COUNTERFACTUAL EVALUATION OF FARM MODERNIZATION MEASURE OF LATVIAN RDP 2007-2013 WITH PROPENSITY SCORE MATCHING

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CONTENTS

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Programme: Latvian RDP 2007-2013

Approach to evaluation: balancing the importance of measure with resource allocation (personnel, time, money)

Study: Counterfactual evaluation of economic variables of Farm Modernization measure

Purpose: Impact assessment of the measure, direct and indirect effects, answers to evaluation questions

Period: 2006 (2007) - 2014 (2013)

Focus of evaluation: Quantitative assessment of programme economic variables

Start-date: April 2014 (tentative evaluation)

Current status of evaluation: Finished

Authors role in the evaluation: Data processing, application of methods, analysis of results using judgment criteria, answers to evaluation questions

CONTEXT OF EVALUATION (2)

Steps in evaluation process:

1. estimation of programme gross direct impact for economic growth (Axis1 and Axis3 measures)
2. estimation of programme gross direct impact for employment (intended for Axis3 measures, unintended for Axis1 measures)
3. estimation of direct impact for labor productivity (Axis1 measures)
4. estimation of deadweight effects (Axis1 and Axis3 measures)
5. estimation of programme gross aggregate direct impact for economic growth (Axis1 and Axis3 measures) after subtracting deadweight
6. estimation of substitution and displacement effects at programme area level
7. estimation of programme net direct impact for economic growth after subtracting substitution
8. estimation of programme net direct impact for employment after subtracting displacement

Approach: counterfactual analysis (PSM-DiD method)

Working steps:

- selection of statistical software (STATA MP13)

- selection of data source (FADN database)

- selection of relevant units (period covered - data gaps, non-overlapping principle

- construction of treatment and control groups

- selection of covariates for matching (values before the programme)

Four steps in empirical analysis:

1. selection of observational covariates and estimation of propensity scores

2. stratification of propensity scores and testing of balancing properties in each block

3. calculation of the Average Treatment on Treated (ATT) by matching

4. sensitivity test for robustness of estimated ATT effects.

STATA MP13 commands / modules:

1. pscore, psmatch2 - logistic regression

2. psmatch2 - estimation of ATT (method yielding the results with the highest t-value preferred)

- nearest neighbor

- radius

- kernel

DATA & INFORMATION SOURCES

Data needs:
- simultaneous sufficciency of number of units for treatment and control groups vs. number of variables for matching

Data collection:
- queries upon request from FADN database maintained by the department of AREI on the annual basis

Challenges:
- only 943 units
- about 250~300 units with incomplete period
- bias towards large-sized farms
- rather small number of non-participants suitable for controls

MAJOR FINDINGS - LOGISTIC REGRESSION

#	Variable	Coefficient	Standard Deviation	z	P>|z|	[95% confidence interval]	
1	Labor input	-0.358689	0.096130	-3.73	0.00	-0.547099	-0.170279
2	Gross investments	0.000001	0.000003	0.40	0.69	-0.000004	0.000006
3	Livestock units	0.013963	0.004427	3.15	0.00	0.005287	0.022640
4	Gross income	-0.000056	0.000615	-0.09	0.93	-0.001261	0.001150
53	Veterinary expenses	-0.000477	0.000841	-0.57	0.57	-0.002127	0.001172
54	Fuel, lubricants	-0.000043	0.000057	-0.76	0.45	-0.000154	0.000068
55	Electricity, heating	-0.000090	0.000039	-2.33	0.02	-0.000165	-0.000014
56	Total assets	0.000007	0.000003	2.53	0.01	0.000002	0.000012
	Constant	-2.839204	0.459745	-6.18	0.00	-3.740288	-1.938120
	Logistic	Observations	LR chi2(31)	Prob>chi2	Log likelihood		Pseudo R2
	regresion	548	289.13	0	-230.79756		0.385

Empirical approach:
- dropping collinear variables
- adding higher order variables
- retaining insignificant variables

MAJOR FINDINGS - DIRECT IMPACT ON GVA

Calculation basis	Gross Value Added EUR		
	2007	2014	DiD (2014-2007)
Unmatched participants (P=1) (309)	125,946	146,980	21,034
Unmatched non-participants (P=0) (239)	35,164	22,712	-12,452
Total Ø (538)	36,575	48,049	11,475
Difference (1-0)	90,782	124,268	33,486
Difference (1-Ø)	89,371	98,930	9,559
Matched participants (M=1) (309)	125,946	146,980	21,034
Unmatched participants (M=0) (239)	38,652	23,587	-15,064
ATT	87,294	123,392	36,098

Direct impact on GVA: EUR 36,098
Number of supported farms: 3,861
Gross impact: MEUR 139.37
Purchasing parity in 2014: 64%
Gross impact measured in PPS: 217.77M

