A COUNTERFACTUAL APPROACH TO THE EVALUATION OF SCHOOL POLICIES: METHODS AND MODELS OF ANALYSIS

Author

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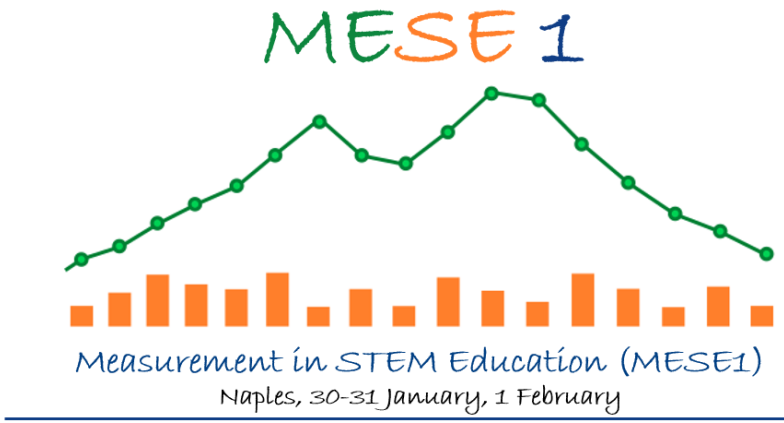

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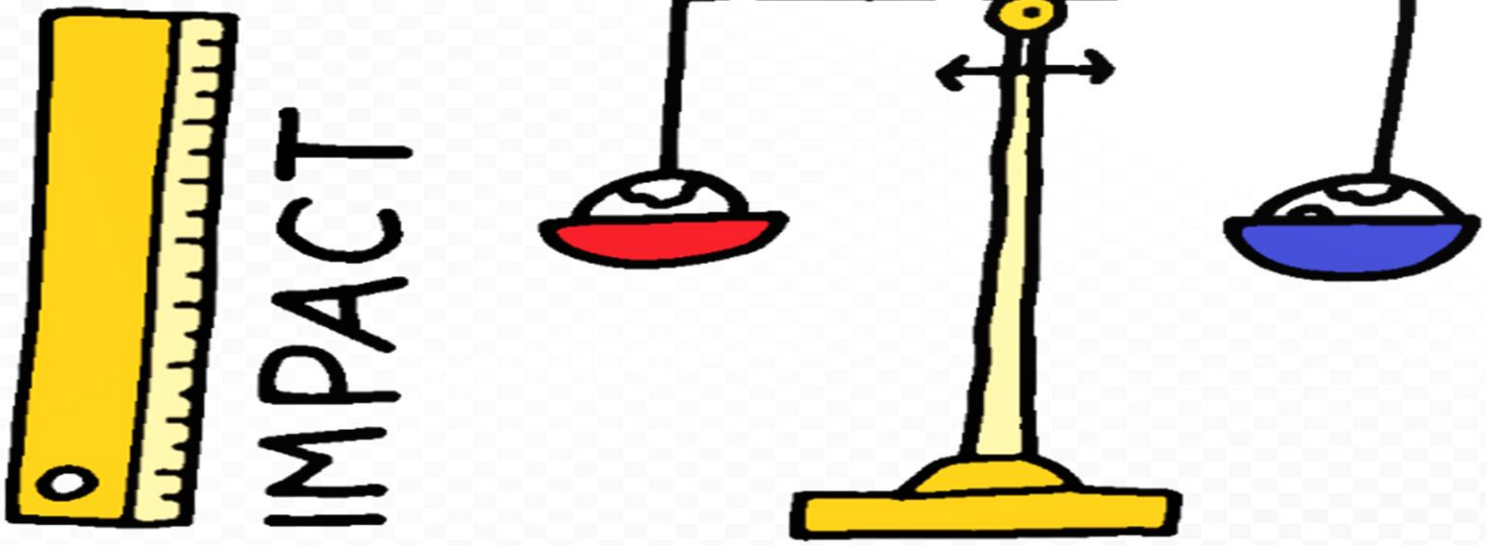
What is the impact assessment?

The purpose of the evaluation of the effects is to verify the ability of an intervention to modify the behaviors or conditions of a specific target population in the desired direction (Martini e Sisti, 2009).

