The Matching methodology in agricultural economics: applications from Austria

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Doctorial thesis
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Farmers make decisions like…

- Causal effects for agriculture and society
- Application of the **Matching methodology**
  (e.g. Pufahl and Weiss, 2009; Mayen et al., 2010; Michalek, 2012; Takahashi and Barrett, 2014; Datta, 2015; Shete and Rutten, 2015; Villano et al., 2015;…)

- Support measures
- Investments
- Agro-tourism
- Organic farming, etc.
Matching is based on...

the assumption that under given observable variables the potential outcome is independent from decision making

"unconfoundedness assumption" (Rosenbaum and Rubin, 1983),

the existence of similar non-investing farms

"overlap assumption" (Heckman et al., 1999),

and finds pairs of farms with similar observable characteristics but different decision making using distance functions and algorithms.
Objectives

- Estimating effects of **supported farm-investments** on **farm-economic** parameters
- Estimating effects of **supported farm-investments** on **structural** parameters and their dynamics
- Estimating effects of **low-input decisions** on **farm-economic** parameters

- Discussing the applicability of the Matching methodology for agricultural economic research questions and available data sets.
Basic model
Combining Matching with the difference-in-difference estimator (CDiD)

\[ \tau \mid (T = 1) = \sum_{A=1}^{n_A} (Y_{A,t} - Y_{A,t'}) Z/n_A - \sum_{B=1}^{n_B} (Y_{B,t} - Y_{B,t'}) Z/n_B \]

\( t' \) time before the investment; \( t' \) time after the investment

\( \text{CDiD} = \text{Conditional difference-in-difference estimator}; \text{ATT} = \text{Average treatment effect on the treated}; \)

Source: Kirchweger und Kantelhardt, 2015
Specific „dynamic“ model analysing the effects of supported investments

\[ \tau \mid (T = 1) = \text{ATT} = \text{Development of investing farms} - \text{Development of non-investing farms} \]

Source: Kirchweger und Kantelhardt, 2015
Selected results
Effects (ATT) of supported farm-investments on animal husbandry (LU) for cattle farms

Number of farms: t-2 – t+5: 3507; t+6: 2466; t+7: 1892; t+8: 1263; t+9: 578

ATT= Average treatment effect on the treated; LU =Livestock unit; Signif. Codes (t-test): 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘ ’ 1;

Source: Kirchweger und Kantelhardt, 2015
Selected results
Effects (ATT) of supported farm-investments on animal husbandry (LU) for pig farms

Number of farms: t-2 – t+5: 332; t+6: 258; t+7: 214; t+8: 159; t+9: 78

ATT = Average treatment effect on the treated; LU = Livestock unit; Signif. Codes (t-test): 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1;

Source: Kirchweger und Kantelhardt, 2015
Selected results
Effects (ATT) of supported farm-investments on intensity in animal husbandry (LU/ha) for *cattle farms*

Number of farms: t-2 – t+5: 3507; t+6: 2466; t+7: 1892; t+8: 1263; t+9: 578

ATT= Average treatment effect on the treated; LU = Livestock unit; Signif. Codes (t-test): 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘ ’ 1;

Source: Kirchweger und Kantelhardt, 2015
Selected results
Effects (ATT) of supported farm-investments on intensity in animal husbandry (LU/ha) for pig farms

Number of farms: t-2 – t+5: 332; t+6: 258; t+7: 214; t+8: 159; t+9: 78
ATT= Average treatment effect on the treated; LU =Livestock unit; Signif. Codes (t-test): 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘ ’ 1;
Source: Kirchweger und Kantelhardt, 2015
Conclusions I

The results of the supported investment analysis show…

- a significant increase in animal husbandry,
- but also in farming intensity (environment)
- and different effects depending on farm type and time.

Matching is especially applicable…

- when there are many control farms available
- and heterogeneous effects are expected (see also Lechner, 2002; Puhfal and Weiss, 2009)
- i.e. for analyses of supported investments or organic farming
Conclusions II

It has to be considered that …

- the matching methodology highly depends on observable variables,
- and decision making in agriculture is not always observable.

Further research is necessary …

- to understand agricultural decision making
- and in including other methods in such models.
Let’s do the match!!!

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Published Papers:
Kirchweger, S., Kantelhardt, J., 2015. The dynamic effects of government-supported farm-investment activities on structural change in Austrian agriculture. Land Use Policy 48, 73-93