The effect of Swiss Regional Nature Parks on agricultural earnings:

Evaluating the impact of parks using causal analysis methods

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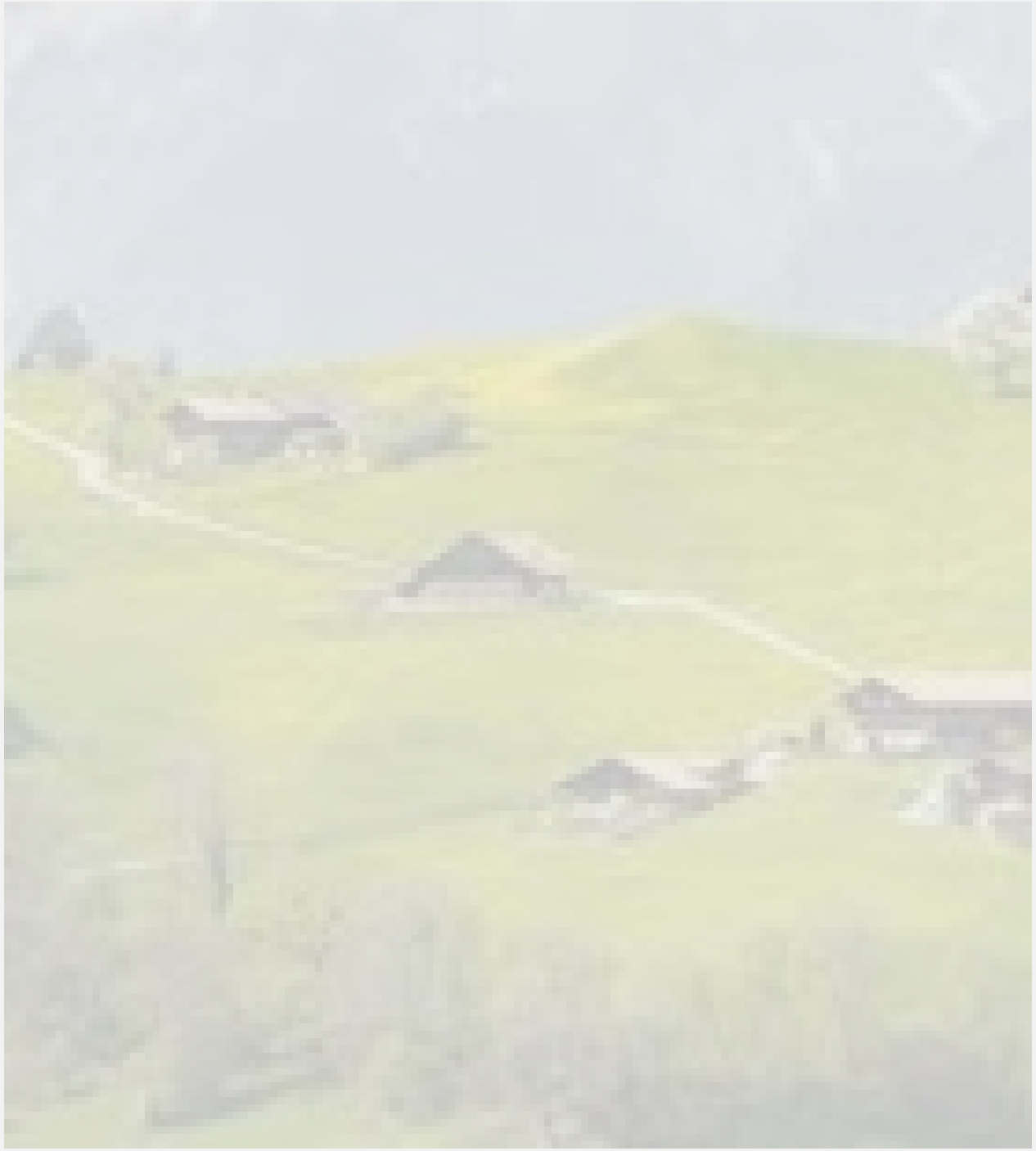
Presenting

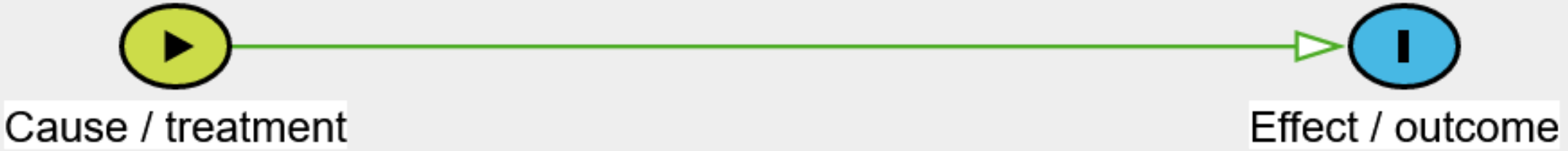
- Relevance of an impact evaluation
- Research question and hypothesis
- Scope
- Methods
- Preliminary results
- Preliminary conclusions and discussion



Relevance

- Why an impact evaluation?

- Park effect on…



Research question

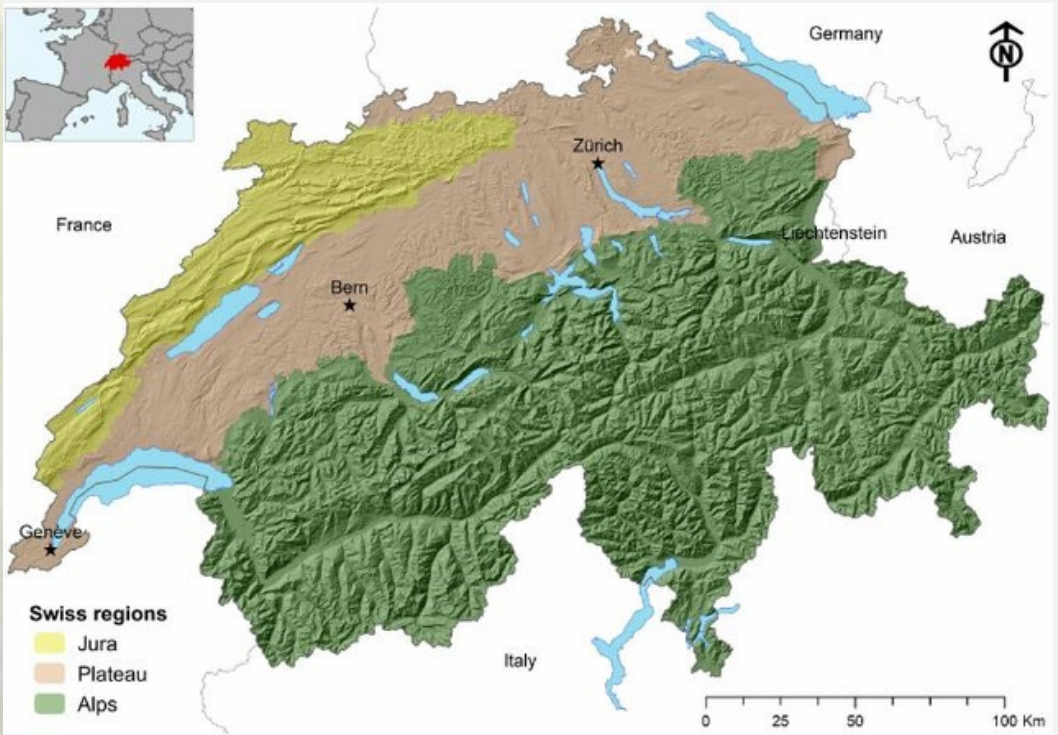
- Research question
- Hypothesis (H_0)

