When did coronavirus arrive in Europe?

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Abstract

The first cluster of coronavirus cases in Europe was officially detected on 21st February 2020 in Northern Italy, even if recent evidence showed sporadic first cases in Europe at the beginning of the year. In this study we have tested the presence of coronavirus in Italy and, even more importantly, we have assessed whether the virus had already spread sooner than 21st February. We use a counterfactual approach and certified daily data on the number of deaths (deaths from any cause, not only related to coronavirus) at the municipality level. Our estimates confirm that coronavirus began spreading in Northern Italy at least a week before the beginning of February.

Keywords: Coronavirus; Europe; Counterfactual approach

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1 Introduction

Recent evidence shows sporadic first cases of coronavirus (SARS-CoV-21) in Europe at the beginning of 2020. In particular, it has been recently confirmed that a patient hospitalized on 27th December for suspected pneumonia near Paris had coronavirus.[1] Likewise, a German businessman with mild symptoms tested positive with coronavirus on the 27th January 2020 (Rothe et al. 2020). The first official case in Italy was detected on 21st February 2020 in the Northern area. Nevertheless, there is increasing anecdotal evidence that the virus might have reached Italy sooner with a consequent early spread leading to the explosion of the pandemic in late February. According to a survey conducted by the television broadcast Report, aired on 30th March, it seems that there had already been a large number of pneumonia cases at the start of 2020 in Northern Italy, particularly in Piacenza (Emilia-Romagna), located 18 Km from Codogno (Lombardy) where the first Italian case of coronavirus was officially reported. A press review identifies that on 30th December Piacenza Hospital had 40 cases of pneumonia in the previous week and on 7th January Milan had a peak of pneumonia cases with requests for extra hospital beds.[2] These pneumonia cases had similar characteristics to interstitial pneumonia caused by coronavirus, even if no tests were done to confirm the virus that caused them. In fact, medical professionals did not attribute these cases to coronavirus. The medical protocols to test for the presence of the virus involved not only that the patient had respiratory problems, but also that he/she had come from China, or that he/she was in contact with people coming from China. This means that as those infected spread the disease, everybody was looking for patient zero, i.e., the patient coming from China, but nobody was looking at the patient one, i.e., the patient not directly connected with China. The possibility that the virus might have spread in Italy long before 21st

[1] $https://www.france24.com/en/20200505 - france - s - first - known - covid - 19 - case - was - in - december$

[2] $https://www.liberta.it/news/cronaca/2019/12/30/pneumologia - presa - dassalto - oltre - 40 - casi - di - polmonite - nellultima - settimana$
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$https://milano.corriere.it/notizie/cronaca/20_gennaio_07/influenza - ospedali - sotto - assedio - piu - 27 - cento - picco - polmoniti - 04404f04 - 30bf - 11ea - b117 - 147517815558.shtml.$

February is quite likely also considering that from 17th November, i.e., the date of the first case in Wuhan (China) to 31st January, i.e., the date in which Italy suspended flights to and from China, there were 203.894 arrivals from China, of which 15.400 from Wuhan to Fiumicino (Rome) and 125.000 to Malpensa (Milan). Moreover, by analysing the first 5,830 laboratory-confirmed cases in Lombardy through standardized interviews of confirmed cases and their close contacts, Cereda et al. (2020) estimate that the virus reached Southern-Lombardy around a week before the case of Codogno.

The purpose of this paper is to assess the plausibility that coronavirus spread in Italy before 21st February and to investigate approximately when. In light of anecdotal evidence, in the main analysis, we focus on Piacenza as a case study, while we report the analysis on other municipalities at the bottom of the paper. We analyze official daily data on the number of deaths made available by the Italian National Institute of Statistics (Istat)[3] for 6,866 municipalities for the period 1st January - 30th March 2020. Therefore, we need to compare Piacenza with a scenario where Piacenza was not hit by the virus until 21st February 2020. To this aim, we must estimate a valid counterfactual scenario using as control group municipalities with similar characteristics to Piacenza, but which are less likely to have been affected by the virus before 21st February 2020. Counterfactual approaches are usually adopted to estimate the impact of a specific policy change on an outcome of interest. In this paper, we make unconventional use of this evaluation approach as we consider as policy change the possible diffusion of coronavirus in Piacenza earlier than 21st February 2020. The method adopted is the trajectory balancing method, recently developed by Hazlett and Xu (2018). Considering that the data is available from 1st January, we use as potential date for the beginning of the coronavirus in Italy the 21st of January. This choice is a trade-off between available data and having at least pre-treatment time periods to estimate the counterfactual scenario. The preliminary results show that in Piacenza there have been unexpected deaths since the onset of February and that by 21st February there have been about 19 deaths more than the counterfactual situation. This

