Enhancing Eco-Scheme Participation: The Impact of Information Framing in a Randomised Controlled Trial

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Abstract

Farmers' participation in a new Eco-Scheme aimed at establishing Skylark plots in Slovenia was examined through two consecutive randomized controlled trials utilizing information-based interventions. The first trial employed gain- and loss-framing to highlight environmental outcomes, while the second used positive and negative descriptive norms to frame enrolment behavior. Neither intervention produced a significant overall effect on enrolment rates. However, among larger farms and those with prior participation in agri-environmental schemes, the treatments influenced both the decision to enrol and the extent of land enrolled. These findings suggest that generic information framing, when not targeted, may be insufficient to effectively promote farmer uptake of agri-environmental measures.

Introduction

The sustainable management of natural resources and the conservation of biodiversity within agricultural ecosystems heavily rely on voluntary agri-environmental schemes (AES), which offer financial incentives to farmers for adopting environmentally beneficial practices (Hasler et al., 2022). These schemes include, for instance, Agri-Environmental-Climate Measures (AECMs) and Eco-Schemes under the European Union's Common Agricultural Policy (CAP) (Pe'er et al., 2022). A key challenge to the effectiveness of these initiatives lies in low enrolment rates, on average below 5%, particularly for more demanding measures, which limit their potential to achieve intended environmental outcomes (Alliance Environment, 2019).

Improved access to information—often delivered through information campaigns—has been associated with increased farmer participation in AES. However, the effectiveness of such campaigns may vary depending on contextual factors, including behavioural and socio-psychological determinants (Schulze et al., 2024). Beyond merely providing information, such campaigns can serve as platforms for behaviourally informed interventions, which present (novel) information in a way that activates psychological mechanisms to support desired behavioural outcomes within a target population (Michie et al., 2008). Among these interventions, nudges have gained increasing popularity. Nudges aim to influence behaviour by modifying the decision-making environment—such as the presentation of information and choices—without altering economic incentives (Thaler and Sunstein, 2008). They are often simple, low-cost tools that can be incorporated into existing policy frameworks (Ferraro et al., 2017). *Despite their promise, the effectiveness of nudges remains uncertain due to potential publication bias in the existing literature, which tends to overreport positive results (Mertens et al., 2022).*

To test the effectiveness of nudges based on provisioning and framing of information, we implemented two randomized controlled trials (RCTs) examining farmer enrolment in a new Eco-Scheme promoting the establishment of Skylark plots in Slovenia. The first RCT examined the impact of gain and loss framing, grounded in Prospect Theory (Kahneman and Tversky, 1979), which posits that losses are psychologically more salient than equivalent gains. Two treatment letters emphasized either the environmental gains of enrolment or the losses associated with non-enrolment in terms of biodiversity conservation, while a control letter omitted such framing. Although loss framing has demonstrated consistent effectiveness in consumer behaviour research, its effects in agricultural contexts remains uncertain due to the complexity of farm management decisions and farmers' typically business-oriented decision-making processes (Dessart et al., 2019).

In the second RCT, we investigated the influence of descriptive norm framing. Again leveraging the Ministry's outreach campaign, we tested whether positive or negative framing of social norms—i.e., portraying enrolment as common or rare among peers—would affect farmer behaviour. Descriptive norms convey what is commonly done by others (e.g., "most farmers in your area have enrolled"), and their effectiveness may depend on whether they are framed positively or negatively (Cialdini et al., 2006; Mollen et al., 2021). While several studies have explored social norm nudges in agricultural settings, their findings vary widely, and no prior study has specifically examined the effect of descriptive norm framing on actual enrolment behaviour (Chabé-Ferret et al., 2023; Klebl et al., 2023).