- To what extent the status “park” has an effect on agricultural earnings?
- No difference between the average agricultural earnings in park municipalities vs. non-park municipalities

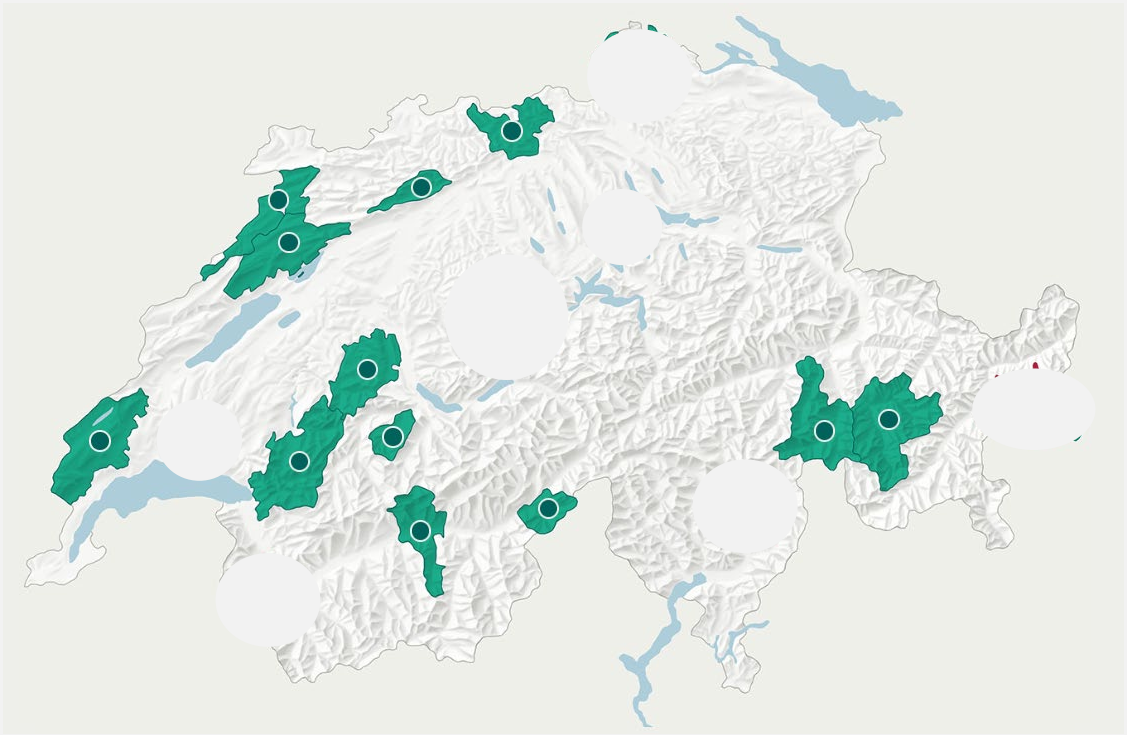
Scope: national level, major bioregions, and cantonal/individual

- Jura and Alps
- Switzerland

- Cantonal/individual: Parks considered



Major bioregions of Switzerland



Regional Nature Parks under study

Methods

- Swiss level
- Regional level

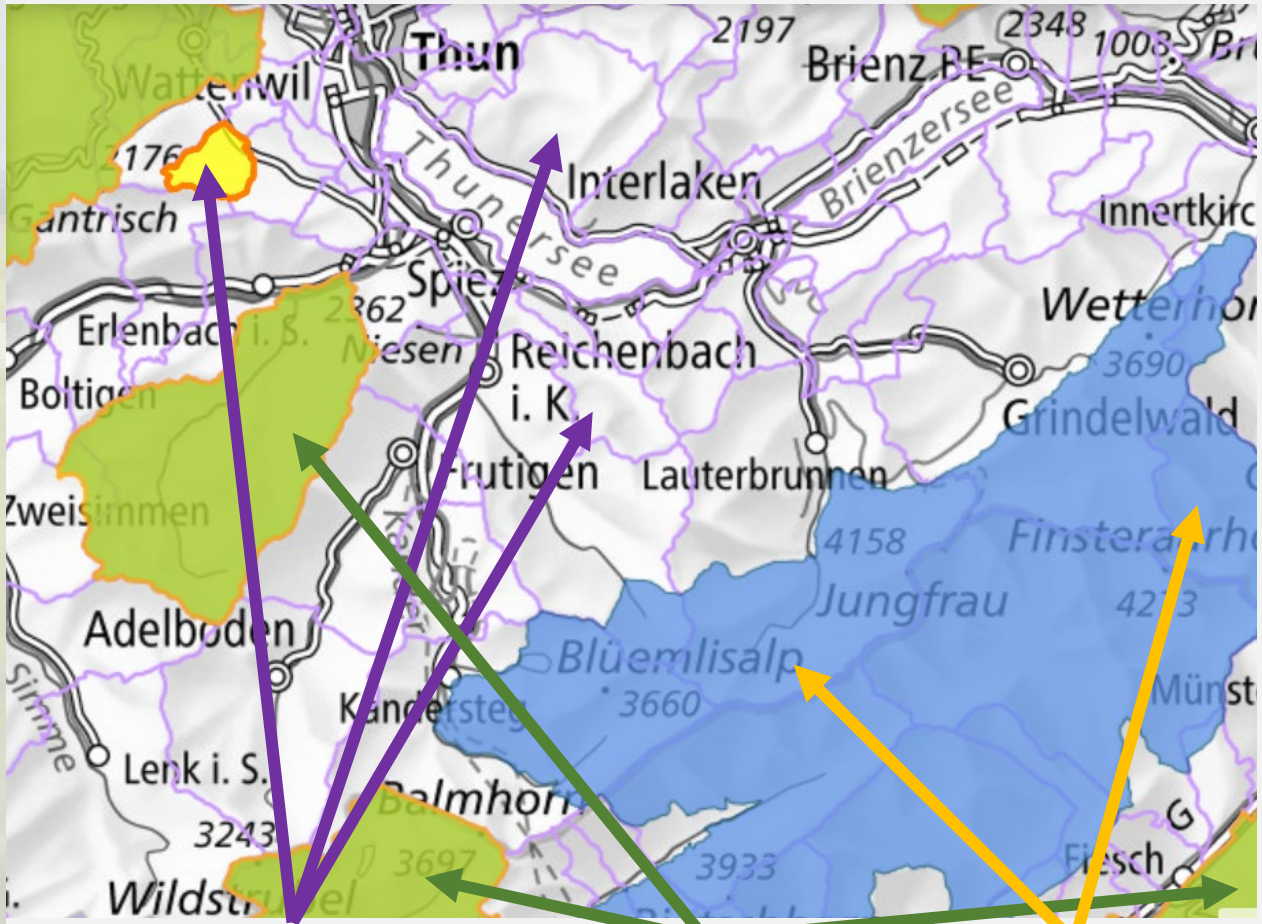
- FlexpanelDiD* (Dettmann et al. 2020)