[3]The mortality data recorded by the individual municipalities are acquired within the information system managed by the Ministry of the Interior and then transmitted to Istat, which processes and validates the data.

means that the virus probably spread in Italy at least a week before the beginning of February and that by 21st February several hundred individuals were already infected (even assuming a high mortality rate, such as 10%). A placebo test and several robustness checks confirm the statistical significance of this estimate.

2 Methodology

In order to assess if coronavirus was present in Piacenza earlier than 21st February 2020, we adopt a novel counterfactual approach, the trajectory balancing method developed by Hazlett and Xu (2018). Trajectory balancing is a general reweighting approach for causal inference which builds upon the synthetic control method (SCM), developed by Abadie and Gardeazabal (2003) and Abadie et al. (2010), enabling to estimate the treatment effect in the presence of one or few treated units. The idea behind trajectory balancing is that in a difference-in-differences (DiD) setting, is possible to construct, transparently, a "synthetic" counterfactual unit that can better mimic what would have happened to the treated unit in the absence of treatment. The "synthetic" unit is built as a weighted average of control units whose pre-treatment characteristics closely match that treated unit. Therefore, this method allows constructing a "synthetic" Piacenza, i.e. what would have happened to the number of deaths in Piacenza in the absence of coronavirus. If the death trend of the "synthetic" Piacenza moves away from the counterfactual estimate before 21st February 2020, we might argue that there were people infected by coronavirus before this, official, date. We use the Italian municipalities with similar characteristics to Piacenza to construct the counterfactual scenario. Thus, the treatment effect, in each post-treatment period ($t > T_0$), is given by the difference between the average of post-treatment outcomes of treated units and the "synthetic" control unit, as follows:

$$\widehat{ATT}_t = Y_{it} - \sum_{G_i=0} w_i Y_{it}, \qquad T_0 < t \leq T,$$

where G_i is the group indicator, equal to 1 if i belongs to the treated group, and equal to 0 if i belongs to the control group, and Y_{it} is the outcome variable of unit i at time t, w_i is the control weight. The Average Treatment Effect before 21st February represents the unexpected deaths due to coronavirus. Trajectory balancing relies on minimum assumptions:

1. Among municipalities with the same pre-treatment histories, the unit that receives treatment is independent of potential outcomes of the untreated in the post-treatment periods, i.e. $Y_{it} \perp\!\!\!\perp G_i | Y_{i,pre}$, $\forall t > T_0$.

2. Each municipality's expected post-treatment outcomes are approximately linear in pre-treatment outcomes.

3. There exists a set of non-negative weights $\{w_i\}_{G_i=0}$ for the control units such that $\sum_{G_i=0} w_i = 1$ and the pre-treatment outcomes are balanced between the treatment and reweighted control group.

This approach seeks balance on the first P principal components of the features, where P is chosen automatically by a method that minimized the worst-case bias. In other words, the trajectory balancing procedure ensures that the weighted control group is similar to the treated with respect to average values before the treatment. The weights have to be positive and sum to 1, as described in Assumption 3. Thus, the weights are chosen such that,

$$Y_{it} = \sum_{G_i=0} w_i Y_{it}, \qquad 1 < t \leq T_0.$$

The method inherits the same useful properties as the SCM in coping with time-varying confounding through explicitly using the pre-treatment outcome data. Besides, trajectory balancing never directly fits a model, hence, chances of erroneous extrapolation based on estimated model parameters is minimized.