The RCTs were conducted on a case of an Eco-scheme for establishing Skylark plots (hereafter: Skylark scheme), which was introduced in 2023 for the first time. In the Skylark scheme, farmers are required to provide unsown patches on arable land, where cereals, oilseed rape, clover, crimson clover, or clover grass mixture are cultivated on the rest of the field. Each plot needs to be at least 25 m2 large and at least 2.5 m wide and should be provided at the density of one plot per half a hectare. Therefore, only about 0.5% of the cropping surface is usually lost per hectare. Additionally, while the use of herbicides and pesticides on the plots is discouraged, it is permitted when there is trouble with weeds. As many eligible crops are sown in autumn in Slovenia, Skylark plots are most likely to be established during this time. However, formal enrolment into the scheme takes place in the following spring when farmers submit their annual CAP subsidy application. The payment of 60€ per ha (30€/patch) is then processed by the payment agency in late summer.

The scheme is implemented in five Slovenian lowland regions where Skylarks feed and nest predominantly on arable land. In total, there is 37,852 ha of eligible arable land. However, since only arable land sown with specific crops can be enrolled, the actual area of eligible land is smaller and varies from year to year due to crop rotation. For example, in 2022, 16,787 ha (45 %) of eligible land was sown with eligible crops. The contract duration for farmers is one year, which means all farmers, regardless of their previous enrolment, must decide annually whether to participate. In this way, enrolment in consecutive years and the location of plots may change based on the crop rotation practices of each farm.

Methods

We conducted the RCTs in two consecutive years, using the same design and procedure. In September 2022 (Experiment 1) and in September 2023 (Experiment 2), the Ministry sent information letters to all eligible farmers to raise farmers' awareness about the Skylark scheme and to invite them to enrol. To ensure fair access to information, we purposefully sent letters with identical information to all farmers, except for a short manipulated message in the middle or at the end of the letter that did not convey any essential information regarding the requirements and implementation of the scheme.

In each RCT, individual farms as experimental units were randomly assigned to three equally sized treatment arms: the control group that did not receive the framed information, and two treatment groups that i) received gain and loss framed messages in Experiment 1 and ii) positively and negatively framed descriptive norms in Experiment 2. The randomization was independent in both years and stratified by the five regions where the Eco-scheme is available.

In Experiment 1, we tested a nudge that framed enrolment into the scheme as a gain or a loss for the Skylark population and nature conservation in Slovenia. Based on the literature review, we hypothesised that the farmers who received the loss-framed message would enrol more frequently than farmers in the other two groups.

In Experiment 2, a nudge based on descriptive norm framing was tested. The Ministry again sent information letters to all eligible farmers, where in addition to the material on the scheme the control group received, farmers in the two treatment groups were also provided with information on enrolment rates in the first year and framed the enrolment levels as high or low (Table 1). Based on previous studies, we expected positive descriptive norms to increase enrolment rates compared to both other groups (Mollen et al., 2021), while negative descriptive norms would have no effect.

Our sample consisted of all farms in Slovenia that were eligible to enrol in the Skylark scheme. In Experiment 1, our sample included 4,586 farmers, of which 1,528 were in the control group, 1,530 in the gain-framed group and 1,528 in the loss-framed group. In Experiment 2, 1,517 farmers received control letters, 1,514 received positively framed letters and 1,517 farmers received negatively framed letters, totalling 4,548 recipients.

Table 1: Framed messages used in information letters (note: the original text in Slovene was not bolded).

2022	**Gain framing:** "**By implementing** this scheme on your arable land, the breeding conditions for Skylark **can improve** and, hence, **increase the chance** for its chicks' survival. Therefore, by **implementing** this scheme, you are **contributing to the increase** of the population of this endangered bird species and **to biodiversity conservation** in the Slovenian countryside."	**Loss framing:** "**By not implementing** this scheme on your arable land, the breeding conditions for Skylark **can deteriorate** and, hence, **decrease the chance** for its chicks' survival. Therefore, by **not implementing** this scheme, you are **contributing to the decline** of the population of this endangered bird species and to a **biodiversity loss** in the Slovenian countryside."
2023	**Positive descriptive norm:** "In 2023, farmers in this area enrolled **as much as** 1,041 ha into the scheme and provided **more than** 2,000 Skylark plots.	**Negative descriptive norm:** "In 2023, farmers in this area enrolled **only** 1,041 ha into the scheme and provided **less than** 2,100 Skylark plots."