- Cantonal/individual level

- Synthetic Control Method* (Abadie et al. 2010)

*Both methods rely on **matching** and **difference in differences** (quasi-experiment).
Stata 17

Data and unit of analysis

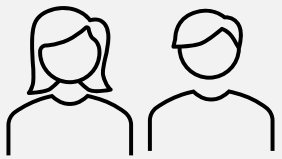


Comparison units

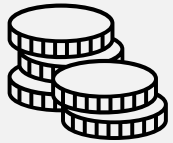
Treated units

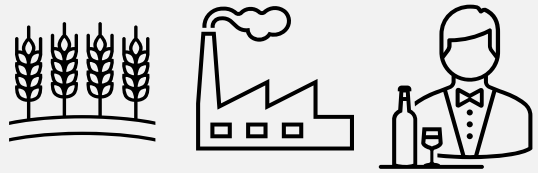
Not considered

Matching variables:



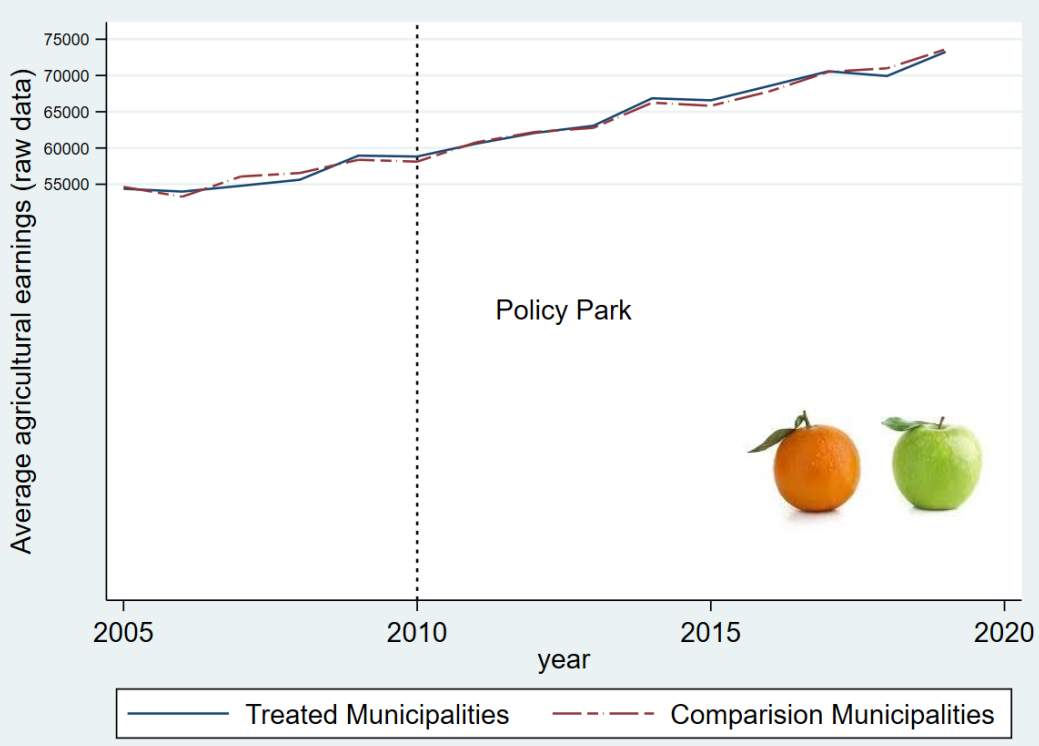
Age

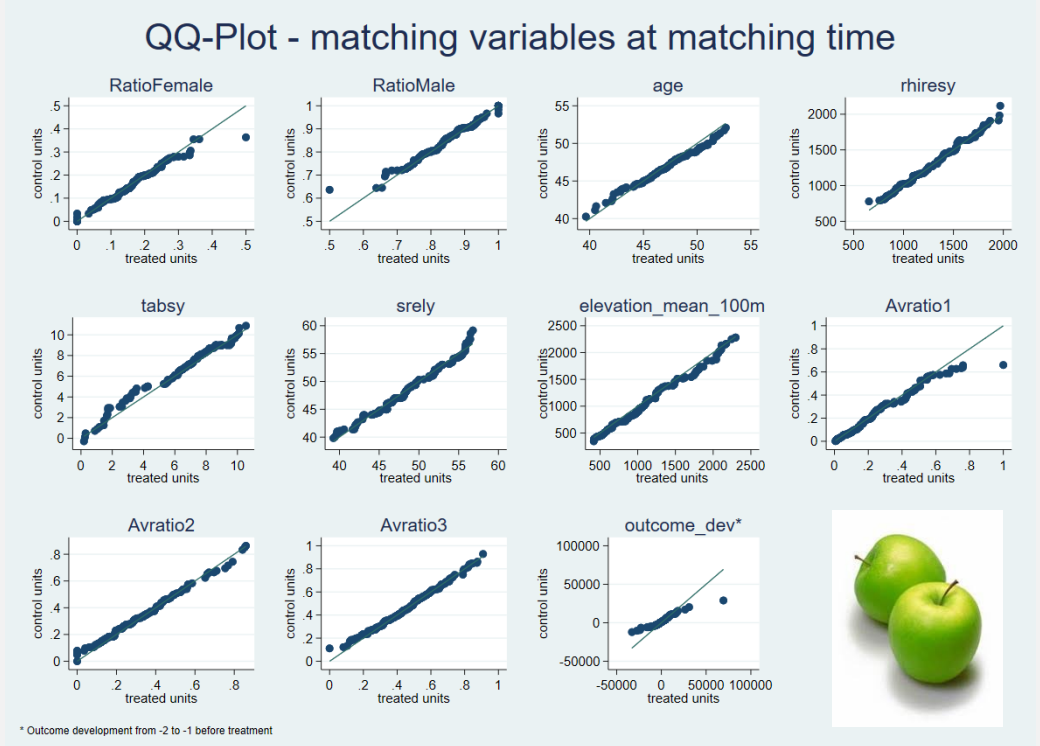




Economic sectors

Preliminary results: National level (flexpanelDiD)





