Innovativeness, innovation adoption and priming: Nudging farmers in a large-scale randomized experiment in France

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Presented at EAAE Congress – 29/08-1/09 2023

Draft - Do not cite

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Summary. This article is an empirical contribution on measuring farmers' ability to innovate, and on the effectiveness of a nudge-type non-monetary incentive on their (stated) intention to adopt an innovation such as the French “Label bas carbone”, a voluntary scheme that certifies carbon credits. We propose an original methodology for measuring farmers' capacity to innovate (“innovativeness”), adapting the scale of Goldsmith and Hofacker (1991) to the specificities of farmers' decisions in a professional setting. Based on an online survey with more than 6,000 responses from French farmers, we validate this scale and evaluate with a randomized experiment included in the questionnaire the net impact of a priming nudge targeting the most innovative farmers. The results indicate that the nudge tested has no

significant or detectable impact on the surveyed sample, leading us to discuss the effectiveness of nudges when trying to influence high-stakes decisions.

Keywords: Innovation - Carbon farming - Nudge - Behaviour - Experiment

1. Introduction

Rogers' innovation adoption and diffusion model (Rogers and Cartano 1962; Rogers, 2010) describes the dynamics of consumers' adoption of an innovation as an S-curve. Most empirical studies thus show different profiles, with a minority of "early adopters", often described as "innovative", followed by a majority of more or less late adopters, and a small percentage of laggards. As information about an innovation spreads, uncertainty about the adoption of innovative product decreases. The number of adopters increases and the adoption rate is accelerated by mimicry behaviours and the evolution of social norms surrounding the innovation. This work has inspired research in sociology and economics on the dynamics of adoption by farmers and the diffusion of technological innovations in the agricultural sector (see Sunding and Zilberman 2001, and Montes de Oca Munguia, Pannell, and Llewellyn 2020, for two comprehensive reviews). Research shows that not all farmers adopt an agricultural innovation at the same time, and that it is important to accelerate the adoption pace by innovative early adopters to trigger wider and faster diffusion among less innovative farmers. As part of the agro-ecological transition, finding ways to accelerate the dissemination of innovations to respond to environmental emergencies, including global warming, is crucial.

Behavioral factors are recognized as important drivers of innovation adoption in the literature and thus, behavioural policy options such as nudges are gaining more and more interest (Streletskaya et al., 2020). In this article, we focus on the role of a behavioural factor, namely farmer's innovativeness, defined as a personality trait, and seek to understand its role in the adoption of innovations. Besides, we also test for the impact of a nudge designed to increase adoption among the most innovative farmers (defined as those who score high on the innovativeness scale). A nudge is a non-monetary incentive that aims to guide individuals' choices without forcing them, by activating the behavioural factors that influence their decisions. This generally inexpensive mode of intervention was popularized by Thaler and Sunstein (2008). Nudges have been mobilized for marketing purposes, and have then inspired public policies, first in the health and education domains, and more recently in the environmental field, with the objective to change citizens' practices (Schubert, 2017). The majority of nudges target consumer behaviours, however several studies test the impact of nudges with farmers in the United States (Wallander et al., 2017) and Europe (see Ferrari et al, 2019, for a review; Chabe-Ferret et al, 2019). We are therefore interested in the impact of a nudge targeting farmers who are likely to be the first to adopt an innovation, and which could then quickly create a multiplier effect for accelerating adoption.

Our contribution is threefold. *First*, we propose an original methodology to measure farmer's innovativeness. Since innovativeness is a behavioural trait, it is not a directly observable variable. We need to design and test a measure of this latent variable that is as reliable as possible. We adapt the work of Goldsmith and Hofacker (1991), which focuses on consumers' purchasing decisions of innovative products, to take into account the specificity of farmers' decisions in a professional context. Then, we combine this psychometric score with a self-reported indicator to identify the most innovative farmers of our sample. *Second*, we test the robustness of our measure, by controlling that farmers scoring high on our innovativeness scale are indeed more likely to adopt an innovation on their farm. *Third*, we test the causal impact of a priming nudge designed to raise the interest of innovative farmers for the innovation presented to them.

Our empirical strategy is based on a a randomized experiment embedded in a survey on 6,005 farmers, for which we drew a control group and a treatment group. We measure the effectiveness of this nudge on the stated intention to adopt of targeted farmers (farmers with a high innovativeness score) but also on the rest of the sample (farmers with a lower innovativeness score) to evaluate potential backfire effects.

We apply our analysis to the particular case of the adoption of the "Label Bas Carbone" (henceforth LBC) by farmers in France. The LBC is a certification framework for net carbon emission abatement, which was established by the French Ministry of Ecological Transition in 2018. It is part of the toolbox that is mobilized by French authorities to attain the carbon neutrality objective set by the Green Deal for 2050 (European Commission, 2021). The agricultural sector, which is responsible for 30% of the EU's greenhouse gas emissions, is bound to contribute to this objective. The "Label Bas Carbone" in the agricultural sector certifies voluntary farms which adopt a package of agricultural practices resulting in proven avoided greenhouse gas emissions or/and additional carbon sequestration (in soils or trees). Certified carbon credits can then be sold by farmers on the voluntary market for carbon (Ministry of Environment, 2018). It is therefore a kind of new "green business model", as evoked by the European Commission in its proposal for a Union certification framework for carbon removals (European Commission, 2022). Farmers sell certified environmental services (net reduction of CO2-equivalent emissions) to firms that wish to offset their own emissions, for example as part of their corporate social responsibility strategy.

The article is organized as follows. In section 2, we define the innovation adoption process in our particular setting, LBC adoption. Section 3 explains how we intend to measure farmer innovativeness. Section 4 offers a brief review of nudges and introduces the priming nudge used in the survey. In sections 5 and 6, we respectively present the data collection methodology and the sample, followed by the results. Section 7 discusses results and concludes.

2. Defining the innovation adoption process

To correctly measure the intention to adopt an innovation by French farmers, the challenge was to select an innovation adaptable to all types of farming systems. It was necessary to ensure that the characteristics of this innovation were sufficiently defined for farmers to consider implementing it on their farms, without the innovation being too generalized, at the risk that it could no longer be considered an innovation and that farmers' answers are the result of biased preconceived ideas about it. Moreover, since farmers' decisions to adopt an innovation which results in a change of practice is not as easy as deciding to buy a new product on a supermarket shelf, we had to characterize finely the process leading to such a decision. This section will therefore define what an innovation is, discuss the extent to which the LBC in agriculture meets our criteria and then describe the steps followed to characterize the adoption decision.

The definition of an innovation is subjective. Innovations belong to a continuum; they can change the individual's habits marginally or totally. Each individual places the innovation at different points on the continuum (Roehrich, 2004). It is therefore necessary to ensure that the object of the study is indeed an innovation from the farmer's perception. Moreover, the characteristics of the innovation are paramount in the adoption of the innovation, as Rogers (2010) explains in his diffusion theory, along with the interactions of the innovation with other innovations, practices and activities (Liu et al., 2018). When individuals positively evaluate the attributes of an innovation, they are more likely to adopt it. Thus, the attributes of innovation must be evaluated to avoid attributing the lack of adoption of an innovation to (lack of) innovativeness when it is in fact to the lack of attractiveness of the attributes of the innovation.