Enrolment data for both experiments were obtained from the Ministry. The data included the area each farmer enrolled into the Skylark scheme, enrolment into AECM, enrolment into other Eco-schemes (only available in Experiment 2), total farm area and total area of eligible arable land for Skylark scheme, livestock units/ha, geographical region, gender and age.

To evaluate the effectiveness of the framing treatments, we started by using a three-sample test of proportions to compare percentages of enrolment by treatment. Due to the non-normal distribution of enrolled area, we then used the Kruskal-Wallis non-parametric test to investigate if the median for treated and untreated units is the same in terms of the area enrolled. Next, we used a hurdle regression model, as this model aligns with the two decision-making processes that farmers undertake. To maximise their utility, farmers first decide whether to enrol into the scheme. If they decide to enrol, this influences their utility maximising choice regarding the amount of land to enrol (Feng, 2021). In our hurdle model, we included the main effect of interventions as well as other covariates and interactions between covariates and a treatment group for exploratory purposes. The covariates in the model included gender, age, enrolment in other agri-environmental measures, livestock units/ha, and eligible arable land. The knowledge gained through such exploratory analyses can be used for future message targeting, whereby the alignment of message discourses (e.g. a focus on economic vs nature conservation consequences) with farm characteristics may lead to increased effectiveness of interventions for different types of farms. As we had no prior beliefs about the effect of farm characteristics on enrolment in the second and the third model, all covariates and interactions were included in both parts (enrolment decision and area enrolled) of the model.

We tested four hypotheses in each hurdle model (e.g. Treatment 1 vs Control and Treatment 2 vs Control in both enrolment decision and enrolled area model parts), so we used Bonferroni correction for multiple testing and thus considered p-values below 0.0125 as significant for direct effects of treatment in both parts of the model. As covariates and interactions were used for control and exploratory purposes, we did not adjust the p-value for them and used p=0.05 as the statistical significance threshold.

After running regression models, average marginal effects of treatments were estimated for all models. Additionally, plots of average predicted probabilities were produced for all interaction terms to compare the effects of treatment in different population subgroups.

RESULTS

Experiment 1

In 2023, only 111 out of 4,357 farmers enrolled into the Skylark scheme, together providing plots on 1,004.3 ha of arable land. In gain treatment (1,437 farms), 32 farmers enrolled 442.0 ha, in loss treatment (1,460 farms) 35 farmers enrolled 275.0 ha and in the control group (1,460 farms), 44 farmers enrolled 292.0 ha of land. 220 farmers who received the letter did not submit their subsidy application. There were no statistically significant differences in the socio-demographic and farm-related characteristics of the three experimental groups. Three-sample test of equal proportions showed no statistically significant differences in enrolment rates between the three treatment groups ($\chi 2$ = 2.16, df = 2, p-value = 0.339), while Kruskal-Wallis test shows that there were also no statistically significant differences in area enrolled among the three groups ($\chi 2$ = 2.12, df = 2, p-value = 0.347).

Table 2: Hurdle regression model results for Experiment 1.

	Zero-inflated		Conditional	
	Estimate	**P-value**	**Estimate**	**P-value**
(Intercept)	0.07	0.866	0.73	0.153
Gain framing	0.25	0.183	-2.06	0.047
Loss framing	0.05	0.745	-1.61	0.052
Eligible arable land	0.03	**<0.001**	0.04	**<0.001**
Age	0.01	0.359	0.00	0.766
Gender - Female	0.23	0.274	0.01	0.975
AECM - Yes	0.80	**<0.001**	0.15	0.571
LU/ha	-0.07	0.531	-0.01	0.933
Gain:eligible arable land			-0.02	**0.026**
Loss:eligible arable land			-0.02	**0.007**
Gain:Age			0.03	0.056
Loss:Age			0.02	0.067
Gain:Female			1.85	**0.004**
Loss:Female			-0.19	0.631
Gain:AECM			1.31	**0.017**
Loss:AECM			1.40	**<0.001**
Gain:LU/ha			-0.13	0.587
Gain:LU/ha			-0.30	0.147