Similar results for the Jura and Alps regions

Average treatment effect for the treated

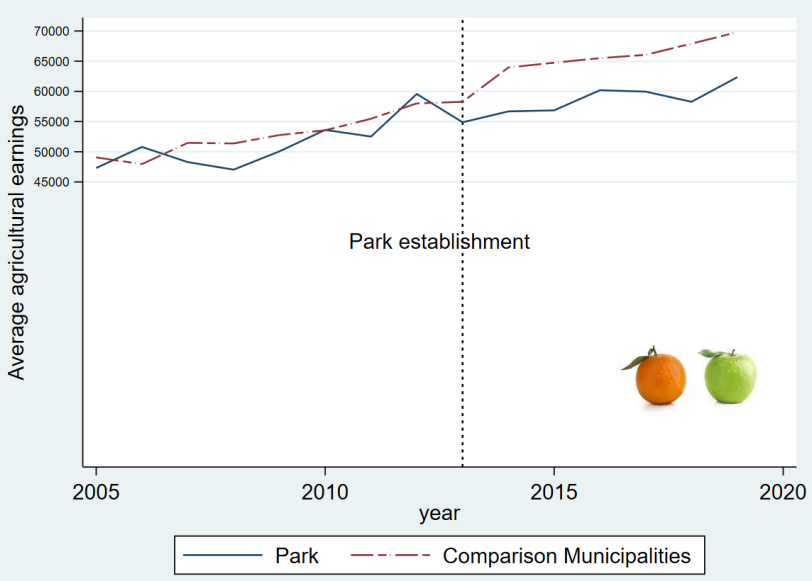
Estimator : Nearest neighbor
Distance metric : Statistical DF

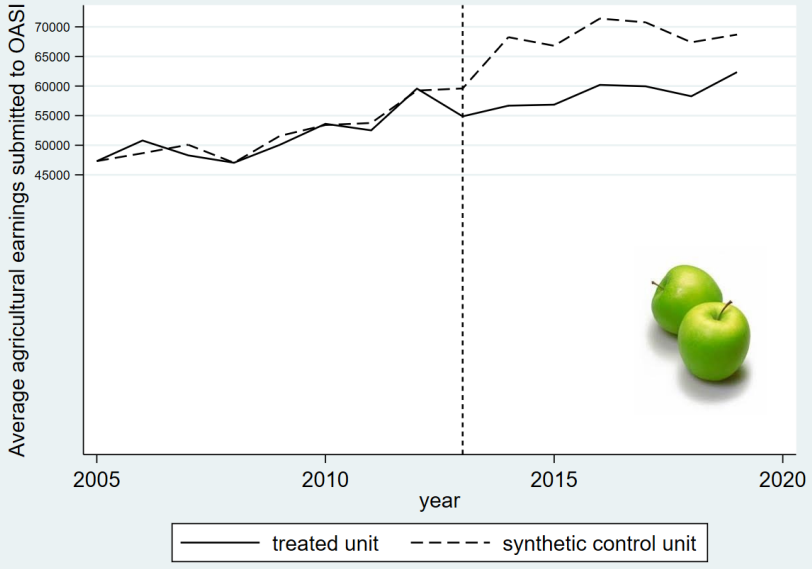
No. of treated obs = 167
No. of unique controls = 152
Mean no. of matches = 1

Outcome	mean Diff		DiD*	AI robust S.E.	z	P>|z|
	treated	controls				
mrevcot	9.9e+03	7.9e+03	2.0e+03	1.4e+03	1.3496	0.1790

* Consistent bias-corrected estimator as proposed in Abadie & Imbens (2006,2011).

Preliminary results: Canton/individual level (case 1 - synthetic)

