



30th Pacioli

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Does Investment Support Improve Farm Performance?

Evidence from CAP Sub-Measure 4.1 in Italy, 2014–2022

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Investment as a lever of competitiveness in the CAP

Investment is a key driver of farm competitiveness, yet agricultural holdings often face structural and financial barriers that constrain their capacity to invest.

For this reason, investment support is a central component of rural development policy; in the 2014–2022 programming period, these interventions were implemented under Measure 4 “Investments in physical assets”

€22.3^{bn}

EU budget for Measure 4 in 2014–2020 — the best-funded RDP measure

22.3%

Share of total EU rural development spending channelled through Measure 4

€5.8^{bn}

Italian allocation across regional RDPs for the same period

27.6%

Share of Italy's total RDP budget — higher than the EU average

Reg. (EU) 1305/2013 · EAFRD

Sources: European Commission 2021; Buglione et al. 2019

Sub-Measure 4.1

THE INSTRUMENT

Sub-Measure 4.1 is the core CAP instrument for on-farm investment aimed at improving overall farm performance—co-financed capital grants covering up to 40–90% of eligible expenditure.

ELIGIBLE INVESTMENTS

Land improvements, buildings, machinery
Precision farming, irrigation efficiency
Renewable energy, digital assets, software
Risk-prevention and environmental infrastructure

HOW IT WORKS

Support is allocated through public calls for applications issued under the RDPs. Farms submit investment projects, which are evaluated according to eligibility and selection criteria established at regional level. Projects that obtain sufficient scores are financed within the available budget, and support is generally granted as a partial reimbursement once the investment has been implemented

Reg. (EU) 1305/2013, Art. 17

Has access to Sub-Measure 4.1 during the 2014–2022 programming period contributed to increasing the added value of beneficiary farms in Italy?

Data and identification strategy

DATA

Italian FADN farm-level accountancy panel, 2010–2024. Representative commercial farms — ~11,000 obs/year.

TREATMENT

Binary & absorbing — a farm is treated from the first year its 4.1 application is approved.

Staggered adoption across 8 cohorts (2015–2022), reflecting annual regional calls.

A TWO-STAGE IDENTIFICATION STRATEGY

STAGE 1

Propensity score matching

Removes selection on observables. Cohort-specific, nearest-neighbour, caliper 0.01 SD.



STAGE 2

Staggered csDID

Callaway & Sant'Anna (2021). Removes time-invariant unobserved heterogeneity and common trends.

Heckman et al. 1997 · Caliendo & Kopeinig 2008 · Callaway & Sant'Anna 2021

Cohort-specific matching and dynamic estimator

STAGE 1 - PS MATCHING

8 cohort-specific probits → propensity scores → 1:1 nearest-neighbour match (caliper 0.01 SD on log-odds, no replacement) → common-support trimming → pooled matched panel.

COVARIATES - 3-YEAR PRE-TREATMENT AVERAGES

- UAA, livestock units
- Economic size (SO)
- Holder age, gender
- Farming type
- Previous RDP measures
- Diversification
- Machinery power
- Total labour, family share
- Altitude zone
- Organic certification
- Pre-treatment added value

Rosenbaum & Rubin 1983 · Austin 2011

STAGE 2 - csDID

$$ATT(g, t) = E[Y_t(g) - Y_t(\infty) | G = g]$$

Estimator: Callaway and Sant'Anna (2021) difference-in-differences estimator for staggered treatment

