How can economic experiments help improve agricultural policy interventions?

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Summary

This research briefing introduces **economic experimental approaches** and how they can be used to better understand farmers' behaviour and test the cost-effectiveness of alternative agricultural policy interventions.

Economic experiments can help quantify the **causal effect** of interventions and improve the evidence base to make policy more **cost-effective**. They are particularly useful to better understand **behavioural** dimensions in farm management beyond the assumption of profit maximisation. We distinguish 3 types of experimental approaches, namely:

- **Randomised Control Trials**, which are social experiments in which interventions are tested on a randomly selected group of participants, whose behaviour is compared to that of a control group,
- **Laboratory-based experiments**, which are based on serious games played in a controlled setting,
- And **survey-based experiments**, which embed the principles of experimental approaches in standard surveys.

Experiments have been particularly successful at testing the effect of **nudge** interventions, such as new framings of policies. They have often shown that despite small effects of nudges in magnitude, they can be a cost-effective tool because of their low implementation costs. Experiments have also revealed possible unintended effects of such intervention, which can help refine them ahead of full-scale implementation.

Experiments have helped refine our understanding of the way farmers react to **risk**, showing that most farmers are risk-averse and averse to losses, which can explain some farm management decisions, such as innovation adoption, uptake of crop insurance or crop diversification.

The experiments implemented in the second "focussed study", show that if **conditionality** of basic payments in the European CAP was substantially increased, the overall adoption of environmentally friendly practices would increase (even though voluntary contributions on top of the mandatory contributions fall on average), which would not be the case if conditionality was only marginally increased (Dessart et al. 2021).

Many experiments have investigated the acceptability of a range of design features for voluntary **Agri-Environmental Schemes**, providing evidence that farmers are willing to trade off support payments for greater flexibility in contracts, tend to prefer contracts including non-constraining collective dimensions and practice-based payments over result-based payments in some contexts.

We identify important best practices and limitations, in particular the **need for large representative sample and replication** of experiments. Different experimental approaches should be used, not as a standalone evaluation tool, but **in complement** to each other and to other policy evaluation tools to provide a wide evidence base for policy making.

The use of economic experiments to inform agricultural policy interventions is growing and more questions about farmers behaviour and intervention design could be addressed. Several **transdisciplinary networks** in Europe and the US have recently emerged to develop the methods and support the diffusion of best practices, as well as to create bridges between academia, policymakers, and practitioners to foster the inclusion of such approaches and the evidence they provide in policy evaluation. Experimental approaches will be used in the context of the **new Scottish Strategic Research Programme** (RESAS 2022-2027) to better understand barriers to uptake of best practice in Scottish agriculture and to test potential interventions. Suggestions are welcome!

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What are economic experiments?

The general objective of experimental approaches is to measure a parameter of interest free **from the effect of all possible uncontrolled factors that may introduce bias**. This parameter of interest can be a specific behavioural characteristic of individuals (e.g. risk aversion) or the **causal effect** of an "intervention" on a defined outcome (e.g. the effect of different framings on the uptake rates of an agri-environmental scheme). Experimental approaches have in common that they use carefully designed protocols to observe individuals' decision making in a **controlled setting,** by opposition to observed data (Colen *et al.* 2016).

When assessing the impact of an intervention, one key issue is to be able to assess what decisions farmers would make under this intervention versus what decisions they would make in its absence (the counterfactual situation), the difference between both situations representing its net impact. To address this issue, RCTs, framed field experiments, lab and lab in the field experiments, as well as survey experiments carefully allocate subjects either to a treated group in receipt of the intervention and a control group who does not.

What types of economic experiments exist?

We distinguish 3 broad categories of experimental approaches: Randomized Control Trials (RCTs), laboratory-based experiments and stated-preferences-based experiments.