For farmers, the LBC (implemented only since 2018) is a very innovative method to finance a part of their agricultural activities. It potentially represents a welcome diversification of their activities and revenues, since the net savings in greenhouse gas emissions and additional carbon sequestration, certified by this label, open the way to carbon credits purchasable by third parties (local authorities, agri-food companies wishing to improve their environmental performance,

etc.) as part of a system of offsets or payments for environmental services (Ministry of Energy Transition, 2018). Thus, the entry into a LBC process for a farm (or a group of farmers) can be considered as an innovation, because beyond the adoption of new -but not necessarily innovative - farming practices related to the commitment to reduce net emissions, the farmer creates a "new" activity: he produces carbon credits, which can be sold on the voluntary carbon market, at a price ranging from €20 to €80 per ton. To control that the LBC is indeed understood by respondents as an innovation, with relevant and attractive attributes, control questions have been added in the survey about relative advantage, compatibility, complexity, triability, and observability of the LBC.

Technology adoption is usually not a binary decision but a process (Weersink and Fulton, 2020). Farmers first become aware of the technology, then collect information on the technology and then, they might test it and then may end up buying it and using it. Considering that the adoption of the LBC is a process, we use a six-level proxy called Y to characterize its adoption. The adoption variable **Y** used in our analysis includes therefore four ordered thresholds:

-Information collection: **Y**=1 if the farmer does not reach this threshold, that is if the farmer declares not wanting to get additional information on the LBC (later labelled: ***no information***);

-Potential applicability: **Y**=2 if the farmer does not reach this threshold, that is if the farmer does want to have more information and believes that the LBC is not of interest to his farm (later labelled: ***want information***);

-Use intention: **Y**=3 if the farmer does not reach this threshold that is if the farmer believes that the LBC is of interest to his farm and does not intend to use it (later labelled: ***interest***);

-Intention to adopt: **Y**=4 if the farmer is above the threshold, that is if the farmer believes that the LBC is of interest to his farm and he declares that he intends to adopt it (later labelled: ***adopt***).

We add two additional values for our variable **Y**: **Y**=5 if farmers declare that they already are certified by a LBC (later labelled: ***already adopted***) and **Y**=0 if farmers are opposed to the LBC (later labelled: ***opposed***).

During the process of adoption of a practice, idea or technology, provided that it is an innovation for the farmer and that the attributes of the innovation are favourable to him, farmer's innovativeness has a role (Blasch et al., 2022), as discussed in the next section.

3. Building a measure of farmer innovativeness

Behavioral economics and the literature on the adoption of innovation share many common concerns. As stressed by Streletskaya et al. (2020), both benefit from interdisciplinarity, have a strong empirical basis and seek to go beyond traditional economic models to account for empirical regularities. In line with the suggestions of Streletskaya et al. (2020), our study aims to benefit from a cross-pollination of both literatures by using a large-scale survey of adoption intentions to test for the impact of a behavioural factor, farmers' innovativeness, and to test for a nudge expected to boost the adoption of an innovation by innovative individuals. In this section, we first review the concept of innovativeness and describe how we build a psychometric scale of farmers' innovativeness. Then, in Section 4, we review the studies that have experimented nudges on farmers and we describe the type of nudge used in our study.

Innovativeness as a behavioural trait or attitude has received little attention in the economics literature. Economists sometimes use indexes of innovativeness, usually by using result proxies such as the type and number of new practices adopted by the farmer (Brown and Roper, 2017; Yaron et al., 1992) or past use of new technologies (Khanna, 2001). We found an exception with the articles of Michels et al. (2020a, 2020b) who use a measure of innovativeness based on the marketing literature (Hirschman, 1980, see more details below). For example, in Michels et al. (2020a), 815 German farmers are asked a single question: *"As soon as a new technological innovation is launched in the market, I am very interested in testing it."* (1 = strongly disagree; 5 = strongly agree). They find a mean innovativeness of 2.26 (SD: 1.07) and show that mobile internet adoption significantly increases with this innovativeness score. We also draw on the innovativeness literature in marketing to design a measure of innovativeness applied to farmers.

The notion of innovativeness was first used in the field of marketing to understand the reasons for the diffusion of an innovative product or service within a population of consumers. Innovativeness is defined as the extent to which individuals adopt new ideas, behaviours, information, or products more quickly than other members of the same population (Roehrich, 2004; Kuswati and Irmawati, 2018). However, there is no real consensus on a definition. In

fact, the concept has evolved over time (Kuswati and Irmawati, 2018). Initially the concept of innovativeness was approached through a single psychological trait characterizing the individual, a kind of general or innate innovativeness, which would weigh in the decision, regardless of the type of innovation. Yet Goldsmith and Hofacker (1991) developed the concept of domain-specific innovativeness. Innate innovativeness is the extent to which individuals receive new ideas and make innovative decisions independently of experiences communicated by other individuals. It is a personality trait, supposedly a permanent genetic trait (Midgley and Dowling, 1978). However, "being innovative" does not imply being innovative in all domains; an individual may be open to new foods but reluctant to use new technologies. This is what Goldsmith and Hofacker (1991) emphasize through the domain-specific innovativeness, the individual's ability to innovate in a specific domain (Dan et al., 2019; Kuswati and Irmawati, 2018). When researchers are interested in a particular innovation, such as smartphone adoption, it would be more relevant to measure the individual's capacity to innovate in the specific field of information and communication technology. In the case of agriculture, the innovativeness should not be elicited at a global level, in the daily life of the farmer, but at a specific level, that of the professional environment in which the farmer has an expert view on innovations. Each type of innovativeness leads to separate scales. Studies have shown that working with the wrong innovativeness scale may lead to erroneous results. This is the case when innate innovativeness is used to predict behaviour in a specific domain (Kuswati and Irmawati, 2018). In our study, we aim to use a measure of domain specific innovativeness of farmers to explain their adoption of the LBC.

However, there is currently no measure of farmers' domain specific innovativeness available in the literature. It is thus necessary to adapt existing studies, by creating our own measure of domain-specific innovativeness for farmers and evaluating the quality of this measure. The Goldsmith and Hofacker (1991) six-item scale measures the ability to innovate in a specific domain among *consumers* (see Table 1, left column). This scale describes a social innovation because 4 of its 6 items compare the individual surveyed to others. It is a balanced scale with both positive and negative items. It has proven to be very reliable, with strong predictive validity, since correlations with the actual act of adoption can range from 0.38 to 0.63 (Roehrich, 2004). Thus, this scale is transferable to several domains: Jeong et al. (2017) used it in the field of technology and Goldsmith and Flynn (1992) in the field of fashion. Nyeck et al. (1996) use it in several countries (Canada, Israel, France) and Araujo et al. (2016) offer a

meta-analysis of the scale from 276 studies. Based on this literature review, we adapt the scale to farmers as shown in Table 1, right column.

