An earthquake as a lab

Evidences from 2009 Abruzzo

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”If you want to understand geology, study earthquakes, if you want to understand economics, study the biggest calamity to hit the U.S. and world economies.”
(B. Bernanke)

Introduction

Abruzzo's Earthquake

The event

April 6th, 2009 at 3:32 a.m.: an earthquake 6.3 on the moment magnitude scale hit Abruzzo.

Policy intervention

Decreto Abruzzo with a potential impact on labor market

Literature

Employment rate dropped together with the unemployment rate. Heterogeneous effects on employment outcomes by education and gender [1] [2]

Let’s get the hands dirty!

Research Question

Has the earthquake impacted labor market (annual labor income) despite the policy intervention? Is there any asymmetric impact?

Motivations

1. Earthquakes periodically affect Italy: positive knowledge is prerequisite for normative judgement on the policy
2. The earthquake is a test on the policies to reduce the gender gap in the labor market

Methodology

DiD: an intuition

Treatment group

whole Abruzzo

Control groups

1. Molise, Lazio
2. Marche
3. Puglia, Campania, Toscana

Assumptions

1. Parallel trend ▸ check it!
2. No spillover (damages and migrations, á la Aragon Rud 2013)
3. No participation effect (admin data) ▸ check it!

Data and variables

1. admin data provided by Inps (in the lit: LFS)
   - legal working population
   - data from 2006 to 2010 (up to 2016 for the event study)
2. we are interested in annual labor income
   - income=0 if unemployed and missing income
   - measurement error
3. ATECO 2007 sections
   - outcome variable too: partially bad control $\rightarrow$ extension of the model
   - exclude some sections based on economic reasoning and data (robust results) ▸ check the data!

Econometric model (estimation via Ols)

$$\mathbb{E}Y_{rti} = \vartheta_r + \vartheta_t + \rho\mathbb{T}_{rt} + \alpha_0\mathbb{F}_i + \sum_{R/\{Abruzzo\}} \alpha_r\mathbb{F}_i + \delta\mathbb{T}_{rt}\mathbb{F}_i + \sum_{j=2007}^{2016} \alpha_j\mathbb{F}_i + \sum_{R/\{Abruzzo\}} \tau_r t$$

$$\mathbb{T} \equiv \mathbb{I}(r = \text{Abruzzo},\ 2009 \leq t \leq 2010)$$

Legenda

1. $Y \rightarrow$ annual income
2. i: individual, t: time, r: region
3. $\vartheta_r \rightarrow$ region FE
4. $\vartheta_t \rightarrow$ time FE
5. $\mathbb{T} \rightarrow$ dummy treatment "earthquake" in Abruzzo (2009-10)
6. $\mathbb{F} \rightarrow$ dummy female
7. $\tau_r t \rightarrow$ pre-existing different linear time trend (Besley Burges 2004, Wolfers 2006)