- *Effect **on** what*
- *Effect **of** what*
- *Factual and counterfactual situation*



*Effect **on** what*

The first step is to define on which dimension (or which ones) the effects of the intervention are to be sought, therefore effect on what (**outcome variable**)

- School weakness indicator:

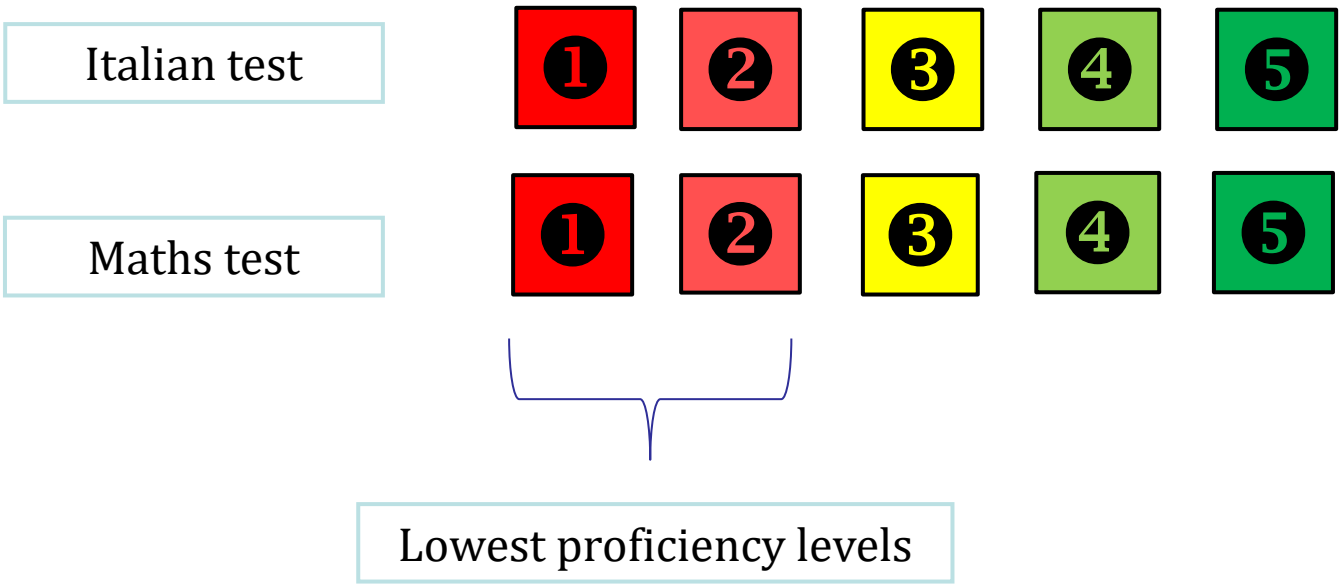
percentage of students at the lowest competence

