Evaluating the effects of the Greek RDP on Water Abstraction: A Case Study of the region of Thessaly

Evaluation Under Data Sparseness

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Outline

RDP overview

Evaluation purpose and questions

Evaluation approach

Data

Preliminary findings

Strengths and weaknesses of the approach

Lessons learnt and applicability

Overview of Greek RDP

Intervention Logic for Water abstraction

CAP impact indicator

I.10

Total RDP budget: € 5,389.18 m

RD Priority 5
(resource efficiency)

FA 5A
€ 625.84 m

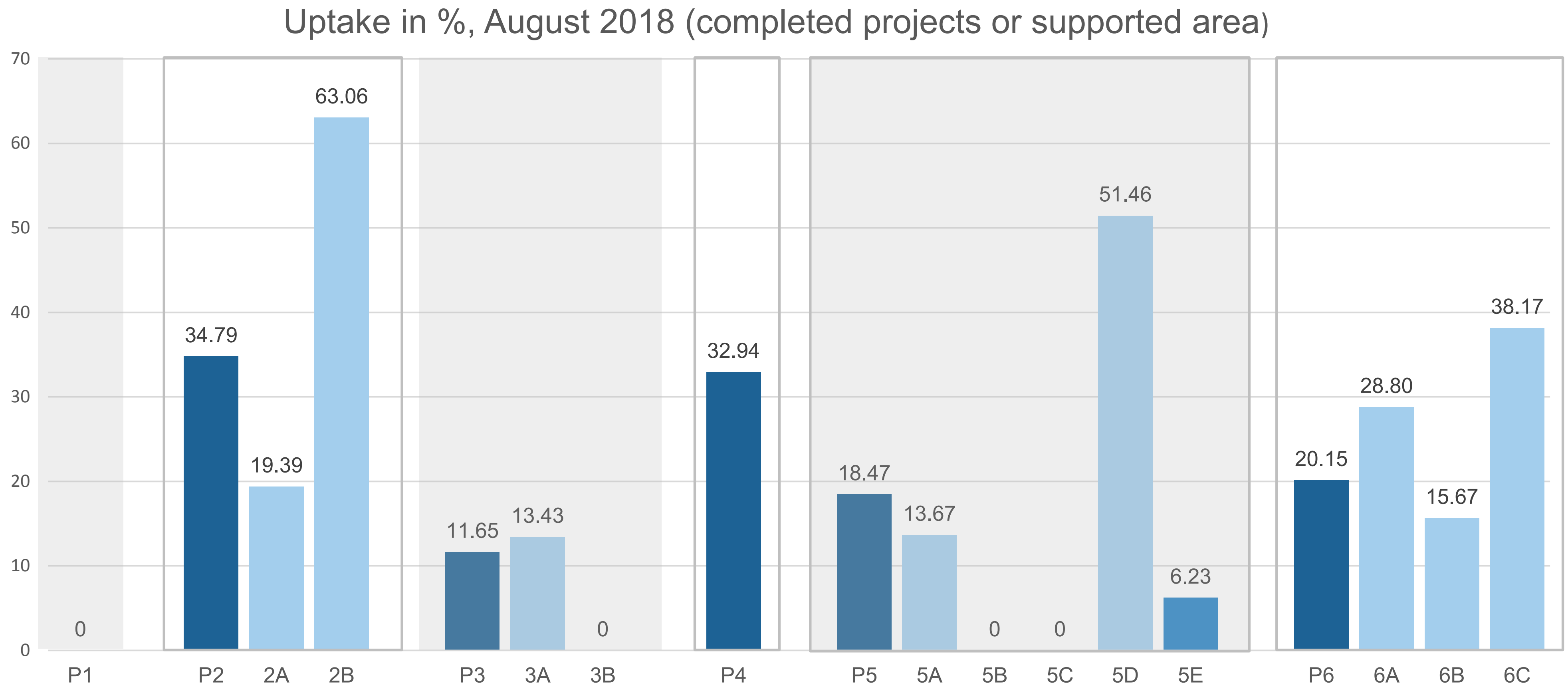
- **M01** € 9.45 m
- **M02** € 3.56 m
- **M04** € 603.93 m
  - **M04.1.2** Beneficiary is the farm holding
  - **M04.3.1** Beneficiary is the State
- **M16** € 8.90 m

RD Priority 4
(ecosystems related to agriculture and forestry)