Goldsmith and Hofacker (1991)	Our psychometric scale
Compared to my friends I own few rock albums.	**Compared to the neighbouring farms,** the farming model on my farm is not very innovative.
In general, I am **the last in my circle of friends** to know the titles of the latest rock albums.	In general, **I am among the last farmers around me** to know what's new in terms of farm equipment.
In general, **I am among the last in my circle of friends** to buy a new rock album when it appears.	In general, I am **among the last of the farmers around me** to adopt new farming practices.
If I heard that a new rock album was available in the store, **I would be interested enough** to buy it.	If I hear about new farming practices, **I would be interested enough** to test them.
l will buy a new rock album, **even if I haven't heard it yet**.	I will adopt a new agricultural practice **even if I have never seen it applied before.**
I know the names of new rock acts **before other people do.**	I hear about new agricultural technologies **before other farmers do.**

Note: Likert scale for each item ranging from "1 Strongly disagree" to "5 Yes strongly agree"

Table 1. Psychometric scale used to measure farmer innovativeness (right column), adapted from Goldsmith and Hofacker, 1991 (left column)

However, this scale focuses mostly on the speed of innovation adoption, so Du et al. (2021) propose to complement it with a dimension on information seeking, close to what Hirschman (1980) proposes. We therefore added two questions, also on a 5-item Likert scale: *"When adopting a new technology or agricultural equipment, I take my time to learn to master them properly"* and *"I do my best to make full use of all the features of new machinery and equipment or take full advantage of a new farming practice"*. To ensure the reliability of the farmer-adapted scale, as Goldsmith and Hofacker (1991) do, control questions that reflect innovativeness in agriculture are asked of respondents. A positive correlation between responses to these questions and the scale measuring innovativeness has been interpreted as an element of item validity.

The scores of each question are added together and lead to an innovation score per individual (variable ***PSYCHO_INNOV*** for PSYCHOmetric scale to measure INNOVativeness) ranging from 8 to 40. Besides, in the survey, we use an additional proxy for innovativeness (***SR_INNOV*** for Self-Reported INNOVativeness). As Dohmen et al. (2011) in the context of risk aversion, we use a single question to assess the respondent's willingness to innovate: *"How willing are you to innovate on your farm?"* (1: not willing at all to 10: very willing).

Based on this literature review, we designed our survey to test two hypotheses:

H1: *Both the psychometric scale and the self-reported willingness to innovate are good proxies to rank farmers according to their level of innovativeness.*

H2: *The LBC adoption rate is higher for farmers with a high innovativeness score.*

4. Designing a nudge to boost the adoption of innovation amongst farmers

Nudges are policy interventions that modify the decision context of individuals without altering their options or the structure of monetary incentives (Thaler and Sunstein, 2008). Nudges, increasingly considered as a policy option, are meant to guide decisions in a cost-effective way towards desirable outcomes. Some authors have proposed a typology of nudges according to the type of targeted behavioural bias (Dolan et al., 2012 for the MINDSPACE typology; Szaszi et al, 2018; Palm-Forster et al., 2019 for the Ag-E MINDSPACE typology, an application to farmers). Several nudges have been tested in agriculture. In their review on published studies on farmers' decision-making, classified using the Ag-E MINDSPACE typology, Palm-Forster et al. (2019) show that the main types of nudges used with producers are salience (drawing attention to what is novel and seems relevant to them), norms (what others do) and priming (subconscious cues).

We use a nudge with two characteristics. *First*, our nudge is a priming nudge where we use a lexical field associated with innovation to trigger the adoption of the innovation. Priming is defined as non-conscious activation of psychological concepts and processes such as norms, goals, emotions etc. and psychologists have found priming to matter in appraisal and evaluation, motivation and goal pursuit, social perception and judgment, and social behaviour (Bargh, 2006). Economists have used priming as a methodology to activate identity (see Afridi et al., 2015) but also as a way, for example, to increase donations to not-for-profit organizations for water quality protection (Ellis et al., 2016). *Second*, our nudge is designed to target the personality traits of farmers scoring high on the innovativeness scale. Few nudges of this type are recorded in the literature (Ingendahl et al., 2021; Stutzer et al., 2011) and none with farmers. Our nudge shares features with the literature on self-congruency where a message is expected to be more effective if framed to be congruent with the recipient's personality profile (Hirsh et al., 2012).

Our nudge therefore aims to guide the most innovative farmers' decisions towards the adoption of the LBC. For this purpose, we use two descriptions of the LBC in the survey. One is a benchmark description of the LBC in agriculture and the different steps that a farmer has to

take to be certified by the LBC. The other is the same LBC description, providing exactly the same information, but using a lexical field associated with innovation (innovativeness, inventiveness, experimenting, development, be an example for others, be the first…) in order to trigger adoption among farmers with a high innovativeness score. Table 2 presents the two versions of the description of the LBC.

Benchmark version - control group	**Nudged version - treatment group**
The LBC, created in 2019, allows farmers to be paid for the services they provide to mitigate climate change.	The LBC, created in 2019, is the **first carbon standard in agriculture**. It allows farmers **who wish to evolve and experiment** to be paid for the services they provide to mitigate climate change.
The steps of the certification process are:	The steps of the certification process are:
1) Carry-out a "carbon footprint" analysis of farm activities. An approved certification organization carries out this analysis and, with the farmer, identifies the progress that can be made to reduce emissions and/or store more carbon.	1) Carry-out a "carbon footprint" analysis of farm activities. An approved certification organization carries out this analysis and, with the farmer **who wants to renew his practices**, identifies the progress that can be made to reduce emissions and/or store more carbon.
2) Take actions to improve the carbon balance Reducing greenhouse gas emissions and/or increasing carbon storage will imply, for example, a change in livestock feed, fertilization or tillage, or planting trees, etc.	2) Take **innovative** actions to improve the carbon balance **Renew, test solutions, be inventive!** Reducing greenhouse gas emissions and/or increasing carbon storage will imply, for example, a change in livestock feed, fertilization or tillage, or planting trees, etc.
3) Certify the improvements made to the initial carbon balance. Net emission reductions are officially certified and registered in a dedicated register.	3) Certify the improvements made to the initial carbon balance. Net emission reductions are officially certified and registered in a dedicated register.
4) Obtain payments for environmental services Private companies or communities can finance these certified reductions at a price negotiated on a case-by-case basis.	4) Obtain payments for environmental services Private companies or communities can finance these certified reductions at a price negotiated on a case-by-case basis.
Why commit? -Be able to benefit from additional income; -Have the satisfaction of contributing to the climate.	Why commit? -Be able to benefit from additional income; -**Renew farming practices** and have the satisfaction t**o see the agricultural sector** contribute to the climate; -**Be a reference for other farmers and helping them to commit as well.**

Table 2. Description of the LBC in the questionnaire (two versions)

Farmers may have different attitudes and preferences with respect to innovation (as hypothesized in **H1**), and will therefore perceive our priming nudge differently according to their innovativeness score. The literature on nudges shows that badly targeted nudges, especially those based on a priming-like mechanism, may backfire and yield opposite results

to those pursued. Thunström et al (2018) illustrate this backfiring effect with a salience nudge designed to curb consumer over-spending by highlighting the opportunity costs of buying non-essential items: they find out that their nudge reduced spending for "tightwads" (who felt that they had to reduce spending even more) and increased it for "spendthrifts" (who understood the nudge as a reminder to spend), resulting in lower overall consumer welfare. They show that "one-size-fits-all-type of nudges can backfire", when they target only one type of attitude or personality traits but address a heterogeneous population. Similar results were found in other studies, emphasizing the need to target the right population when nudging (Marreiros et al, 2017). In the agricultural domain, Peth et al (2018) design an extra-laboratory experiment based on a business management game with farmers to measure the impact of two nudges (an empathy nudge and a social comparison nudge) on farmers' compliance rate with environmental regulations. They detect a positive effect but also find that the social comparison nudge increases the severity of non-complying behaviour in the deviant sub-population. They hypothesize that this may be due to "reactance" which describes the defiance or negative reaction triggered by a signal perceived as not legitimate. This type of issue may also arise with our nudge.

