IMPACT OF AGRI-ENVIRONMENTAL SCHEMES ON FARM PERFORMANCES IN FIVE EU MEMBER STATES

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1. Background
2. Research Question
3. Methodology
4. Data
5. Results
6. Conclusions

1. BACKGROUND

EU Agri-environmental Schemes (AES)

Institutional framework

- Section of CAP Rural Development
- Designed at national or regional level every budget period
- Voluntary contracts of at least 5 years between the farmer and the government

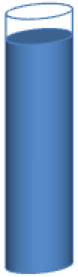
- Compulsory present in all RDPs
- Most significant measures in terms of EU fundings for Rural Development

Aim

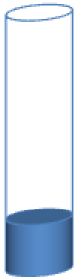
- Reducing agricultural pollution risks, protecting biodiversity and landscape
- Main categories: organic farming, input reduction, crop rotation, extensification, landscape, protection of rare plants variates and animal breeds

2. RESEARCH QUESTION

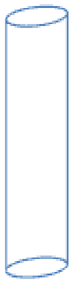
In the scientific literature on AES …



a lot of studies investigate the reasons of farmer's participation in AES and the environmental effectiveness of farmers' environmental practices



a few studies analyse the impact of AES adoption on farmer's behaviour and performances



none of the studies compare the effects of AES on farmer's performances across different EU countries. None of the studies focus on the effects on farm economic results

AIM

Performing a comparative analyses on the effects of AE measures uptake on farmer's practises and economic performances across five EU Member States, France, Germany, Spain, UK and Italy

3. METHODOLOGY

We performed our study by **Difference-in-Differences Propensity Score Matching**

Propensity Score Matching (PSM)

Semiparametric method used to evaluate the effect of a treatment in a non-experimental setting

Y^1 : outcome value in the case of treatment
Y^0: outcome value in the case of no treatment
D=1 for treated individuals
D=0 for non treated individuals

Treatment effect

$$Y^1 - Y^0$$

evaluation problem and selection bias

PSM solves these problems by

Matching each treated individual with one or more non treated individuals that have similar observed characteristics (X) and interpreting the differences in their outcomes as the effect of the treatment.

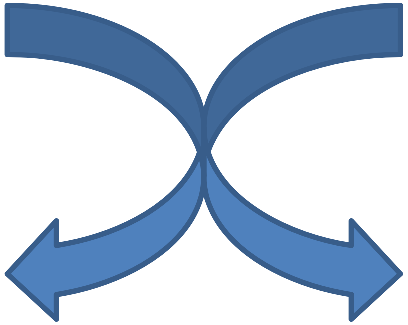
The matching is based on a balancing score p(X) (Rosenbaum & Rubin, 1983)

PSM controls for selection bias on observables (X included in the binary model) but not on selection bias on unobservables.

We combined the **Propensity Score Matching** estimator with the **Difference-in-Differences** estimator (Heckman et al., 1997): control for observed covariates, time invariant unobserved covariates, time trend, use of pre-treatment outcomes

From a balanced panel of farmers for each country observed over the period 2003-2006 we got

country treated group
farmers that did not partecipate in AES in 2003 while they did participate in 2006



country control group
farmers who did not participate for the whole period

I step we estimated a logit model of farmers participation in AES and we got the individual farmer propensity scores. The data used are pre-treatment data (2003)

II step we applied the ten nearest neighbour matching estimator with replacement and with caliper (0.1). The 10 NN showed good matching quality (covariates balancing property, standardised bias, pseudo R2)

III step we calculated the ATT by difference-in-differences matching estimator :

$$ATT = \{E(Y_t^1 - Y_{t'}^0 | D = 1, X) - E(Y_t^0 - Y_{t'}^0 | D = 0, X)\}$$

ATT indicates the differences in the average outcome growth over the period 2003-2006 between farmers adopting AES after 2003 and farmers who did never adopt AES over 2003-2006

4. DATA

Balanced panels of farms of each country observed over the period 2003-2006

		France	Germany	Spain	UK	Italy
Models 1	Full treated sample / Matched control group	I	IV	VII	X	XIII
Models 2	Treated subsample 1^ / Matched control group	II	V	VIII	XI	XIV
Models 3	Treated subsample 2^^ / Matched control group	III	VI	IX	XII	XV

^Treated subsamples 1: share of AE payments on farm income < full treated country sample median
^^ Treated subsamples 2 share of AE payments on farm income > full treated country sample median

15 models - For each model all the steps have been implemented
10 NN with replacement and with caliper for all models (good matching quality and more comparable results)