Field experiments: RCTs

Randomised Control Trials (RCTs), or field experiments, are an impact evaluation method. RCTs test real life interventions (e.g measure or programs) on a smaller group of participants. They are the social version of medical trials, in which a drug and a placebo are being randomly given to, respectively, a treated and a control group. Within this trial phase, random assignment of participants to treatment and control-groups allows for accurate and unbiased appraisal of the cause-effect relationship of an intervention and its outcome. Data is collected from both the control and treatment groups for key indicator variables to measure the effect of the intervention, net from natural trends (which can be observed in the control group). Large samples and repetition are best for RCTs, however these may be costly and time-consuming. RCTs are one of the finest methods to test for causal impact in policy evaluation.

RCTs can be used as a proof of concept to scalable intervention having an impact on their own or as part of co-creation of programs; and as "plumbing approach" by engaging in the details of how schemes and regulations are designed and implemented. Indeed, several alternative designs of the intervention can be tested with different "treatment" groups to define the most cost-effective way of implementing it.

To illustrate these experiments we present a case study where a RCT tested the effect of social comparison nudge (see "Focus on a study #1, p.3).

Laboratory-based experiments

Laboratory-based experiments use a "game-like" approach, in which protocols are carefully designed to re-create, in a simplified way, decisions made by individuals in real life. Participants are then gathered and asked to make a series of decisions under the guidance of a facilitator, called experimenter in this setting. The particularity of laboratory-based experiments is that participants receive a payoff, which is affected by the decisions they make during the games, but potentially also by the decisions made by others. This payoff mimics the economic consequences that individuals face when making decisions in the actual economic world (e.g. investment decisions, decisions to abstract natural resources), and incentivises participants to behave truthfully, in an unbiased

Focus on a study #1: Example of Randomised Controlled Trial.

Can we nudge farmers into saving water? Evidence from a randomised experiment.

By Sylvain Chabé-Ferret, Philippe Le Coent, Arnaud Reynaud, Julie Subervie and Daniel Lepercq (2019)

Objectives

This randomised controlled trial (RCT) tests the effect of social comparison nudges on promoting water-saving behaviours amongst farmers in South-West France, where water scarcity has been exacerbated by climate change.

Approach

Nudges have proven to be a cost-effective intervention to influence behaviours. In this experiment, over four months, a sample of 200 farmers received weekly mobile text messages inviting them to optimise their water usage and which was then monitored using smart meters. They were randomly allocated to a control and a treated group to test the effect of social comparison on water consumption. The treated groups received information about their own water consumption **and the average level of water consumption from all farmers at the watershed level** (social norm), while the control group did not.

Key findings

The results revealed small to very small effects of receiving information about other farmers' average water usage **on average**. This is because, as expected, **larger water users reduced their usage** but, on the other hand, and unexpectedly, **farmers who did not previously use any water appeared to increase their usage**.

Policy recommendations

This study provided evidence of un-intended effect of the intervention, with an increase in water consumption for those who did not use water, demonstrating the need for **better tailoring** and larger testing of this nudge intervention it is actually included in future programmes.

way. They are particularly useful to investigate behaviours in the context of social dilemmas, for example the choice to sacrifice one own's private benefits to contribute to the provision of public goods.

These experiments can be implemented in computer-based economic experiments laboratory, usually within a university setting[1]. In this case, participants are commonly students from the university or members of the general public. The games tend to be context free, meaning that the decisions made are abstract and purely described in terms of the potential payoff gains and losses associated with each decision, to avoid "noise" being introduced by specific framings. They therefore have strong internal validity, meaning that they allow to precisely measure the parameter of interest free from confounding factors. However, because of their abstract nature, they have been criticised for lacking parallelism, i.e. whether the results can be used to draw conclusions on farmers' behaviour in the real world, and hence for policy advice (Thoyer and Préget 2019, Rosch *et al*. 2021). Since they are usually played by students, they are also criticised for lacking external validity, or representativeness (Rosch et al. 2021). Evidence so far shows that students' behaviour in the lab provides reliable

[1] *See for example, in Scotland the Scottish Experimental Economics Laboratory (SEEL) managed by the Department of Economics at the University of Aberdeen.*

information on the sign of the effect of an intervention, but not on the magnitude of the effect, and students can hence be a good subject pool to test research questions closer to economic theory (Cason and Wu 2019).

