Supporting Documents and Materials

Background, Research Questions, Hypotheses, and Transparency Commitment

Background

Livestock production is a major driver of greenhouse gas emissions and land-use pressure, making a shift toward more plant food production an important lever for agricultural sustainability (Grossi et al., 2019; Willett et al., 2019). Yet this shift is not simply a practice adjustment; it asks a farmer to become a different kind of farmer, which can challenge occupational identity at its core (Kump et al., 2026). This distinguishes production type switching from the practice-change decisions — e.g., adopting conservation tillage or joining an agri-environmental scheme — that dominate the literature on farmer behaviour, where considering behavioural factors has been shown to enrich analyses of farmer decision-making and inform more feasible and effective agri-environmental policy (Dessart et al., 2019). That literature relies on the Theory of Planned Behaviour (TPB; Ajzen, 1991) as its standard explanatory framework (Sok et al., 2021), in which self-identity, where studied at all, is treated as one predictor among several rather than a potential barrier in its own right. The role of farmer self-identity in decision-making is comparatively underexplored, particularly in contexts of rapid social-ecological change (Bruno et al., 2022). Yet self-identity can outweigh attitude, norms, and perceived behavioural control in predicting farmers' behavioural intentions (Rise et al., 2010; van Dijk et al., 2016).

A specification matters for what "livestock farmer identity" means in this context. We distinguish two facets. The first, **Good Livestock Farmer Identity**, draws on the good-farmer/symbolic-capital tradition in rural sociology (Burton, 2004; Burton et al., 2020), in which farming practices — including livestock keeping and farm tradition — function as markers of legitimate, community-recognized "good farmer" status. This tradition has been extended to livestock- and species-specific sub-identities: European grassland research identifies "good livestock management" as one of several recognized good-farmer identity types (Jin et al., 2024). The second facet, **Personal Livestock Relational Identity**, captures personal identity centrality rooted in the direct relationship with animals, distinguished from the stockmanship literature's focus on observed attitude and behaviour toward animals (Hemsworth & Coleman, 2011) by instead capturing self-concept — who the farmer is, rather than what the farmer does. We measure Livestock Farmer Identity as a composite of these two facets.

Identity theory offers a specific mechanism for why strong livestock farmer identity might not just fail to predict change, but actively dampen responsiveness to interventions designed to produce it. Identities are self-meanings held against an internalised standard; when situational feedback or external pressure fails to match that standard, individuals engage in corrective, often resistant behaviour aimed at restoring alignment, rather than passively revising their self-concept (Burke & Stets, 2009; Stryker & Burke, 2000). Consistent with this, stronger identity centrality has been shown to exacerbate protective responses specifically under identity threat (Johnson et al., 2025) — though this is not a

universal finding; studies of general attitude structure find no comparable link between centrality and resistance to persuasion (Brandt & Vallabha, 2023), suggesting the effect is more robust when identity itself, not just an attitude, is what is threatened. This mechanism maps closely onto how farmers actually respond to production-type disruption. Farmers' perspectives on production type switching specifically remain largely absent from the literature (Craft & Pitt, 2024). Qualitative work on farmers facing sustainability-driven change finds they cope by opposing, exiting, maintaining, or redefining their occupational identity rather than straightforwardly updating it (Kump et al., 2026), and that productivist farmers in particular deflect sources of identity disconfirmation (Letourneau & Davidson, 2022) — consistent with evidence elsewhere that identity-threatening corrective information reduces belief updating (Trevors, 2022), and that farmer scepticism toward environmentally-consistent beliefs can be sustained by identity-protective motivated cognition (Hess et al., 2024; Lequin et al., 2019).

Despite this, no study has experimentally tested whether livestock farmer identity moderates the effectiveness of interventions aimed at production type switching, nor whether such interventions shift identity-related TPB constructs themselves. This gap matters for policy design: instruments designed without accounting for identity risk under-delivering for exactly the farmers whose transition would matter most, and existing frameworks such as TPB and identity research focused on practice change may not capture this dynamic (Kump et al., 2026; Letourneau & Davidson, 2022). This paper provides experimental evidence on livestock farmer identity as a moderator of policy intervention effects on plant food production.

Research Questions

- **RQ1:** Does livestock farmer identity moderate the effect of advisory and financial interventions on plant food production?

- *RQ2 (exploratory):* Does treatment shift identity-related and TPB constructs over time, and does the moderation of livestock farmer identity operate directly on plant food production outcomes or through TPB constructs as an intermediate step?

Hypotheses

H1: The treatment effect on stated and revealed plant food production is smaller for farmers with strong livestock farmer identity.

Theoretical basis: Identity theory holds that individuals resist behaviours threatening a central, self-defining identity(Burke & Stets, 2009; Stryker & Burke, 2000). Identity centrality — the degree to which a given identity is close to the core of a person's overall self-concept — is a key determinant of this resistance: identity-threat research finds that stronger identity centrality predicts more pronounced identity-protective responses under threat (Johnson et al., 2025). The effect is better established specifically within identity-threat paradigms, which more closely match the present context of production-type switching as a threat to occupational self-concept (Kump et al., 2026; Letourneau &

Davidson, 2022). This is consistent with evidence that self-identity can be a stronger predictor of behavioural intention than attitude, norms, and perceived behavioural control (Rise et al., 2010), including specifically among farmers (van Dijk et al., 2016).

Exploratory Expectation 1a: Strong livestock farmer identity makes changes in TPB constructs and stated behaviour change less likely.