5. RESULTS - Effects of AES uptake on farm production choices - Subsamples 2

	France		Germany		Spain		UK		Italy	
	treated	control	treated	control	treated	control	treated	control	treated	control
UAA	5.56	3.92 (+;*)	6.59	2.22 (+;*)	-0.23	-0.42	5.01	0.20 (+;**)	3.62	-1.96 (+;**)
Rented land	5.26	2.97 (+;**)	-0.22	-1.62	-0.20	-2.77	0.76	-1.17	2.22	-2.83 (+;**)
Share of grassland	0.007	-0.00 (+;**)	0.00	-0.01 (+;***)	0.00	0.00	0.01	0.01	0.07	0.04 (+;*)
Number of crops	0.02	-0.14 (+;**)	0.06	0.02	-0.09	-0.05	-0.03	-0.19 (+;**)	0.35	0.06 (+;***)
Fertiliser exp (ha)	5.96	10.36 (--;**)	17.47	18.68	16.33	-26.27 (+;**)	6.92	13.54 (--;***)	-18.34	0.82 (--;***)
Hired labour h	33.27	-1.67	-550.52	-45.85 (--;**)	-80.28	226.72 (--;**)	-185.99	-26.04	182.12	-140.6

Family working hours are not affected by AES participation in any countries
Crop protection expenditure is affected only in Germany

5. RESULTS -Effects of AES uptake on farm economic performances - Subsamples 2

	France		Germany		Spain		UK		Italy	
000 euro	treated	control	treated	control	treated	control	treated	control	treated	control
Revenue ha	-0.022	0.052 (--;*)	0.121	0.259 (--;***)	-1.503	-0.324 (--;***)	-0.033	0.016	-0.328	0.271 (--;***)
VC ha	-0.020	0.021 (--;*)	0.072	0.144 (--;**)	0.033	-0.302 (+;***)	0.024	0.086	-0.024	0.044 (--;**)
Income ha no paym	-0.068	0.037 (--;***)	0.112	0.191 (--;**)	-0.699	0.394 (--;***)	-0.067	-0.081	-0.344	0.199 (--;***)
Income ha	-0.014	0.037 (--;**)	0.166	0.191	-0.472	0.394 (--;***)	-0.022	-0.081	-0.046	0.199 (--;**)
Tot income no p	-5.717	4.667 (--;***)	24.515	10.542 (+;*)	-17.443	2.001 (--;***)	-8.026	-7.407	-8.889	6.301 (--;***)
Tot income	0.442	4.667 (--;**)	33.264	10.542 (+;***)	-10.621	2.001 (--;***)	-0.878	-7.401 (+;**)	6.721	6.301

6. CONCLUCIONS

- The combination of PSM and DID estimators is an interesting estimator when panel data are available
- The effects of AES adoption on farmer's choices and economic performances are stronger when a larger share of farm income is dependent on AE payments
- In none of the countries the AES have an effect on family labour.
- In Spain the adoption of AES seems not to produce any environmental benefits. The income per hectare is largely negatively affected and the AE payment seems to be not enough to compensate this income foregone
- In France and Italy the AE uptake affects a large numbers of farmer decisions variables and it seems to produce environmental benefits. The AE payment is not enough to compensate the income drop per hectare (drop smaller compared to Spain)
- In Germany the AE payments compensate fairly the income foregone of adopters
- In UK the income per hectare of adopters is not affected by AE participation even in the absence of AE payment

THANK YOU FOR YOUR ATTENTION

PROPENSITY SCORE MATCHING

PSM is a 2 step procedure:

I step estimation of a binary model of participation in the treatment (p(X))

II step each treated individual is matched with one or more non treated individuals based on the propensity score p(X).

Different kind of matching estimators: Nearest Neighbour, Radius, Stratification, Kernel …

After matching the most common parameter calculated is the AVERAGE TREATMENT EFFECT ON THE TREATED (ATT)

$$ATT = \{E(Y^1|D=1, P(X)) - E(Y^0|D=0, P(X))\}.$$

Assumptions:

1. Conditional Mean Indipendence $E(Y_0|P(X), D=1) = E(Y_0|P(X), D=0)$
2. Common Support Condition $p(X) < 1$

PSM controls for selection bias on observables (X included in the binary model) but not on selection bias on unobservables.

DIFFERENCE-IN-DIFFERENCES

$$DID = \frac{1}{N}\sum_{i=1}^{I\cap S}[(Y_{it}^{1} - Y_{it'}^{0}/D = 1) - \sum_{j=1}^{J\cap S} W_{ij}((Y_{jt}^{0} - Y_{jt'}^{0})/D = 0)]$$

$$ATT = \{E(Y_t^1 - Y_{t'}^0 | D = 1, X) - E(Y_t^0 - Y_{t'}^0 | D = 0, X)\}$$

ATT indicates the differences in the average outcome growth over the period 2003-2006 between farmers adopting AES after 2003 and farmers who did never adopt AES over 2003-2006

<u>Assumption</u>

The conditional mean indipendence assumption is replaced by a weaker assumption: difference-in-differences conditional mean indipendence

$$E\left(Y_t^0 - Y_{t'}^0 \middle| P(X), D = 1\right) = E\left(Y_t^0 - Y_{t'}^0 \middle| P(X), D = 0\right)$$