To increase their external validity, these decontextualised games can be taken to the field and played by a representative group of stakeholders from the population of interest (e.g. farmers or members of a specific community), in which case these experiments are called "lab-in-the-field". Adding context in the instructions of the games played by participants, these experiments would then be considered "framed lab-in-the-field experiment", increasing their parallelism (see for example our Focus on a study #2). However, increasing levels of context is often associated with reduced internal validity (Thoyer and Préget 2019).

Practically, when taken to the field, experiments can be implemented using pen and paper, but interaction between participants is made easier by using a mobile lab[2] (i.e. a set of networked tablets or laptops). In this context, the payoffs received by participants can be in cash or in kind, but the use of in-kind incentives can lead to some degree of bias if in-kind incentives are valued in different ways by participants, with risks of decreasing the internal validity of the experiment.

Stated preferences-based experiments

Discrete choice experiments (DCEs) are a survey-based technique used to assess the relative preferences of a population of interest for the characteristics (or attributes) of a good or intervention. Widely used until now to measure either consumers' preferences for characteristics of goods they may buy, or the general public's preferences for environmental policies, DCEs are now more frequently used to measure farmers' preferences for alternative agricultural policy intervention designs or new agricultural practices. In a DCE, farmers are presented with a series of scenarios and are asked to choose between two alternatives the possibility to keep their current practices (Figure 1). The choice of the scenarios presented to farmers follows a rigorous selection process that guarantees the controlled nature of the data collected. Modelling the choices made by farmers within the survey allows researchers to estimate, in isolation from other potential confounding factors, the effect of a design characteristic on farmers' willingness to engage in new farming practices or agricultural schemes.

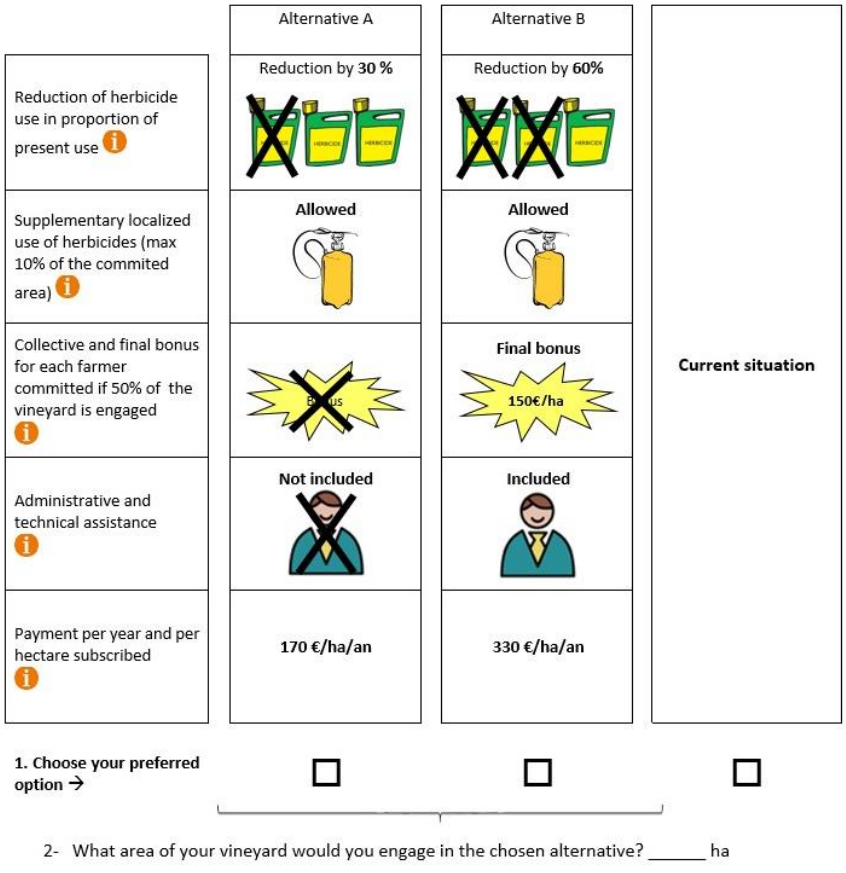

Figure 1: Example a choice farmers face in a DCE (source: Kuhfuss et al. 2016a)

[2] *A mobile lab is available at the James Hutton Institute.*

Experiments have also been included in standard surveys of farmers, either, inspired by RCTs, through the allocation of farmers to alternative versions of the questionnaire to test the effect of framings or information or re-creating the decision processes of a laboratory experiment in a survey (but excluding the associated payoff). We will refer to this last type of experiments as survey experiments.