FA 4
€ 2,426.39 m

- **M01** € 15.85 m
- **M02** € 112.17 m
- **M07** € 0.98 m
- **M10** € 434.86 m
- **M11** € 595.80 m
- **M12** € 9.15 m
- **M04** € 0 m
- **M16** € 21.13 m
- **M13** € 1,063.53 m

Level of RDP uptake in Greece



Evaluation purpose

- **Background:** Academic research
- **Main purpose:**
  - Address the challenge to examine alternative evaluation approaches when data are limited and there is no time to conduct a farm survey
  - Demonstrate how to combine alternative sources of data in one evaluation and overcome major data constraints
- **Timeline:** Less than a month (started October 2018 – application to MA for providing the data; ended November 2018 – final results)

Evaluation elements

Table 1: Evaluation elements used

Evaluation questions	Indicators
Common evaluation questions n. 28: To what extent has the RDP contributed to the CAP objective of ensuring **sustainable management** of natural resources and **climate action**? **Common evaluation questions n. 26:** To what extent has the RDP contributed to improving the environment and to achieving the EU biodiversity strategy target of **halting the loss of biodiversity and the degradation of ecosystem services**, and to restore them	I.10 Water Abstraction in Agriculture **Definition:** The volume of water which is applied to soils for irrigation purposes

Evaluation approach

1. **Quantitative assessment at micro-level:** Treatment effects with propensity score matching (PSM)
2. **Qualitative assessment:** A short survey with managers of irrigation water user associations

Reasons for choosing this approach:

1. Existence of a convenience sample of non-beneficiaries from FADN data
2. Previous experience with the RDP 2007-2013 ex-post evaluation and AIR 2017
3. Triangulation
4. Partial robustness, validity, transparency & credibility
5. Practicability & Cost effectiveness

Evaluation approach: main steps

1. **Preparing data:**
   - A random sample of 76 beneficiaries from the region of Thessaly provided by the MA
   - All 156 farm holdings of non-beneficiaries from the 2012-13 FADN records
2. **Checking sample representativeness:**
   - Sample of beneficiaries to FADN: Mann–Whitney U test
   - Sample of beneficiaries and/or of FADN non-beneficiaries to the FSS: Likelihood Ratio test
3. **Calculating the Indicator I.10 at the farm level**
4. **Building comparison group:**
   - PSM with logit
5. **Analysing difference:**
   - ATE and ATT
6. **Checking validity of findings:** z-test
7. **Triangulation**

Data situation (1)

Table 2: Data situation for I.10 Water Abstraction (m^3 per holding)

Data description	Beneficiaries /Control Group
Data source	*MA for beneficiaries, FADN for non-beneficiaries, FSS and WFD for regional data*
Unit of analysis	Farm level (region: Thessaly)
Time series/frequency	Cross section sample
Accessibility for evaluators	FADN units
Data confidentiality issues	No

Data situation (2)