3 Data

With the spread of the coronavirus pandemic, an increase in the number of deaths was observed, higher than that officially attributed to coronavirus (see Report Istat-ISS on the impact of the Covid-19 epidemy on total resident population mortality for the first quarter 2020 for the estimation at the provincial level and

Buonanno et al. 2020 for the estimation in Lombardy municipalities).[4] Monitoring the progress of deaths as a whole, regardless of the cause, is therefore of great interest. Istat released data on the daily number of deaths (deaths from any cause, not only related to coronavirus) on 6,866 of the 7,904 Italian municipalities (Figure A.1 in Appendix A shows the geographical coverage of this data in Northern Italy). This sample covers the 86% of the Italian total population. Considering the evidence coming from the survey conducted by the television broadcast Report, we consider the municipality of Piacenza as the unit of interest (treated unit) to verify if the virus was present before 21st February.[5] In our research, we do not compare the number of deaths in 2020 with the average number of deaths of previous years[6] nor do we compare the observed number of deaths with the time series (expected value), as in the SISMG[7] report. On the contrary, we adopt the counterfactual approach trajectory balancing, with the idea that a linear combination of units not affected by the intervention could represent what would have happened to the treated unit better than the aforementioned approaches. Trajectory balancing takes into account unobserved factors (for example flu epidemics), that can also vary over time. To construct the "synthetic" unit of Piacenza, in the main analysis we limit the set of potential control units, commonly named donor pool to the 31 municipalities in our sample located in the North of Italy,[8] and having a population size similar to Piacenza (between the 50% more and 50% less of the Piacenza population). As suggested in Abadie et al. (2015), by restricting the donor pool to municipalities with characteristics more similar to Piacenza, we reduce the risk

[4]Besides, the official data noise is large and pervasive, especially at the regional and provincial level (see Peracchi 2020).

[5]In Appendix C we test for the presence of coronavirus before 21st February in other Italian municipalities for which newspaper reported anecdotal evidence of an early spread of the virus.

[6]In this case, as claimed in a note by Istat, we would observe a reduction of the number of deaths. The phenomenon could be attributed to the reduced impact of seasonal risk factors (climatic conditions and flu epidemics) in the first two months of the year.

[7]SISMG is the Italian daily mortality monitoring system that aims to monitor in real time the number of daily deaths in the elderly population (age 65 years and over) in the 34 biggest Italian municipalities that represent around the 20% of the entire Italian population. The expected value is defined as the average per day of the week and number of the week calculated in the five previous years and weighed for the resident population (Istat data) to take into account the progressive ageing of the population.

[8]Northern regions are: Aosta Valley, Emilia-Romagna, Friuli-Venezia Giulia, Liguria, Lombardy, Piedmont, Trentino-Alto Adige, and Veneto. The only Northern municipality missing in the donor pool because of lack of data is Vicenza (located in Veneto).

of interpolation bias. The municipalities in the geographical area considered have similar local economic structures and sector specialization, factors that can act as a vehicle of disease transmission (see Ascani et al. 2020 for details). In other words, we consider the municipalities in which the virus could l spread equally. Moreover, the same geographical area means a similar impact of seasonal risk factors (climatic conditions and flu epidemics). We are including in the donor pool municipalities potentially affected by the virus before 21st February 2020. This implies, if anything, that our estimates might be a lower bound of the true effect. To build a "synthetic" unit as close as possible to Piacenza, we use the following predictors: the average number of deaths in the first 20 days of the years 2015-2019, the total number of deaths in the previous year, the total population recorded in November 2019, the share of the population aged over 65, the number of employees in 2017, and the proportion of those employed in manufacturing.[9]

4 Results

Panel (a) of Figure 1 shows the trends in the number of cumulative deaths per 10,000 inhabitants since 1st January of the municipality of Piacenza (dark line) and the "synthetic" Piacenza (dashed line), i.e., the weighted outcome of the 31 municipalities based on the trajectory balancing approach. The horizontal axis represents the day from 1st January to 21st February, while the vertical axis represents the number of deaths per 10,000 inhabitants. As previously explained, we consider 21st January to be the possible date of the beginning of contagion. The figure shows that the deaths trend follows its synthetic counterpart very closely pre-treatment as well as until the end of January. From the beginning of February, we observe an increasingly positive gap between the trends, which on 21st February amounts to +1.84 more deaths per 10,000 inhabitants. This means that in Piacenza, a municipality with 104,000 inhabitants, we observe approximately

[9]We control for employment as it is likely related to the speed of the spread of the contagion (see Ascani et al. 2020), while the share of employment in manufacturing is a proxy which takes into account that the most vulnerable people are those affected by respiratory diseases that are more widespread in industrialized areas. Data come from the Statistical Register of Active Enterprises (ASIA) archive. ASIA is produced by Istat and covers the universe of firms and employees of industry and services.