The hypothetical nature of the payment and the stated dimension of preferences is the key difference between DCEs and survey experiments and other experimental approaches described above (lab, lab in field, framed field and RCT). The hypothetical nature of these studies may induce respondents to overstate their required compensation. However, Barabas and Jerit (2010), show that, in the case of survey experiments on health and immigration policies, the results of such experiments provide accurate measurements of the effects of the interventions tested. Though, their results show that the absolute value of the effect tends to be larger than what the effect of the intervention is in real settings. They conclude that if accounting for attenuation effects, then survey experiments can be reliable tools.

Stated preferences-based experiments have the advantage that they are less expensive to run than other experimental approaches previously described. They therefore allow testing a wide range of scenarios and options, as a first step in the process of gathering evidence to support policy intervention design, to select a narrower set of promising designs. These can in turn be tested using other experimental approaches, with actual gains at stake (Thoyer and Préget 2019).

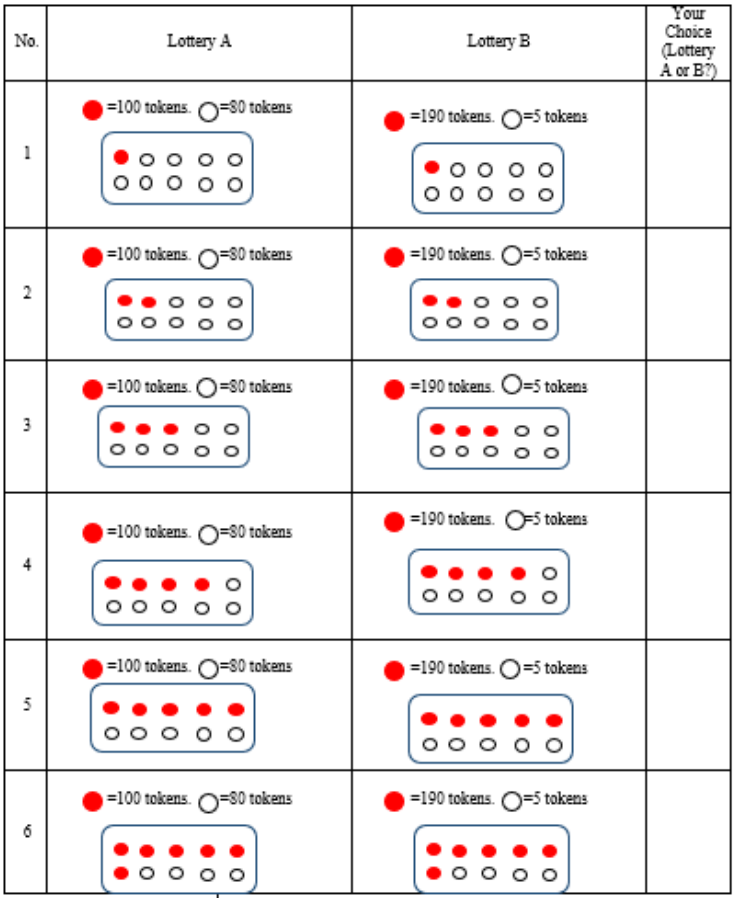

Figure 2: Example of decontextualised lotteries used to elicit attitudes to risk, source: Laure Kuhfuss, project Foodland

Examples of use

The first application of experimental approaches aims at better understanding which generic factors drive farmers' decision making, while the second aims at measuring, ex ante, the expected impact of an intervention on specific decisions made by farmers (e.g. impact of a scheme on pesticides used).