- **Data on beneficiaries: areas cultivated**

	A	B	C	D	E	F	G	H	I	J	K
1	ΚΩΔΙΚΟΣ ΠΑΡΑΓΩΓΟΥ	ΚΩΔΙΚΟΣ ΑΓΡΟΤΕΜΑΧΙΟΥ	ΚΩΔΙΚΟΣ ΔΑΟΚ	ΔΑΟΚ	Σ ΟΜΑΔΑΣ ΚΑΛΛΙ	ΟΜΑΔΑ ΚΑΛΛΙΕΡΓΕΙΩΝ	ΩΔΙΚΟΣ ΠΟΙΚΙΛΙΑ	ΠΟΙΚΙΛΙΑ	ΕΠΙΛΕΞΙΜΗ ΕΚΤΑΣΗ	ΓΕΩΡΓΟΠΕΡΙΒΑΛΛ	ΓΕΩΡΓΟΠΕΡΙΒΑΛΛΟΝΤΙΚΟ
2	00000819	3513628163003	420	ΛΑΡΙΣΗΣ	12	ΒΑΜΒΑΚΙ	02338	AVRA	5	0205	ΠΡΟΣΤΑΣΙΑ ΤΩΝ ΕΥΑΙΣΘΗΤΩΝ ΣΤΑ ΝΙΤΡΙΚΑ
3	00000819	3513628163004	420	ΛΑΡΙΣΗΣ	6	ΑΓΡΑΝΑΠΑΥΣΗ	1000	ΧΩΡΙΣ ΚΑΛΛΙΕΡΓΕΙΑ	0.6	0205	ΠΡΟΣΤΑΣΙΑ ΤΩΝ ΕΥΑΙΣΘΗΤΩΝ ΣΤΑ ΝΙΤΡΙΚΑ
4	00000819	3513628163005	420	ΛΑΡΙΣΗΣ	1	ΣΙΤΑΡΙ	7964	ΣΙΤΟΣ ΣΚΛΗΡΟΣ SIMETO	0.4	0205	ΠΡΟΣΤΑΣΙΑ ΤΩΝ ΕΥΑΙΣΘΗΤΩΝ ΣΤΑ ΝΙΤΡΙΚΑ
5	00000819	3523688572057	420	ΛΑΡΙΣΗΣ	1	ΣΙΤΑΡΙ	7964	ΣΙΤΟΣ ΣΚΛΗΡΟΣ SIMETO	0.2		
6	00000819	3533706719437	420	ΛΑΡΙΣΗΣ	8	ΖΩΟΤΡΟΦΕΣ	8110	ΣΑΝΟΣ ΚΡΙΘΑΡΙΟΥ, ΒΡΩΜΗΣ, ΒΙΚΟΥ, ΑΛΛΟΙ ΣΑΝΟΙ	1		
7	00000819	3543682822020	420	ΛΑΡΙΣΗΣ	1	ΣΙΤΑΡΙ	7964	ΣΙΤΟΣ ΣΚΛΗΡΟΣ SIMETO	1.06		
8	00000819	3543682822200	420	ΛΑΡΙΣΗΣ	1	ΣΙΤΑΡΙ	7964	ΣΙΤΟΣ ΣΚΛΗΡΟΣ SIMETO	0.53		
9	00000819	3543682822555	420	ΛΑΡΙΣΗΣ	1	ΣΙΤΑΡΙ	7964	ΣΙΤΟΣ ΣΚΛΗΡΟΣ SIMETO	1.02		
10	00000819	3543716918420	420	ΛΑΡΙΣΗΣ	1	ΣΙΤΑΡΙ	7964	ΣΙΤΟΣ ΣΚΛΗΡΟΣ SIMETO	4.07	0205	ΠΡΟΣΤΑΣΙΑ ΤΩΝ ΕΥΑΙΣΘΗΤΩΝ ΣΤΑ ΝΙΤΡΙΚΑ
11	00000819	3513628163001	420	ΛΑΡΙΣΗΣ	1	ΣΙΤΑΡΙ	7964	ΣΙΤΟΣ ΣΚΛΗΡΟΣ SIMETO	0.62		
12									14.5	0.6	
13	00001921	3583519008330	420	ΛΑΡΙΣΗΣ	12	ΒΑΜΒΑΚΙ	02313	ST 457	2.22	0205	ΠΡΟΣΤΑΣΙΑ ΤΩΝ ΕΥΑΙΣΘΗΤΩΝ ΣΤΑ ΝΙΤΡΙΚΑ
14	00001921	3803531535191	420	ΛΑΡΙΣΗΣ	1	ΣΙΤΑΡΙ	7899	ΣΙΤΟΣ ΣΚΛΗΡΟΣ ΔΙΑΦΟΡΑ	1.6		
15	00001921	3793535003101	420	ΛΑΡΙΣΗΣ	1	ΣΙΤΑΡΙ	7899	ΣΙΤΟΣ ΣΚΛΗΡΟΣ ΔΙΑΦΟΡΑ	2.04		
16	00001921	3673532313051	420	ΛΑΡΙΣΗΣ	1	ΣΙΤΑΡΙ	7899	ΣΙΤΟΣ ΣΚΛΗΡΟΣ ΔΙΑΦΟΡΑ	0.4	0205	ΠΡΟΣΤΑΣΙΑ ΤΩΝ ΕΥΑΙΣΘΗΤΩΝ ΣΤΑ ΝΙΤΡΙΚΑ
17	00001921	3583519008001	420	ΛΑΡΙΣΗΣ	6	ΑΓΡΑΝΑΠΑΥΣΗ	1000	ΧΩΡΙΣ ΚΑΛΛΙΕΡΓΕΙΑ	0.22	0205	ΠΡΟΣΤΑΣΙΑ ΤΩΝ ΕΥΑΙΣΘΗΤΩΝ ΣΤΑ ΝΙΤΡΙΚΑ
18	00001921	3563511044002	420	ΛΑΡΙΣΗΣ	18	ΝΤΟΜΑΤΕΣ ΠΡΟΣ ΜΕΤΑΠΟΙΗΣΗ	8216	ΝΤΟΜΑΤΕΣ ΜΕΤΑΠΟΙΗΣΗΣ	0.3		
19	00001921	3553513454023	420	ΛΑΡΙΣΗΣ	18	ΝΤΟΜΑΤΕΣ ΠΡΟΣ ΜΕΤΑΠΟΙΗΣΗ	8216	ΝΤΟΜΑΤΕΣ ΜΕΤΑΠΟΙΗΣΗΣ	1		
20	00001921	3503481778200	420	ΛΑΡΙΣΗΣ	12	ΒΑΜΒΑΚΙ	02313	ST 457	5.2		
21	00001921	3673532313751	420	ΛΑΡΙΣΗΣ	1	ΣΙΤΑΡΙ	9148	ΣΙΤΟΣ ΣΚΛΗΡΟΣ MAESTRALLE	1.5	0205	ΠΡΟΣΤΑΣΙΑ ΤΩΝ ΕΥΑΙΣΘΗΤΩΝ ΣΤΑ ΝΙΤΡΙΚΑ