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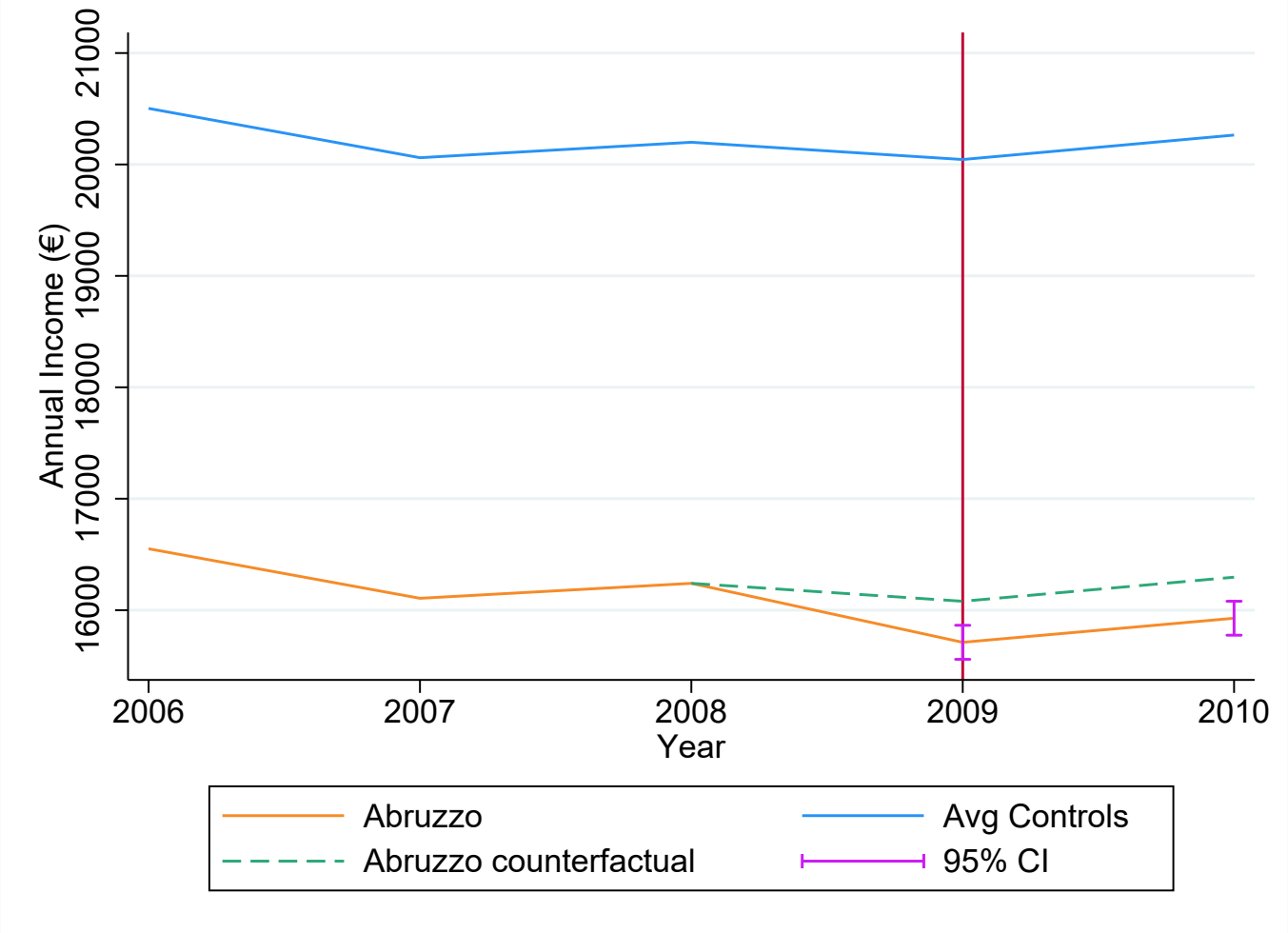
Remarks

1. clustered standard errors at individual level
2. an event study model too ▸ for the math!