Understanding behaviour

Farmer's level of risk aversion has been shown to play a significant role across a range of decisions: innovation adoption, uptake of crop insurance, crop diversification (Bocquého *et al*. 2014). Economists have developed a range of experimental protocols to measure individual's risk aversion in a laboratory setting. These measures of risk preferences can then be used to improve the predictive capacity of models simulating farmers'

decisions (Colen *et al.* 2016). In some of these protocols, participants are asked to choose between lotteries displaying different levels of risk (see for example Figure 2). The comparison of individual choices between these lotteries tells us how much more risks they are willing to take for a given expected gain, reflecting their risk aversion. Participants decisions in the lab can be expected to reveal their level of risk attitudes as their decisions in the lab will impact the level of monetary incentive they receive at the end of the experiment, in a similar way as decisions made on the farm can impact the farm's profitability and *in fine* a farmer's revenue. This representation of "risky decisions" by lotteries illustrates how day-to-day complex decisions, such as investments in new technologies, can be simplified to be represented and measured in the lab.

Economic experiments have now provided broad evidence that a majority of European farmers are risk averse rather than risk neutral or risk takers (Iyer *et al.* 2020). In addition, Bocquého *et al.* (2014), show in a study of cereal farmers in France, that farmers in their study tend to overestimate the likely occurrence of rare extreme events such as hail, and to be averse to losses, meaning that, for example, yield losses due to the adoption of pro-environmental practices may be perceived as more important than the associated increased gross margins of an equivalent monetary value. Attitudes to risks and losses can therefore create a discrepancy between the Cost-Benefit ratio of new practices and how it is perceived by farmers.

Current research also investigates how best to measure other generic "behavioural characteristics" of farmers through standard protocols using lab or lab in the field experiments, to enrich farmers' decision making (economic) models. Some examples are time preferences (how much of a farmer's decisions are being driven by short term vs longer term consequences), trust, farmers' willingness to collaborate (Rommel *et al.* 2022), warm glow and altruism.

The extent to which these generic measures of behavioural characteristic are good predictors of decisions made by farmers in farm management is an on-going area of research, with some evidence that these can be context specific (e.g. Finger *et al.* 2022 for attitudes to risk), but other that they are associated with actual adoption behaviour (e.g. Bocquého 2012 for loss aversion).

Testing intervention and policy designs

Agri-environmental schemes (AES) design

DCEs can help to understand the characteristics farmers look for when enrolling in agri-environmental schemes, ultimately leading to higher uptake rates. Broch *et al.* (2012) and Vedel *et al.* (2015) studied afforestation programs in Denmark and found that **farmers prefer to have the option of cancelling the contract, and require extra compensation for monitoring, respectively.** Christensen *et al.* (2011) researched agriculture related contracts, also in Denmark, and found that farmers preferred having greater flexibility in the contract over having flexible farm management requirements (see Focus on a study #3 for more details). DCEs have been applied to study and compare farmers' preferences at the continental scale (Ruto *et al.* 2009) but can also be used to improve cost-efficiency of AES by tailoring their design to account for the regional preferences (Espinosa-Goded *et al.* 2010).

DCEs have been used to test ways to boost farmers' uptake of AES through the integration of a collective dimension in the AES design. For instance, Kuhfuss *et al.* (2016a) provide evidence that offering a bonus payment, paid if at least 50% of local farmers participate, could increase participation in agri-environmental schemes in France by larger proportions than an equivalent increase in the standard payment made to farmers. This can be interpreted as being due to farmers' preference to participate in an AES if they know that others also do so, under the effect of social norms and conditional cooperation behaviour. However, Villanueva et al. (2015) show that making

group participation a contractual *obligation* can be negatively perceived. Indeed, they find that farmers in Southern Spain prefer participation in the schemes to remain at the individual level rather than conditioned on group participation, because of expected transaction costs and loss of freedom from joint enrolment.

In addition, a series of laboratory experiments have demonstrated the potential significant effect of

Focus on a study #2: Example of framed lab-in-the-field experiment.

Farmers and the new green architecture of the EU common agricultural policy: a behavioural experiment.