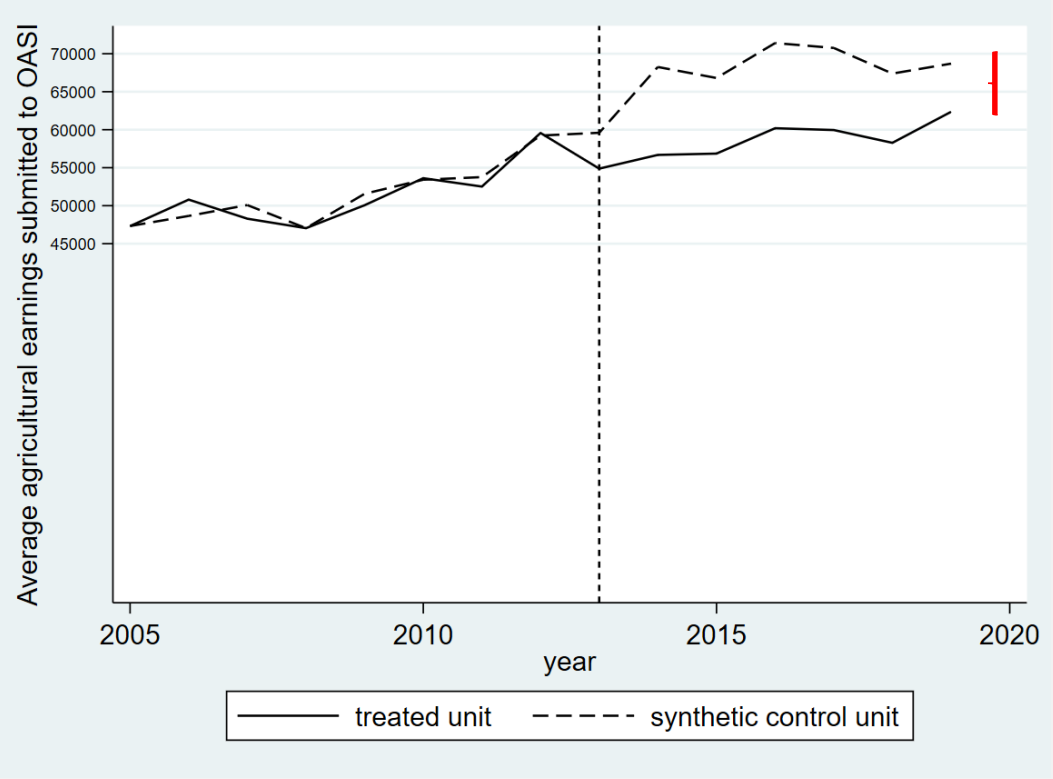




Covariate balance in the pretreatment periods:

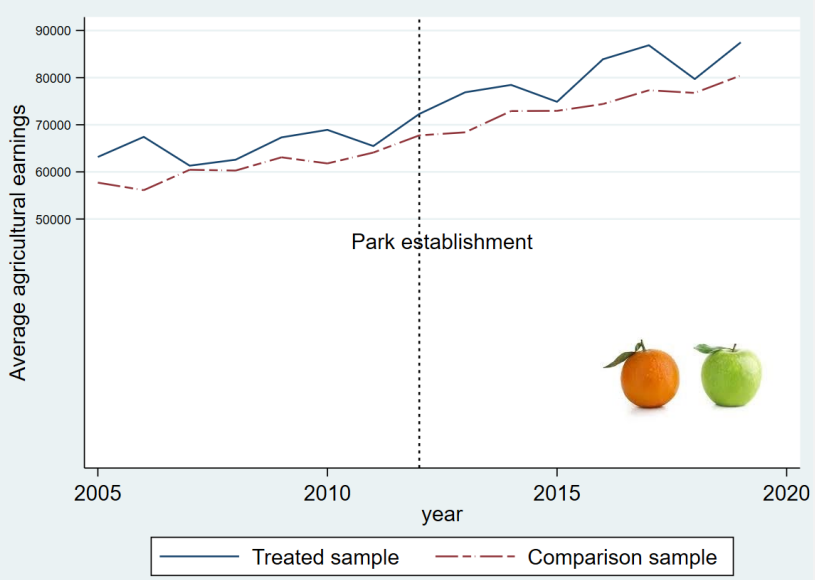
Covariate	V.weight	Treated	Synthetic Control Value	Synthetic Control Bias	Average Control Value	Average Control Bias
RatioFemale_	0.0977	0.1829	0.1829	-0.01%	0.2096	14.58%
RatioMale_	0.0188	0.8171	0.8171	0.00%	0.7904	-3.26%
age	0.0008	45.7318	45.4499	-0.62%	46.0631	0.72%
rhiresy	0.0008	1079.3349	1113.2493	3.14%	1169.2914	8.33%
tabsy	0.0049	2.5481	2.5656	0.69%	3.9891	56.55%
srely	0.0452	47.8847	47.8974	0.03%	49.0421	2.42%
elevation_mean_100m_	0.2437	1804.6887	1804.5105	-0.01%	1546.2456	-14.32%
Avratio1_	0.0093	0.4323	0.4160	-3.76%	0.1859	-57.00%
Avratio2_	0.1149	0.1764	0.1747	-0.99%	0.2941	66.71%
Avratio3_	0.3992	0.4098	0.4093	-0.12%	0.5200	26.91%
mrevcot(2005)	0.0278	47314.0869	47326.0766	0.03%	49067.8092	3.71%
mrevcot(2008)	0.0344	47041.7410	47044.7842	0.01%	51377.8535	9.22%
mrevcot(2012)	0.0025	59568.3055	59231.9521	-0.56%	58011.6120	-2.61%

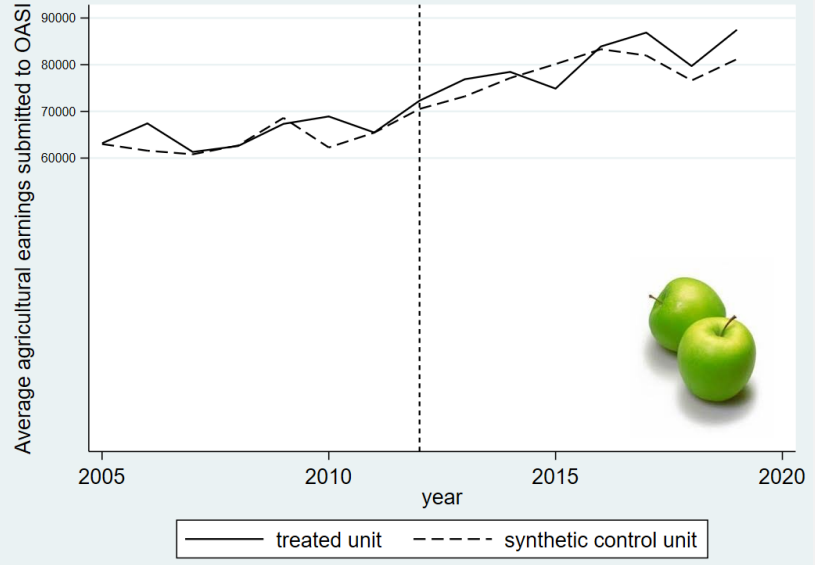
Preliminary Results: Canton/individual level (case 1 continued)




```
. reg Y park D_post c.park#c.D_post, vce(robust)

Linear regression                               Number of obs     =         30
                                                F(3, 26)          =      28.28
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7830
                                                Root MSE          =     3749.9

------------------------------------------------------------------------------
             |               Robust
           Y | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
        park |   -234.5453   2061.723    -0.11   0.910    -4472.479    4003.388
      D_post |    16172.56   2056.232     7.87   0.000     11945.91     20399.2
             |
c.park#c.D_post |  -8866.355   2703.339    -3.28   0.003    -14423.15   -3309.562
             |
       _cons |    51386.57   1445.267    35.56   0.000     48415.78    54357.36
------------------------------------------------------------------------------

. abar
Arellano-Bond test for AR(1): z =  -0.11  Pr > z = 0.9153
```