In the hurdle model (Table 2), neither treatment had a statistically significant effect on the decision to enrol and average marginal effects were similarly small (-1.23% (95% CI -2-56,-0.11) for gain and and -0.03% (95% CI -1.74,1.20) for loss framing, respectively). After correcting for multiple hypothesis testing (α = 0.0125), treatments do not have statistically significant effects on enrolled area despite the large average marginal effects (-226 ha (95% CI -974,522) for gain and -232 ha (95% CI -980, 516) for loss treatment, respectively). However, multiple interactions were statistically significant, including between gain framing and gender, and between both types of framing and enrolment in AECM and eligible arable land, all of which were affecting the amount of land enrolled, but not enrolment decision (Table 2). Plots of average marginal effects for all interaction terms, shown in Fig. 1A, point to a lack of differences in effect sizes between treatment groups in most population subsamples. However, those who received gain or loss framed letters enrolled on average about 5 ha more land in the Eco-scheme if they were also enrolled in AECM, while there was no such difference for control group. Additionally, women who received gain-framed letter enrolled about 6 ha of land more on average than any other group of participants. Looking at the direct effects of covariates, enrolment in AECM is statistically significantly positively associated with enrolment in the Skylark scheme, while the amount of eligible arable land has a statistically significant positive effect on both enrolment and the amount of land enrolled (Table 2).