- **Data on non-beneficiaries:**

All 156 non-beneficiaries from the FADN 2012-13 data from the region of Thessaly. The data were prepared by a post-graduate student in the framework of a Ph.D research.

Data situation (3): from cultivated areas to water needs

Size of cultivated area by irrigated crop

Weather and soil data and crop’s agronomic conditions

Estimation of optimal and sub-optimal irrigation

Main assumption: Farmers are optimizing crop yields and costs

- Maximization of crop yields implies that irrigation water is optimum (or narrowly sub-optimum)
- Minimization of irrigation costs is reflected on the choice of cultivation mix and not on irrigation water quantities

Major findings

Propensity Score Matching

Stata: effects with psmatch, logit score model, few variables for the logit (concentration, maize or cotton producer)

Water Abstraction

Beneficiaries = 166,216 m^3

Non-beneficiaries = 192,732 m^3

Difference = 26,516 m^3

Irrigation	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
Treat (1 vs 0)	-21779.36	9406.728	-2.32	0.021	-40216.21	-3342.513

Average Treatment Effect (All Holdings):

21,779 m^3 of irrigation water per year (cultivation season) per farm

Irrigation	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATET						
Treat (1 vs 0)	-25895.16	10959.55	-2.36	0.018	-47375.47	-4414.848

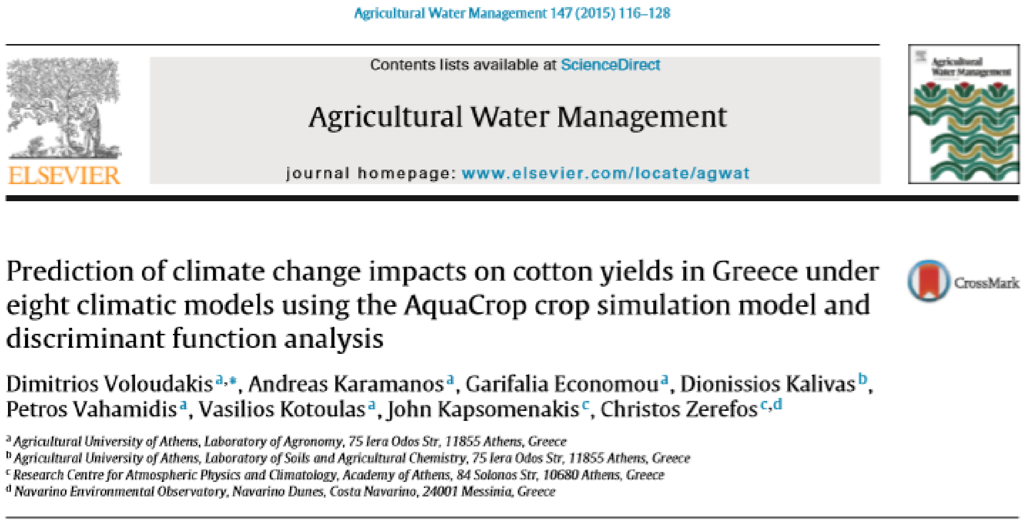
Average Treatment Effect on Beneficiaries:

