs in others dimensions

We assess here if re-calibrating second-order beliefs in one dimension (second-order beliefs regarding either ES benefits, ES adoption, or ES WTA) results in changing second-order beliefs in another dimension.

*Result: Whatever the ES considered re-calibrating second-order beliefs for one dimension (benefits or adopt) has a significant impact on second-order beliefs for another dimension (adopt or WTA).*

The first important result from Table 3 is that for both ES considered re-calibrating second-order beliefs for one dimension (benefits or adopt) as a significant impact on second-order beliefs for another dimension (adopt or WTA). In addition, the direction of the change in second-order beliefs makes sense. As discussed previously farmers underestimate the second-order beliefs regarding benefits for the environment to be expected from ES. When they are shown the true beliefs of their peers on benefits (re-calibration of second-order beliefs for benefits), i) they significantly increase their second-order beliefs on adoption (from 36.23% to 41.35% for ES EFA, and from 38.2% to 42.48% for ES FTI), and ii) they significantly decrease their second-order beliefs on WTA (from €446.38/ha to €421.69/ha for ES EFA, and from €401.85/ha to €380.44/ha for ES FTI). Similarly, re-calibrating second-order beliefs regarding adoption (i.e., showing that true first-order beliefs are in fact greater than the subjective second-order beliefs) significantly reduces the second order beliefs about WTA (farmers believe that ES can be implemented by peer farmers with lower monetary subsidy).

*Result: We document heterogeneous responses to our treatments depending upon the*

Table 3: Effect of re-calibrating second-order beliefs for one dimension (benefits or adopt) on second-order beliefs for another dimension (adopt or WTA)

Eco-scheme	Second-order beliefs		Farmer sample	Treated	Control	T-test
	re-calibrated	elicited				
EFA	Benefits	Adopt	Full	41.35%	36.23%	-4.37***
	Benefits	Adopt	Under	35.83%	26.71%	-6.54***
	Benefits	Adopt	Above	50.20%	51.57%	0.84
EFA	Benefits	WTA	Full	421.69 €/ha	446.38 €/ha	1.52*
	Benefits	WTA	Under	440.97 €/ha	485.19 €/ha	1.91**
	Benefits	WTA	Above	391.19 €/ha	382.74 €/ha	-0.44
EFA	Adopt	WTA	Full	438.99 €/ha	446.39 €/ha	0.46
	Adopt	WTA	Under	447.72 €/ha	457.16 €/ha	0.52
	Adopt	WTA	Above	399.10 €/ha	398.76 €/ha	-0.01
FTI	Benefits	Adopt	Full	42.48%	38.28%	-3.84***
	Benefits	Adopt	Under	37.25%	31.24%	-4.75***
	Benefits	Adopt	Above	53.65%	51.18%	-1.47*
FTI	Benefits	WTA	Full	380.44 €/ha	401.85 €/ha	1.50*
	Benefits	WTA	Under	393.65 €/ha	428.04 €/ha	1.79*
	Benefits	WTA	Above	352.34 €/ha	350.79 €/ha	-0.09
FTI	Adopt	WTA	Full	389.31 €/ha	401.85 €/ha	0.89
	Adopt	WTA	Under	387.49 €/ha	409.71 €/ha	1.41*
	Adopt	WTA	Above	395.65 €/ha	367.41 €/ha	-0.95

This table provides an analysis of the effect of re-calibrating second-order beliefs for one dimension (benefits or adopt) on second-order beliefs for another dimension (adopt or WTA). “Full” corresponds to the full sample of observations. “Under” restrict the sample to observations where the subjective second-order beliefs are under the true regional means. “Above” restricts the sample to observations where the subjective second-order beliefs are above the true regional means. For instance, the second-order beliefs for adoption of ES EFA are 41.35% for farmers whose second-order beliefs regarding benefits of ES EFA have been re-calibrated, and 36.23% for farmers who have not. The difference is significant at 1%. \*\*\*, \*\* and \*: difference between treated and control is significant at 1, 5 and 10%.

*fact that subjective have second-order beliefs under or above the true regional means.*

Being shown the true regional mean does not have any significant effect on the subjective second-order beliefs in other dimensions when subjective second-order beliefs are above the regional means. On contrary we observe a significant impact of our treatments for respondent whose second-order beliefs are below the regional means. For instance, the three first lines Table 3 report the second-order beliefs for adoption of ES EFA according to the fact that respondents have been treated (the true regional mean for benefits has been displayed) or are in the control group (no information provided). Re-calibrating second-order beliefs regarding benefits of ES EFA increases the second-order beliefs for adoption of ES EFA from 36.23% (control group) to 41.35% (treated group). When we restrict the analysis to respondents having downward biased second-order beliefs regarding benefits of ES EFA, the impact of being treated is higher (from 26.71% in the control group to 35.83% in the treated group). On contrary, no impact is found for respondents having upward biased second-order beliefs regarding benefits of ES EFA.



Table 4: Econometric assessment of re-calibrating second-order beliefs for one dimension (benefits or adopt) on second-order beliefs for another dimension (adopt or WTA)

	Second-order beliefs <i>Benefits</i> $\rightarrow$ <i>Adopt</i>			Second-order beliefs <i>Benefits</i> $\rightarrow$ <i>WTA</i>			Second-order beliefs <i>Adopt</i> $\rightarrow$ <i>WTA</i>			
	Full	Under	Above	Full	Under	Above	Full	Under	Above	
ECO-SCHEME ECOLOGICAL FOCUS AREA (EFA)										
Treatment <i>Benefits</i>	6.978** (2.448)	9.713*** (2.434)	1.000 (2.298)	21.618 (50.471)	12.100 (44.736)	29.325 (35.518)				
Second-order beliefs <i>Benefits</i>	0.526*** (0.059)	0.753*** (0.092)	0.554*** (0.104)	-0.345 (1.437)	-1.011 (3.673)	2.843** (0.982)				
Treatment <i>Adopt</i>				45.010 (46.610)	42.756 (44.481)	16.777 (33.187)				
Second-order beliefs <i>Adopt</i>				-0.257 (1.565)	-1.311 (2.288)	4.839*** (0.403)				
Region fixed-effects	yes	yes	yes	yes	yes	yes				
R-squared	0.745	0.635	0.839	0.598	0.581	0.697				
N	2656	1638	1018	1971	1219	752				363
ECO-SCHEME TREATMENT FREQUENCY INDEX (TFI)										
Treatment <i>Benefits</i>	6.273*** (1.948)	6.119*** (1.793)	3.565** (1.335)	20.836 (38.959)	13.349 (35.474)	9.742 (22.158)				
Second-order beliefs <i>Benefits</i>	0.509*** (0.067)	0.678*** (0.075)	0.584*** (0.082)	-0.304 (1.361)	-1.070 (2.554)	3.131*** (0.582)				
Treatment <i>Adopt</i>				36.289 (35.127)	31.497 (29.231)	47.531 (27.061)				
Second-order beliefs <i>Adopt</i>				0.166 (1.664)	-0.622 (2.827)	4.786*** (0.303)				
Region fixed-effects	yes	yes	yes	yes	yes	yes				
R-squared	0.789	0.737	0.855	0.598	0.577	0.719				
N	2658	1741	917	1998	1332	666				394

This table provides effects of re-calibrating second-order beliefs for one dimension (benefits or adopt) on second-order beliefs for another dimension (adopt or WTA). The dependent variables are the second-order beliefs *Adopt* and the second-order beliefs for *WTA*. We report the result of linear regressions. Columns “Full” correspond to the full sample of observations. Columns “Under” restrict the sample to observations where the subjective second-order beliefs are under the true regional means. Columns “Above” restrict the sample to observations where the subjective second-order beliefs are above the true regional means.

We further explore this issue in Table 4 which provides an econometric assessment of re-calibrating second-order beliefs on corresponding second-order beliefs. Columns “Full” correspond to the full sample of observations. Columns “Under” restrict the sample to observations where subjective second-order beliefs are under the true regional means. Columns “Above” restrict the sample to observation where the subjective second-order beliefs are above the true regional means. Considering “Under” and “Above” sub-samples allows us to assess heterogeneous impacts of treatments depending upon the level of subjective second-order beliefs compared to true regional means.

#### 4.3.2 Effect of re-calibrating second-order beliefs on first-order beliefs

We assess in Table 5 if re-calibrating second-order beliefs results in changing the corresponding first-order beliefs of respondents.

Table 5 calls for a few comments. The impacts of re-calibrating second-order beliefs on first-order beliefs are not consistent across domains. Re-calibrating the second-order beliefs regarding benefits for environment to be expected from ES, or the willingness to accept for implementing ES, significantly modifies the first-order beliefs of farmers. On contrary, no effect is found on first-order beliefs for re-calibrating second-order beliefs regarding adoption of ES.

The impact of re-calibrating second-order beliefs about WTA differs depending upon the fact that subjective second-order beliefs of farmers are below or above the true beliefs. Farmers with a subjective second-order beliefs below true beliefs update their first-order beliefs upward, whereas farmers with a subjective second-order beliefs above true beliefs update their first-order beliefs in the opposite direction (downward). These updating processes are very important in magnitude. Displaying the true second-order beliefs allows farmers to build more accurate subjective second-order beliefs.