Results

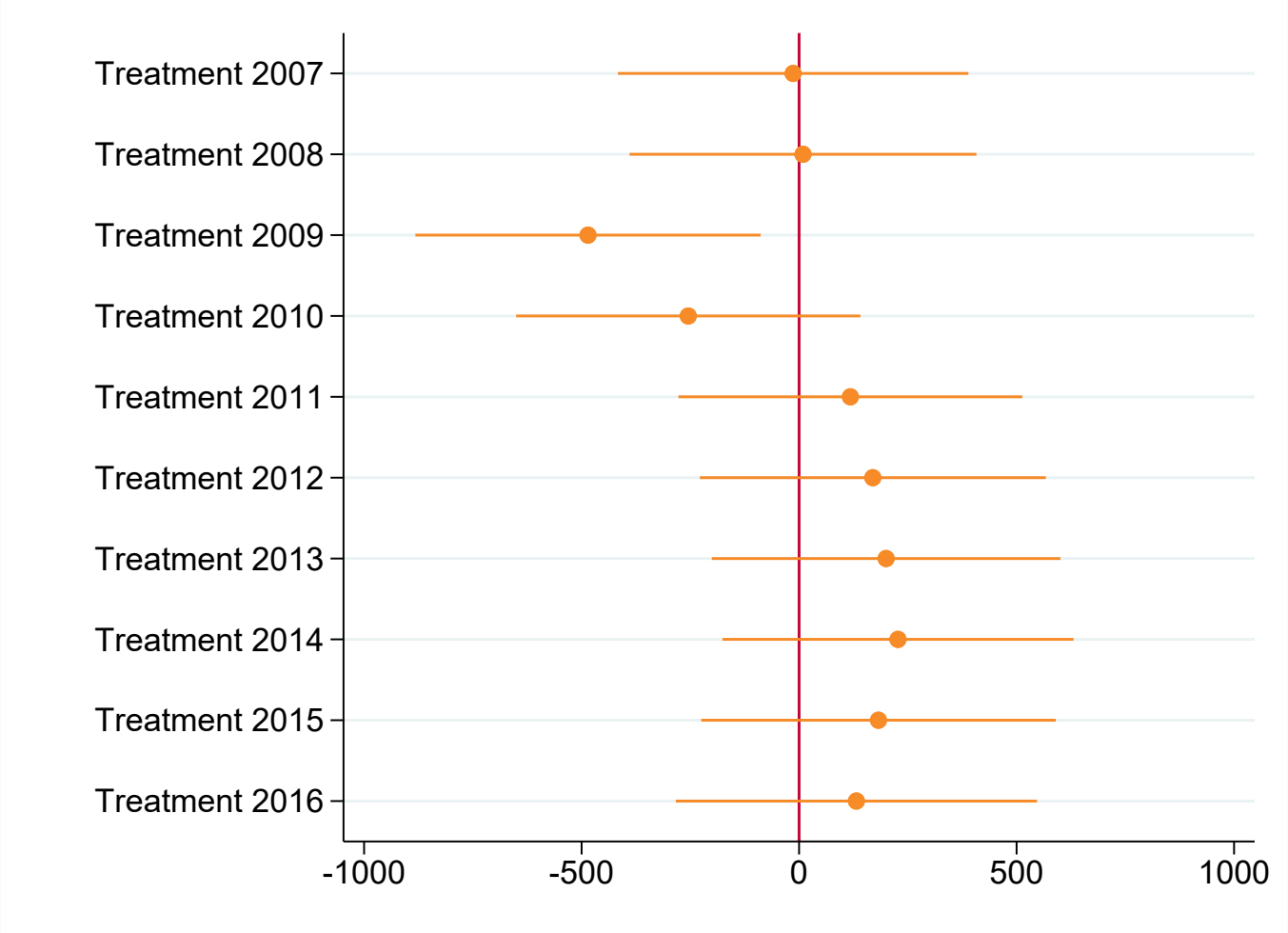
Predicted DiD

Figure 1: Ols prediction of the DiD model (Treatment: Abruzzo - Control: Lazio and Molise) with no additional covariates on the whole sample from 2006 to 2010



Event study graph

Figure 2: Ols estimated coefficients of the DiD model (Treatment: Abruzzo - Control: Lazio and Molise) with no additional covariates and one treatment dummy per period on the whole sample from 2006 to 2016. 95% CI