MAJOR FINDINGS - DIRECT IMPACT ON PRODUCTIVITY

Calculation basis	Labor productivity EUR/AWU		
	2007	2014	DiD (2014-2007)
Unmatched participants (P=1) (309)	13,511	11,976	-1,535
Unmatched non-participants (P=0) (239)	7,823	3,925	-3,898
Total Ø (538)	6,259	8,626	2,366
Difference (1-0)	5,688	8,051	2,363
Difference (1-Ø)	7,252	3,350	-3,902
Matched participants (M=1) (309)	13,511	11,976	-1,535
Unmatched participants (M=0) (239)	9,631	2,887	-6,744
ATT	3,880	9,089	5,209

Direct impact on labor productivity: EUR/AWU 5,209

Number of supported farms: 3,861

Total support: MEUR 357

Average support per supported: EUR 92,463

Average AWU in supported farms in 2014: 9.42

Total farm employment in 2013: 82,900

Gross direct impact on productivity : EUR/AWU 2,285

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Calculation basis	Employment AWU		
	2007	2014	DiD (2014-2007)
Unmatched participants (P=1) (309)	10.33	9.42	-0.91
Unmatched non-participants (P=0) (239)	5.65	4.15	-1.49
Total Ø (538)	5.53	5.03	-0.50
Difference (1-0)	4.68	5.27	0.59
Difference (1-Ø)	4.80	4.39	-0.41
Matched participants (M=1) (309)	10.33	9.42	-0.91
Unmatched participants (M=0) (239)	5.34	5.23	-0.11
ATT	4.99	4.19	-0.80

Direct impact on farm employment: AWU -0.80
Number of supported farms: 3,861
Total impact on farm employment: AWU -3,089

MAJOR FINDINGS - DEADWEIGHT LOSS

Calculation basis	Annual average gross investments EUR		
	2007	2014	DiD (2014-2007)
Unmatched participants (P=1) (309)	166,607	170,722	4,115
Unmatched non-participants (P=0) (239)	47,976	12,923	-35,053
Matched participants (M=1) (309)	166,607	170,722	4,115 (2%)
Unmatched participants (M=0) (239)	55,636	23,537	-32,099 (-57%)
Deadweight loss (M)			-23% (-57/2)

The measure does not create deadweight loss as the differences between the investments of matched participants and matched non-participants are significant
The participants would not make investments in the absence of programme support

MAJOR FINDINGS - LEVERAGE EFFECTS

Calculation basis	Total taxes paid EUR		
	2007	2014	DiD (2014-2007)
Unmatched participants (P=1) (309)	53,936	75,850	21,914
Unmatched non-participants (P=0) (239)	18,139	19,333	1,193
Total Ø (538)	38,324	51,201	12,877
Difference (1-0)	35,797	56,518	20,720
Difference (1-Ø)	15,612	24,649	9,037
Matched participants (M=1) (309)	53,936	75,850	21,914
Unmatched participants (M=0) (239)	19,514	24,266	4,752
ATT	34,423	51,585	17,162

As the ATT calculated is positive and significant, the measure creates leverage effect - programme support induces the increase in expenditures by participants

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	Indicators		
Type	**Indicator**	**Target value**	**Result**
Output	Number of supported farms	3,650	3,861
	Total investments, EUR	826,030,031	238,767,357
Impact	Net additional value added, PPS	245,000,000	217,770,000
	Changes in gross value added per employed, EUR/AWU	2,230	2,285

The planned volume of investments was not achieved
The target value of the contribution of the measure to economic growth was not met
The target values of the contribution of the measure to labor productivity was met

15. The calculated changes in labor productivity shows that target value of the respective indicator is met. The measure is effective with respect to labor productivity. The efficiency of the measure is cakculated by dividing planned public financing against targeted productivity by allocated public financing against the estimated changes in productivity. The efficiency of the measure is 354%.

1. The effectiveness of the measure is only partial at 89%. The efficiency of the measure stands at 206%.

2. The measure has negative impact on employment by reducing the number of total farm employment by 3,089 AWU.

20. Direct unplanned negative effect on employment; significant leverage; no deadweight

STRENGTHS AND WEAKNESSES OF THE METHOD USED

- statistical rigour if compared to naive methods

- opportunity to use a few matching techniques and select the most appropriate one

- rather recently developed method (this century)

- availability of data
- quality of data
- usually too few units for controls
- using the same units as controls for more then one treated
- only farm data in FADN database
- differences in covariates with State Revenue data used for other measures
- comparisons with previous evaluations almost impossible

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1. Contrafactual analysis allows for a statistically sound estimation of economic variables if compared to previously used naive methods
2. Method can be used for Axis1 and Axis3 measures
3. The use of the method in analysis of environmental variables for Axis2 measures depends on availability of data
4. Method requires good availability, quality and quantity of relevant data to build a data panel
5. Contrafactual analysis can be considered a proper tool in evaluation of indirect effects both at measure and programme level

OPEN ISSUES TO BE DISCUSSED

1. How to interpret the obtained deadweight effects if values are negative or greater than one?

2. How to interpret an effectiveness of a measure when results are negative?

3. Could efficiency be evaluated in that case at all?

4. What would be a proper proxy for GVA if data from State Revenue is used?

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