We therefore test the following hypothesis with our randomized experiment:

> ***H3:*** *The average stated intention to adopt the LBC is greater amongst the innovative farmers in the treated (nudged) group than amongst the innovative farmers of the control group.*

The corollary is to test for a potential backfire effect: less innovative farmers are averse to the priming message, resulting in a lower average adoption rate amongst less innovative farmers of the treated group, compared to the average adoption rate of less innovative farmers in the control group.

5. Data collection and sample description

5.1 Implementation of the online survey

To address our research questions (measuring farmers' innovativeness and assessing the impact of a nudge for the most innovative farmers) and test our three hypothesis, we built a survey for a large sample of French farmers, regardless of their type of production or socio-economic profile.[1]

[1] In fact, the LBC methodology exist for field crops, cattle, hedges and is currently being developed for vineyards and market gardening/horticulture. To control for this potential bias, respondents were invited to assume that there is a validated LBC method for their type of farm.

The objective of this survey was threefold: to collect variables that enable to measure respondents' innovativeness and to verify that our proposed measurement methods are valid; to collect information on respondents' intention to adopt the LBC, and to test our nudge by integrating a randomized treatment allocation into the survey and comparing the intention to adopt of treated and untreated respondents, also distinguishing between more innovative and less innovative farmers in these two groups to identify whether the target population is indeed more sensitive to the nudge.

To be able to take into account the heterogeneity of farmers' situations with respect to the LBC (more advanced for some types of production than for others) and because the literature shows that the detectable effect of nudges on farmers' production decisions is often very small, we needed a high number of respondents. Our survey was designed to be distributed online by a polling institute (BVA) which has a panel of about 90,000 French farmers' email addresses. For voluntary and anonymous farmers to complete the questionnaire, the survey had to be as short and clear as possible. The survey was carried out with the Limesurvey software and sent by email by BVA to its entire panel of farmers (after a first test on a small sample of farmers). The email invited farmers to respond to a survey conducted by researchers on the remuneration of services provided by agriculture. The email was written to encourage as many farmers as possible to click on the survey link while avoiding terms related to innovation and the environment to limit potential respondent selection bias. In addition, the email guarantees that the survey is anonymous and specifies that it lasts about 15 minutes.

The questionnaire consists of 4 main parts: (1) questions on the characteristics of the farm (main production, size, type of production and sign of quality, financial situation and future of the farm); (2) questions on agricultural practices on majority crops[2]; (3) a section presenting the LBC (including the nudge for 50% of respondents) with questions to measure their innovativeness and their attitude towards the LBC; and (4) a final section detailing the socio-demographic characteristics of the respondent.

[2] The objective with these questions is to detect whether respondents already have practices that limit greenhouse gas emissions or store carbon in the soil. The answers to this part are not exploited in this article.

5.2 Data collection

The first wave was launched on June 15, 2022. We collected 2,500 complete responses. Because early summer is usually a busy time for farmers, we decided to postpone the re-launch of the survey until winter. The second wave was launched on December 8th, 2022 and ended on January 18, 2023, enabling us to collect 3,505 additional responses, for a total of 6,005 complete responses. Of the 90,000 farmers in the BVA panel, several email addresses were not valid and many emails were not read. Since we do not know how many farmers read our invitation, we cannot compute a response rate. Nevertheless, we know that there were 14,534 clicks on the survey link, and that 41% of them resulted in a complete questionnaire, which shows the interest of farmers in following through with our survey. We also collected a very large number of end-of-the-survey comments, some are very long and very revealing of farmers' opinions on the LBC. This will be studied in a separate paper.

5.3 Sample description

The main socio-demographic characteristics of our sample are the following. A large majority of our respondents are male (87%). Respondents are slightly younger than the population of farmers in France. Those over 60 are mostly under-represented in favour of those under 55, which is common in online surveys. However, no conclusion can be drawn from the fact that certain categories of farmers are over- or under-represented in our sample in relation to the total population of farmers in France, because the panel of farmers who received the invitation is itself not representative. Our sample is also composed of large farms to the detriment of small farms of less than 50 hectares, especially less than 20 hectares. This is probably due to the fact that the BVA panel of farmers includes many field crop farms that generally have a larger agricultural area than livestock, market gardening and viticulture which are under-represented in our survey (see Table 3).

	Our sample	France (data 2016)
Mean UAA	155 ha	69 ha
Organic farming	11.9%	12.1%
Average age	48.6 years	52.2 years
Education (frequency)		
No diploma	*0.8%*	*6%*
Lower than high school diploma	*12.4%*	*42%*
High school diploma and undergraduate	*63.4%*	*28%*
Graduate studies and more	*23.4%*	*24%*
Main activity (frequency)		**France (data 2020)**
Field crops	*44.6%*	*28,69%*
Market gardening and horticulture	*1.2%*	*3,94%*
Wine growing	*2.4%*	*15,14%*
Fruits & other permanent crops	*1.1%*	*3,92%*
Dairy cattle	*13.4%*	*8,99%*
Meat cattle	*8.5%*	*12,42%*
Mixed cattle	*0.5%*	*2,14%*
Sheep, goats	*4.1%*	*9,10%*
Pigs and poultry	*2.6%*	*4,79%*
Mixed crops - mixed livestock	*20.8%*	*10,41%*
Unclassified farms	*0.8%*	*0,47%*
Total number of farms	**6,005 farms**	**389,779 farms**

Table 3. Sample representativeness

The fact that our sample is not representative is not problematic as such, since our goal is to understand the behavioural determinants of innovation adoption among farmers and to test the impact of our nudge. On the other hand, it is important that the various characteristics are well balanced between the control group (3,035 responses, 50.5%) and the treatment (nudged) group (2,970 responses, 49.5%). We find no significant difference between the two groups in terms of gender, age, utilized agricultural area, type of farming, marital status of the respondent and level of education (see also Appendix A for spatial distribution of respondents).

Regarding our variable of interest **Y**, i.e. the six-level proxy for the adoption process, Table 4 and Figure 1 show the distribution of respondents according to the level of intention to adopt the LBC.