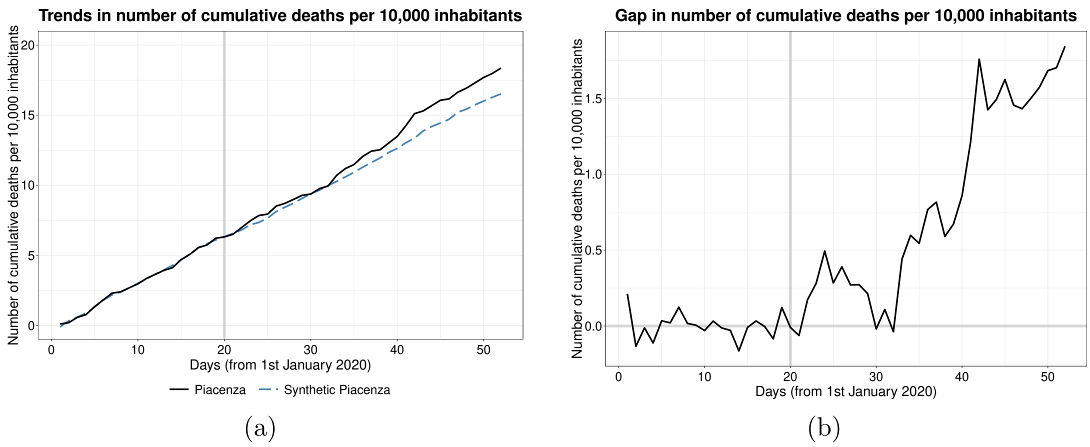


Figure 1: Trends and gap in number of cumulative deaths per 10,000 inhabitants in Piacenza

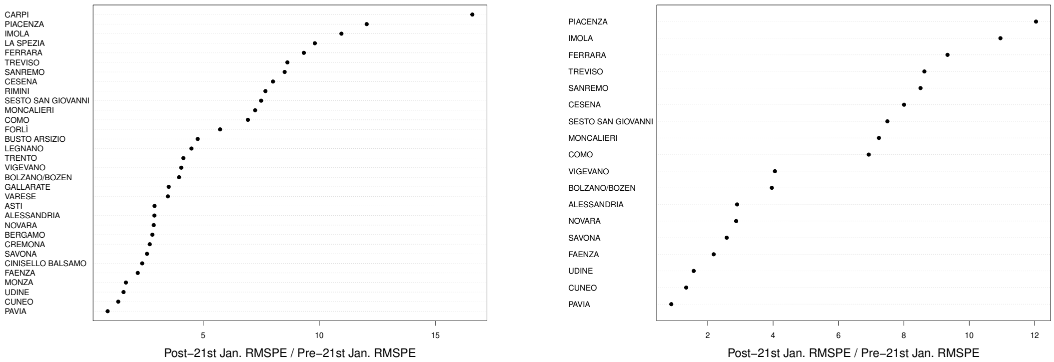
19 deaths more than predicted by the counterfactual scenario. The 'unexpected' deaths since the beginning of February imply that the virus had been already spread for some time in Piacenza. The gap, i.e., the difference between Piacenza and its "synthetic" counterpart, is presented in Panel (b) of Figure 1. The extremely good fit between Piacenza and its "synthetic" version in the absence of coronavirus is also confirmed in Table 1 that represents the covariates balance in the pre-treatment period. It exhibits the values of Piacenza and "synthetic" Piacenza in the pre-treatment characteristics before and after reweighting via trajectory balancing.

Table 1: Covariate balancing

	Treated	Controls Mean	Controls Trajectory balancing
Share of 65+ population (2019)	0.244	0.252	0.245
Total population (November 2019)	104,573	86,570.7	105,752.7
Total deaths (2018)	1,271.000	995.032	1,136.930
Avg deaths in the first 20 days (2015-19)	3.900	3.401	3.863
Share of empl. in manufacturing (2017)	0.138	0.166	0.147
Total employees (2017)	42,651.5	31,318.8	39,535.2