25,895 m^3 of irrigation water per year (cultivation season) per farm

Triangulation and qualitative assessment

Triangulation:

- Are AquaCrop estimates correct? (Scientific evidence)
  - ✓ Search in the scientific literature to see if the model was correctly calibrated and yielded similar results to those that are published in scientific journals for the same or similar regions
  - ✓ Ask scientists working in this field to provide their opinion on the AquaCrop estimates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Prediction of climate change impacts on cotton yields in Greece under eight climatic models using the AquaCrop crop simulation model and discriminant function analysis

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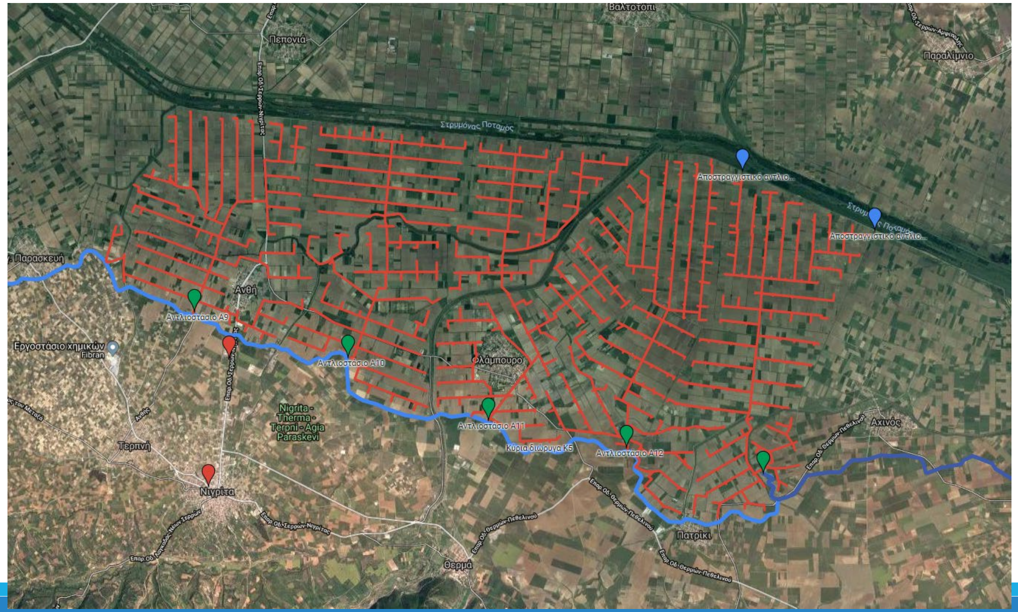

Informal Qualitative Assessment:

- Are treatment effect estimates correct? (Empirical evidence)
  - ✓ Consult irrigation water associations managers

Alternative approaches to assess water abstraction

What if I had not access to FADN data? → I would have established a counterfactual from data kept by water user associations if sample representativeness allowed

Naïve group comparisons: → Comparisons of average water abstraction for beneficiaries versus average abstraction for Thessaly and for various categories of holdings according to the FSS in Thessaly

Strengths and weaknesses of the approach

Strengths	Weaknesses
• Establishes causality under data sparseness • Cross validated (triangulated) • Obtains an objective measure of the indicator • Micro results can be scaled up to River Basin District level • Accepts climate change evaluations	• Data constraints for estimating the ATE based on PSM • Data fragmented and non-harmonized • Irrigation estimates (or observations) very volatile • Standard errors of ATE estimates very wide due to sampling constraints

Words of warning or lessons learned

Irrigation data: They are very volatile from year to year (and will become more in the future)

- When DiD is used examine the data very carefully to avoid weather extremes in the case of a very dry or very wet starting or ending year

There is an extreme wealth of data but, it is fragmented (in various databases) and not harmonized (in terms of definitions, geographic boundaries, etc.)

- Eurostat/OECD and WFD have different definitions of abstraction/use

Examine the financial data very carefully. Measures targeting water abstraction also target water quality and soil erosion or soil organic matter

- Example: In Greece, set aside of land with a slope of over 8% is getting a premium

Thank you

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Work is still in progress, please check my research gate address for updates!

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