Results

	(1) Ols	(2) Ols	(3) Ols	(4) Ols	(5) Ols	(6) Ols	(7) Ols	(8) Ols	(9) Ols
Baseline ρ	-368.4***	1,611	-708.0***	-435.6***	-706.2***	-530.8***	-667.2**	-560.2**	-554.6**
	(123.6)	(1,379)	(253.2)	(141.1)	(133.7)	(114.1)	(286.5)	(266.4)	(227.3)
Treatment ρ	-332.5	1,606	-596.5	-380.3	-615.5**	-538.3**	-709.8**	-569.6**	-641.1***
	(300.1)	(2,902)	(683.3)	(264.5)	(255.5)	(235.3)	(275.9)	(263.7)	(244.8)
Treatment#Female δ	42.13	-373.5	14.42	34.62	33.84	155.9	61.08	18.94	199.1
	(406.5)	(3,787)	(892.2)	(401.2)	(388.2)	(364.0)	(404.1)	(388.1)	(364.1)
Observations	718,692	8,095	93,337	555,331	674,271	1,494,793	539,843	674,271	1,494,793
Lazio	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Molise	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Marche	No	No	No	No	Yes	Yes	No	Yes	Yes
Campania	No	No	No	No	No	Yes	No	No	Yes
Puglia	No	No	No	No	No	Yes	No	No	Yes
Toscana	No	No	No	No	No	Yes	No	No	Yes
Positively Impacted Ateco	No	Yes	No	No	No	No	No	No	No
Negatively Impacted Ateco	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Neutrally Impacted Ateco	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Linear time trend	No	No	No	No	No	No	Yes	Yes	Yes

Standard errors in parenthesis for the Baseline - Clustered standard errors in parentheses for the Extension

*** p<0.01, ** p<0.05, * p<0.1

A brief comment

1. The impact is robust across specifications (with the exception of the Ateco sections excluded in extension)

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1. The impact is robust across specifications (with the exception of the Ateco sections excluded in extension)
2. The impact is not only statistically significant but also economically significant. For the baseline model: about 2.3% with respect to 2008 income.
3. In the baseline the impact is less pronounced:
    - exclusion of some Ateco
    - further analysis needed

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3. In the baseline the impact is less pronounced:
   - exclusion of some Ateco
   - further analysis needed
4. scarce differences for gender
   - more controls are needed (more blurred event study graph)
   - survey data may be better
   - consistent with the lit

Conclusion

Limitations

1. annual labor income for legal workers
2. Cassa Integrazione Guadagni
3. family composition and education level
4. city level data + migrations
5. solution: use LFS to replicate the study