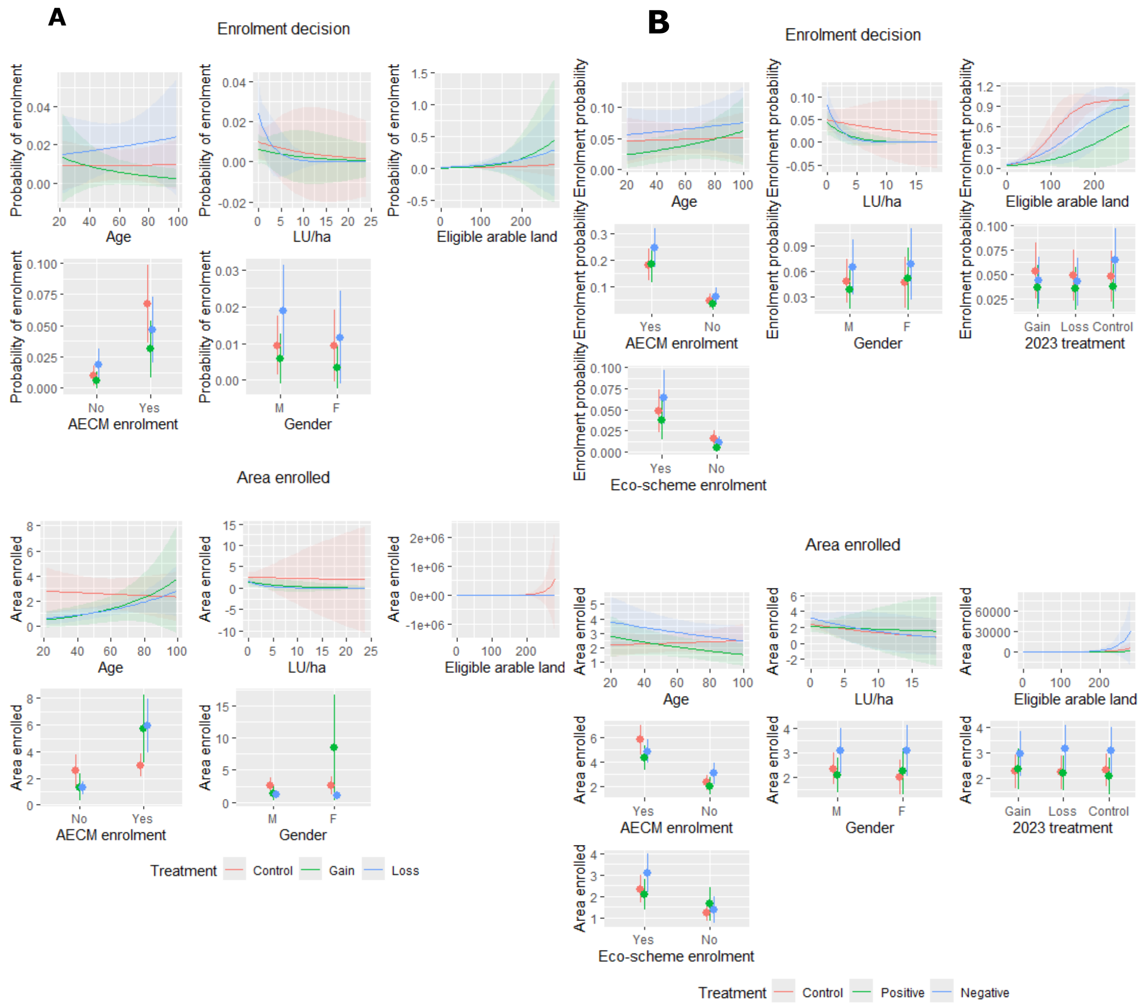

Figure 1: Average marginal effects of treatment in Experiment 1 (A) and Experiment 2 (B), depending on each covariate in the model. The upper part of the figure, "Enrolment decision", corresponds to the zero-inflated part of the hurdle regression model where probability of enrolment is the likelihood on a scale from 0 to 1, while the lower part, "Area enrolled", corresponds to the conditional part of the hurdle regression model and area enrolled is measured in hectares.

Table 3: Hurdle regression model results for Experiment 2.

	Zero-inflated		Conditional	
	Estimate	**P-value**	**Estimate**	**Pr(>|z|)**
(Intercept)	-4.32	<0.001	-0.10	0.744
Positive norm	-1.57	0.106	1.00	0.038
Negative norm	-0.76	0.397	0.45	0.331
Gender - F	-0.05	0.854	-0.15	0.231
Age	-0.00	0.852	0.00	0.680
LU/ha	-0.06	0.630	-0.06	0.456
AECM - Yes	1.47	**<0.001**	0.91	**<0.001**
Eco-schemes - Yes	1.15	**<0.001**	0.63	**<0.001**
Eligible arable land	0.03	**<0.001**	0.03	**<0.001**
2023 Loss framing	-0.09	0.712	-0.02	0.898
2023 Control	-0.11	0.664	0.03	0.807
Positive norm:AECM	0.28	0.491	-0.16	0.442
Negative norm:AECM	0.08	0.843	-0.45	**0.024**
Positive norm:Other Eco-schemes	0.79	0.103	-0.40	0.122
Negative norm:Other Eco-schemes	0.71	0.122	0.19	0.443
Positive norm:eligible arable land	-0.02	**0.012**	-0.01	0.109
Negative norm:eligible arable land	-0.01	0.114	0.00	0.232
Positive norm:Female	0.36	0.348	0.23	0.264
Negative norm:Female	0.11	0.775	0.16	0.400
Positive norm:Age	0.01	0.368	-0.01	0.139
Negative norm:Age	-0.00	0.824	-0.01	0.231
Positive norm:LU/ha	-0.24	0.295	0.04	0.710
Negative norm:LU/ha	-0.44	**0.036**	-0.02	0.879
Positive norm:2023 loss	0.06	0.868	-0.06	0.758
Negative norm:2023 loss	0.07	0.855	0.09	0.639
Positive norm:2023 contol	0.14	0.712	-0.16	0.385
Negative norm:2023 control	0.52	0.140	0.01	0.951

Experiment 2

In 2024, 292 farms enrolled 3,020 ha into the Skylark scheme out of 4,376 farmers that submitted their general CAP subsidy application. 172 farmers (out of 4,548 farmers that received a letter in total) did not submit their subsidy application. While the total share of farmers (6.7%) and land enrolled into the scheme (7% of eligible arable land) still remains low, the enrolment rate almost tripled compared to 2023.