Y: Adoption of LBC		Number and share of respondents
opposed (**Y**=0)	Opposed to the LBC	257 (4.28%)
no information (**Y**=1)	Does not want to have information on the LBC	1,299 (21.65%)
want information (**Y**=2)	Would like just to have information on the LBC	390 (6.50%)
interest (**Y**=3)	Believes that the LBC could be of interest to his farm but not ready to commit	894 (14.90%)
adopt (**Y**=4)	Wants to get involved in the LBC	2,275 (37.92%)
already adopted (**Y**=5)	Already involved in the LBC	884 (14.74%)

Table 4. Distribution of the discrete variable of interest **Y**: Adoption of LBC

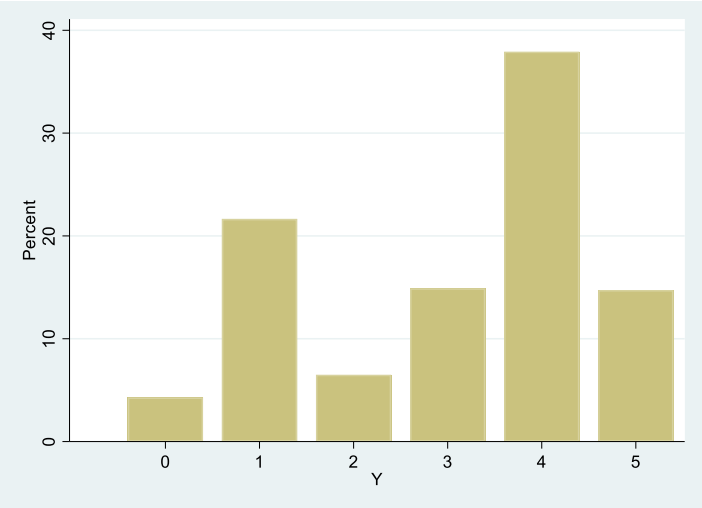

Figure 1. Distribution of the discrete variable of interest **Y**: Adoption of LBC

Almost 15% of respondents declare that they "have already started a LBC process within their farm" and 38% "wish to apply for certification for a LBC on their farm". Only 4% say they are opposed to the LBC and 22% are not interested in the LBC.

6. Results

6.1 Farmers' innovativeness

The first measure of the innovativeness we consider here is the self-reported measure (***SR_INNOV***). The mean of the ***SR_INNOV*** over the total sample is 6.80, on a score scale ranging from 1 to 10. The second measure (***PSYCHO_INNOV***) is the combination of the

adapted Goldsmith and Hofacker (1991) scale and the two questions of Du et al. (2021) adapted to the agricultural context. The average score of the ***PSYCHO_INNOV*** measure on our 6,005 respondents is 28.96, on a score scale ranging from 8 to 40. The distribution of both measures is presented in Figure 2.

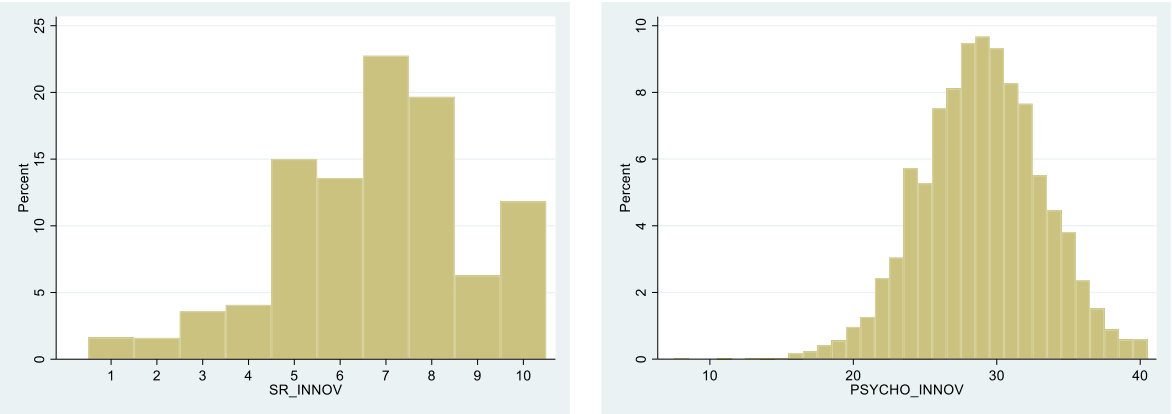

Figure 2. Distribution of our two measures ***SR_INNOV*** (left panel) and ***PSYCHO_INNOV*** (right panel)

To compare the validity of the psychometric scale (***PSYCHO_INNOV***) with the one resulting from the simple self-reported measure (***SR_INNOV***), we adapt the three control questions proposed by Goldsmith and Hofacker (1991) to the agricultural context:

-*"How often do you keep up-to-date with the latest agricultural news?"* ***Keepup_Latest_News*** variable coded from 1 (never) to 4 (often)

-*"How often do you talk to an agricultural advisor, cooperative members or other farmers about innovations in your sector?"* ***Often_Exchange*** variable coded from 1 (never) to 4 (often)

-*"Do you appreciate these moments of information gathering and exchanges on innovations in terms of agricultural practices?"* ***Like_Exchange*** variable coded from 1 (no I do not like it at all) to 5 (yes, I appreciate it very much)

Table 5 shows the correlation between the two measures of innovativeness and with the control variables. As expected, our two proxies of farmers' innovativeness are highly correlated with each other (Pearson correlation coefficient: 0.5876). We also show that the two measures are valid, as they are both positively correlated with the three control questions adapted to the agricultural context. The ***PSYCHO_INNOV*** measurement appears to perform somewhat better than ***SR_INNOV***, as it is more correlated with the two control variables ***Keepup_Latest_News***

and ***Often_Exchange***.

	SR_INNOV	***PSYCHO_INNOV***
SR_INNOV	1	
PSYCHO_INNOV	0.5876	1
Keepup_Latest_News	0.2833	0.3564
Often_Exchange	0.2847	0.3256
Like_Exchange	0.3792	0.3634

Table 5. Correlations of scales for measuring innovativeness with control variables

In order to assess the impact of the nudge on more innovative farmers, we test different ways to classify our respondents in the "more innovative" or "less innovative" category, based on our two measures ***PSYCHO_INNOV*** and ***SR_INNOV***. The classification used to present our results combines our two measures. First, we identify the 20% of farmers who have the highest score using each of our two measures. This corresponds to a score higher or equal to 9 for ***SR_INNOV*** (18%) and higher or equal to 33 for ***PSYCHO_INNOV*** (20%). We test different thresholds, but because the discrete scale of ***SRINNOV*** only goes from 1 to 10, we are quite limited, since we want about the same proportion of respondents with both measures. Second, crossing the two measures (see Table 6), we see that there are discrepancies in classification between the two measures: 4,313 farmers (72%) are "less innovative" with the two measures and 580 (10%) are identified as "more innovative", but 1112 (18%) are classified differently depending on the measure considered. We choose to eliminate these 18% of respondents from the rest of the analysis because we are not sure whether they can be considered more or less innovative. Third, using a conservative approach, we define the dummy variable ***INNOV*** as 1 if the respondent is classified as "more innovative" by both measures and 0 if the respondent is classified as “less innovative” by both measures. This reduces our sample size to 5,498 observations

		PSYCHO_INNOV		Total
		Less innovative	More innovative	
SR_INNOV	Less innovative	4,313 (72%)	605 (10%)	4,918 (82%)
	More innovative	507 (8%)	580 (10%)	1,087 (18%)
Total		4,820 (80%)	1,185 (20%)	6,005 (100%)

Table 6. Table of contingencies between the two measures of innovativeness

If we exclude respondents who declare to be opposed to the LBC (Y = 0), we show that the proportion of more innovative farmers (average rate of ***INNOV)*** increases with the value of Y, i.e. the scaled intention to adopt LBC (see Table 7). A Student test also shows that the mean of **Y** is significantly higher (one-sided test: 0.000) for more innovative farmers (3.66) than for less innovative farmers (2.90). This result is expected and reassuring: the most innovative farmers are more likely to adopt the LBC than less innovative farmers (validation of **H2**). This shows that the innovativeness of farmers is significantly and positively correlated to our variable of interest.

