Assessing Microeconomic Effects of Farm-Investment Support in Austria: a *Matching* Approach

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***Abstract* -The increasing demand for agricultural policy evaluation and the complexity of identifying the effects of policy measures are two challenges to agricultural economics. In this context the following paper shows the opportunities and limitations of a*direct radius-matching*approach in evaluating EU rural development policies, as exemplified by the agricultural investment support program for Austria. To determine the causal effects of investment support on the structure of participating farms, the approach is combined with the *Difference-in-Difference estimator (DiD).* The results indicate a positive impact on farm growth. As this approach is based on crucial assumptions, sensitivity analysis with modified calliper width for radius-matching is used. They show that wide callipers are preferable to narrow ones, when heterogeneous effects appear. However, we find that the approach used, in combination with pre-studies and stakeholder information, can help towards a consistent farm-policy evaluation in rural-development programmes.**

Introduction

The fact of increasing funds and complex outcomes in rural-development measures requires consistent evaluation. Furthermore, evaluation is increasingly necessary to verify those expenditures to other societies. These challenges have been recognised by the EU and guidelines for a consistent evaluation have been set up but have not been carried out by practical evaluators (Henning and Michalek, 2008).

In order to fulfil a consistent evaluation quantitative ex-post policy evaluation methods can be used, which aim to assess effects which are directly caused by the programme. When empirical data for evaluation of farm programmes is used, several evaluation-problems arise (Pufahl and Weiss, 2009). One of the major difficulties is the identification of an adequate control group, which is required for measuring causal effects. Rural-development measures in particular show systematic differences in participants and non-participants (selection bias), caused by voluntary selection to programme participation. Therefore *before/after analysis* or *with/without treatment analysis* with bounding the groups by economic and structural variables (Forstner et al., 2008) have been used for Evaluation of farm-investment support. The first analysis has its main drawback in evaluating gross effects instead of net effects, whereas the second contains selection bias caused by heterogeneous individuals.

Further reduction of selection bias can be achieved by using *matching*, which compares participants pair-wise with similar non-participants. Whereas this method is commonly applied in medicine and macroeconomics, there have been a number of recent papers introducing *matching* as an innovative non-parametric method for the evaluation of agricultural policies (Henning and Michalek, 2008; Pufahl and Weiss, 2009) but has never been used for evaluating farm-investment support. Causal effects of farm-investment support are hard to define, as those payments are always in combination with an investment. This paper therefore considers the causal effects of support and investment jointly.

The objective of this study is to apply *matching* to identify adequate controls for participants in rural-development programme evaluation. The *matching* approach is combined with a d*ifference-in-difference estimator (DiD)* for measuring the *Average Treatment Effect on the Treated (ATT)* in the Austrian farm-investment programme. We use IACS-data (Integrated Administration and Control System) and focus on the structural effects on participants in the Upper-Austria region. Furthermore, the heterogeneity and robustness of results are investigated to show the opportunities and limitations of this approach in overcoming the challenges mentioned.

Method and Database

The *matching* method identifies similar non-participants for each participant, based on some set of observed variables (covariates, X) which determine the selection into programme and influence outcome variables *(Conditional Independence Assumption)*. *Matching* reduces selection bias occurring through observables, whereas the DiD allows the control of unobservable trend bias by comparing the development of participants ($Y_{i,t}$-$Y_{i,t'}$) and non-participants ($Y_{j,t}$-$Y_{j,t'}$) from a situation before(t') and after treatment (t) (see Formula 1).

$$ATT = E(Y_{i,t} - Y_{i,t'} \mid X) - E(Y_{j,t} - Y_{j,t'} \mid X) \quad (1)$$

We use *direct-radius matching*, where the similar control group is identified directly by selected covariates. Similarity is defined with a calliper,

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which can be set for each covariate individually. Therefore further analysis is carried out to assess sensitivity of different calliper width.