In this trial, 83 farmers receiving positive descriptive norms enrolled 815 ha, 98 farmers receiving negative descriptive norms enrolled 865 ha and 111 farmers from the control group enrolled 1,339 ha. There were no statistically significant differences in the characteristics of the three experimental groups. The three sample test of equal proportions showed that there are no statistically significant differences among the three treatment groups in terms of enrolment rates ($\chi2 = 4.18$, df = 2, p-value = 0.124), while Kruskal-Wallis test showed no statistically significant differences in area enrolled among the three groups ($\chi2 = 4.30$, df = 2, p-value = 0.117).

In the hurdle regression model, there were again no direct statistically significant effects of our treatments neither on enrolment decision (average marginal effect for positive treatment: -1.95% (95% CI -3.85,0.06); for negative treatment: -0.66% (95% CI -2.58,1.26)) nor on area enrolled (statistically insignificant average marginal effect for positive treatment: -4.25 ha (95% CI -10.9,2.34), for negative treatment = 12.27 ha (95% CI -14.1,38.59)) (Table 3). However, positive norm statistically significantly interacted with eligible arable land and there was also a statistically significant interaction between negative norm and livestock unit per ha, both negatively affecting the decision to enrol. Finally, those who received negatively-framed message and were enrolled in AECM enrolled statistically significantly less land (Table 3). The average marginal effects of all interactions, displayed in Fig. 1B, show that within different population subgroups, the effects of the different treatment groups were similar. The most prominent difference in marginal effects among the treatment groups is for eligible arable land, where enrolment probability increases much faster for the control group than for the positively framed group and is thus around 60% higher in the control group for farms with around 150 ha of eligible arable land (Fig. 1B). Among the covariates, enrolment in AECM and other Eco-schemes and more eligible arable land were consistently statistically significantly positively associated with both enrolment decision and the amount of land enrolled (Table 3).

Discussion

Recent economic research has increasingly emphasized the role of behavioural factors in shaping farmers' decisions to adopt environmentally sustainable practices (Dessart et al., 2019). This behavioural perspective offers a foundation for designing interventions—particularly through information framing—that aim to improve enrolment in agri-environmental schemes (Chabé-Ferret et al., 2023). Despite growing interest in such nudges, evidence regarding their effectiveness remains mixed and inconclusive (Mertens et al., 2022).

In our first experiment, we found no statistically significant overall effect of gain or loss framing on enrolment in the Skylark scheme. This result contrasts with previous literature, which has generally found positive effects of such framing (Ropret Homar and Knežević Cvelbar, 2021). The negative direction of effects observed in our interaction model was therefore unexpected but given their insignificance could result from random variation.

Our exploratory analysis revealed several statistically significant interactions, particularly concerning the amount of land enrolled. These findings suggest that the impact of framing may depend on farm-specific characteristics. First, both gain and loss framing showed negative interactions with the amount of eligible arable land, deviating from the commonly reported positive effect of framing interventions. This may indicate that larger farms—typically more commercially oriented and strategic in their decision-making (Bojnec and Latruffe, 2013) — may perceive conservation-oriented messages as misaligned with their economic objectives. Tailored interventions that better align with the operational realities and incentives of large farms may be more effective in increasing their participation.