*Effect **of** what*

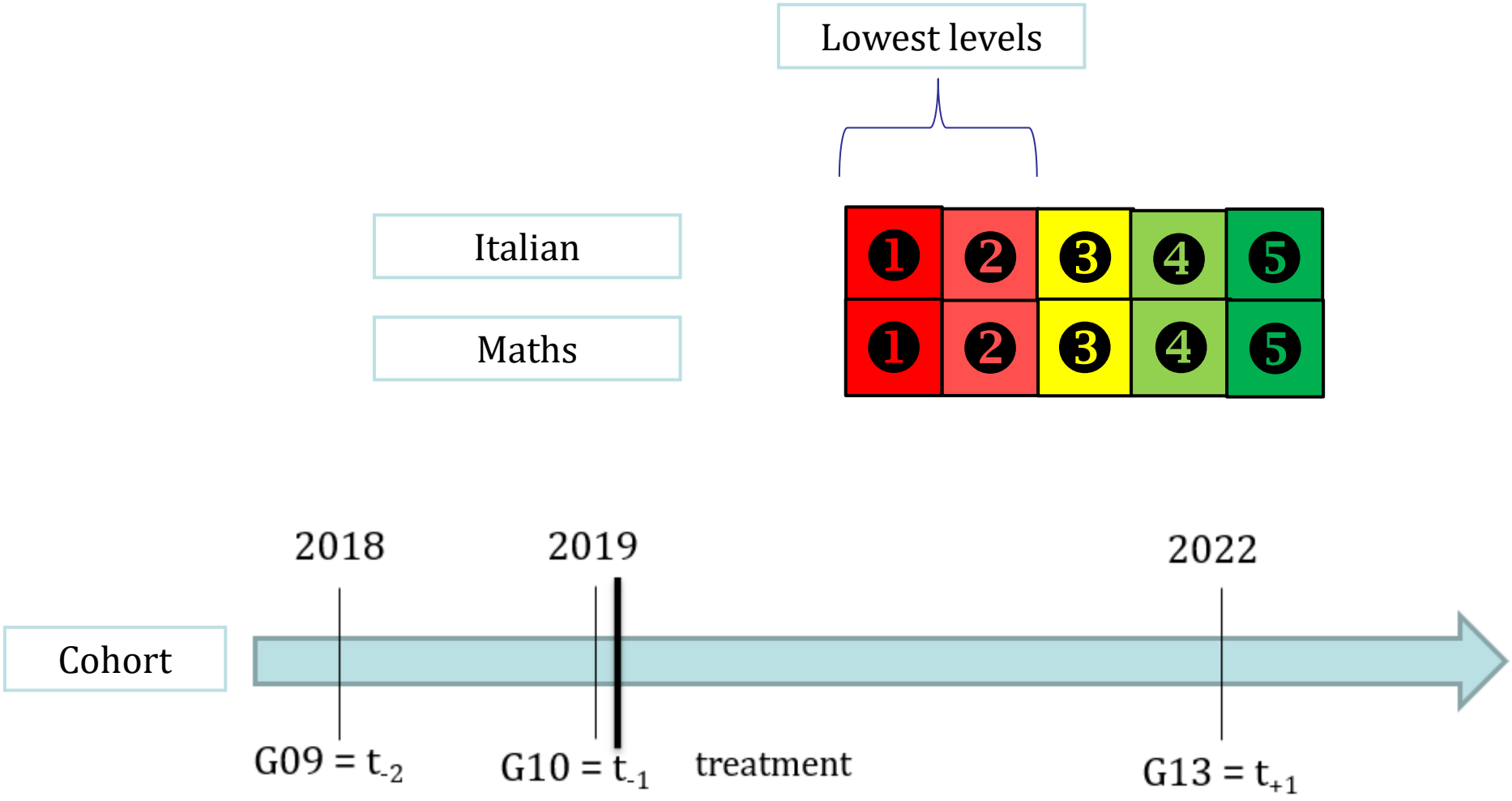
Binary variable: training courses for a specific group of students

T = group variable
- 0 = untreated school
- 1 = treated school

How to compute the outcome: test proficiency levels



How to compute the outcome: test proficiency levels



Dataset structure

	Istituto	indirizzo	Grado	anno	Indicatore_difficoltà_std	Indicatore_difficoltà	Trattato
1	RMIC000000	CLASSICO	9	2018	,33326	102,44	0
2	RMIC000000	LINGUISTICO	9	2018	,99954	140,63	0
3	RMIC000000	SCIENTIFICO	9	2018	,74046	69,77	0
4	RMIC000000	CLASSICO	10	2019	-,30714	102,44	0
5	RMIC000000	LINGUISTICO	10	2019	,30075	140,63	0
6	RMIC000000	SCIENTIFICO	10	2019	-,68754	69,77	0
7	RMIC000000	CLASSICO	13	2022	-,23409	102,44	0
8	RMIC000000	LINGUISTICO	13	2022	,33403	140,63	0
9	RMIC000000	SCIENTIFICO	13	2022	-1,04046	69,77	0