IACS-data and data on farm-specific payments serve as the database. We use 3,106 participating farms on farm-investment support programme from 2002 to 2006 and 19,081 non-participants from 2000 to 2009.The different time periods are related to specific data characteristics.

Results of Direct Matching

The *direct-matching* identifies 2,514 pairs of participants and controlson the following covariates: organic farming, minor agricultural production areas, mountain farm zones, utilized agricultural area (UAA), share of arable land, livestock and milk quota. For the metric covariates, a calliper is set to 15% or 5 hectare for UAA, 2 LU for livestock and 5 tons for milk quota. The mean of variables show non-significant differences between selected participants and controls after *matching* (see Table 1).

Table 1. Mean values of variables for participants and non-participants before and after *matching.*

	Before *Matching*		**After *matching***	
Variable (2000)	Participants	Non-participants[2]	Selected participants	Controls
Number of farms	3,106	19,081	2,514	2,514
Share of organic farming	10%	**8%**	6%	6%
Utilised agricultural area (ha)	23.24	**15.60**	21.85	21.47
Arable land (ha)	12.83	**8.80**	12.64	12.41
Livestock (LU)	31.57	**17.64**	30.13	29.67
Ruminants (LU)	22.79	**13.32**	20.43	20.59
Pigs (LU)	8.11	**3.75**	9.09	8.53
Dairy cows (LU)	11.49	**6.46**	10.18	10.27
Milk quota (t)	46.19	**22.18**	38.03	37.44
Programme payments (Euro)[1]	17,010	-	15,959	-

[1)] payment of farm-investment programme (measure 121) from 2000 to 2009
[2)] **bolt numbers** indicate statistical significant differences on the 1%-level (t-Test) for participants and non-participants

Computing the ATT we find that, the mean results indicate anacceleration in farm growth particularly in animal husbandry, where participating farms could increase their livestock by 8.9 LU more than the controls in the period of 2000 to 2008 (see Figure 1; base scenario).

Sensitivity analysis with wider and narrower callipers (25 and 5%) shows a trade-off between the reduced similarity of matching-partners and the decreasing number of participants, where corresponding non-participating farms exist. A very substantial reduction in participants can be observed under narrow calliper-width. No significant difference between the scenarios is found in common variables like UAA and livestock, whereas in farm-type specific variables like dairy cows, the scenarios differ significantly (see Figure 1).

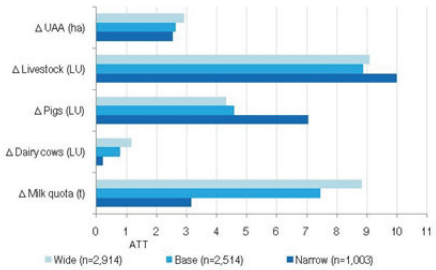

Figure 1. ATT of farm-investment support programme in Upper Austria for scenarios with different calliper width.

First Conclusions and Outlook

It can be concluded that farm-investment support has a positive, but heterogeneous, impact on farm growth. Sensitivity analysis indicates, under the narrow scenario, a big loss of dairy farms, which are the main receiving holdings of investment support. So a wider calliper-width can communicate a more accurate "picture" of the farm-investment programme. As this approach is highly depending on the selection of covariates we will also compare the results with the results of *propensity score matching*. The propensity score for each farm is determined as the probability of participation and allows the use of more covariates then the direct approach.

Even though the used *matching* approach is dependent on several assumptions, next to individual adjustments it allows transparency for non-scientific stakeholders in the evaluation process. This is particular necessary as practical information is important to find covariates. Furthermore, it shows the advantage of easily communicated results. We would like to stress that policy evaluation must be carried out with and for stakeholders and not only for scientists. We acknowledge that further research has to be done on identifying covariates and their influence on participation. However, we find so far that the approach used, in combination with pre-studies and stakeholder information, can help towards a consistent farm-policy evaluation in rural-development programmes.

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