Second, we identified a positive and statistically significant interaction between prior enrolment in AECM and exposure to either gain or loss framing: farmers with AECM experience enrolled, on average, 5 additional hectares in the Skylark scheme. This enhanced responsiveness to nudges among AECM participants was consistent across both experiments, as evidenced by a statistically significant negative interaction between negative descriptive norms and AECM enrolment in Experiment 2. Moreover, AECM participation independently and positively influenced both enrolment probability and the area enrolled in both trials. These findings are consistent with the view that AECM participants often hold more pro-environmental attitudes and are more aware of farming's ecological impacts (Dessart et al., 2019; Klebl et al., 2023), making them more receptive to conservation messages.

We also observed a significant gender-based interaction: women exposed to gain-framing messages enrolled, on average, 6 hectares more than their male counterparts. Although few studies have examined gender differences in response to framing, existing findings are either neutral (Ezquerra et al., 2018) or suggest that women are more sensitive to loss framing (Cochard et al., 2020). The reverse effect found in our study warrants further investigation to understand its underlying drivers.

In the second experiment, descriptive norm framing overall also had no statistically significant effect on enrolment. Interestingly, while both positive and negative frames showed negative effects on enrolment probability, they were positively associated with the area enrolled. Previous research typically shows that positively framed norms have beneficial effects, while negatively framed norms tend to be neutral or detrimental (Cialdini et al., 2006; Mollen et al., 2021). One potential explanation why both frames had the same direction of the effect is that farmers may have focused more on the actual enrolment figures—identical in both versions—rather than on the descriptive framing.

Despite the lack of overall treatment effects, we observed some noteworthy interactions. A statistically significant negative interaction between livestock density (LU/ha) and negative framing suggests that this nudge backfired among more intensive farms. Similarly, a negative interaction between positive framing and eligible arable land was identified. These results may reflect a "boomerang effect," where large farms interpret the framing as misrepresentative or unconvincing, particularly if they alone could account for a substantial portion of total enrolment. Such outcomes underscore the risks of using social norm messages in contexts where the desired behaviour is not yet widespread (Chabé-Ferret et al., 2023; Cialdini et al., 2006).

While the actual share of eligible land used in the Skylark scheme may be underestimated due to crop suitability constraints, the observed enrolment rates (2% and 7% in Experiments 1 and 2, respectively) suggest substantial room for improvement. Our findings indicate that information framing alone is unlikely to significantly increase enrolment unless it addresses other barriers farmers face. Prior studies have identified concerns such as potential yield loss, weed proliferation, and more difficult cultivation as key deterrents (Alif et al., 2024). Additionally, the offered payment of €60/ha may not sufficiently compensate for the perceived risks and effort required to participate. Future research should investigate these structural and economic barriers to identify the primary bottlenecks limiting scheme uptake.

Conclusions

The two experiments presented here are among the first randomized controlled trials evaluating agricultural policy nudges in a European context (Chabé-Ferret et al., 2023). A key strength of our study lies in its real-world implementation: farmers were unaware that the Ministry collaborated with researchers or that the letters they received had been experimentally manipulated. Moreover, the trials were conducted at the national level, encompassing the full population of eligible farmers and minimizing sample selection bias.

We tested the effect of two behavioural nudges—gain/loss framing and descriptive norms—on enrolment in a new Eco-Scheme. Overall, no statistically significant effects were found at the population level. However, treatment effects emerged among specific subgroups, particularly farmers with AECM experience, those re-enrolling in the scheme, those with large areas of eligible land, women, and farmers with high livestock density. Our findings highlight the importance of audience segmentation and the contextual

sensitivity of behavioural interventions. Policy strategies aiming to enhance AES participation should therefore consider targeted, tailored approaches rather than relying solely on broad-based nudges (Hawkins et al., 2008).
Finally, the low enrolment rates suggest that behavioural interventions alone may not suffice. Addressing practical concerns—such as production risks and administrative burdens—and considering enhancements to scheme design or payment levels may be necessary to drive more widespread adoption. Moreover, given the potential for nudges to backfire under certain conditions, their application must be carefully considered within the specific agricultural and socio-economic context (Chabé-Ferret et al., 2023; Chater and Loewenstein, 2023).

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