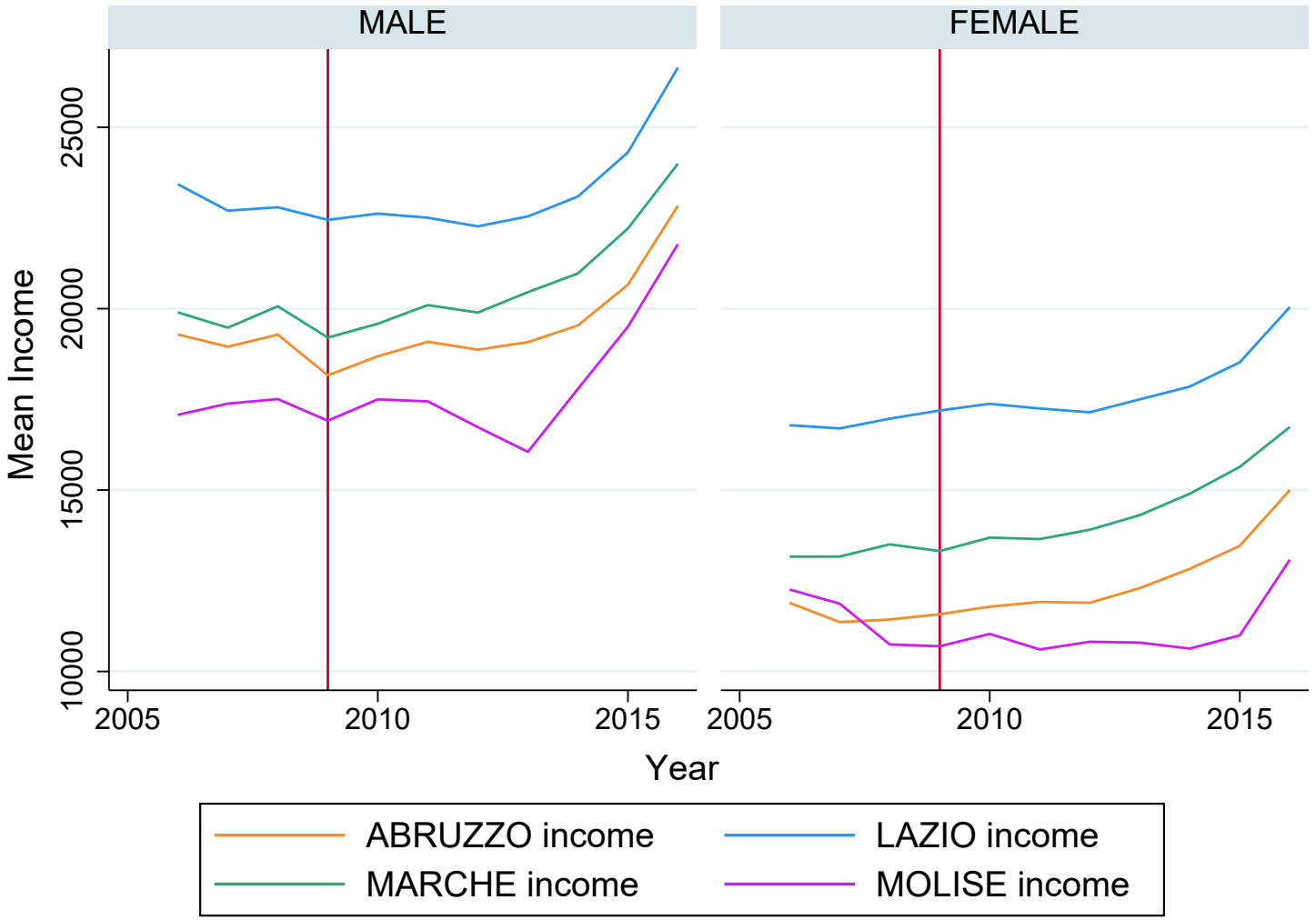
Further Research

1. explore the different gender impact using data on families
2. explore the effects on income of newly hired workers
3. explore the effects on neighboring regions using city level data and data on internal migrations
4. shed light on sectoral differences (IV Ateco with Ateco before treatment)
5. inequality (instead of average income consider the distribution)

Questions?