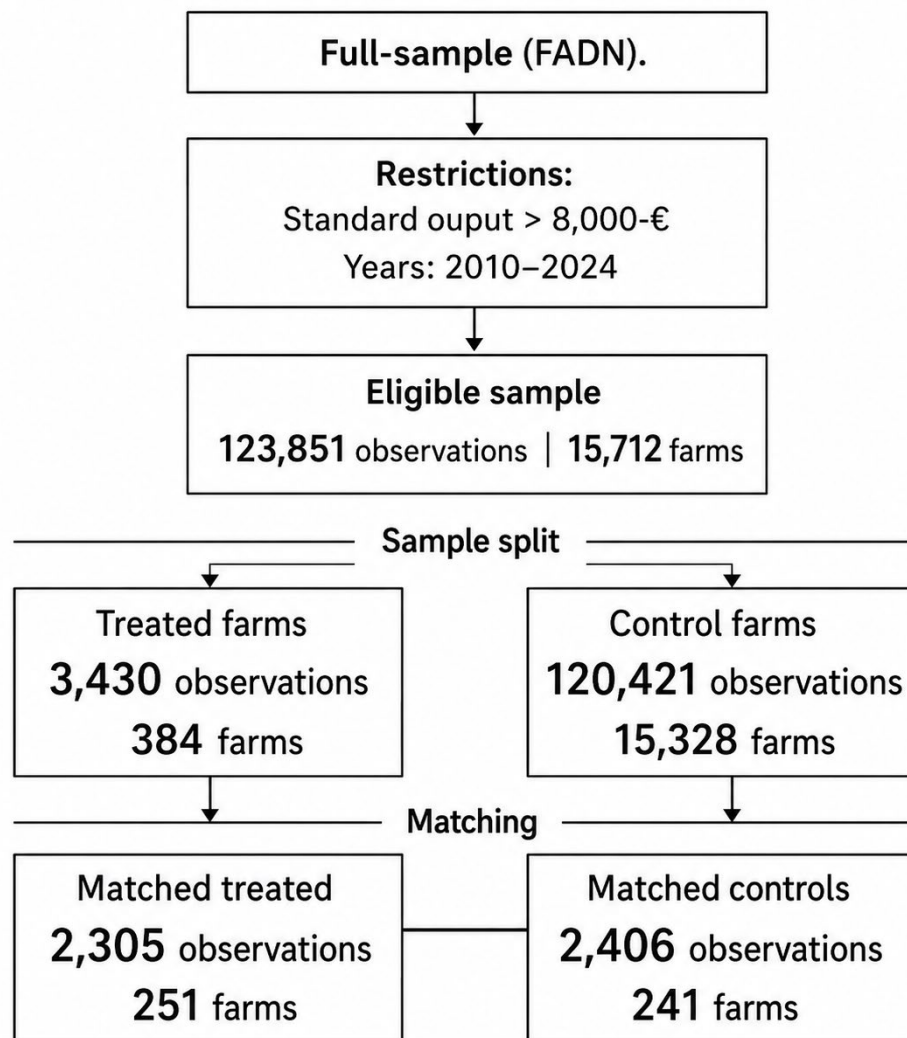
Outcome variable: farm net added value

Treatment: first access to Sub-measure 4.1

Comparison between treated and never-treated → over time → weights → doubly robust