Y: Adoption of LBC	Average rate of ***INNOV***
opposed (**Y**=0)	12%
no information (**Y**=1)	5%
want information (**Y**=2)	6%
interest (**Y**=3)	6%
adopt (**Y**=4)	15%
already adopted (**Y**=5)	24%

Table 7. Average rate of INNOV according to Y

The probability of belonging to the most innovative group is higher when individuals are more willing to take risks and have strong preferences for the future, favouring future profitability over present profitability (see Table 8). Having higher environmental preferences also

increases the probability of belonging to the most innovative group. However, being sensitive to social norms and being willing to adapt to new regulations reduce the probability of belonging to the most innovative group.

Independent variable	**Description**	**Coef. (Std. Err.)**
Risk preference	Willingness to take risks (1 to 10)	0.717*** (0.035)
Time preference	Willingness to give up a profitable investment today in order to be able to invest in better technologies in the future (1 to 10)	0.193*** (0.029)
Other farmers' adoption of LBC	Inclination to adopt the LBC if other farmers did the same: low (1) to high (5)	-0.357*** (0.051)
Adaptation	Adaptation to a new regulation which would impose a costly adaptation: low (0), medium (1), high (2)	-0.169** (0.068)
Environmental preferences	5-item scale: score from 0 to 20	0.122*** (0.017)
Constant		-7.918*** (0.320)
#Obs	4,893	
Log likelihood and test	-1,224.64***	

Table 8. Logistic regression of ***INNOV*** on behavioural factors

6.2 Nudge impact assessment

We have previously verified that our control and treatment groups are well balanced on all socio-demographic characteristics, including the measurement of respondents' innovativeness and variable ***INNOV*** (see Table 9). Any difference in the intention to adopt the LBC between the two groups can therefore be attributed to the nudge only.

Variable	Whole sample	Control group	Nudged group	Mean comparison test: control vs. nudge p-value
SR_INNOV (scale 1 to 10)	6.80 (2.03)	6.77 (2.04)	6.83 (2.03)	0.2457
PSYCHO_INNOV (scale 8 to 40)	28.96 (4.23)	28.93 (4.27)	28.98 (4.20)	0.6601
INNOV (dummy)	0.1185 (0.3233)	0.1181 (0.3228)	0.1189 (0.3238)	0.9316

Table 9. Average innovativeness scores by type of innovativeness measurement scores (standard deviations are in brackets)

In addition, we exclude the 884 farmers in our sample who have already started a LBC certification process (**Y** = 5) before responding to the survey. Indeed, their commitment in the LBC process could not be impacted by our nudge. We also exclude the 257 farmers who declare to be opposed to the LBC (**Y** = 0). So, to test the impact of the nudge, we consider the Y-levels from **Y** = 1 to **Y** = 4 (see Section 2). We checked that our two groups are still well balanced on that sub-sample (4,858 observations).

Table 10 shows that the distribution of farmers across the values of the **Y** variable is not significantly different between the control group and the treatment group. On average, see column **Total** of Table 11, farmers who were nudged (mean 2.82, SD 1.27) are no more willing to adopt the LBC than farmers in the control group (mean 2.88, SD 1.25).

Y: Adoption of LBC	Control group	Nudged group	Total
no information (1)	621	678	1,299
want information (2)	185	205	390
interest (3)	459	435	894
adopt (4)	1,144	1,131	2,275
Total	2,409	2,449	4,858

Table 10. Number of farmers by level of adoption in the control and treatment groups

This first result is disappointing but it may be due to the backfire effect of the nudge on the less innovative farmers, as hypothesized in section 4. This negative effect on the less innovative farmers could cancel out the positive effect on the most innovative farmers. We therefore measure the impact of the nudge by distinguishing its impact on the two classes of farmers.

Results are the same for both the more innovative and the less innovative farmers: the nudge does not encourage farmers to adopt the LBC (Table 11).

	Total (4.858 farmers)	**Less innovative** (3,605 farmers)	**More innovative** (391 farmers)
Control group	2.88	2.77	3.43
	(1.25)	(1.27)	(1.02)
Nudged group	2.82	2.71	3.25
	(1.27)	(1.28)	(1.09)
Total	2.85	2.74	3.34
	(1.26)	(1.27)	(1.09)
Student test (two-sided test)	0.1091	0.2151	0.1120

Table 11. Mean (and SD) of Y for control and treatment groups, by category of innovativeness. None of the differences is significant at 1% (***), 5% (**) or 10% (*)

Yet, we confirm a significant effect of innovativeness on average adoption. This confirms the reliability of the measurement scale proposed through the combination of the ***SR_INNOV*** variable and the ***PSYCHO_INNOV*** variable. Therefore, **H2** is validated. On the other hand, and contrary to our initial hypothesis, we cannot conclude on a positive and significant effect of our nudge on the declared intention to adopt the LBC, neither on the total population, nor on the targeted population of the most innovative farmers. Therefore, **H3** is not validated.

The results are unchanged if we consider the binary variable ***ADOPT*** defined as ***ADOPT*** = 1 if **Y** = 4, ***ADOPT*** = 0 if **Y** = 1, 2 or 3 [***ADOPT*** = . (missing value) if **Y** = 0 or 5] (see Table 12).

	Total (4.858 farmers)	**Less innovative** (3,605 farmers)	**More innovative** (391 farmers)
Control group	0.4749	0.4273	0.7077
	(0.4995)	(0.4948)	(0.4560)
Nudged group	0.4618	0.4099	0.6480
	(0.4986)	(0.4919)	(0.4788)
Total	0.4683	0.4186	0.6777
	(0.4990)	(0.4934)	(0.4679)
Student test (two-sided test)	0.3617	0.2889	0.2073

Table 12. Mean (and SD) of ***ADOPT*** for control and treatment groups, by category of innovativeness. None of the differences is significant at 1% (***), 5% (**) or 10% (*)

Furthermore, we could hypothesize that the effect of the nudge on the most innovative farmers is not significant because these farmers do not consider the object of the study, the LBC, to be an innovation. Therefore, to check this, we compare the effect of the nudge on the sub-group of the most innovative farmers who consider that the LBC is an innovation (see Table 13). We find no significant difference in the willingness to adopt LBC, and no evidence that considering LBC to be an innovation conditions the impact of the nudge.

	ADOPT ***Mean (SD)***
Control group	0.8209
(134 farmers)	(0.0332)
Nudged group	0.7886
(123 farmers)	(0.0370)
Total	0.8054
(257 farmers)	(0.0247)
Student test (two-sided test)	0.5156

Table 13. Mean (and SD) of ***ADOPT*** for control and treatment groups, if farmers consider LBC as an innovation and belong to the most innovative farmers. None of the differences is significant at 1% (***), 5% (**) or 10% (*)

6.3 Behavioural and contextual factors of LBC adoption

Although the nudge has no impact, we are interested in identifying the behavioural and contextual factors that can explain the declared intention to adopt the LBC (Table 14 for the 4-level adoption variable **Z**; see Table 15 in Appendix B for dummy **ADOPT**).