Statistical units

↓

3.089 Treated
3.998 Untreated

↓

Outcome

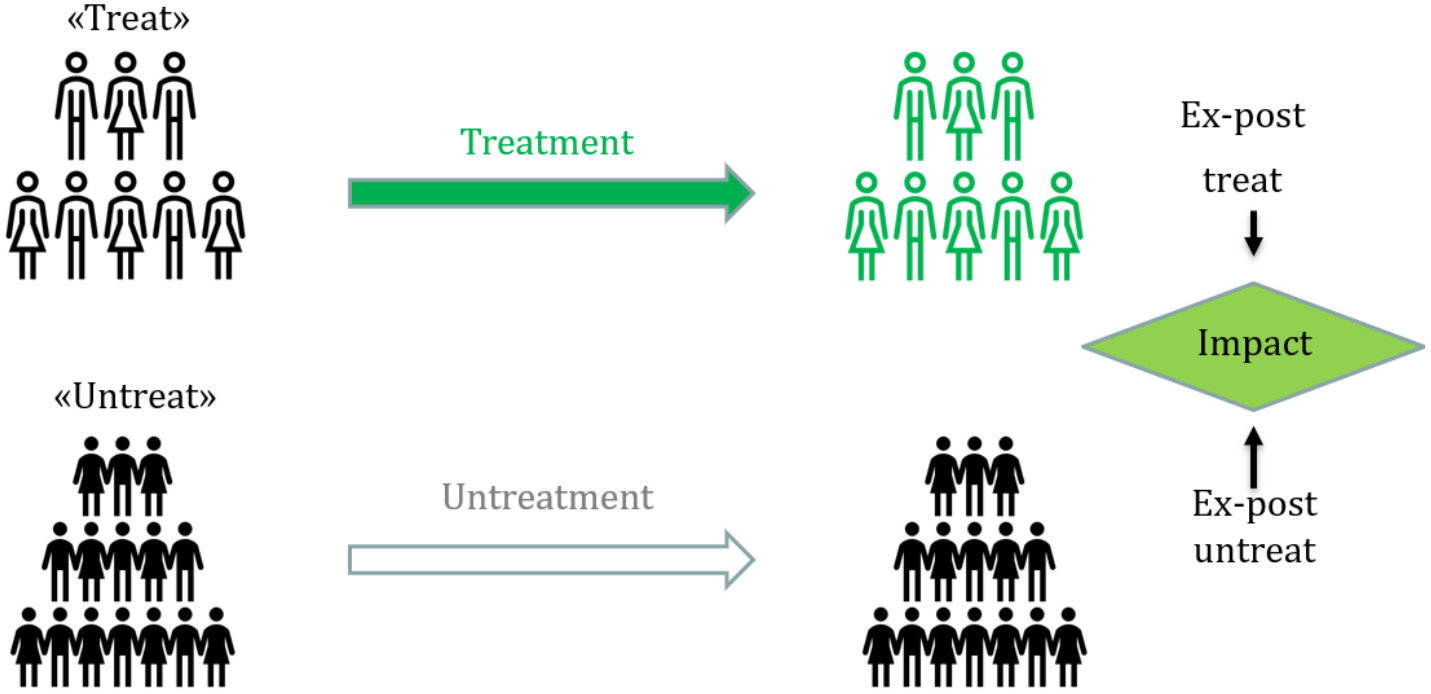
↓

% students at lowest levels (ita + math)

Effect of a policy

Effect = factual – counterfactual

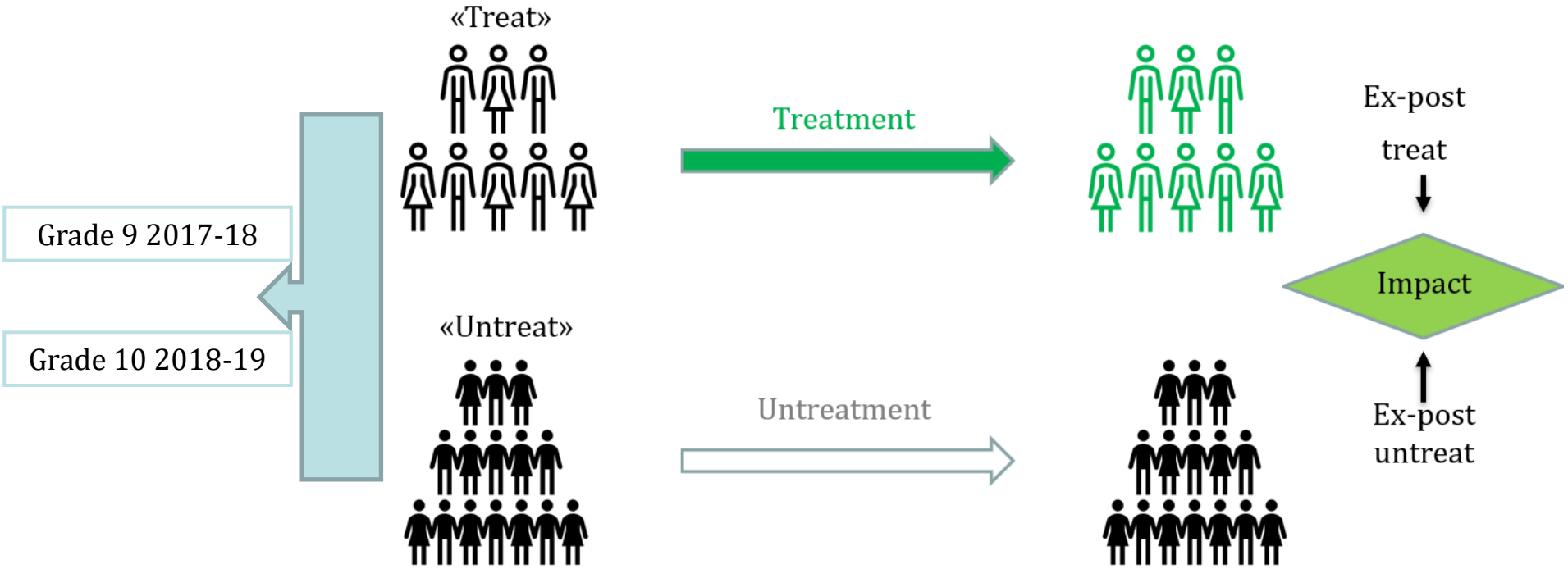
the factual value is the observed value on the outcome variable after administration of the treatment in the treated group, while the counterfactual value is an unobserved value that can be estimated on the basis of the possibility of obtaining a control group