Sant'Anna & Zhao 2020 · Callaway & Sant'Anna 2021

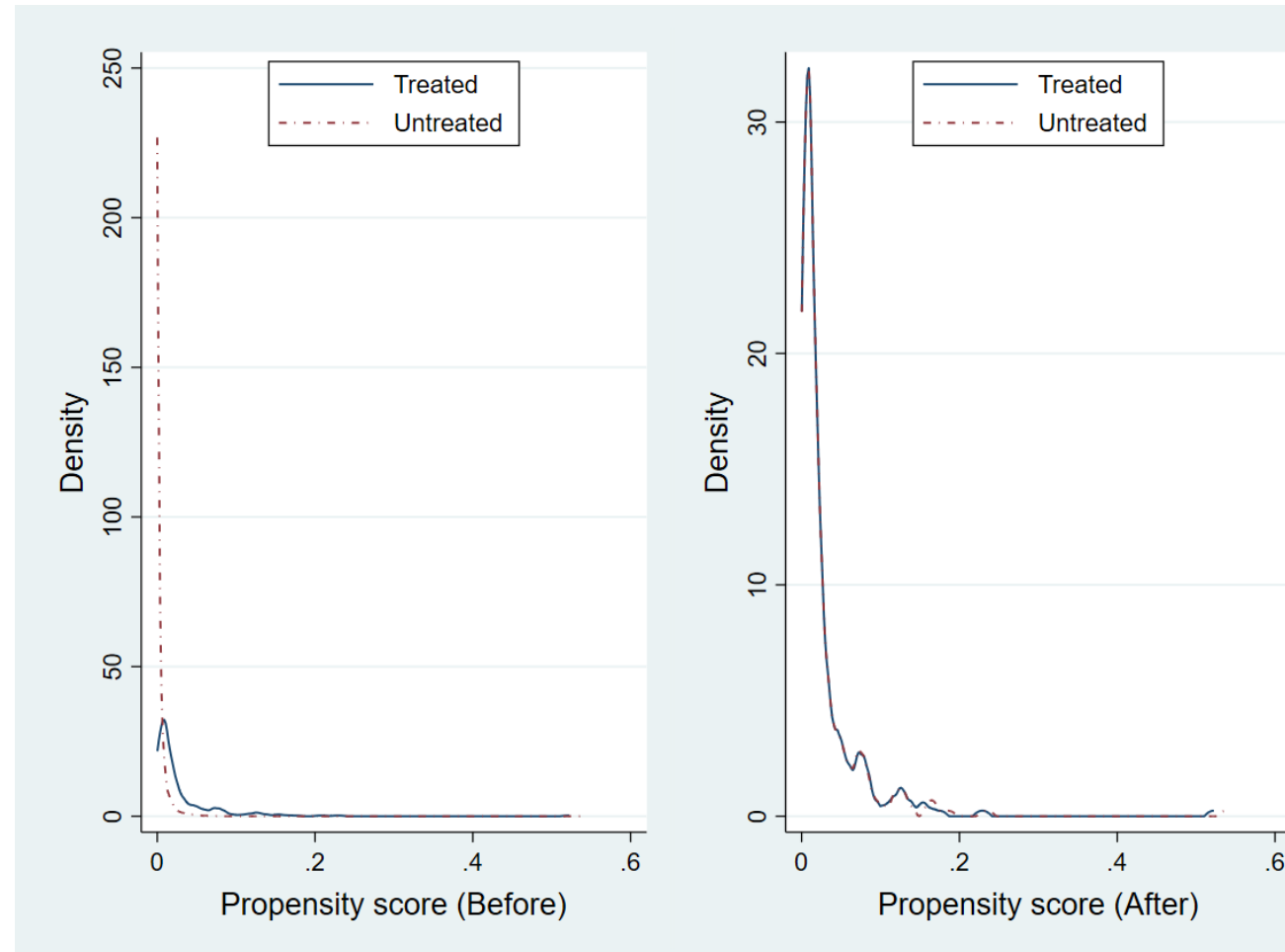
Sample selection



Propensity score distribution, before and after

Before — untreated farms heavily concentrated near zero; treated distribution flatter and wider.

After — the two densities are essentially indistinguishable across the entire support.



Meta-analysis of cohort-specific matching

Variable	Coefficient	Std. Error	95% CI
Value added	2.96e-09*	1.70e-09	[-3.64e-10, 6.29e-09]
% family labour	-0.0023	0.0014	[-0.0050, 0.0004]
Labour units	0.00016	0.00011	[-0.00007, 0.00038]
Livestock units	4.42e-07	6.20e-07	[-7.72e-07, 1.66e-06]
UAA	-2.98e-06	4.70e-06	[-0.0000122, 0.0000062]
Young	0.0043***	0.0007	[0.0029, 0.0057]
Economic size	0.0014***	0.00036	[0.00069, 0.00209]
Female	-0.0011	0.00084	[-0.00277, 0.00053]
Diversification	0.0020***	0.00074	[0.00055, 0.00345]
Organic	0.00080	0.00076	[-0.00069, 0.00229]
Subsidies	0.0011***	0.00019	[0.00074, 0.00149]
Machinery power (kW)	2.70e-06**	1.29e-06	[1.68e-07, 5.24e-06]
Farm type (ref: field crops)			
Horticulture	0.0098	0.0077	[-0.0053, 0.0249]
Permanent crops	0.0002	0.00091	[-0.00159, 0.00199]
Grazing livestock	-0.00007	0.00085	[-0.00174, 0.00159]
Granivore livestock	-0.0016	0.0012	[-0.00395, 0.00078]
Mixed crops	-0.0010	0.0019	[-0.00468, 0.00265]
Mixed livestock	0.0160	0.0177	[-0.01861, 0.05065]
Combining crop and livestock	-0.0026	0.0017	[-0.00605, 0.00080]
Altitude (ref: Mountain)			
Hill	-0.00091	0.00077	[-0.00242, 0.00059]
Plain	-0.0024***	0.00091	[-0.00422, -0.00065]