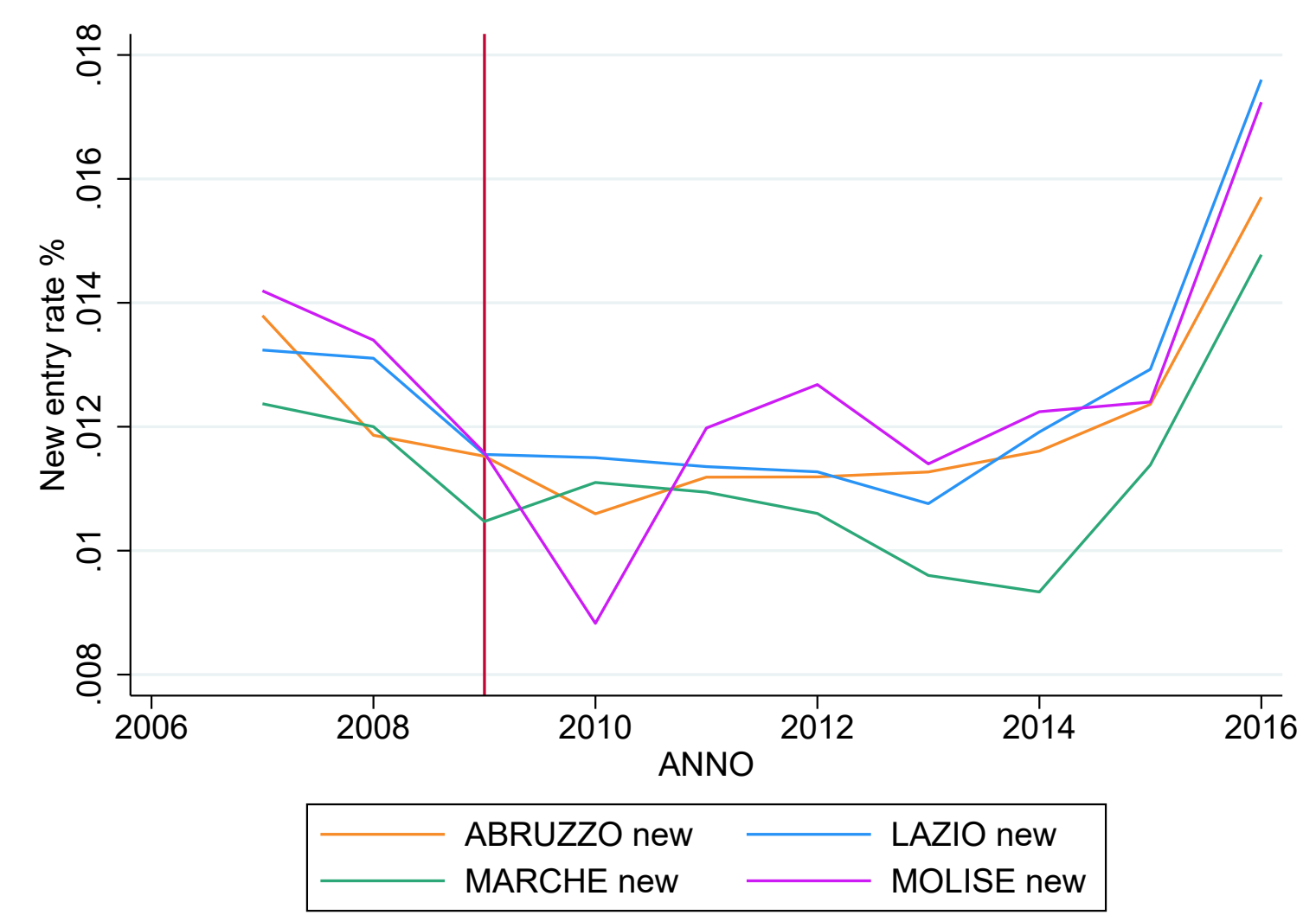
Parallel trend

DiD idea



(Proxy) of entry rate in the dataset

DiD idea



Ateco sections selection

Data & Variables

Table 1: Ols estimate of the baseline DiD (Treatment: Abruzzo - Control: Lazio and Molise), using as dependent variable the proportion of workers in each Ateco sections. Whole sample from 2005 to 2010 and without any imputation of income. Only results with $p < 0.075$ are reported

Ateco section	P-value	Coefficient
A - Agriculture	0.0011	0.0026
I - Accommodation & Catering	0.0091	-0.0077
L - Real Estate	0.0442	-0.0013
N - Admin & Support	0.0605	-0.0066
O - P.A. & Defense	0.0134	0.0043
R - Artistic & Entertainment	0.0565	0.0023

Event study (estimation via Ols)

Model specification

$$\mathbb{E}Y_{rti} = \vartheta_r + \vartheta_t + \alpha_0 \mathbb{F}_i + \sum_{R/\{Abruzzo\}} \alpha_r \mathbb{F}_i + \sum_{j=2007}^{2016} \rho_j \mathbb{T}_{j,rt} +$$

$$\sum_{j=2007}^{2016} \left(\delta_j \mathbb{F}_i \mathbb{T}_{jrt} + \alpha_j \mathbb{F}_i\right) + \sum_{R/\{Abruzzo\}} \tau_r t$$

$$\mathbb{T}_j \equiv \mathbb{I}(r = \text{Abruzzo}, t = j)$$

References i

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