Independent variables	Variable description	Coef. (Std. Err.)
Nudge	Dummy for control (0) vs nudged group (1)	-0.103 (0.065)
INNOV	Dummy for less (0) vs more (1) innovative farmers	0.381*** (0.143)
Risk preferences	Willingness to take risks (1 to 10)	0.023 (0.019)
Time preferences	Willingness to give up a profitable investment today in order to be able to invest in better technologies in the future (1 to 10)	-0.001 (0.019)
Favourable context	Considering the context to be favourable to try the LBC (1 to 10)	0.408*** (0.021)
Other farmers' adoption of LBC	Inclination to adopt the LBC if other farmers did the same: low (1) to high (5)	0.135*** (0.037)
Adaptation	Adaptation to a new regulation which would impose a costly adaptation: low (0), medium (1), high (2)	-0.019 (0.043)
Environmental preferences	5-item scale: score from 0 to 20	0.046*** (0.011)
LBC known	The farmer knew about the LBC before the survey, no (0), yes (1)	0.254*** (0.072)
LBC innovative	The LBC is an innovative solution. Not at all (0) to Yes absolutely (4)	0.361*** (0.048)
LBC better option	The LBC is a better option for reducing farm's impact on the climate than more traditional schemes such as agri-environmental measures. No not at all (0) to yes absolutely (4)	0.259*** (0.045)
LBC complex	The LBC is complex to understand and mobilize. No not at all (0) to yes absolutely (4)	0.071* (0.040)
LBC compatible	The LBC is compatible with farm's objectives (in terms of needs, constraints and values...) No not at all (0) to yes absolutely (4)	0.530*** (0.048)
LBC observable	It is possible to observe the implementation of the LBC among farming neighbors or in professional circle. No not at all (0) to yes absolutely (4)	-0.141*** (0.040)
LBC expe	Before committing to a LBC, it is possible to try it out with the help of advisors. No not at all (0) to yes absolutely (4)	0.413*** (0.042)
/cut1		5.096 (0.226)
/cut2		5.686 (0.230)
/cut3		6.867 (0.239)
#Obs.	3,996	
Log likelihood and test	-3970.268***	

Table 14. Ordered logit regression of the 4-level adoption variable **Z**; significance levels: 1% (***), 5% (**) or 10% (*)

As already shown, innovativeness (**INNOV**) increases adoption (variable **Z**). Having high environmental preferences also increases adoption. In addition, considering the context as favourable to try the LBC and knowing that other farmers adopt the LBC increase the probability of adopting the LBC, suggesting that farmers are sensitive to the descriptive social norm. To ensure the reliability of these results, control variables concerning the attributes of the innovation are added to ensure that the measured impact of the treatment, the nudge, is not biased by a preconceived farmer's opinion on the LBC and its attributes (see Table 14 for description of variable names). As expected, most LBC's "positive" attributes (**LBC innovative**, **LBC better option**, **LBC compatible**, **LBC expe**) have a positive impact on adoption. However, **LBC observable** has a significant negative impact, which is surprising and intriguing. This result suggests that farmers who can observe the implementation of the LBC among their neighbours are less willing to adopt the LBC. However, recall that just knowing that other farmers –who they do not know– implement the LBC as indicated in the variable "**Other farmers' adoption of LBC**" increases adoption. These two results might suggest that farmers who have implemented the LBC on their farm consider that it was not a positive experience and share their disappointment with fellow neighbours.

7. Discussion and conclusion

In this article, we propose a methodology to measure farmers' innovativeness, we check that innovativeness is positively correlated with the adoption of innovation, and we test for the impact of a nudge designed to increase innovation adoption by innovative farmers. We formulate three hypotheses; the first two cannot be rejected while the third is. First, we find we can classify farmers according to their innovativeness using a one-item self-reported innovativeness and a psychometric scale adapted to farmers. Second, we find that high-scoring farmers on our innovativeness scales are more likely to adopt an innovation. Third, our nudge seems to have no significant effect on the adoption rate of nudged farmers, whatever their innovativeness score. It fails to boost the stated intention to adopt of the most innovative farmers, and it does not have a backfire negative effect on less innovative farmers by discouraging them to adopt innovation.

We will first discuss our (disappointing) result on the effectiveness of our nudge in light of the literature on nudges. We will then highlight the limitations of our work and propose further developments.

7.1 The effectiveness of nudges and the specific case of farmers

Carl Sunstein (the father of nudges) published a prominent article in 2017 entitled "Nudges that fail". He shows with a number of examples that nudges are sometimes ineffective, or less effective than expected, or in some cases counterproductive, leading to unintended consequences. He identifies seven potential reasons, which can explain (in isolation or combined) this lack of success. Some nudges: (1) are not strong enough in face of the strong antecedent preferences of decision-makers; (2) are confronted to counternudges (3) produce confusion in the target audience; (4) have only short-term effects; (5) produce "reactance"; (6) are based on an inaccurate understanding of what kinds of choice architecture will move people in particular contexts; (7) produce compensating behaviour, resulting in no net effect.

Hummel and Maedche (2019) conduct a quantitative review on the effect sizes of nudging published in 100 scientific papers in different application domains from 2008 to 2018. They show that the median relative effect size of nudging is 21% but this figure hides a great heterogeneity across the types of nudges and studies, with some effects being null and even negative. They also warn that their results represent the upper band of true effects due to the suspicion of a strong publication bias against null or counter-intuitive results, and the fact that many studies might be under-powered (Doucouliagos and Stanley, 2013). Mertens et al (2022) reach the same type of conclusions with a meta-analysis of nudges across different various behavioural domains and measure the average effect size. They estimate it to be too large to be plausible, and also point at the publication bias to moderate practitioners' overoptimistic expectations about the impact of nudges. Szaszi et al (2022) comment this meta-analysis, highlighting that many studies also show a near-zero effect, and conclude that "there is no reason to expect large and consistent effects of nudge interventions".

None of the analyses mentioned above focus on the agriculture domain. As the study by Hummel and Maedche (2019) shows, most of the empirical evidence described in the scientific literature on nudge effects relates to the behaviour of patients, consumers or citizens. It focuses on behavioural changes, in relation to seemingly low-stake, short-term decisions such as food choices, electricity and water consumption, or donations to charities. Longer-term, higher-stakes decisions taken in a professional context, and potentially having a strong impact on the economic agent's income, such as investments or recruitment, could be less sensitive to nudges. Indeed, it can be assumed that nudges target primarily the automatic, intuitive, and thinking process of System 1 rather than the more conscious, rational and logical thinking of System 2,

although the two are linked (Kahneman, 2011). In the professional domain, when economic agents have to make long-term decisions, they are more likely to follow a well-informed rational optimization rule than a time-saving satisficing rule. Yet this question is clearly under-explored and simply not mentioned in studies testing nudges on farmers.