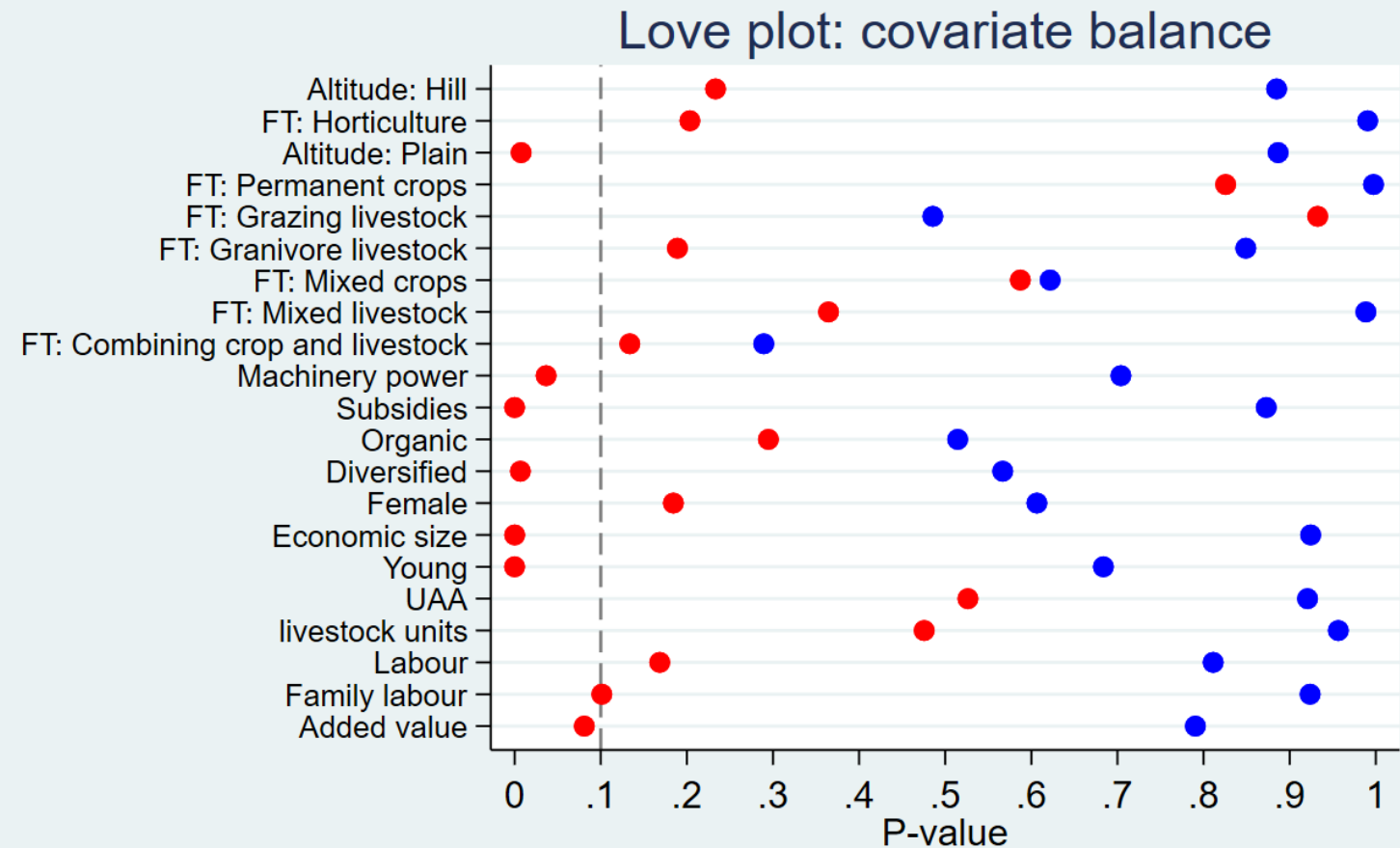
Notes: Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

Covariate balance, before and after matching

Before matching, almost every covariate sits below the $p = 0.10$ balance threshold.

After matching, every covariate moves to the right of the 0.10 line.