Different psychological mechanisms are consistent with the type of belief updating process we have documented. One possible interpretation is that farmers seek to conform to the norm if they believe that others will conform as well as it is the case in models of normative expectations (Sugden, 2000). We explore further this issue in Table 6 which provides an econometric assessment of re-calibrating second-order beliefs on corresponding first-order beliefs. For *Benefits*, first-order beliefs are expressed by dummy variables indicating if a farmer believes that the proposed ES will generate benefits to environment. For *Adopt*, first-order beliefs are expressed by dummy variables indicating if a farmer is

Table 5: Effect of re-calibrating second-order beliefs on corresponding first-order beliefs

Eco-scheme	Re-calibrated second-order beliefs	Farmer sample	Mean first-order beliefs		T-test
			Treated	Control	
EFA	Benefits	Full	58.46%	51.31%	-3.23***
		Under	42.79%	32.01%	-3.99***
		Above	83.59%	82.60%	-0.36
EFA	Adopt	Full	64.62%	66.41%	0.78
		Under	59.25%	61.08%	0.70
		Above	88.98%	90.08%	-0.32
EFA	WTA	Full	449.14 €/ha	449.9 €/ha	0.04
		Under	353.93 €/ha	284.09 €/ha	-6.99***
		Above	561.59 €/ha	663.66 €/ha	3.42***
TFI	Benefits	Full	66.96%	59.30%	-3.53***
		Under	55.68%	43.42%	-4.55***
		Above	91.47%	88.38%	-1.26
TFI	Adopt	Full	63.88%	62.46%	-0.61
		Under	58.09%	57.21%	-0.33
		Above	84.29%	85.22%	0.27
TFI	WTA	Full	387.86 €/ha	390.78 €/ha	0.19
		Under	288.47 €/ha	242.38 €/ha	-6.09***
		Above	484.67 €/ha	385.51 €/ha	4.04***

This table provides an analysis of the effect of re-calibrating second-order beliefs on the corresponding first-order beliefs. For instance, the first-order beliefs regarding benefits for the environment for ES EFA are 58.46% for farmers whose second-order beliefs have been re-calibrated, and 51.31% for farmers who have not (difference significant at 1%). *Under*: sub-sample of farmers with subjective second-order beliefs lower than true second-order beliefs. *Above*: sub-sample of farmers with subjective second-order beliefs greater or equal than true second-order beliefs. \*\*\*, \*\* and \*: difference between treated and control is significant at 1, 5 and 10%.

ready to adopt the proposed ES conditionally to receiving adequate subsidies. We then use probit models for these two first-order beliefs, and we report the marginal effects in Table 6. For *WTA*, farmers reports their own willingness to accept the ES. We report then the result of linear regressions. Columns “Full” correspond to the full sample of observations. Columns “Under” restrict the sample to observations where subjective second-order beliefs are under the true regional means. Columns “Above” restrict the sample to observation where the subjective second-order beliefs are above the true regional means. Considering “Under” and “Above” sub-samples allows us to assess heterogeneous impacts of treatments depending upon the level of subjective second-order beliefs compared to true regional means.

Table 6: Econometric assessment of re-calibrating second-order beliefs on corresponding first-order beliefs

	First-order beliefs <i>Benefits</i>			First-order beliefs <i>Adopt</i>			First-order beliefs <i>WTA</i>		
	Full	Under	Above	Full	Under	Above	Full	Under	Above
ECO-SCHEME ECOLOGICAL FOCUS AREA (EFA)									
Treatment <i>Benefits</i>	0.087*** (0.030)	0.113*** (0.040)	0.014 (0.033)						
Second-order beliefs <i>Benefits</i>	0.013*** (0.000)	0.016*** (0.001)	0.005*** (0.001)						
Treatment <i>Adopt</i>				-0.027 (0.028)	-0.032 (0.034)	-0.019 (0.035)			
Second-order beliefs <i>Adopt</i>				0.008*** (0.000)	0.011*** (0.001)	-0.001 (0.002)			
Treatment <i>WTA</i>							30.280** (13.485)	61.287*** (11.834)	-7.844 (17.821)
Second-order beliefs <i>WTA</i>							0.935*** (0.036)	0.904*** (0.056)	0.981*** (0.052)
Region fixed-effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
R-squared	0.278	0.182	0.069	0.147	0.126	0.031	0.948	0.930	0.956
N	2715	1677	1038	1969	1609	358	1072	597	475
ECO-SCHEME TREATMENT FREQUENCY INDEX (TFI)									
Treatment <i>Benefits</i>	0.101*** (0.024)	0.121*** (0.032)	0.028*** (0.011)						
Second-order beliefs <i>Benefits</i>	0.012*** (0.000)	0.015*** (0.001)	0.003*** (0.001)						
Treatment <i>Adopt</i>				-0.027 (0.026)	-0.038 (0.024)	-0.026 (0.047)			
Second-order beliefs <i>Adopt</i>				0.009*** (0.000)	0.014*** (0.001)	-0.002* (0.001)			
Treatment <i>WTA</i>							12.500 (7.252)	38.524*** (7.829)	-15.291 (9.846)
Second-order beliefs <i>WTA</i>							0.960*** (0.040)	0.924*** (0.077)	1.004*** (0.045)
Region fixed-effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
R-squared	0.286	0.212	0.050	0.014	0.147	0.063	0.956	0.943	0.962
N	2716	1782	934	1982	1590	392	1078	573	505

This table provides effects of re-calibrating second-order beliefs on the corresponding first-order beliefs. For *Benefits* and *Adopt* first-order beliefs are expressed by dummy variables indicating if a farmer believes that the proposed ES will generate benefits to environment or if a farmer is ready to adopt the proposed ES. The dependent variable are then the probability for *Benefits* and *Adopt* estimated with probit models. We report the marginal effects. For *WTA*, the dependent variable is farmer's own willingness to accept the proposed ES (in per ha). We report the result of linear regressions. Columns "Full" correspond to the full sample of observations. Columns "Under" restrict the sample to observations where the subjective second-order beliefs are under the true regional means. Columns "Above" restrict the sample to observations where the subjective second-order beliefs are above the true regional means.

Different results from Table 6 should be pointed out.

*Result: There is a strong statistical relationship between second-order beliefs and first-order beliefs.*

Second-order beliefs are indeed highly significant for all dimensions (benefits, adopt, wta) and for both ES. Restricting for the time being the discussion to the full sample, increasing the second-order beliefs regarding benefits by 1 percent increases the likelihood of reporting benefits for the environment by 1.3 percentage point for ES EFA, and by 1.2 percentage point for ES TFI. Increasing the second-order beliefs regarding adoption by 1 percent increases the likelihood of adoption by farmers by 0.8 percentage point for ES EFA, and by 0.9 percentage point for ES TFI. For WTA, we find that when second-order beliefs regarding the WTA increase by 1 € per ha, the own farmer's WTA increases by 0.95 and 0.96 € per ha for ES EFA and FTI, respectively.

*Result: Re-calibrating second-order beliefs (being treated) modifies first-order beliefs, however the impact differs according to the dimension considered (benefits, adopt, WTA).*

Being shown the true second-order beliefs regarding benefits for environment increases the likelihood of reporting benefits for the environment by 8.7 percentage point for ES EFA, and by 10.1 percentage point for ES TFI. No significant impact is found for respondent having been shown the true beliefs regarding adoption. Re-calibrating second-order beliefs for WTA modifies first-order beliefs only for ES EFA. For WTA, being shown the true regional WTA increases farmer's own WTA by 30.28 € per ha for ES EFA.

*Result: Heterogeneous impacts of treatments*

We conduct an heterogeneity analysis by separating subjects whose second-order beliefs are under or above true regional means. We expect that being shown the true regional mean may affect differently farmers in these two sub-groups. This is clearly the case for benefits. For ES FTI, only farmers who hold second-order beliefs below the true regional mean adjust upward their first-order beliefs when they are treated. A similar result is for for both ES when considering WTA. Farmers who hold second-order beliefs above the

true regional mean are unaffected by the treatment (we observe a decrease of their WTA by -7.84 and -15.29 € per ha for ES EFA and FTI, but both numbers are not statistically different from zero). On contrary, Farmers who hold second-order beliefs below the true regional mean increase their WTA by 61.29 and 38.52 € per ha for ES EFA and FTI when they are treated.

## 5 Discussion

We have assessed the accuracy of French farmers in forming second-order beliefs (beliefs about other beliefs) about eco-schemes (ES), a new policy instrument proposed in the reform of the EU CAP. Our work relies on a nation-wide large scale web-survey on more than three thousands French farmers. To elicit second-order beliefs about ES, we have used the introspection method and asked to survey respondents their beliefs regarding others.

Our first contribution is to demonstrate that French farmers hold biased second-order beliefs regarding ES, with a strong tendency to underestimate the proportion of peers considering that ES would be good for the environment and the proportion of peers wishing to adopt the ES on their farm. For second-order beliefs on the proportion of peers considering that ES would be good for the environment, the average bias represents between -15.30 and -15.48 percentage points, depending upon the ES considered, and more than two-third of the respondents have a negative bias. For second-order beliefs on the proportion of peers wishing to adopt the ES on their farm, the average bias represents between -27.75 and -30.93 percentage points, and more than 85 percent of respondents have a negative bias. Interestingly, farmers overestimate the minimum subsidy that would lead farmers to adopt ES (by 55.56 to 64.38 €/ha depending upon the ES).