Ferrari et al. (2019) conduct a review of existing evidence on green nudging interventions to leverage more sustainable behaviour among actors of the food chain. They select 13 articles on nudges targeting farmers and encouraging a more responsible use of inputs. Tested nudges (some of them, however, are only tested in the lab with students) are mostly salience, norms and priming nudges. The work by Kuhfuss et al. (2016) uses a survey-based randomized controlled trial (RCT) and measures a positive impact of a social comparison on the stated intention of responding French farmers concerning their intention to maintain their sustainable farm practices, once their agri-environmental contract ends. The results of an RCT conducted in the South-West of France by Chabé-Ferret et al. (2019) indicate that a social comparison nudge has small detectable albeit heterogeneous effects on farmers' irrigation water use. Yet other larger evaluations yield less optimistic results. Wallander et al. (2017) test the effect of nudging farmers to take part in the US land retirement program. They implement a very large RCT examining the effect of informational outreach and behavioural nudges included in invitation letters to join the program. They show that the reminders work with farmers previously involved in the program, thus typically addressing inattention behaviour. But no difference could be detected between treatment and control groups when the initial informational nudge was augmented with peer comparisons and social norms messages. Pellegrin et al. (2018) found that a salience nudge (identifying how local rare species could be restored thanks to farmers' enrolment in compensation programs) was not effective.

These studies show that nudges in general, and nudging farmers in particular, can fail, even if we find little evidence in the literature, notable due to the usual bias against the publication of null results (Palm-Forster et al, 2019). Our study provides new evidence that some nudging policies have no detectable effects, even with a very large sample.

7.2 Limitations and further developments

Our data analysis is preliminary. Some farmers may already be using innovative practices but given the additionality required by the LBC (the farmer must demonstrate that he is going to do additional efforts), they may have had a "reactance" response, either by declaring that they

were against the LBC or that they were not willing to adopt it. A quick read of farmers' comments at the end of the survey seems to confirm this hypothesis.

Second, we have considered the respondent farmer as the sole decision-maker on his farm. However, a farm is also a business. We should therefore explore further the theory of entrepreneurial innovation to better understand what innovativeness means at the firm level. In the future other farmers' behavioural traits, relating to their ability to run a business, could be explored and nudged, perhaps with more success.

Third, our treatment of the innovativeness proxies is currently quite crude. We not only took a deterministic approach to our measurement of innovativeness but we also used an ad hoc threshold to classify farmers as more or less innovative. Our next step will be to consider innovativeness as a latent variable and use a model such as a hybrid choice model (Ben Akiva et al., 2002) as in Zemo and Termansen (2022) to simultaneously estimate the behavioral model of innovativeness and the adoption model.

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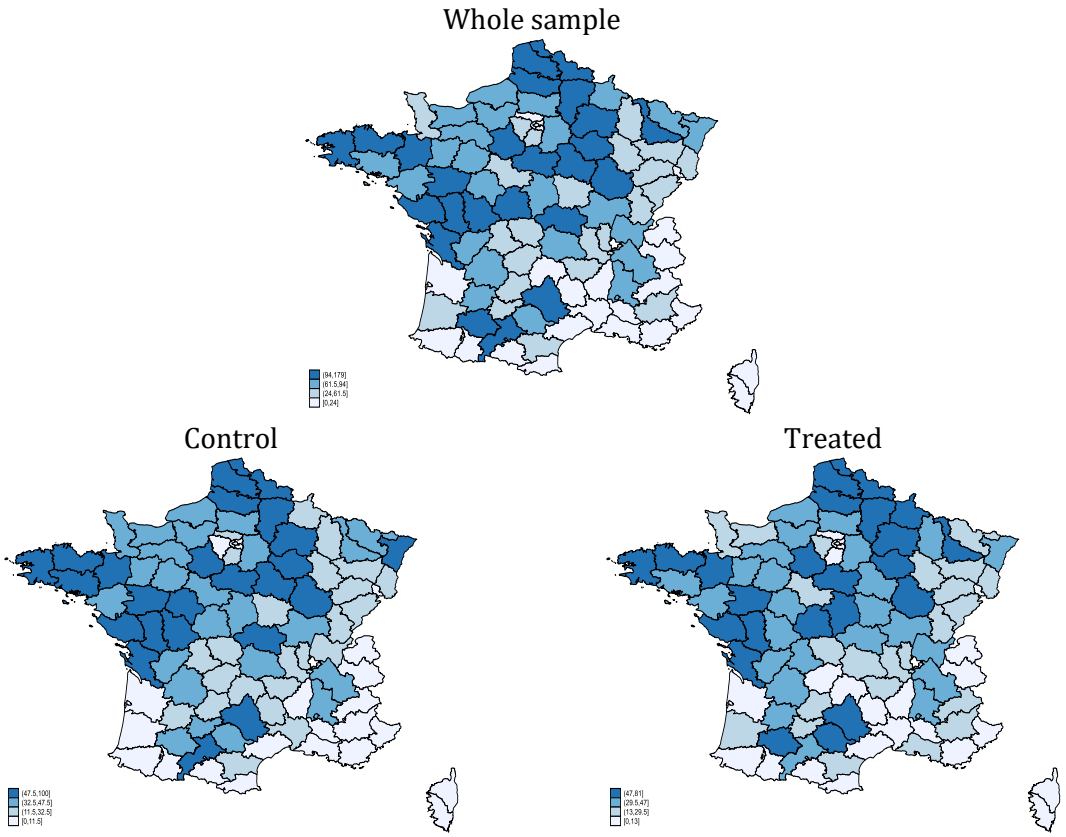
Appendix A. Spatial distribution of respondents



Appendix B. Behavioural and contextual factors of LBC adoption: logistic regression of dummy variable ADOPT

Independent variables	Variable description	Coef. (Std. Err.)
Nudge	Dummy for control (0) vs nudged group (1)	-0.084 (0.077)
INNOV	Dummy for less (0) vs more (1) innovative farmers	0.286* (0.157)
Risk preferences	Willingness to take risks (1 to 10)	0.041* (0.023)
Time preferences	Willingness to give up a profitable investment today in order to be able to invest in better technologies in the future (1 to 10)	0.019 (0.023)
Favourable context	Considering the context to be favourable to try the LBC (1 to 10)	0.401*** (0.025)
Other farmers' adoption of LBC	Inclination to adopt the LBC if other farmers did the same: low (1) to high (5)	0.018 (0.043)
Adaptation	Adaptation to a new regulation which would impose a costly adaptation: low (0), medium (1), high (2)	-0.036 (0.051)
Environmental preferences	5-item scale: score from 0 to 20	0.032** (0.013)
LBC known	The farmer knew about the LBC before the survey, no (0), yes (1)	0.115 (0.085)
LBC innovative	The LBC is an innovative solution. Not at all (0) to Yes absolutely (5)	0.289*** (0.056)
LBC better option	The LBC is a better option for reducing farm's impact on the climate than more traditional schemes such as agri-environmental measures. No not at all (1) to yes absolutely (5)	0.276*** (0.053)
LBC complex	The LBC is complex to understand and mobilize. No not at all (1) to yes absolutely (5)	0.017 (0.047)
LBC compatible	The LBC is compatible with farm's objectives (in terms of needs, constraints and values...) No not at all (1) to yes absolutely (5)	0.506*** (0.056)
LBC observable	It is possible to observe the implementation of the LBC among farming neighbors or in professional circle. No not at all (1) to yes absolutely (5)	-0.073 (0.046)
LBC expe	Before committing to a LBC, it is possible to try it out with the help of advisors. No not at all (1) to yes absolutely (5)	0.391*** (0.050)
Constant		-6.197*** (0.281)
#Obs.	3,996	
Log likelihood and test	-2038.5856***	

Table 15. Logistic regression of **ADOPT**; significance levels: 1% (***), 5% (**) or 10% (*)