Preliminary results: Canton/individual level (case 2 - synthetic)






```
. reg Y park D_post c.park#c.D_post, vce(robust)

Linear regression                               Number of obs     =         30
                                                F(3, 26)          =      34.65
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7853
                                                Root MSE          =       4155

------------------------------------------------------------------------------
             |               Robust
           Y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        park |   1686.828   1475.58     1.14   0.263    -1346.269    4719.926
      D_post |   14527.48   1881.513    7.72   0.000     10659.97    18394.98
             |
c.park#c.D_post |  357.2242   2933.074    0.12   0.904    -5671.796    6386.244
             |
       _cons |   63489.23   1006.528   63.08   0.000     61420.28    65558.18
------------------------------------------------------------------------------

. abar
Arellano-Bond test for AR(1): z =   1.17  Pr > z = 0.2410
```

Preliminary conclusions and discussion

Overall, no difference in average agricultural earnings in park vs. non-park municipalities at the three levels (H_0 cannot be rejected)

In one case (canton/individual level) differences exist (H_0 could be rejected)

- What does it really mean?
  - Enough difference over time?
  - Park objectives/Mgmt. plan
  - Qualitative studies
  - Other impact evaluations/outcomes
  - Accountability
  - Knowledge management

Monitoring: data needs

- Outcome of interest – constraints
- Panel data – strongly balanced
- Data for long pre and post treatment periods
- Covariates/matching variables needed (omitted variable – farmers' skill)

Thank you for your attention

Merci de votre attention

Vielen Dank für Ihre Aufmerksamkeit

References and figure credits

References

- Abadie et al. 2010
- Dettmann et al. 2020

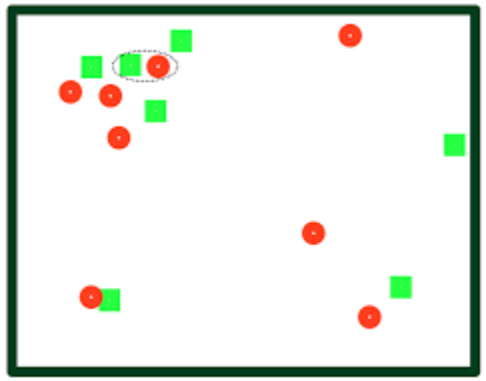
Figures/maps/pictures

- Picture: Naturpark Diemtigtal: ©Swiss Parks Network (modified)
- Map of Parks of National Importance: ©Swiss Parks Network 01/2023 - Data: Swiss Parks Network / Federal Office for the Environment FOEN, swisstopo
- Map of Geographical regions in Switzerland: Prof (Honorary) Mikhail Kanevski, UNIL; Multifractal Portrayal of the Swiss Population 2015
- Map geo admin: swisstopo, OFEV, cantons
- Picture: Oranges to apples
- Picture: Apples to apples
- Graph: Nearest Neighbor matching
- Dettmann et al. 2020
- Figure weights: SCM: Matteo Courthoud; Published in Towards Data Science; Jul 30, 2022
- Other figures and graphs: developed by the authors using Stata 17 or https://dagitty.net/dags.html#

FlexpanelDiD (Dettmann et al. 2020): How does it work?

- Several treated units with heterogenous treatment time (staggered treatment)
- Matches on covariates – Nearest Neighbor
- Conditional parallel trends assumption

- Uses ps-test, Kolmogorov-Smirnov test, Q.Q plot for normal distribution and matches diagnostics
- Estimation result for average treatment effect for the treated (ATT): with mean bias-corrected and corrected standard errors



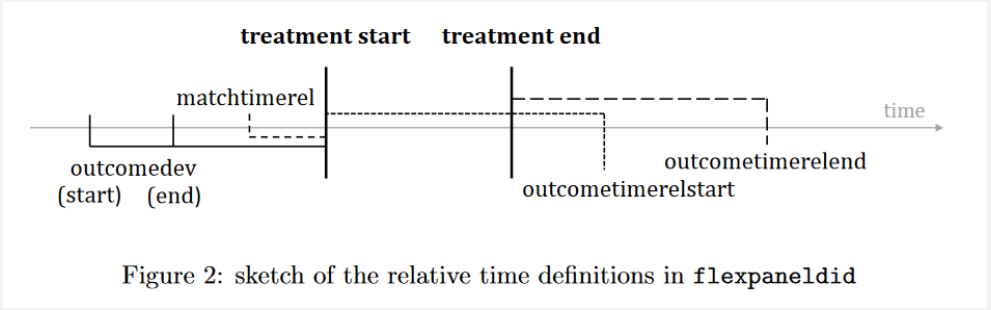
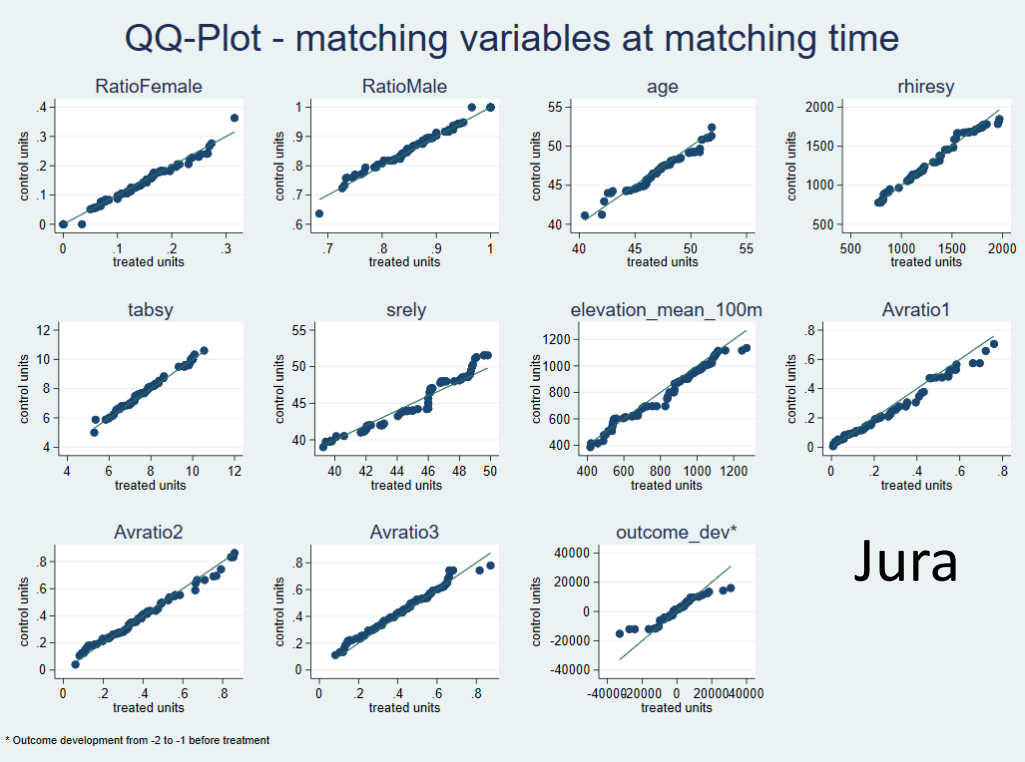