● Before ● After



Average treatment effect on the treated

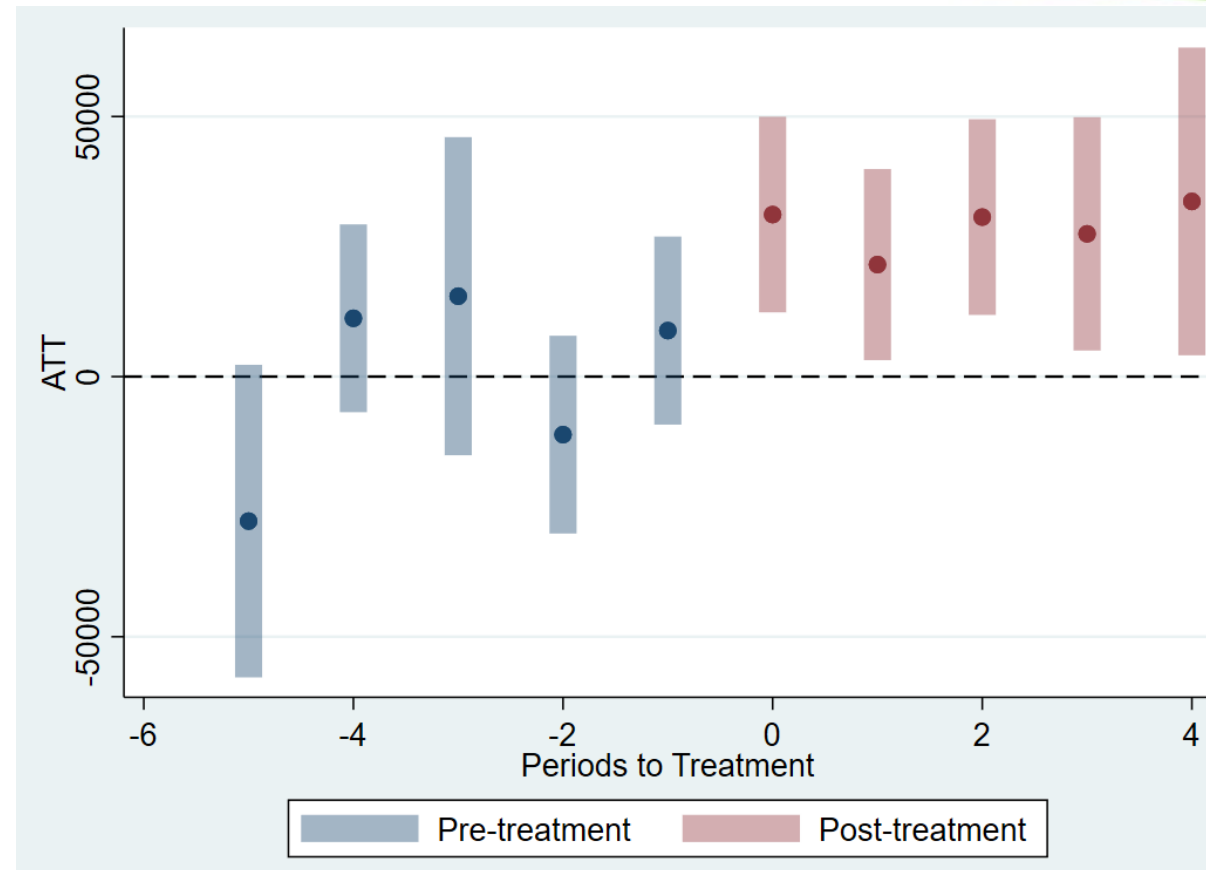
ATT · CSDID

+39,397€ ***

SE 10,160 · $z = 3.88$ · $p < 0.001$

95% CI [19,483 - 59,310]

Beneficiary farms gain on average €39,400/year in net added value relative to matched controls.



Pre-treatment - coefficients
 ≈ 0 ✓ parallel trends

Post-treatment - stable
 positive effect, $t = 0 \rightarrow +4$

Three observations, one policy implication

FINDING 01

The treatment seems to work.

Sub-Measure 4.1 produces a statistically robust uplift in farm net added value — roughly €39,400 per beneficiary farm per year.

FINDING 02

The effect is stable in the first post-treatment years.

The event study shows the gain emerging immediately at $t = 0$ and persisting through $t = +4$, with no decay over the observed horizon.

FINDING 03

Barriers to participation appear to remain.

Beneficiaries differ structurally from the broader farm population — only 65% of treated farms even satisfy common-support, and residual imbalances persist along policy-priority traits.

POLICY IMPLICATION

Future policy should work more on how farms self-select into participation — and on the design of the selection criteria themselves