By Dessart, F. J., Rommel, J., Barreiro-Hurlé, J., Thomas, F., Rodríguez-Entrena, M., Espinosa-Goded, M., Zagórska, K., Czajkowski, M., van Bavel, R. (2021)

Objectives of the paper

The new green architecture of the Common Agricultural Policy (CAP) 2021-2027 proposed enhancing conditionality and introducing eco-schemes. This research tests farmers' behaviour, in terms of provision of public goods, under this new architecture. It investigates how and to which extent a) enhancing conditionality and b) decreasing farmers' basic income support would affect farmers' adoption of more environmentally friendly practices.

Approach

This experiment investigated farmers' adoption of environmentally friendly practices. It was carried out as an online game, with 600 farmers from Germany, Spain and Poland who received virtual 'tokens' representing their net farm income (profit from their farm and CAP direct payments). Participants randomly received one of 3 different levels net farm incomes of 300, 265 and 215 tokens, representing different levels of basic income. Farmers were then required to contribute some of their tokens to the environment, representing conditionality. This mandatory contribution was randomly set from low to enhanced levels of conditionality at 5, 40 or 90 tokens. Researchers elicited farmers' adoption of environmental practices by asking participants to decide how many of the remaining tokens they would voluntarily give to the environment in exchange of a compensation covering 90% of their costs (farmers' adoption of eco-scheme).

Key findings

The results showed that with a small increase in mandatory contributions (from 5 to 40 tokens), voluntary participation to the environment decreased but the overall contribution to the environment was unchanged. However, when with a large increase in mandatory contributions (from 5 to 90 tokens), voluntary contribution to the environment also decreased on average, but the overall contribution was significantly increased. Results also showed that decreases in net farm income tokens (from 300 to 265 and 215), on average decreases contributions to the environment significantly.

Policy conclusions

This research showed that if conditionality is substantially increased the overall adoption of environmentally friendly practices would increase, but small increases in conditionality may not change the overall adoption. Furthermore, reducing direct payments in favour of eco-schemes may decrease the total adoption of environmental if the payment of voluntary schemes does not entirely compensate for income forgone and cost incurred.

using an **agglomeration bonus** - a bonus payment paid on top of the standard per hectare AES payment, if the enrolled plot is adjacent to another plot enrolled in the scheme – on the spatial coordination of uptake of AESs (Parkhurst *et al*. 2022, Banerjee *et al*. 2012, 2014, 2017, Kuhfuss *et al*. 2022). This bonus scheme could potentially help mitigate habitat fragmentation but is still to be tested in a real-world setting, for example through a field experiment.

More recently, DCEs have investigated farmers' preferences for result-based agri-environmental payment schemes (Niskanen *et al.* 2021, Tanaka *et al.* 2022). The research by Niskanen *et al.* (2021) conducted in Finland found that this type of schemes is less acceptable than the practice-based schemes, with only a quarter of the farmers willing to adopt them. Nonetheless, a study conducted in Japan by Tanaka *et al.* (2022) showed that most farmers were willing to participate in result-based schemes aiming at enhancing biodiversity, in an area where farmers had previous experience with schemes with similar environmental objectives.

Nudge interventions

RCTs and survey experiments have been used to test "nudge" interventions[3]. A first strand of the literature looks at the effect of nudges on farmers' stated intention to adopt beneficial management practices. Using a survey experiment in France, Kuhfuss *et al.* (2016b) found that farmers who were informed that, according to a previous survey, a majority of farmers had declared that they would maintain the practices adopted under an AES at the end of their contract were significantly more likely to also be willing to maintain these practices, demonstrating the effect of descriptive social norms on farmers' decision making. This was followed by Howley and Ocean (2021) confirming the effect of social norms in the context of UK farmers' maintenance of agri-environmental practices, through the use of a survey experiment, in which farmers were either provided with a descriptive norm (with a reference to the use of agri-environmental practices by many other farmers) or with the possibility to signal their green credentials publicly (through an award or through advertisement on a website), or none of these options (i.e. in the control groups). A similar positive effect of nudges was also confirmed through the same approach by Howley and Ocean (2022) in the context of technology adoption by farmers under injunctive norms (i.e. most farmers think farmers *should* adopt new technologies) or with the possibility to signal their uptake publicly (i.e. social signalling).