Then, using a randomized experiment, we have exposed respondents to different informational treatments, and we have explored the impact of the re-calibration of second-order beliefs on different dimensions of ES adoption. Our second contribution is to show that using informational treatments, it is possible to re-calibrate inaccurate second-order beliefs of farmers with significant impacts on their behaviors. We demonstrate in particular that i) re-calibration of second-order beliefs in one dimension modifies second-order beliefs in another dimension and ii) re-calibration of second-order beliefs modifies first-order beliefs (i.e., farmer's own beliefs). For instance, being shown the true second-order beliefs

regarding benefits for environment increases the likelihood of reporting benefits for the environment by 8.7 to 10.1 percentage point depending upon the ES considered.

The fact that farmers have biased second-order beliefs regarding CAP policy instruments, and that this misperception impacts on their attitude, offers a new explanation for the low uptake of voluntary measures proposed in the CAP to European farmers to protect biodiversity losses or to mitigate climate change (Pe'er et al., 2017). Since we have demonstrated experimentally that individual support for pro-environment policies increases after farmers update their second-order beliefs, we believe that that policy-makers should focus more closely on second-order beliefs as a key factor for making the Common Agricultural Policy greener. Scholars should also invest more in understanding second-order beliefs, as a way to modify individual attitudes and behaviors.

## References

- Ahler, D. J. (2014). Self-fulfilling misperceptions of public polarization. *The Journal of Politics* 76(3), 607–620.
- Beedell, J. and T. Rehman (1999). Explaining farmers' conservation behaviour: Why do farmers behave the way they do? *Journal of Environmental Management* 57(3), 165–176.
- Bicchieri, C. and Y. Fukui (1999). The great illusion: Ignorance, informational cascades, and the persistence of unpopular norms. In *Experience, reality, and scientific explanation*, pp. 89–121. Springer.
- Bursztyn, L., A. L. González, and D. Yanagizawa-Drott (2020, October). Misperceived social norms: Women working outside the home in saudi arabia. *American Economic Review* 110(10), 2997–3029.
- Bursztyn, L. and D. Y. Yang (2021, August). Misperceptions about others. Working Paper 29168, National Bureau of Economic Research.
- Charness, G., U. Gneezy, and V. Rasocho (2021). Experimental methods: Eliciting beliefs. *Journal of Economic Behavior & Organization* 189, 234–256.
- Cullen, P., P. Dupraz, J. Moran, P. Murphy, R. O'Flaherty, C. O'Donoghue, R. O'Shea,



- and M. Ryan (2018). Agri-environment scheme design: Past lessons and future suggestions. *EuroChoices* 17(3), 26–30.
- ECA (2011). *Is Agri-environment Support Well Designed and Managed?:(pursuant to Article 287 (4), Second Subparagraph, TFEU)*. Number 7. Publications Office of the European Union.
- Jachimowicz, J.M., H. O. O. J. S. E. and A. D. Galinsky (2018). The critical role of second-order normative beliefs in predicting energy conservation. *Nature Human Behaviour* 2, 757–764.
- Levendusky, M. and N. Malhotra (2016). Does media coverage of partisan polarization affect political attitudes? *Political Communication* 33(2), 283–301.
- Ma, S., S. M. Swinton, F. Lupi, and C. Jolejole-Foreman (2012). Farmers’ willingness to participate in payment-for-environmental-services programmes. *Journal of Agricultural Economics* 63(3), 604–626.
- Mildenberger, M. and D. Tingley (2019). Beliefs about climate beliefs: The importance of second-order opinions for climate politics. *British Journal of Political Science* 49(4), 1279–1307.
- Pe’er, G., Y. Zinngrebe, J. Hauck, S. Schindler, A. Dittrich, S. Zingg, T. Tschardtke, R. Oppermann, L. M. Sutcliffe, C. Sirami, J. Schmidt, C. Hoyer, C. Schleyer, and S. Lakner (2017). Adding some green to the greening: Improving the eu’s ecological focus areas for biodiversity and farmers. *Conservation Letters* 10(5), 517–530.
- Prentice, D. A. and D. T. Miller (1996). Pluralistic ignorance and the perpetuation of social norms by unwitting actors. In *Advances in experimental social psychology*, Volume 28, pp. 161–209. Elsevier.
- Pronin, E., D. Y. Lin, and L. Ross (2002). The bias blind spot: Perceptions of bias in self versus others. *Personality and Social Psychology Bulletin* 28(3), 369–381.
- Ross, L., D. Greene, and P. House (1977). The “false consensus effect”: An egocentric bias in social perception and attribution processes. *Journal of Experimental Social Psychology* 13(3), 279–301.

- Schuldt, J. P., Y. C. Yuan, Y. Song, and K. Liu (2019). Beliefs about whose beliefs? second-order beliefs and support for china's coal-to-gas policy. *Journal of Environmental Psychology* 66, 101367.
- Shamir, J. and M. Shamir (1997, 08). Pluralistic Ignorance Across Issues and Over Time: Information Cues and Biases. *Public Opinion Quarterly* 61(2), 227–260.
- Sugden, R. (2000). The motivating power of expectations. In *Rationality, rules, and structure*, pp. 103–129. Springer.
- Todorov, A. and A. N. Mandisodza (2004, 09). Public Opinion on Foreign Policy: The Multilateral Public that Perceives Itself as Unilateral. *Public Opinion Quarterly* 68(3), 323–348.
- Yeboah, F. K., F. Lupi, and M. D. Kaplowitz (2015). Agricultural landowners' willingness to participate in a filter strip program for watershed protection. *Land Use Policy* 49, 75–85.

# A Survey

## A.1 Invitation email received by farmers

Dear farmer

We are researchers from INRAE and we are carrying out a study that will allow us to adjust the CAP aids as well as possible.

This survey is an opportunity to give your opinion on an important subject 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 will only be used for research purposes (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 (translated from French to English)

*General information block.*

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 studies); College certificate; CAP, BEP or other diploma of this level ; Baccalaureate, professional certificate or other diploma of this level; Higher education from Bac +2 to Bac +4 (BTS, DEUG, license, master 1, etc.); Higher education Bac +5 and more (engineer, master 2, doctorate, etc.); Other]

A4 In which region is your farm located?

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

*Eco-scheme block.*

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 Thinking of all the costs induced by this measure but also of the possible benefits, 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]

Q9 (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

B9 (not T2) Subject to receiving adequate /financial support, could you consider adopting this measure on your farm? [Yes ; No ; I do not know]

*Farm characteristics block.*

C1 What is the main orientation of your farm? [ Polyculture and polybreeding; Big cultures ; Market gardening and horticulture; Viticulture; Fruit crops and other permanent 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 concerned by any of the following quality signs? (Answer yes if you are concerned by the specifications of the quality sign, whether the quality sign 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 engaged in another quality approach or another environmental approach, for all or part of its production, excluding agri-environmental measures (MAE) of the CAP? Please specify the procedure(s) in which the operation is involved. Bio-dynamic 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 (mention such as farm, mountain or country 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 circuit (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 collectives? A group for exchanging experiences and results, or collective training (type GEDA, GVA, CETA, Civam, GAB, group led by the chamber of agriculture or other organization - excluding dairy control) / Membership of a cooperative use of agricultural equipment (CUMA) /

An agricultural work bank or 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 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 manage my farm better; 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 operation; 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 run my farm
- My friends’ opinions are helpful in helping me run 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

*Agri-environmental measures block.*

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. [DFAC Field Crop Systems; AECM Field crop systems adapted for intermediate zones; AECM Grassland and Pastoral Systems; AECM “herbivorous” livestock mixed cropping systems; AECM “Monogastric” livestock polyculture systems; Other]

D3 During the 2015-2020 period, did you benefit from one or more “localized” AECMs? [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" measures: Soil cover and maintenance of covers; "GRASS" measures: Management and maintenance of fodder surfaces; "LINEA" measures: Maintenance of hedges, trees, groves, embankments, riparian forests;



"ENVIRONMENT" measures: Maintenance and management of remarkable environments; "OPEN" measures: Opening and management of derelict environments; "PHYTO" measures: Reduction or absence of phytosanitary treatments; Other]

D5 During the 2015-2020 period, did you benefit from one or more AECMs 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 from which 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? [For technical reasons related to the characteristics of my operation; For financial reasons (insufficient financial aid); For administrative reasons (eg heaviness or complexity of application files); For lack of information on the measures; Because I don't trust the institutions that finance and manage aid; 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? [Due to your own environmental sensitivity; Because of your perception of the expectations of society or citizens; Due to a local dynamic in favor of the environment; Due to the level of financial aid; Because of the opinions or 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

*Farmer psychological traits block.*

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 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
- A turnover insurance for crops

E3 Can you indicate your feelings 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 charge
- I try to live my life independent 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 my area

E4 Can you indicate your feelings 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 feelings 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 people. 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

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 personally the three most important values? (3 responses maximum) [Peace; Human rights; Respect for human life; The democracy;

The rule of law; Individual freedom; Legality; Tolerance; Solidarity, support for others; Personal development; Respect for other cultures; Religion; None of these values; I do not know]

E8 You will find a number of qualifiers 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 the 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 Description of ES in the survey

### B.1 Introduction script common to both ES in the survey

[ENGLISH TRANSLATION]

Within the framework of the CAP reform under discussion, new measures are envisaged 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.

