Supporting Documents and Materials

Background, Research Questions, Hypotheses

Background

Agri-food system transformation toward more sustainable and resilient production and consumption is essential for climate, environmental, and public health targets (Willett et al., 2019), with livestock production being a major driver of greenhouse gas emissions, nutrient imbalances, and land use pressure (Grossi et al., 2019). A transition from livestock to more plant food production is needed but remains slow globally and in Switzerland (Djanibekov et al., 2026; Müller et al., 2025). Policy instruments play an important role in supporting this transition (Fesenfeld et al., 2023), yet the causal effectiveness of measures promoting production type shifts to more plant-rich food has not been tested experimentally in the Swiss and European context.

To design effective and feasible policy instruments, it is necessary to understand what determines whether and how farmers make this shift. For individual farmers, production types have substantial implications, affecting livelihoods, land use, and established production systems (Meraner et al., 2018). While agronomic and economic conditions are important, considering behavioural factors enriches analyses of farmer decision-making and leads to more feasible and effective agri-environmental policy (Dessart et al., 2019). One well-established behavioural lens is the role of risk in farm-level decision-making: European farmers are consistently found to be risk-averse and loss-averse (Finger et al., 2024), and this risk aversion has been shown to shape farmers' choice of management strategies, including a preference for on-farm over off-farm risk mitigation (Meraner & Finger, 2019). This is directly relevant here, since production type switching from livestock to plant food production carries substantial financial and agronomic risk exposure of its own, as discussed below. Complementing this risk-based perspective, the Theory of Planned Behaviour (TPB; Ajzen, 1991), the dominant framework for capturing these behavioural factors more broadly (Sok et al., 2021), predicts farmers' behavioural intention from attitudes, subjective norms, and perceived behavioural control. A substantial body of research has applied the TPB and its extensions to show that these factors matter for farmers' adoption of sustainable practices such as organic farming, agri-environmental schemes, and conservation tillage (Dessart et al., 2019; Sander et al., 2024).

However, this evidence base is built almost entirely on practice change within existing production systems — farmers' perspectives on production type switching and livestock-to-plant transitions at the farm level remain largely absent from the literature (Craft & Pitt, 2024). Such a shift involves substantial risks: financial risks including opportunity and transaction costs and uncertain returns on investment, and agronomic risks such as yield variability and climatic uncertainty in unfamiliar crop systems. Previous research has identified several factors related to opportunity costs that consistently shape participation decisions in agri-environmental schemes, including market conditions, implementation effort, profitability, and management and contract flexibility (Schaub et al., 2023). Farmers additionally perceive high administrative burdens as a key driver of limited uptake (Mack et al., 2019), and transaction costs increase with more targeted and tailored programmes. While this evidence predominantly stems from research on agri-environmental schemes and technology adoption, the same cost dynamics can be expected to arise when farmers consider switching production types, entailing forgone income, increased management complexity, and administrative effort.

This gap points to the need for a field experiment that simultaneously tests the effectiveness of advisory and financial interventions on plant food production, and examines the behavioural mechanisms through which these interventions operate.

Research Questions

- **RQ1:** Do advisory and financial interventions increase plant food production and value creation on treated Swiss farms relative to control farms, and what is their policy relevance?

- **RQ2:** Does the combined treatment (advisory plus experimental budget) outperform advisory alone?

- *RQ3 (exploratory): Through which mechanisms do these interventions operate?*

Hypotheses

H1: Farms receiving advisory services, and farms receiving advisory services plus an experimental budget, show greater increases in plant food production and value creation relative to control farms.

Rationale: Both treatments are expected to reduce the perceived and actual risk of production-type switching, which farmers weigh heavily in production decisions (Finger et al., 2024; Meraner & Finger, 2019). Advisory services provide farm-specific information and knowledge that may reduce uncertainty about which production strategies are viable, reducing farmers' perceived risks and increasing perceived behavioral control; they may also carry normative elements, insofar as advisors convey information about peers' behaviour or expectations. The experimental budget directly offsets financial risk and transition costs for farmers and thus can alter their attitudes and behaviors. We do not take a position on which specific channel — informational, normative, or material — drives any observed effect; the treatments as implemented are compound interventions rather than isolated tests of a single mechanism, and any treatment effect on farmers' decision may operate through simultaneous shifts in perceived risk, attitudes, subjective norms, and/or perceived behavioural control (Ajzen, 1991; Sok et al., 2021).

H2: Farms receiving advisory services plus an experimental budget show greater increases in plant food production and value creation than farms receiving advisory services alone.

Rationale: The experimental budget is expected to add a detectable effect beyond advisory alone because it directly reduces financial risks and transition costs that advisory information alone reduces less. The experimental budget may additionally reinforce advisory's effects through a normative or identity-related signal — e.g., recognition of farmers as a capable or innovative operator. Since the budget is always administered together with tailored advisory services, however, the incremental effect of adding the experimental budget cannot be attributed to financial risk reduction alone; it reflects the compounded effects of the combination of advisory services and budget.

Pre-Registration and Transparency

We commit to reporting results for all pre-specified hypotheses and outcomes regardless of statistical significance or consistency with our predictions. Deviations from this pre-analysis plan will be clearly documented and justified in any resulting publications.