Another strand of the literature intends to measure the effect of nudges on actual farmers' behaviour. After testing the idea of empathy nudges using a lab experiment with students and members of the public (Czap *et al.* 2015), Czap *et al.* (2019) implemented a real scale experiment (RCT) to test the effect of enrolment letters to advertise the Conservation Stewardship Program (the US version of AESCs) on enrolment rates. They found that sending letters doubled farmers' uptake of AECS, compared to the group of farmers who did not receive such a letter, and that letters containing a hand-written message calling on farmers' empathy towards the environment had the largest effect.

The role of information and advice

Through lab-experiments the influence of information and advice in shaping decision-making has been tested. The "cattle and disease game" studies expert advice on farmers (Harvey and Fisher, 1997; Barham *et al.*, 2018). A variant of this game found that subjects take more advice from peers than from experts, and that they learn by doing at different paces. The advice they took

[3] *Thaler and Sunstein (2008) define a "nudge" as the use of a specific policy design, type of information and framing of information which influences people's decisions without changing the structure of economic incentives or restricting their available options.*

improved their performance but less than it would have if they were to take further advice (Lapple and Barham, 2019).

Best practice and limitations

The reliability of results obtained through experimental approaches depends, first, on the size of the sample which participated in the experiments. Indeed, only large enough samples[4] can provide the **statistical power** necessary to provide reliable result for evidence-based policymaking. The experimental design needs to define the required sample size to measure the effect of an intervention on the population of interest as well as how it may affect sub-groups in different ways, through power analysis.

Reliability also depends on the **representativeness** of the sample. Self-selection can be an issue for experiments, as it is for most methods requiring data collection from stakeholders, as respondents participating in the experiments may more interested in the topic being studied than the average farmer, which could bias the results. Recruitment processes need to be carefully designed to ensure representativeness of the farmers involved (e.g. stratification). This is often made easier when a dataset of farmers and their characteristics (such as the Agricultural Census) is available, from which a representative sample can be drawn, and when researchers can merge the data collected from experiments with existing datasets to enrich the potential explanatory analysis that can be done (Thoyer and Préget 2019).

Readers also need to be aware of the **publication bias** and its potential detrimental effects on information available. Indeed, research that finds significant effects tends to be more easily published in academic journals, meaning that the academic literature may provide an over-optimistic perspective on the effect of some interventions (Curzi *et al*. 2022). This is one reason that can explain why, in some instances, interventions which had a significant impact on the desired outcome in published experiments, have failed when implemented at full scale. The current move towards **open science**, with pre-registration of protocols, should help the publication of null results, which are informative of which potential interventions are unlikely to be successful in changing farmers' behaviour.

The **replication and duplication** of the same findings from an experiment in different contexts is key for the accumulation of comparable evidence and the built up of robust results that hold when interventions are scaled up or brought in another context (Duflo 2020, Curzi *et al*. 2022). Since experiments follow strict protocols, which are easily shared and replicated, they are particularly suited for the purpose of replication. This is the one of the aims of several networks, bringing together researchers, practitioners, and policy makers to support the use of experiments (J-Pal[5], and more recently C-BEAR[6] in the US, REECAP[7] in Europe) (Banerjee 2022).

Not only experiments need to be replicated, but their results need to be **complemented by other approaches** with the aim to triangulate findings, contributing to providing evidence that complement other perspectives (Colen *et al*. 2016).

[4] *The actual sample size depends on the expected size of the effect that is to be measured and is defined using a power analysis, but as an example, samples sizes of studies referenced in this briefing start from around 200 farmers.*

[5] J-Pal: The Abdul Latif Jameel Poverty Action Lab, https://www.povertyactionlab.org

[6] C-BEAR: Center for Behavioral and Experimental Agri-Environmental Research, https://centerbear.org

[7] REECAP: Research Network on Economic Experiments for the Common Agricultural Policy, www.reecap.org

Focus on a study #3: Example of Discrete Choice Experiment.