4.1 Placebo test

To evaluate the significance of the results we run an in-space placebo test, i.e., we reassign the treatment to each of the 31 municipalities that composed the "synthetic" Piacenza, where we presume that the coronavirus arrived later. We will deem the effect of the arrival of the virus in Piacenza statistically significant if the estimated effect is large relative to the distribution of placebo effects. We follow Abadie et al. (2015) and in Panel (a) of Figure 2 show the ratios between the post-21st January Root Mean Square Prediction Error (RMSPE) and the pre-21st January RMSPE for Piacenza and all 31 municipalities. RMSPE measures the magnitude of the gap in the outcome variable between each municipality and its "synthetic". A large gap between the post and pre presumed date of the first contagion, indicates a relevant effect, i.e. an unusual pattern of deaths compared to the counterfactual counterpart. As shown in Figure 2, Piacenza is the municipality with the second-highest RMSPE ratio, after the municipality of Carpi. However, this test does not take into account whether the placebo unit shows more or less deaths than its counterfactual and Carpi actually shows a large negative trend in the number of deaths in the period under analysis. In fact, if we repeat the test only on the municipalities with a number of deaths per 10,000 inhabitants higher than the counterfactual prediction on the date of 21st February, as shown in Panel (b) of Figure 2, we observe that Piacenza ranks first.



(a) (b)

Figure 2: Ratio of Post-21st January 2020 RMSPE to Pre-21st January 2020 RMSPE: Piacenza and Control Municipalities

4.2 Robustness checks

As suggested in Abadie (2019), we report in Table 2, the estimates of several robustness exercises, which help us verify the sensitivity of our results to changes in the design of the evaluation approach. Particularly, we change:

1. the treatment data, backdating and postdating the treatment by 5 days;

2. the donor pool, enlarging and restricting the number of control units to municipalities with a population size between 40% and 60% more or less of the Piacenza population. Besides this, we propose a leave-one-out analysis, i.e., we re-run the trajectory balancing, excluding from the sample one-at-a-time each of the municipalities that contribute to the counterfactual;[10]

3. the predictors of the outcome variable, adding a measure of air quality (PM-10) in 2018;[11]

[10]Table D.1 in Appendix D reports the trajectory balancing weights assigned for each iteration of the leave-one-out procedure.

[11]PM-10 is an air pollutant that could serve as a carrier for viruses. Setti et al. (2020) highlighted the relationship between the rapid COVID-19 infection spread in Northern Italy and PM-10 pollution. Air pollution data is from 573 monitoring stations distributed across the Italian territory. We employ the kriging spatial interpolation to impute the PM10 average yearly value for each municipality. Given the likely measurement error of this variable, we control for it only for this robustness check

4. the algorithm to assess weights, using the SCM[12](see Abadie et al. 2010, and Abadie et al. 2015 for more details).

All robustness tests lead to estimates which are very close to those reported in the main analysis. Moreover, in Figure 3 we can observe that the estimates coming from leave-one-out distribution are centered around the synthetic Piacenza, showing that our findings are not driven by the specific weight given to a municipality in the donor pool.

Table 2: Robustness tests

	N. of cumulative deaths per 10,000 inhabitants on 21st February
Main estimate	1.84
Alternative matching date	
- Backdating 5 days earlier	1.67
- Postdating 5 days later	1.65
Alternative population thresholds	
- Enlarged donor pool	1.83
- Restricted donor pool	1.68
Leave-one-out procedure	1.85
Addition of covariates	
- Adding the quality of air	2.25
Alternative balancing method	
- SCM	1.40

Notes: In the leave-one-out procedure, we consider the average of the number of cumulative deaths per 10,000 inhabitants on 21st February for the nine iterations.

[12]The SCM weights are shown in Table B.1 in the Appendix B.