### B.2 Script to describe ES “Increasing Ecological Focus Areas”

[ENGLISH TRANSLATION]

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

#### The context

One way to preserve and improve 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 preserve at least 5% of the arable land to constitute 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; arable land

- farms with more than 75% of their arable land in grass (permanent and temporary grassland) and/or rice;

#### Proposed measure

As part of the 2020 CAP reform, the voluntary establishment of EFA would be directly remunerated but under 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;
- All farms are concerned without any derogation:
  - . 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 these conditions are met. The commitment is annual (no commitment over several years).

### **B.3 Script to describe ES “Reduce use of phytosanitary products to preserve aquatic ecosystems and human health”**

[ENGLISH TRANSLATION]

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 envisaged 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 TFIs 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 of - 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 record book of phytosanitary practices of your farm.

## C Farmers dropout during the survey

### C.1 Summary of farmers dropout during the survey

Table C.1: Respondents drop out at the different stages of the ES-survey

Survey Block	Answer to first question number of farmers <sup>a</sup>	Answer to last question number of farmers	Dropout within block number of farmers (%)
Block 1	3 676	3 614	62 (1.68%)
Block 2	2 997 (-17.07%)	2 465	532 (17.75%)
Block 3	2 465 (-0.00%)	2 387	88 (3.65%)
Block 4	2 369 (-0.75%)	2 334	35 (1.48%)
Block 5	2 064 (-11.57%)	1 856	208 (10.01%)

<sup>a</sup>: Percentages in the second column correspond to the proportion of respondents having stopped the survey between the last question of the previous block and the first question of the considered block. For instance, 17.07% of farmers having answered to the last question of block 1 have not answered to the first question of block 2. Answers to block 1 to 4 are mandatory, and optional to block 5.

### C.2 Dropout between the end of block 1 and block 2

617 farmers dropped out between the end of block 1 and the completion of the first question in block 2 (dropout rate equal to 17.07%). There may be a concern if farmers who have decided not to continue the survey have some specific characteristics. We explore this issue in this Appendix.

We estimate a logit model to predict dropout between the end of block 1 and the completion of the first question in block 2. Dropout is not related to the region where each farmer is location, to farmer's age and to the number of years spent on a farm. On contrary, being a woman increases the probability to drop out. More educated farmers are less likely to drop out.



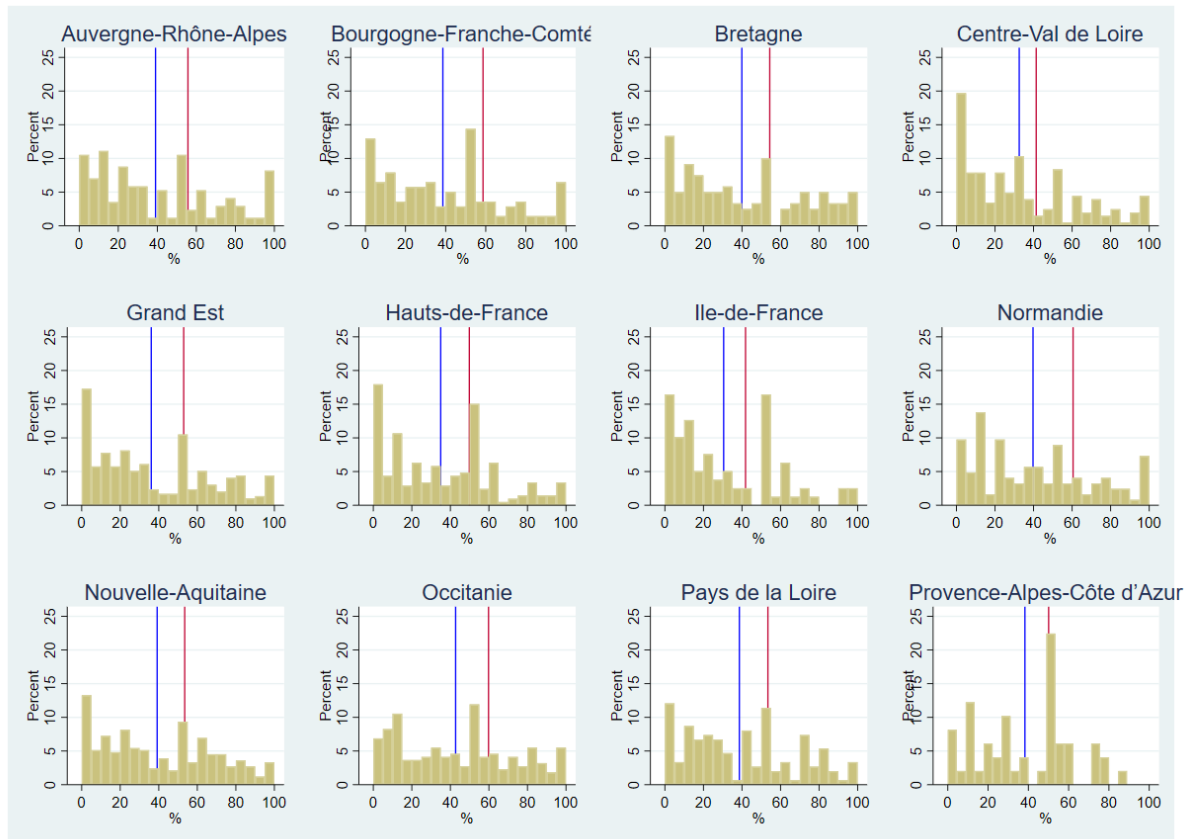
Table C.2: Logit model to explain dropout between the end of block 1 and the completion of the first question in block 2

	lostESblock
genre==Une femme	0.407*** (0.13)
region==Bourgogne-Franche-Comté	0.070 (0.25)
region==Bretagne	0.333 (0.24)
region==Centre-Val de Loire	0.218 (0.22)
region==Grand Est	-0.075 (0.21)
region==Hauts-de-France	0.081 (0.22)
region==Ile-de-France	-0.083 (0.31)
region==Normandie	0.358 (0.23)
region==Nouvelle-Aquitaine	0.110 (0.20)
region==Occitanie	0.101 (0.22)
region==Pays de la Loire	0.109 (0.23)
region==Provence-Alpes-Côte d'Azur	-0.065 (0.35)
Âge	0.010 (0.01)
Ancienneté	0.002 (0.01)
etudes==Autre	-1.159** (0.49)
etudes==Baccalauréat,	-1.157*** (0.34)
etudes==Brevet des collèges	-0.836 (0.53)
etudes==CAP, BEP ou autre diplôme de ce niveau	-0.890*** (0.35)
etudes==Enseignement supérieur Bac +5 et plus	-1.523*** (0.36)
etudes==Enseignement supérieur de Bac +2 à Bac +4	-1.479*** (0.34)
Constant	-1.002** (0.47)
Observations	3610

## D Misperception about second-order beliefs by regions

### D.1 Misperception about second-order beliefs regarding benefits of ES per French region

Figure D.1: Distribution of second-order beliefs for percentage of farmers who consider that the ES EFA provides benefits for environment



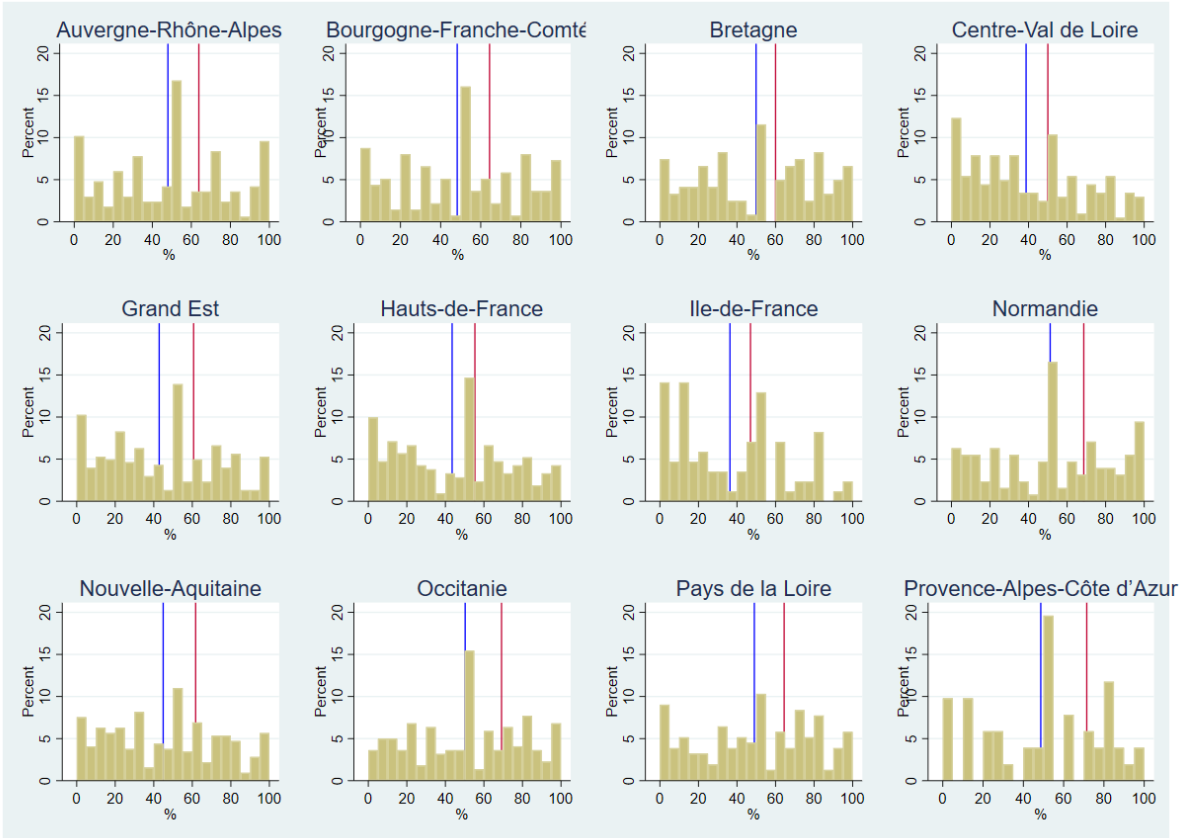
Histograms give in each region the distribution of the second-order beliefs for the percentage of farmers considering that the ES EFA provides benefits to the environment. The blue line represents the regional means for the second order-beliefs. The red line represents the regional mean for the observed distribution of first-order beliefs. Farmers in T1 are excluded.