Determinants of farmers' willingness to participate in subsidy schemes for pesticide-free buffer zones—A choice experiment study

By Tove Christensen, Anders Branth Pedersen, Helle Oersted Nielsen, Morten Raun Mørkbak, Berit Hasler, Sigrid Denver (2011)

Objectives of the paper

Given the limited uptake of agri-environmental subsidy scheme (AEs) in Europe there is a need to identify factors that determine farmer's interest in them. Therefore, this research aims to 1) identify the extent to which farmers are willing to trade off payments for less restrictive scheme requirements and 2) quantify farmers' preferences for specific scheme features.

Approach

This study conducts a discrete choice experiment (DCE) to explore farmers' preferences for participating in schemes aiming to create pesticide-free buffer zones along streams and lakes in Denmark. It investigates preferences for scheme features related to flexibility in contract terms: contract length (1 or 5 years), option to be released from contractual obligations every year (can or cannot be released); as well as features related to flexibility in practical management: buffer zone width (6m or between 6-24 m), changed agricultural practice (fertiliser can or cannot be used), application method (assistance free of charge from extension service to send in application form or application from subsidy on common application form). Additionally, it includes a subsidy ranging from 134 to 510 Euro/ha/year as the monetary attribute.

The authors estimate how much each of these design features influences farmers' decision to join an AES using a sample of 440 farmers and compute farmers' willingness to accept (WTA) lower payments in return for less restrictive scheme requirements, or how much more they would require to be paid in order to accept more restrictive requirement.

Key findings

Results indicate that the overall flexibility of the contract (i.e., shorter contracts that can be cancelled before the expiration date) is more important to Danish farmers than having practical management flexibilities (i.e., to what extent fertilisers can be used in the buffer zone, whether buffer zones' widths are flexible and whether practical assistance in the application process is offered). Farmers are willing to accept a reduction in payment of 128 Euro/ha/ year in return for a shorter contract period (1 year vs. 5 years) and 137 Euro/ ha/year if they get an opportunity to break the contract once a year.

Policy recommendations

The research findings can be used to generate more efficient and cost-effective AES. Results suggest that it is possible to make most of the farmers interested in AES implementing pesticide-free buffer zones not only by offering them higher payments, but also by offering them less restrictive scheme requirements. This is relevant given the limitations on budgets to implement environmental subsidy schemes.

The use of experimental approaches to inform agricultural policy interventions in high-income country is still limited (Palm-Foster *et al*. 2019). Current limitations include the difficulty in recruiting large representative samples of farmers and the lack of funding (Rosch *et al.* 2021). **Strong connections between researchers, policy makers and practitioners are key**, to be able to integrate the principles of randomisations that allow to disentangle the causal effect of interventions in the

pilot phase of policies (Lefebvre *et al*. 2021, Curzi *et al.* 2022), testing alternative intervention designs and their cost-effectiveness ahead of full-scale implementation, and detecting early on potential unexpected consequences of a policy intervention. Again, transdisciplinary networks such as REECAP and C-BEAR are actively working toward this integration.

Finally, Lefebvre *et al.* (2021) reminds of the **ethical challenges** that may be associated with experimental approaches, in particular due to the random allocation of individuals to alternative "treatments", which can be perceived as unfair and/or opaque manipulation. They recommend engaging in a deliberative design of experiments with key stakeholders, design experiments in a way that minimises unequal treatment (*e.g.* delayed implementation), obtain informed consent from participants and provide feedback to participants when results are available to ensure transparency and openness of research.

Upcoming research

As part of the 2022-2027 strategic research programme funded the Scottish Government's Rural and Environmental Science and Analytical Services Division, research teams at the James Hutton Institute will be working on a series of experiments to (i) identify the behavioural barriers to increasing the level of basic and best practice in Scottish agriculture and (ii) to test interventions that could maximise farmer involvement and uptake of best practices. All comments and suggestions are more than welcome for us to produce relevant and impactful research, so feel free to contact us using the email address provided at the end of this briefing.

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