How do we compute the counterfactual?

The counterfactual can be constructed according to the possibility of finding:

1) a control group;
2) measurements of the outcome variable in <u>one or more periods</u> prior to the introduction of the treatment of both groups.



Difference-in-Difference

The method used, difference-in-difference (Angrist & Pischke, 2009; Keele, 2020), makes it possible to estimate the average percentage of students at the lowest proficiency levels (both Italian and maths) of the group of schools considered in the hypothesis in which wouldn't have received the treatment (counterfactual).

Difference-in-Difference one period

$$y = \alpha + \beta T + \gamma P + \delta TP + \bar{\lambda}\bar{X} + \bar{\xi}T\bar{X} + \bar{\vartheta}P\bar{X}$$

ATT (Average treat of treatment)

P = time variable
- 0 = other
- 1 = observation t_{+1}

T = group variable
- 0 = control
- 1 = treated

$\bar{X}$ = control covariates
- School type (SCI, CLA, LIN, LI2, IT, IP);
- Pct_femmine_istituto;
- Pct_posticipatari;
- Pct_stranieri;
- ESCS (Economic, Social and Cultural Status index);
- Territorial context (province)

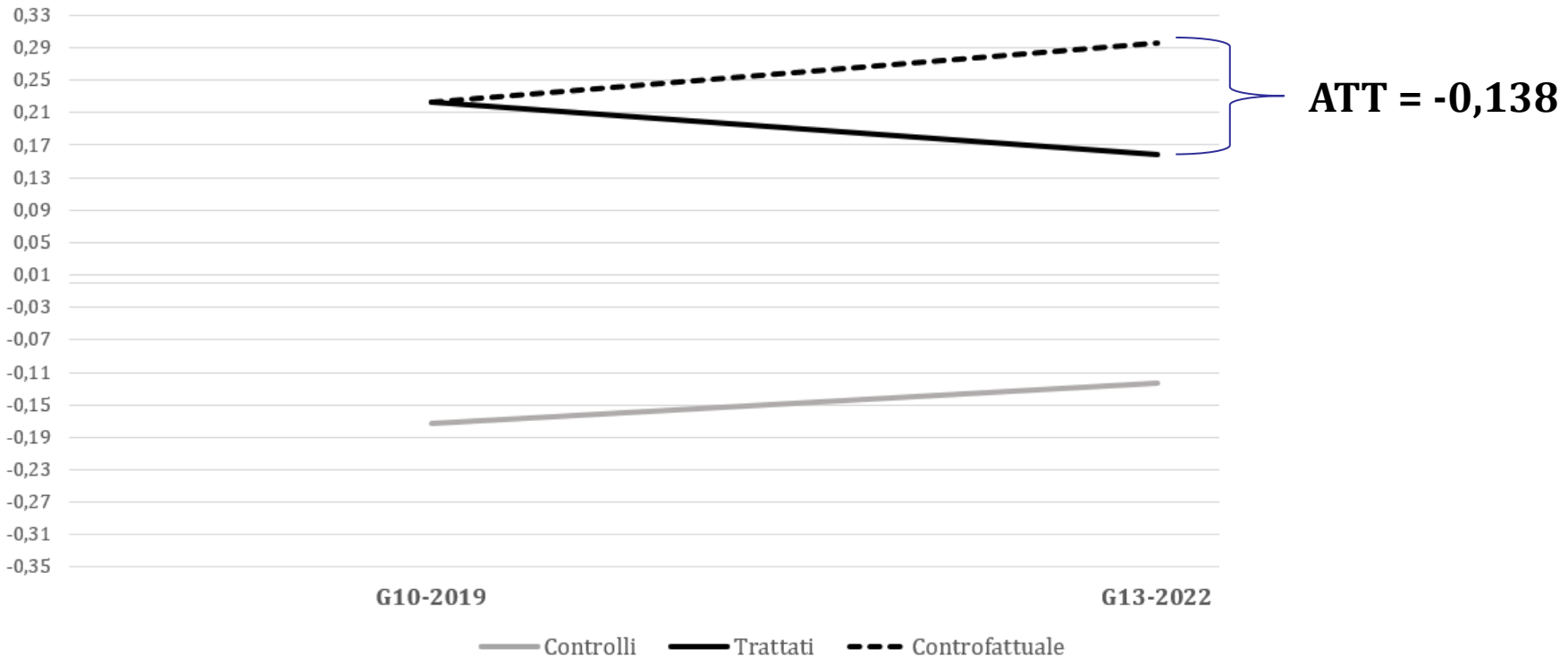
Difference-in-Difference one period - results