Figure D.1 provides the distribution of second-order beliefs for the percentage of farmers who consider that implementing the ES EFA will result in benefits for environment. For each of the 12 French region, the difference between the two vertical line (blue and red) represents a measure of the misperception of second-order beliefs regarding benefits of ES for environment. Farmers have biased second-order beliefs regarding the fact that

the ES EFA generates benefits for the environment. This is the case for all French regions, the average bias being -15.30%. The average bias varies from -8.80% for the Centre-Val de Loire region to -20.79% to the Normandie region.

Figure D.2 provides the distribution of second-order beliefs for the percentage of farmers who consider that implementing the ES TFI will result in benefits for environment. Farmers have biased second-order beliefs regarding the fact that the ES TFI generates benefits for the environment. This is the case for all French regions, the average bias being -15.48%. The average bias varies from -10.12% for the Centre-Val de Loire region to -22.84% for the Provence-Alpes-Côte d’Azur the Normandie region.

Figure D.2: Distribution of second-order beliefs for percentage of farmers who consider that the ES TFI provides benefits for environment



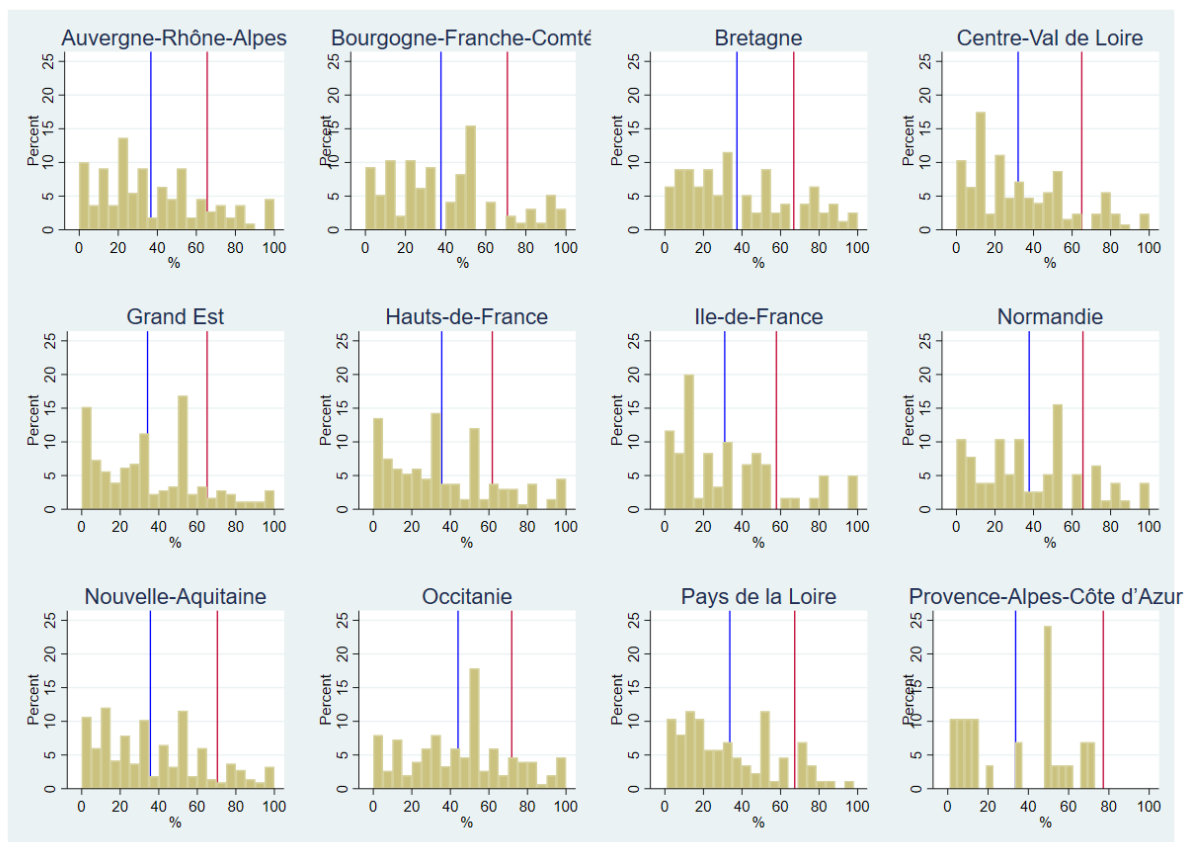
Histograms give in each region the distribution of the second-order beliefs for the percentage of farmers considering that the ES TFI provides benefits to the environment. The blue line represents the regional means for the second order-beliefs. The red line represents the regional mean for the observed distribution of first-order beliefs. Farmers in T1 are excluded.

The main result from Figure D.1-D.2 is that whatever the region and the ES consid-

ered, French farmers have biased second-order beliefs regarding the fact that implementing ES will generate benefits for the environment.

## D.2 Misperception about second-order beliefs regarding adoption of ES per French region

Figure D.3: Distribution of second-order beliefs regarding the percentage of farmers ready to adopt ES EFA subject to receiving adequate monetary subsidies



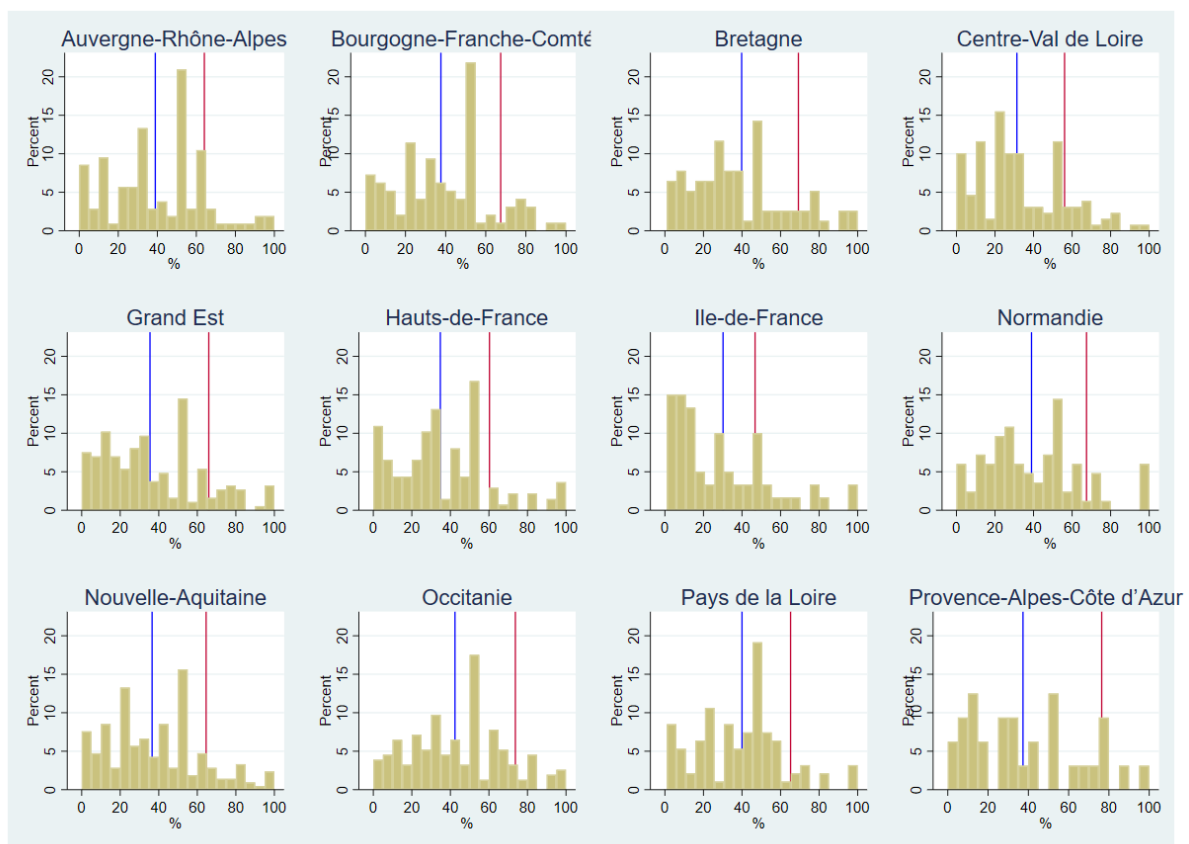
Histograms give in each region the distribution of the second-order beliefs regarding the percentage of farmers ready to adopt ES EFA subject to receiving adequate monetary subsidies. The blue line represents the regional means for the second order-beliefs. The red line represents the regional mean for the observed distribution of first-order beliefs. Farmers in T1 and T2 are excluded.