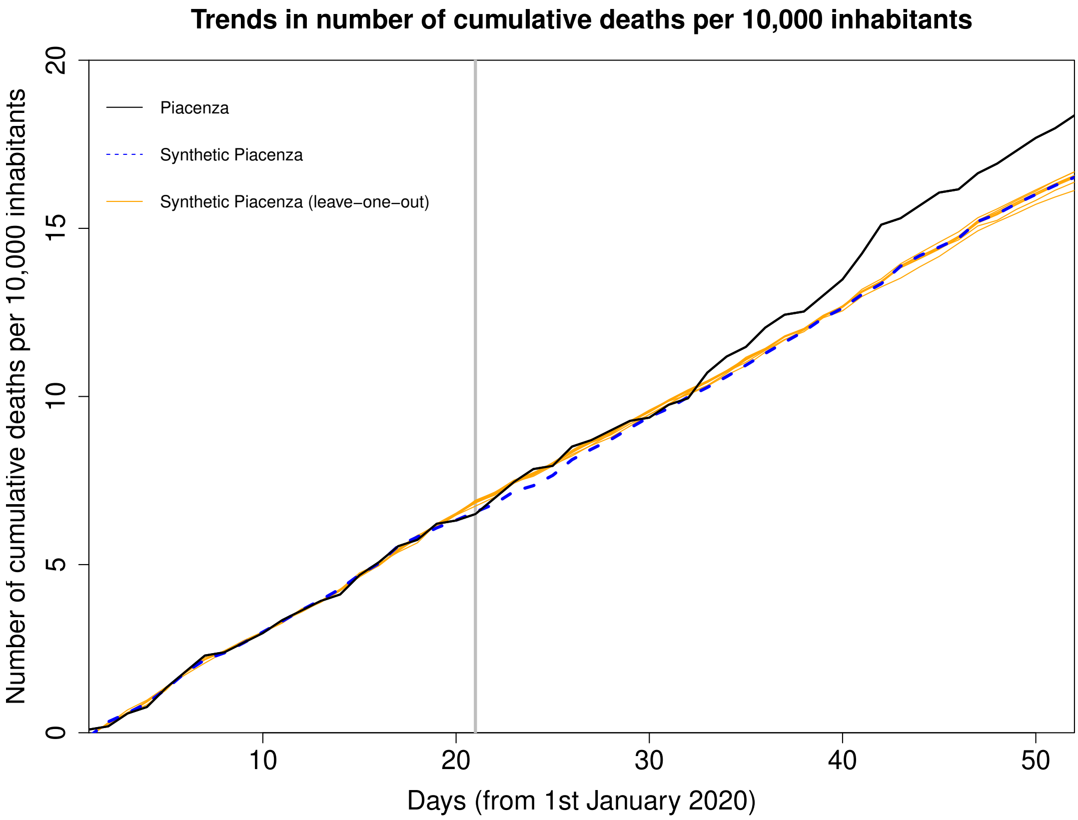


Figure 3: Leave-one-out distribution of the Synthetic Piacenza

5 Conclusion

The increasing evidence of the presence of a few cases of coronavirus in Europe at the beginning of the year has been recently confirmed by serological tests. Our research aims to analyze not only the presence of coronavirus in Italy, sooner than 21st February but, even more importantly, to assess whether the virus had already spread in a specific territory. To test our hypothesis, we adopt the trajectory balancing approach to analyze certified data on the number of deaths at the municipality level. This allows us to avoid the issue of underreporting, which seems to be widespread with official data on coronavirus. We find that Piacenza experienced an unexpected increase in the number of deaths since the beginning of February with respect to the counterfactual. This means that coronavirus had already spread in a specific area of Northern Italy at least a week before the beginning of February and that by 21st February a few hundreds of individuals were already infected. This finding might help in the historical investigation of how the virus spread in Italy first and then in the rest of Europe. Besides, in the era of big data with the spread of digital health, our evidence underlines the need to invest more on the efficiency and timeliness of data collection systems. An effective information system allows us to spot anomalies in the data and helps policymakers in handling emergencies by providing a more precise picture of the situation. Moreover, as highlighted by Birrell et al. (2020), in a pandemic context, a real-time monitoring is vital to avoid making public health decisions on the basis of misspecified models. The coronavirus emergency has demonstrated that most developed countries are lagging behind in this technological challenge, calling for prompt and large investments in this sector. For instance, the Italian daily mortality monitoring system collects the number of daily deaths for individuals aged 65 years and over only for the 34 largest municipalities. Higher coverage of the Italian territory might have allowed detecting the presence of coronavirus in Italy a few weeks in advance.