	Coefficienti non standardizzati		Coefficienti standardizzati		
	B	Errore standard	Beta	t	Sign.
(Costante)	,680	,119		5,722	<,001
T	,462	,170	,230	2,720	,007
P	-,025	,152	-,012	-,162	,871
TP	**-,138**	**,027**	**-,057**	**-5,164**	**<,001**
ESCS_istituto_cntr	-,065	,029	-,026	-2,249	,025
Pct_Femmina_scu	-,029	,006	-,072	-5,086	<,001
Pct_Straniero_scu	,090	,014	,073	6,192	<,001
Pct_Posticipatario_scu	-,093	,006	-,200	-15,197	<,001
SCI	-1,788	,040	-,733	-44,218	,000
CLA	-1,720	,051	-,498	-33,499	<,001
LI2	-,685	,043	-,247	-15,967	<,001
LIN	-1,205	,047	-,390	-25,846	<,001
IT	-,890	,034	-,394	-26,481	<,001
T_SCI	,089	,048	,026	1,851	,064
T_CLA	,125	,063	,023	1,981	,048
T_LIN	,096	,057	,021	1,689	,091
T_LI2	,134	,052	,033	2,568	,010
T_IT	,162	,040	,055	4,058	<,001
P_SCI	,350	,048	,108	7,339	<,001
P_CLA	,224	,062	,047	3,641	<,001
P_LIN	,282	,056	,067	5,052	<,001
P_LI2	,205	,051	,054	3,988	<,001
P_IT	,248	,040	,084	6,270	<,001
AG	1,145	,147	,119	7,767	<,001

$$y = \alpha + \beta T + \gamma P + \delta TP + \bar{\lambda}\bar{X} + \bar{\xi}T\bar{X} + \bar{\vartheta}P\bar{X}$$

R	R-quadrato	R-quadrato adattato
,720[a]	,518	,506

Difference-in-Difference one period - results



	G10-2019	G13-2022	diff
Controlli	-0,17	-0,12	0,05
Trattati	**0,22**	**0,16**	**-0,06**
Controfattuale	0,22	0,30	0,07

Difference-in-Difference two periods

$$y = \alpha + \beta T + \gamma_1 P_1 + \gamma_2 P_2 + \delta_1 T P_1 + \delta_2 T P_2 + \bar{\vartheta}\bar{X} + \bar{\varphi} T\bar{X} + \bar{\lambda} P_1 \bar{X} + \bar{\xi} P_2 \bar{X}$$