Figure 2: sketch of the relative time definitions in `flexpaneldid`

Preliminary results: Major bioregions



Jura

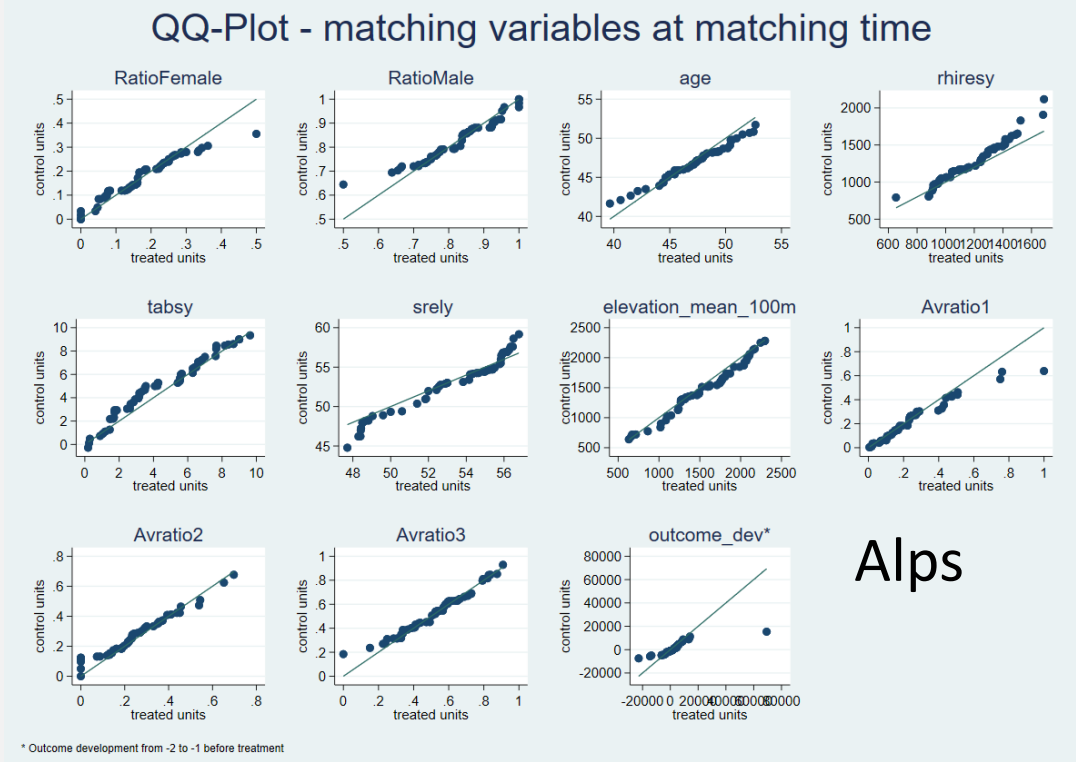
Average treatment effect for the treated

Estimator : Nearest neighbor
Distance metric : Statistical DF

No. of treated obs = 81
No. of unique controls = 53
Mean no. of matches = 1

Outcome	mean Diff treated	mean Diff controls	DiD*	AI robust S.E.	z	P>|z|
mrevcot	1.0e+04	1.1e+04	-7.2e+02	2.3e+03	-0.3142	0.7542

* Consistent bias-corrected estimator as proposed in Abadie & Imbens (2006,2011).



Alps

Average treatment effect for the treated

Estimator : Nearest neighbor
Distance metric : Statistical DF

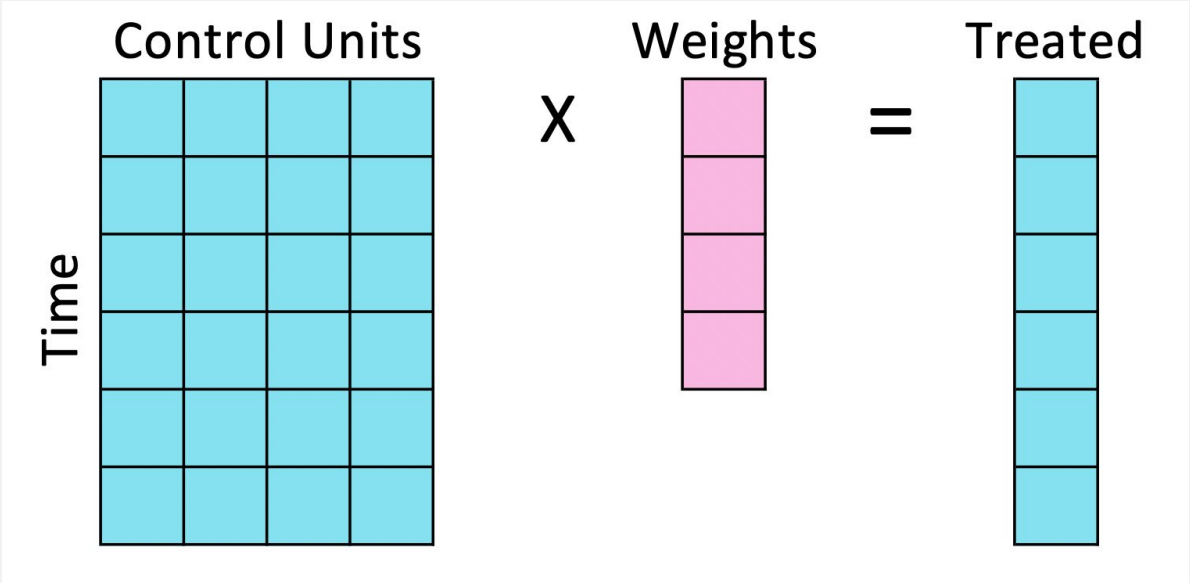
No. of treated obs = 54
No. of unique controls = 49
Mean no. of matches = 1