Analysis Plan

Primary analysis: ANCOVA with baseline controls for intention-to-treat estimates, and panel regression with fixed effects to assess both intention-to-treat (ITT) and treated-to-treat (LATE/TOT) effects across waves, with randomization inference. Given the expected lag between intervention and observable land-use change, stated intentions are treated as primary short-run outcomes, with census-based revealed outcomes as primary medium-run outcomes.

Pooled/treatment specification (primary test of H1; H2 is tested in the Arm comparison specification below):

(ANCOVA, ITT) $Y_i = \beta 0 + \beta 1 \text{ pooledTreatment}_i + \beta 2 \ Y_i\text{,baseline} + \varepsilon_i$

(Panel FE, ITT) $Y_{it} = \beta 1 \ (\text{pooledTreatment}_i \times \text{Post}_t) + u_i + \gamma_t + \varepsilon_{it}$

where $\text{pooledTreatment}_i = 1$ for farms receiving either the advisory service alone or the combined advisory service and budget (i.e., Arm 1 and Arm 2, pooled) and 0 for control farms (Arm 3 and Arm 4); $\text{Post}_t = 1$ for post-treatment survey waves and 0 for baseline; Y_i,baseline is the farm's baseline outcome value; u_i are farm fixed effects; γ_t are wave fixed effects.

β1 is the pooled treatment effect of receiving either advisory service alone or the combined advisory service and budget (i.e., Arm 1 and Arm 2, pooled). H1 is supported if $\beta 1 > 0$.

Arm comparison specification (full sample, arm-specific effects each versus control):

(ANCOVA, ITT) $Y_i = \delta 0 + \delta 1 \text{ Arm1}_i + \delta 2 \text{ Arm2}_i + \delta 3 \ Y_i\text{,baseline} + \varepsilon_i$

(Panel FE, ITT) $Y_{it} = \delta 1 \ (\text{Arm1}_i \times \text{Post}_t) + \delta 2 \ (\text{Arm2}_i \times \text{Post}_t) + u_i + \gamma_t + \varepsilon_{it}$

where Arm1_i and Arm2_i are separate indicators for Arm 1 and Arm 2, each estimated on the same full sample (Arm 1, Arm 2, and control), with control (Arm 3 and Arm 4) as the reference category. $\delta 1$ is the Arm 1 effect versus control; $\delta 2$ is the Arm 2 effect versus control. The Arm 1-versus-Arm 2 contrast is obtained directly from this same model via a linear hypothesis test on ($\delta 2 - \delta 1$), providing a direct head-to-head comparison of the two treatment arms without restricting the estimation sample. This specification is reported alongside the pooled/treatment specification above, not as a replacement for it.

Randomization inference considering rerandomization: Because treatment assignment within Canton Lucerne (Arms 1–3) follows a rerandomization procedure, we will account for this restricted randomization when conducting inference for $\beta 1$, $\delta 1$, and $\delta 2$ wherever the comparison is among Arms 1–3. Specifically, under the sharp null of no treatment effect, we will re-estimate each treatment-effect statistic for every acceptable allocation obtained during the final stage of the rerandomization procedure, holding observed outcomes fixed, to construct a randomization distribution. The p-value is the share of acceptable allocations yielding a statistic at least as extreme as the one observed under the actual allocation. Since Arm 4 is assigned directly and is not part of the rerandomization procedure, no randomization distribution exists for comparisons involving Arm 4; standard asymptotic inference (e.g., robust or clustered standard errors) is used for any specification involving Arm 4 instead.

Covariate balance: For Arms 1–3, covariate balance on the pre-specified tiered covariates is expected by design; rather than testing for balance among these arms, we will present the achieved balance statistics for transparency. We may additionally consider covariate adjustment to further increase precision. For Arm 4, balance relative to Arms 1–3 will be formally tested on the same pre-specified covariates. Where sample size in Arm 4 is sufficient, we will additionally consider adjustment methods (e.g., matching or weighting) to improve comparability if imbalance is detected; any such adjustment will be incorporated into the specifications above as an added covariate or weighting term, and reported as a robustness check alongside the unadjusted estimates.

As a robustness check, both specifications are re-estimated including time-variant control variables (e.g., input prices, weather and yield shocks, direct-payment programme changes) to assess sensitivity of treatment estimates to time-varying confounders.

To assess treated-to-treat (LATE/TOT) effects, accounting for imperfect compliance with assigned treatment, actual take-up (D_i, e.g., advisory sessions attended, budget drawn) is instrumented by treatment assignment, using the same pooled and arm-by-arm structure.

Attrition and withdrawal rates will be reported by arm. For Arms 1–3, achieved balance will be re-presented among farms remaining at each wave; for Arm 4, balance will be retested among farms remaining at each wave. Where attrition is concentrated in specific arms, ex-post matching will be applied to restore comparability.

Secondary and exploratory analyses (RQ3 mechanisms; moderation by occupational identity, treated in a separate paper; network spillovers, treated in a separate paper; policy feedback, treated in a separate paper) are reported separately and are not confirmatory for this pre-registration.

Sponsors and Partners

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