ATT $\delta_2 - 2\delta_1$

P_2 = time variable
- 0 = other
- 1 = observation t_{+1}

P_1 = time variable
- 0 = other
- 1 = observation t_{+1}

$\bar{X}$ = control covariates
- <u>School type (SCI, CLA, LIN, LI2, IT, IP);</u>
- <u>Pct_femmine_istituto;</u>
- <u>Pct_posticipatari;</u>
- <u>Pct_stranieri;</u>
- <u>ESCS (Economic, Social and Cultural Status index);</u>
- <u>Territorial context (province)</u>

T = group variable
- 0 = control
- 1 = treated

Difference-in-Difference two period - results

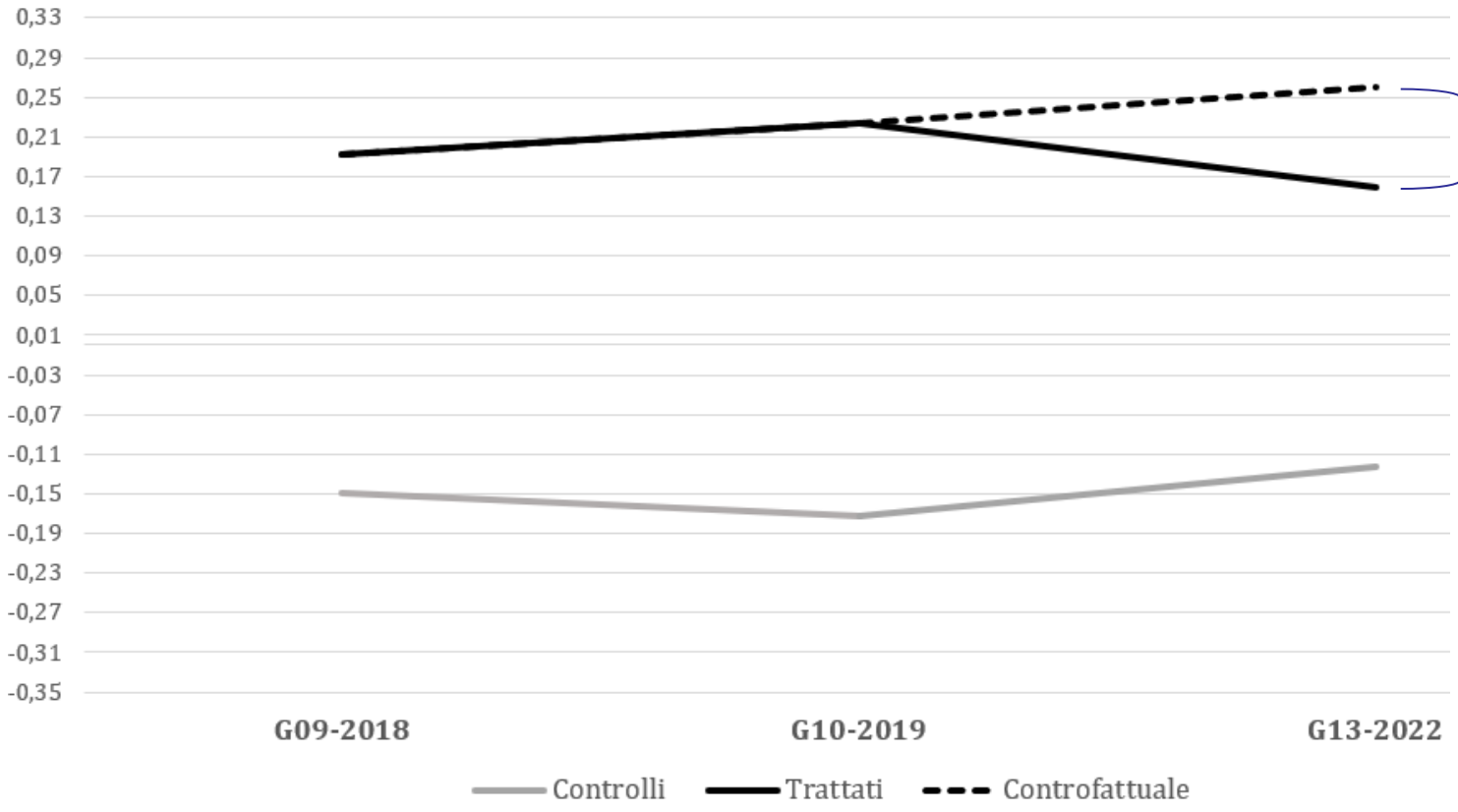
	Coefficienti non standardizzati		Coefficienti standardizzati		
	B	Errore standard	Beta	t	Sign.
(Costante)	,405	,121		3,339	<,001
T	,519	,146	,258	3,546	<,001
P1	,235	,160	,111	1,467	,143
P2	,210	,160	,099	1,313	,189
TP1	**,036**	**,028**	**,013**	**1,301**	**,193**
TP2	**-,101**	**,028**	**-,036**	**-3,603**	**<,001**
ESCS_istituto_cntr	,021	,029	,008	,703	,482
Pct_Femmina_scu	-,034	,006	-,086	-5,976	<,001
Pct_Straniero_scu	,062	,015	,051	4,220	<,001
Pct_Posticipatario_scu	-,076	,006	-,164	-12,449	<,001
SCI	-1,464	,040	-,600	-36,258	<,001
CLA	-1,486	,052	-,430	-28,845	<,001
LI2	-,600	,043	-,216	-13,962	<,001
LIN	-1,140	,047	-,369	-24,415	<,001
IT	-,725	,034	-,320	-21,609	<,001
T_SCI	,071	,042	,021	1,717	,086
T_CLA	,074	,054	,014	1,366	,172
T_LIN	,099	,049	,021	2,028	,043
T_LI2	,134	,045	,033	2,981	,003
T_IT	,155	,034	,052	4,502	<,001
P_SCI	,037	,050	,009	,733	,463
P_CLA	,013	,065	,002	,198	,843
P_LIN	,219	,059	,043	3,736	<,001
P_LI2	,122	,054	,027	2,257	,024
P_IT	,086	,042	,024	2,067	,039
AG	1,114	,149	,116	7,483	<,001