Outcome	mean Diff treated	mean Diff controls	DiD*	AI robust S.E.	z	P>|z|
mrevcot	7.7e+03	8.1e+03	-3.6e+02	2.6e+03	-0.1398	0.8893

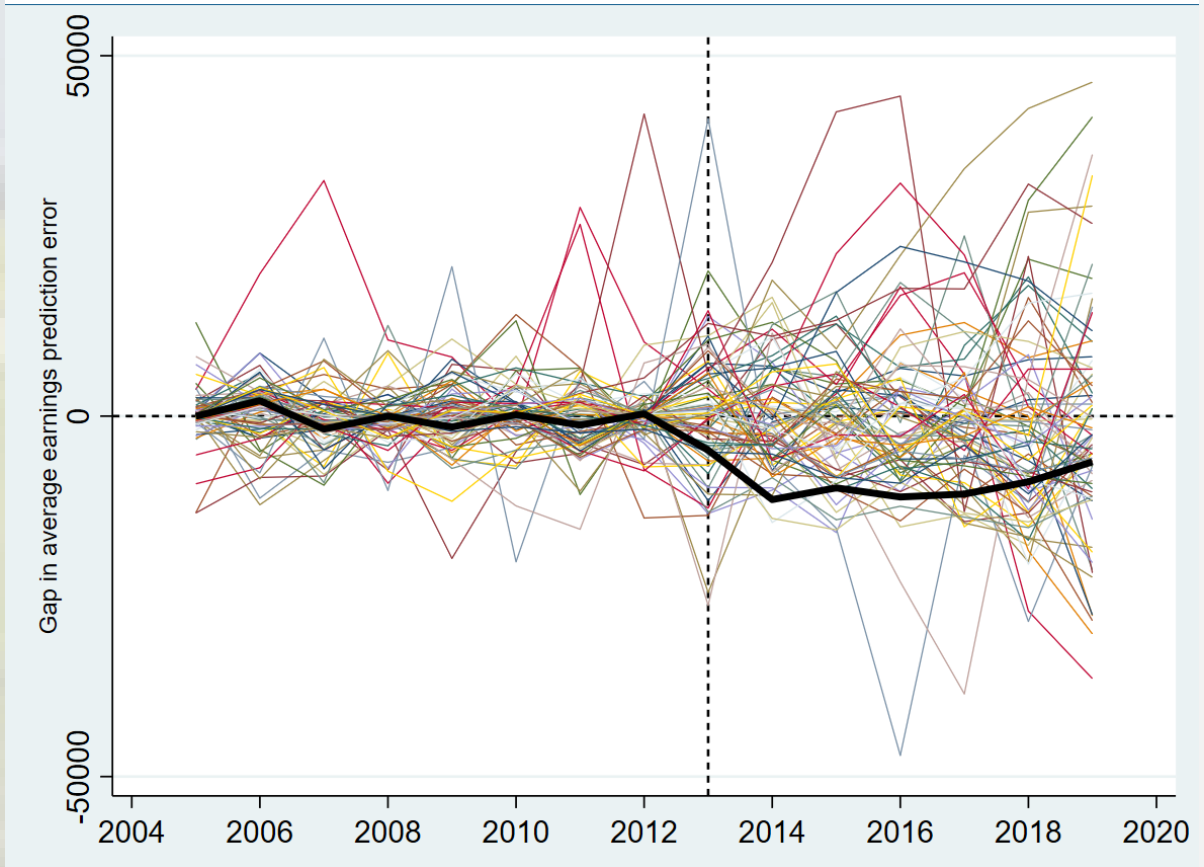
* Consistent bias-corrected estimator as proposed in Abadie & Imbens (2006,2011).

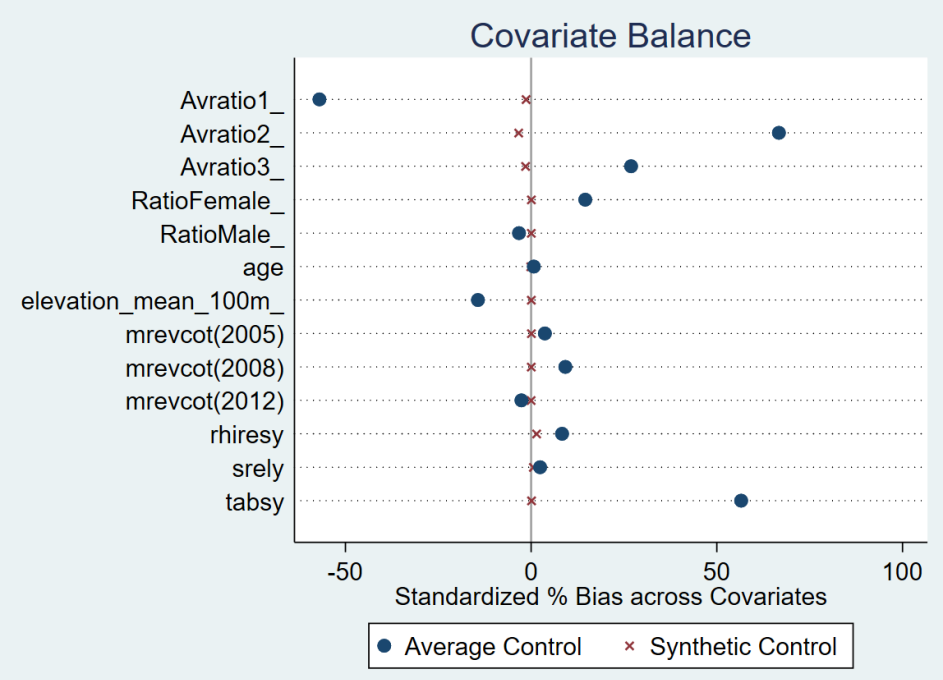
Synthetic control method (Abadie 2010): How does it work?

- One treatment unit (average) and several comparison units
- Matches on covariates, pretreatment (weights)
- Conditional parallel trends assumption
- Placebo tests (in space/in time)



Synthetic control method: (case 1 – placebo test)





The probability of obtaining a post/pretreatment MSPE ratio as large as the unit of treatment is 0.0128