We now document that farmers mis-perceive second-order beliefs regarding adoption of ES. 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 question regarding adoption of ES.

Figure D.3 provides the distribution of second-order beliefs regarding the percentage of farmers in a region ready to adopt ES EFA subject to receiving adequate monetary subsidies. In all regions, farmers have biased second-order beliefs regarding the percentage of peers ready to adopt ES EFA. The average bias is -30.93% and it varies from -26.80% for Ile-de-France to -43.53% to Provence-Alpes-Côte d’Azur.

Figure D.4: Distribution of second-order beliefs regarding the percentage of farmers ready to adopt ES IFT subject to receiving adequate monetary subsidies



Histograms give in each region the distribution of the second-order beliefs regarding the percentage of farmers ready to adopt ES IFT subject to receiving adequate monetary subsidies. The blue line represents the regional means for the second order-beliefs. The red line represents the regional mean for the observed distribution of first-order beliefs. Farmers in T1 and T2 are excluded.

Figure D.4 provides the distribution of second-order beliefs for the percentage of farmers ready to adopt ES EFA subject to receiving adequate monetary subsidies. Farmers have biased second-order beliefs regarding adoption of ES by peers. This is the case for

all French regions, the average bias being -27.75%. The average bias varies from -16.60% for the Ile-de-France region to -39.11% for the Provence-Alpes-Côte d'Azur region.

Figure D.3-D.4 reveal that whatever the region and the ES considered, French farmers have biased second-order beliefs regarding adoption of ES by peers. The bias is substantial and negative: French farmers underestimate second-order beliefs regarding adoption of ES by peers by 28 to 30% on average.

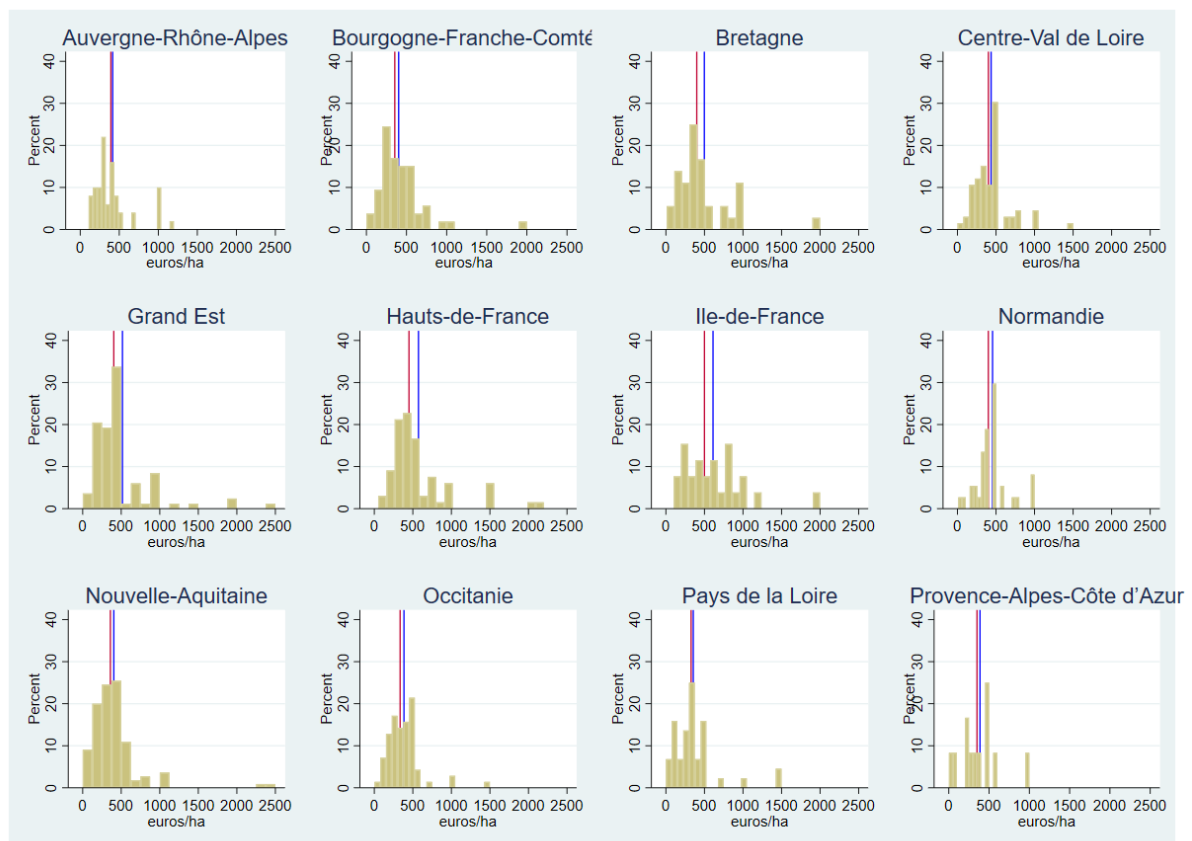
### **D.3 Misperception about second-order beliefs regarding WTA ES per French region**

We assess now if farmers mis-perceive second-order beliefs regarding WTA 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 D.5 provides the distribution of second-order beliefs regarding WTA for ES EFA. In all regions, farmers have biased second-order beliefs regarding WTA for ES EFA. The average second-order beliefs regarding WTA ES for EFA is equal to 450.06 €/per ha whereas true average WTA is 386.11 €/per ha which corresponds to an average bias of 64.38 per ha, varying from 22.94 €/per ha Auvergne-Rhône-Alpes to 111.46 per ha for Ile-de-France.

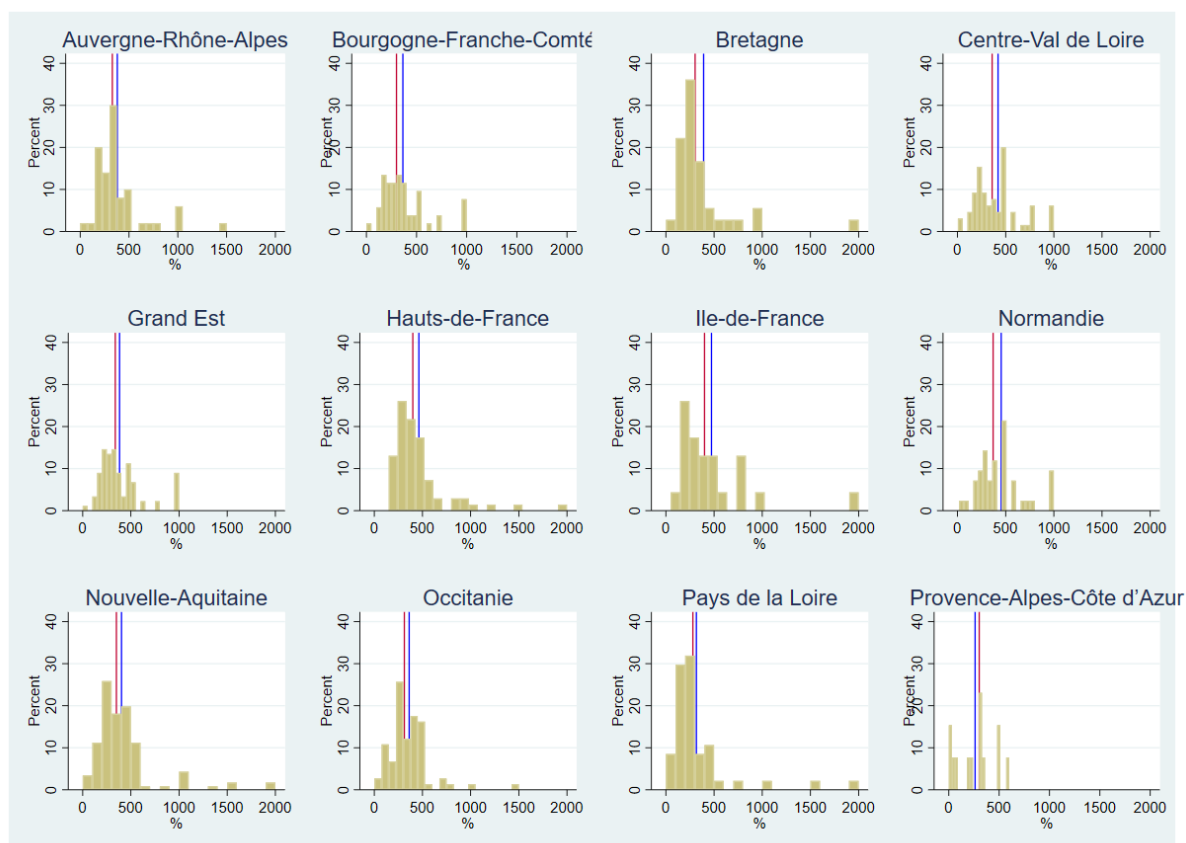
Figure D.6 provides the distribution of second-order beliefs for the WTA for ES FTI. In all regions, farmers have biased second-order beliefs regarding WTA for ES FTI. The average second-order beliefs regarding WTA for ES FTI is equal to 395.10 €/per ha whereas true average WTA is 340.52 €/per ha which corresponds to an average bias of 55.56 per ha, varying from -40.61 €/per ha Provence-Alpes-Côte d'Azur (the only French region where second-order beliefs are below true WTA) to 88.28 per ha for Bretagne.