Theoretical basis: Occupational identity threat in agricultural transitions is associated with identity-protective coping — opposing, deflecting, or resisting disconfirming information — rather than belief updating (Kump et al., 2026; Letourneau & Davidson, 2022). This parallels broader findings that identity-threatening corrective information reduces learning and belief revision (Trevors, 2022), and is consistent with theoretical accounts proposing that farmer climate/environmental scepticism may be sustained by identity-protective motivated cognition (Hess et al., 2024; Lequin et al., 2019).

Exploratory Expectation 1b: Strong livestock farmer identity reduces treatment effects on TPB constructs.

Theoretical basis: This follows as the treatment-effect analogue of 1a: if identity-threatening information triggers deflection and resistance rather than engagement (Kump et al., 2026; Letourneau & Davidson, 2022), advisory content promoting plant food production should shift attitudes, norms, and perceived behavioural control less for farmers with strong livestock farmer identity than for others, consistent with reduced belief updating under identity threat more generally (Trevors, 2022).

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:

Prior to constructing the composite index, we assess the factor structure of the five Livestock Farmer Identity items to test whether they support treatment as reflecting a common underlying construct, structured as two correlated facets (Good Livestock Farmer Identity, Personal Livestock Relational Identity). If the factor analysis supports this structure, Livestock Farmer Identity ($Identity_i$) is computed as the unweighted mean of two facet-level scores: the mean of the two Good Livestock Farmer Identity items, and the mean of the three Personal Livestock Relational Identity items, averaged together. If the factor analysis indicates that one or more items behave substantially differently from the others within their facet (e.g., weak factor loadings), we will reconsider whether all items should contribute equally to the index and adjust its construction accordingly, reporting any such deviation from this pre-registered approach transparently. As an alternative operationalization, we additionally construct $Identity_i$ from the factor scores estimated directly by the factor analysis; H1 is reported under both the additive mean-based index

and the factor-score-based measure. Unless otherwise specified, all subsequent analyses are conducted using the additive index as the primary measure, with the factor-score-based measure reported as a parallel check where estimation permits. This composite is mean-centered prior to constructing the interaction term.

We test H1 using both a panel fixed-effects model and an ANCOVA specification:

(1) Panel fixed-effects model, no additional controls:

$Y_{it} = \beta1\ (Advisory_i \times Post_t) + \beta2\ (Advisory_i \times Post_t \times Identity_i) + u_i + \gamma_t + \varepsilon_{it}$

where $Advisory_i = 1$ for farms receiving advisory services (Arm 1 and Arm 2, pooled), $Post_t = 1$ for post-treatment survey waves (Year 1, Year 2) and 0 for the baseline wave, u_i are farm fixed effects, and γ_t are wave fixed effects.

(2) ANCOVA, estimated cross-sectionally at each post-baseline wave:

$Y_i = \beta0 + \beta1\ Advisory_i + \beta2\ Identity_i + \beta3\ (Advisory_i \times Identity_i) + \beta4\ Y_{i,baseline} + \varepsilon_i$

H1 is supported if β2 is negative and statistically significant. Both specifications are reported.

Robustness Checks

- The models are re-estimated with time-varying controls: farm census data (direct-payment programme participation), Agridea Richtpreise (reference producer prices) by crop, and wave-varying sociodemographic characteristics. Where external weather and yield-shock data can be sourced and merged by region and year, these will be added as an additional check.

- TPB constructs (attitude, subjective norms, perceived behavioural control) are added to the model; this specification is not used to test H1 and instead informs RQ2. As with the identity composite, each TPB composite, we verify that the corresponding items load as expected on their respective construct (confirmatory factor analysis, given the established three-factor TPB structure), consistent with standard practice for validated scales.

- The two facets — Good Livestock Farmer Identity and Personal Livestock Relational Identity — are entered as separate interaction terms (in place of the combined composite) in both the panel FE and ANCOVA specifications, to assess whether the overall effect is driven by one facet, both, or their combination. This is distinct from the factor analysis described above, which assesses the item-level structure of the construct rather than each facet's relationship to the treatment effect. This facet-separated analysis is conducted, and interpreted as informative, only if the factor analysis confirms the two facets are empirically distinct components of the broader Livestock Farmer Identity construct; the primary test of H1 uses the joint moderation effect of the combined $Identity_i$ composite regardless of this outcome.

- As a baseline-only correlational check, we additionally test the cross-sectional association between Livestock Farmer Identity and stated likelihood of accepting treatment (Wave 1) — assessed separately for advisory services and experimental budget — to assess face validity of the identity construct as a predictor of stated resistance prior to any treatment exposure. This analysis is descriptive/exploratory and distinct from the confirmatory test of H1, which relies on realized treatment assignment in post-baseline waves.

- To address potential omitted interaction biases, we may additionally estimate a Lasso or Lassoplus specification.

Where the interaction term is statistically significant, we probe it using simple slopes analysis, reporting the estimated treatment effect at the mean and at ±1 SD of Identity_i, and apply the Johnson-Neyman technique to identify the range of identity values across which the treatment effect is statistically distinguishable from zero.

To assess treated-to-treat (LATE/TOT) effects accounting for imperfect compliance, actual take-up is instrumented by treatment assignment, with the same identity interaction included in the second stage.

If statistical power proves insufficient to detect the moderation effect, the fallback analysis proceeds in order: (a) treatment main effects on TPB constructs and primary outcomes only, using the additive index for both Identity and TPB constructs (factor-score measures are not carried into the fallback analysis), (b) descriptive subgroup analysis by identity profile, (c) qualitative support drawn from semi-structured interviews with farmers of high and low identity profiles and divergent outcome trajectories (15–20 interviews).

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.

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 re-tested among farms remaining at each wave. Where attrition is concentrated in specific arms, ex-post matching will be applied to restore comparability.

Sponsors and Partners

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