$$y = \alpha + \beta T + \gamma_1 P_1 + \gamma_2 P_2 + \delta_1 T P_1 + \delta_2 T P_2 + \bar{\vartheta}\bar{X} + \bar{\varphi} T \bar{X} + \bar{\lambda} P_1 \bar{X} + \bar{\xi} P_2 \bar{X}$$

$$\text{ATT} \quad \delta_2 - 2\delta_1$$

R	R-quadrato	R-quadrato adattato
,681[a]	,464	,452

Difference-in-Difference two period - results



ATT = - 0,101

↓

≈ 49%

	G09-2018	G10-2019	G13-2022	diff
Controlli	-0,15	-0,17	-0,12	0,05
Trattati	**0,19**	**0,22**	**0,16**	**-0,06**
Controfattuale	0,19	0,22	0,26	0,04

Conclusion

1) The statistical techniques used for impact assessment can be a useful tool for measuring the effectiveness of policies activated following the allocation of structural funds against school dropout phenomenon

2) The possibility of finding more information (even about the treatment), relating to students, would allow to isolate any confounding factors that affect the outcomes, such as participation in other curricular or extra-curricular projects

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future developments

1) Compute other types of models such as quantile regression to limit the impact to particular points in the distribution of the outcome variable;
2) cluster the units in order to differentiate the impact by school category;
3) ... any suggestions?

Thanks for your attention!

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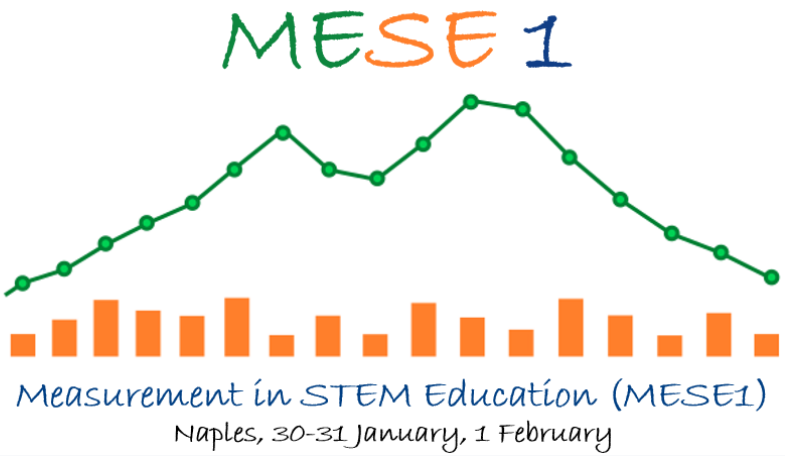

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