Figure D.5: Distribution of second-order beliefs regarding willingness to accept ES EFA



Histograms give in each region the distribution of the second-order beliefs regarding WTA for ES EFA. The blue line represents the regional means for the second order-beliefs. The red line represents the regional mean for the observed distribution of first-order beliefs. Farmers in T1, T2 and T3 are excluded.

Figure D.6: Distribution of second-order beliefs regarding willingness to accept ES FTI



Histograms give in each region the distribution of the second-order beliefs regarding WTA for ES FTI. The blue line represents the regional means for the second order-beliefs. The red line represents the regional mean for the observed distribution of first-order beliefs. Farmers in T1, T2 and T3 are excluded.



## E Mean-test on characteristics of farmers with upward and downward biased second-order beliefs

Note:  $\mu_1$  mean for farmers with second-order beliefs above the true regional mean.  
 $\mu_2$  mean for farmers with second-order beliefs below the true regional mean.

Table E.1: Mean-test on characteristics of farmers with upward and downward biased second-order beliefs for ES EFA

	Second-order beliefs Benefits			Second-order beliefs Adopt			Second-order beliefs WTA		
	Bias $\geq 0$	Bias $< 0$	T-test	Bias $\geq 0$	Bias $< 0$	T-test	Bias $\geq 0$	Bias $< 0$	T-test
genreF	0.137	0.106	1.996**	0.131	0.109	0.906	0.140	0.107	1.287*
age_corr	48.567	50.045	-3.167***	46.970	50.050	-4.067***	49.365	49.734	-0.458
anciennete_corr	21.077	23.524	-4.675***	19.576	23.278	-4.313***	21.944	22.984	-1.150
educ_sup	0.569	0.557	0.499	0.596	0.571	0.648	0.598	0.568	0.739
surface	138.871	146.559	-1.447*	148.490	142.493	0.707	136.190	144.513	-0.931
ResultatNet_high	0.098	0.103	-0.308	0.105	0.100	0.219	0.149	0.093	2.251**
ResultatNet_low	0.425	0.408	0.683	0.424	0.419	0.137	0.405	0.422	-0.418
label_yes	0.261	0.255	0.305	0.222	0.254	-0.937	0.228	0.253	-0.701
farm_bio	0.177	0.129	2.704***	0.194	0.134	2.161**	0.185	0.137	1.638*
MAEC_BIO	0.356	0.278	3.305***	0.350	0.307	1.155	0.358	0.306	1.321*
circuit_court	0.266	0.236	1.370*	0.254	0.230	0.704	0.275	0.228	1.360*
individualism_high	0.095	0.118	-1.296*	0.128	0.105	0.862	0.109	0.108	0.010
collectivism_high	0.041	0.033	0.773	0.026	0.032	-0.401	0.051	0.028	1.408*
openess_high	0.702	0.715	-0.287	0.667	0.709	-0.639	0.730	0.697	0.522
riskaverse	0.263	0.286	-0.973	0.287	0.287	-0.003	0.230	0.296	-1.736**
risklover	0.481	0.490	-0.358	0.497	0.478	0.468	0.578	0.466	2.638***
riskneutral	0.256	0.224	1.454*	0.215	0.234	-0.552	0.193	0.237	-1.257
collectif_YES	0.702	0.694	0.345	0.688	0.687	0.012	0.653	0.693	-1.041
assoc_env	0.432	0.425	0.282	0.439	0.420	0.479	0.406	0.425	-0.460
voisins_plupart	0.550	0.565	-0.612	0.610	0.532	1.976**	0.570	0.539	0.728
voisins_aucun	0.002	0.009	-1.809**	0.000	0.009	-1.273	0.000	0.008	-1.183
gens_resembleenorme	0.045	0.050	-0.460	0.032	0.046	-0.870	0.043	0.044	-0.096
gens_tresdiff	0.115	0.134	-1.115	0.144	0.115	1.150	0.140	0.116	0.890
Farm_Natura	0.159	0.182	-1.247	0.183	0.181	0.072	0.232	0.174	1.835**
Farm_ZV	0.545	0.624	-3.197***	0.565	0.612	-1.202	0.542	0.614	-1.794**

\*\*\*, \*\* and \*: difference is significant at 1, 5 and 10%.

Table E.2: Mean-test on characteristics of farmers with upward and downward biased second-order beliefs for ES FTI

	Second-order beliefs Benefits			Second-order beliefs Adopt			Second-order beliefs WTA		
	Bias $\geq$ 0	Bias < 0	T-test	Bias $\geq$ 0	Bias < 0	T-test	Bias $\geq$ 0	Bias < 0	T-test
genreF	0.120	0.110	0.636	0.140	0.107	1.287*	0.106	0.104	0.072
age_corr	49.097	50.073	-2.134**	49.365	49.734	-0.458	50.031	49.678	0.468
anciennete_corr	21.953	23.430	-2.866***	21.944	22.984	-1.150	23.461	22.865	0.687
educ_sup	0.543	0.569	-1.137	0.598	0.568	0.739	0.536	0.555	-0.498
surface	138.468	147.141	-1.675**	136.190	144.513	-0.931	140.117	141.399	-0.159
ResultatNet_high	0.124	0.090	2.307**	0.149	0.093	2.251**	0.061	0.098	-1.677**
ResultatNet_low	0.398	0.421	-0.963	0.405	0.422	-0.418	0.464	0.421	1.095
label_yes	0.260	0.255	0.252	0.228	0.253	-0.701	0.239	0.245	-0.166
farm_bio	0.182	0.124	3.413***	0.185	0.137	1.638*	0.095	0.189	-3.361***
MAEC_BIO	0.335	0.285	2.193**	0.358	0.306	1.321*	0.251	0.381	-3.453***
circuit_court	0.258	0.239	0.882	0.275	0.228	1.360*	0.230	0.251	-0.595
individualism_high	0.097	0.118	-1.210	0.109	0.108	0.010	0.128	0.088	1.455*
collectivism_high	0.046	0.030	1.566*	0.051	0.028	1.408*	0.018	0.037	-1.277
openess_high	0.698	0.717	-0.431	0.730	0.697	0.522	0.767	0.738	0.445
riskaverse	0.249	0.295	-2.046**	0.230	0.296	-1.736**	0.308	0.271	0.993
risklover	0.488	0.487	0.035	0.578	0.466	2.638***	0.441	0.549	-2.643***
riskneutral	0.264	0.219	2.126**	0.193	0.237	-1.257	0.251	0.180	2.119**
collectif_YES	0.683	0.703	-0.919	0.653	0.693	-1.041	0.672	0.709	-0.999
assoc_env	0.437	0.423	0.581	0.406	0.425	-0.460	0.426	0.433	-0.195
voisins_plupart	0.539	0.572	-1.321*	0.570	0.539	0.728	0.529	0.601	-1.777**
voisins_aucun	0.003	0.009	-1.436*	0.000	0.008	-1.183	0.007	0.009	-0.324
gens_ressembleenorme	0.055	0.045	0.923	0.043	0.044	-0.096	0.060	0.040	1.093
gens_tresdiff	0.129	0.128	0.085	0.140	0.116	0.890	0.158	0.115	1.547*
Farm_Natura	0.158	0.184	-1.386*	0.232	0.174	1.835**	0.193	0.174	0.626
Farm_ZV	0.553	0.624	-2.953***	0.542	0.614	-1.794**	0.586	0.637	-1.298*

\*\*\*, \*\* and \*: difference is significant at 1, 5 and 10%.

## F Characteristics of farmers per treatment

Table F.1: Characteristics of respondents per treatment

	T1		T2		T3		Control	
	mean	sd	mean	sd	mean	sd	mean	sd
genreF	0.140	0.347	0.126	0.332	0.146	0.354	0.118	0.323
Âge	49.036	10.238	50.075	9.755	50.034	10.448	50.050	10.229
Ancienneté	22.086	11.206	23.507	10.990	22.719	11.592	23.405	11.426
Etudes supérieures	0.568	0.496	0.511	0.500	0.564	0.496	0.525	0.500
Surface (ha)	149.348	135.328	145.835	101.943	146.074	115.127	140.728	100.153
Résultat net supérieur à 60 000 €	0.140	0.347	0.103	0.304	0.121	0.326	0.080	0.271
Résultat net inférieur à 15 000 €	0.383	0.486	0.400	0.490	0.398	0.490	0.441	0.497
Produit dispose d'au moins 1 label	0.252	0.434	0.272	0.445	0.254	0.436	0.245	0.430
Exploitation certifiée agriculture biologique	0.153	0.361	0.144	0.352	0.143	0.351	0.143	0.351
MAEC / aide bio	0.316	0.465	0.279	0.449	0.309	0.462	0.317	0.466
circuit_court	0.255	0.436	0.269	0.444	0.226	0.418	0.242	0.429
individualism_high	0.099	0.299	0.115	0.319	0.112	0.315	0.105	0.307
collectivism_high	0.028	0.165	0.043	0.203	0.034	0.182	0.028	0.166
openess_high	0.696	0.461	0.730	0.445	0.651	0.478	0.756	0.431
riskaverse	0.295	0.456	0.262	0.440	0.286	0.452	0.288	0.453
risklover	0.484	0.500	0.499	0.500	0.464	0.499	0.498	0.500
riskneutral	0.221	0.415	0.239	0.427	0.250	0.433	0.213	0.410
collectif_YES	0.715	0.452	0.715	0.452	0.684	0.465	0.691	0.462
assoc_env	0.440	0.497	0.438	0.497	0.414	0.493	0.431	0.496
voisins_plupart	0.552	0.498	0.596	0.491	0.518	0.500	0.569	0.496
voisins_aucun	0.007	0.083	0.007	0.082	0.006	0.080	0.008	0.090
gens_ressembleenorme	0.050	0.219	0.058	0.233	0.039	0.194	0.049	0.216
gens_tresdiff	0.109	0.312	0.148	0.355	0.101	0.302	0.137	0.344
Farm_Natura	0.172	0.377	0.162	0.368	0.180	0.384	0.183	0.387
Farm_ZV	0.635	0.482	0.589	0.492	0.598	0.491	0.611	0.488
Observations	916		907		922		931	

## G Data used to re-calibrate beliefs of farmers

To re-calibrate beliefs about others, we provide respondents with (truthful) information about others in their region. The (truthful) information is computed from a web-survey (*Prior-survey*) conducted a few weeks before the current one (from January 27th to February 2021) on a sample of 1,111 French farmers (different from the current sample).<sup>8</sup> In the *Prior-survey* survey, the same ES were proposed with the same questions regarding benefits from ES, adoption of ES and willingness to accept ES.

Table G.1: Truthful information on other farmers (from the *Prior-survey*)

Region	EFA			TFI		
	Benefits	Adopt	WTA	Benefits	Adopt	WTA
	env.			env.		
	(%)	(%)	€	(%)	(%)	€
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
Ile-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
Observation	1,266	1,195	864	1,260	1,179	873

Regional truthful information is computed from a web-survey (*Prior-survey*) conducted a few weeks before the current one (from January 27th to February 2nd 2021) on a sample different from the current one. In the *Prior-survey*, the same ES were proposed with the same questions regarding benefits from ES, adoption of ES and willingness to accept ES.

Benefits env.: percentage of farmers in a region considering that the proposed ES will generate some benefits for the environments.

Adopt: percentage of farmers in a region who declare that they will adopt the ES subject to adequate monetary compensations. WTA: monetary compensation such as 50% of farmers in a region adopt the proposed ES.

<sup>8</sup>The questionnaire was sent to a sample of 28,000 farmers, on which 1,559 clicked on the link in the invitation, 1,111 completed the two ES scenarios and 858 completed the full survey.

In the *Prior-survey*, respondents have first been asked to provide their own opinion regarding the benefits of the ES for the environment using the following question:

- Do you think that the proposed ES that the proposed ES is beneficial to the environment?

Second, they have been asked if they would be ready to adopt the proposed ES:

- Subject to receiving an adequate financial support, could you consider adopting this ES on your farm?

Finally, they have been asked to report the minimum subsidies that would lead them to implement the proposed ES:

- Subject to receiving adequate financial support, could you consider adopting 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 conditionally to receiving an adequate financial support.

The individual answers have been used to compute the regional means that will be displayed to respondent in the final survey (treatments T1, T2 and T3). More specifically, respondent will be shown the percentage of farmers in their region considering that ES will generate some benefits for the environments, the percentage of farmers in their region who declare that they will adopt the ES subject to adequate monetary compensations, and the monetary compensation such leading % of farmers to adopt the proposed ES (see Table G.1).

Table G.1 reveals that truthful information varies significantly from one region to another. If only 37% of farmers located in the Île-de-France region believe that ES EFA will generate environmental benefits, this percentage reaches 61% in Provence-Alpes-Côtes d'Azur. This indicates the need account for regional heterogeneity in beliefs about others. A similar conclusion is reached for the other characteristics (for both ES).

There may be a concern with the re-calibration of beliefs if the regional mean in the *Prior-survey* differ from individual beliefs in the ES survey. Indeed, if this is the case, farmers may be shown regional means which may have nothing to do with the true means. This may raise for respondents some credibility issues for the regional means proposed,

Table G.2: First-order beliefs on ES (from the ES survey)

Region	EFA			TFI		
	Benefits	Adopt	WTA	Benefits	Adopt	WTA
	env.			env.		
	(%)	(%)	€	(%)	(%)	€
Auvergne-Rhône-Alpes	53	71	429.43	61	65	389.05
Bourgogne-Franche-Comté	61	68	400.63	67	64	356.50
Bretagne	57	71	451.87	57	71	376.28
Centre-Val de Loire	40	65	460.21	47	54	395.12
Grand Est	51	65	473.20	59	66	358.97
Hauts-de-France	47	58	545.23	56	53	434.89
Ile-de-France	40	61	706.50	45	49	550.16
Normandie	57	66	452.13	69	66	443.20
Nouvelle-Aquitaine	52	67	436.52	60	62	409.79
Occitanie	59	75	371.85	67	72	382.08
Pays de la Loire	47	57	393.69	58	60	311.24
Provence-Alpes-Côte d'Azur	44	76	341.73	68	66	272.00
Total	51	66	449.93	59	62	390.78
Observations	2050	1316	531	2047	1348	548

with potentially an impact on the process of updating beliefs. To address this issue, we provide in Table G.2 gives the first-order beliefs regarding ES elicited in the ES survey by French region. We restrict our sample to respondents unaffected by our treatments. For beliefs regarding benefits, respondents in T1 is are excluded. For beliefs regarding adopt, respondents in T1 and T2 is are excluded. Lastly, For beliefs regarding WTA, respondents in T1, T2 and T3 is are excluded. Comparing Table G.1 and Table G.2, we do not notice very strong differences between the regional means in the *Prior-survey* and in the ES survey. The correlation between results at the regional level is positive (from 0.15 for beliefs on benefits from ES EFA to 0.61 for beliefs on adopt from ES TFI). We are then quite confident with the fact that the regional means computed from the *Prior-survey* and displayed to ES survey respondents in T1, T2 and T3 are relevant and accurate.

Table G.3: Characteristics of farmers in the ES survey and in the *Prior-survey*

	<b>ES Survey</b>	<b>Prior-Survey</b>
Organic farming	14.60%	14.22%
Other quality labels	25.55%	24.43%
Short supply chains	24.75%	25.02%
60 years and more	16.89%	16.61%
Agricultural area	143.6 ha	157.91 ha
Farm type		
-Arable and permanent crops	48.88%	50.67%
-Animal production	15.90%	13.68%
-Mixed production	35.21%	32.49%
Number of farms (%)		
-Auvergne-Rhône-Alpes	204 (8.29%)	130 (8.43%)
-Bourgogne-Franche-Comté	164 (6.66%)	106 (6.87%)
-Bretagne	131 (5.32%)	84 (5.45%)
-Centre-Val de Loire	229 (9.30%)	146 (9.47%)
-Corse	0 (0%)	0 (0%)
-Grand Est	342 (13.89%)	258 (16.73%)
-Hauts-de-France	261 (10.60%)	153 (9.92%)
-Île-de-France	88 (3.57%)	41 (2.66%)
-Normandie	151 (6.13%)	103 (6.68%)
-Nouvelle-Aquitaine	375 (15.23%)	231 (14.98%)
-Occitanie	273 (11.09%)	153 (9.92%)
-Pays de la Loire	191 (7.76%)	111 (7.20%)
-Provence-Alpes-Côte d'Azur	53 (2.15%)	26 (1.69%)

Organic farming: Organic certified farm or under conversion to organic farming. Other quality labels: Label Rouge, Protected Designation of Origin (AOC or AOP), Protected Geographical Indication (IGP), Spécialité Traditionnelle Garantie (STG). Short supply chains: direct selling to final customers (with or without intermediary). 60 years and more: Respondent is 60 years old, or more. Agricultural area: used agricultural area in ha. Arable and permanent crops: arable systems, permanent crops horticulture. Animal production: dairy cattle, beef and mixed cattle, sheep, goats and mixed grazing livestock, pigs, poultry and mixed pigs/poultry. Mixed production: mixed livestock. Number of farms: number and percentage of farms per region.

A second potential concern of the re-calibration is that since the sample of farmers used to elicit truthful information on other farmers (*Prior-survey*) differs from the sample of farmers on which the re-calibration of beliefs about other is conducted (ES survey), there may be an issue if the characteristics between the two samples are not the same. In this case, the information provided may not reflect the truth regional mean. We explore



this issue in Table G.3 where we present the mean characteristics of respondents in the ES survey and in the (*Prior-survey*). At it can be seen, the mean characteristics of farmers are very similar between both surveys. This is also the case for the regional distributions.