Appendix

A Geographical coverage of the Istat data in Northern Italy

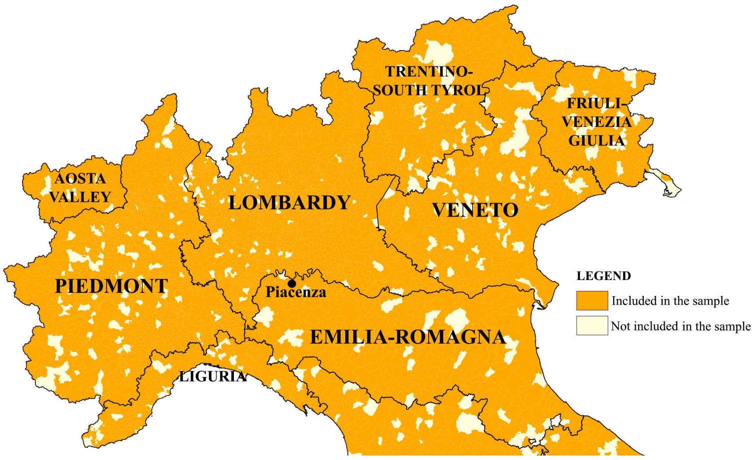


Figure A.1: Geographical coverage of the Istat data in Northern Italy

Notes: Istat released data on the daily number of deaths (deaths from any cause, not only related to coronavirus) for the period 1st January - 30th March 2020 for 6,866 municipalities (87% of the 7.904 total municipalities). In the map, we show the coverage for Northern Italy with data available for 4,041 municipalities (92% of the 4,383 total municipalities).

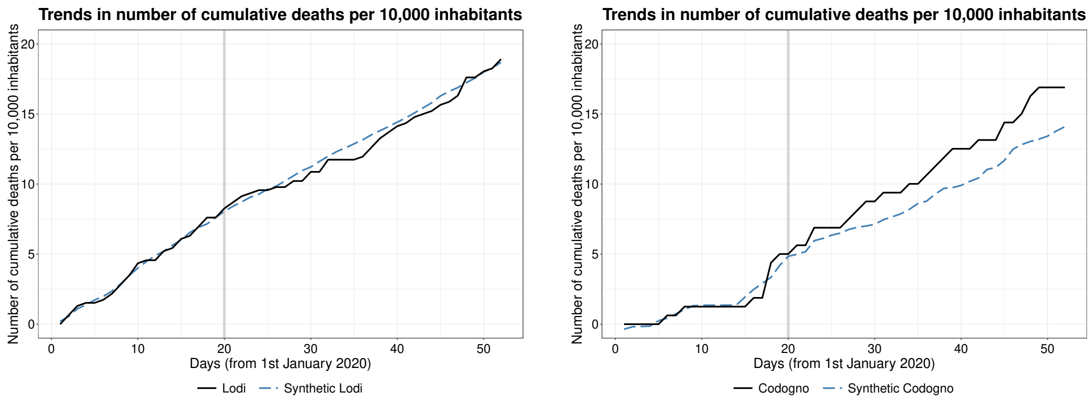
B Trajectory balancing and Synthetic weights

Table B.1: Description of control group

Municipality	Region	Population	Traj. bal. weights	SCM weights
Piacenza	Emilia-Romagna	104,573	NA	NA
Alessandria	Piedmont	93,636	0	0
Asti	Piedmont	76,073	0.04	0
Bergamo	Lombardy	122,243	0	0.07
Bolzano	Trentino-Alto Adige	107,958	0	0
Busto Arsizio	Lombardy	83,874	0	0
Carpi	Emilia-Romagna	72,171	0.06	0
Cesena	Emilia-Romagna	97,025	0.	0
Cinisello Balsamo	Lombardy	76,359	0	0
Como	Lombardy	85,469	0	0
Cremona	Lombardy	73,040	0.17	0
Cuneo	Piedmont	56,032	0.12	0
Faenza	Emilia-Romagna	58,831	0	0.09
Ferrara	Emilia-Romagna	132,331	0	0
Forlì	Emilia-Romagna	117,987	0	0
Gallarate	Lombardy	53,517	0	0
Imola	Emilia-Romagna	69,870	0	0
La Spezia	Liguria	93,297	0	0
Legnano	Lombardy	60,638	0	0
Moncalieri	Piedmont	57,390	0	0
Monza	Lombardy	123,745	0.06	0.46
Novara	Piedmont	104,222	0	0.09
Pavia	Lombardy	73,217	0	0
Rimini	Emilia-Romagna	151,229	0.36	0
Sanremo	Liguria	54,637	0	0
Savona	Liguria	59,926	0	0
Sesto San Giovanni	Lombardy	81,145	0	0
Trento	Trentino-Alto Adige	118,872	0.04	0.15
Treviso	Veneto	85,667	0.08	0
Udine	Friuli-Venezia Giulia	99,042	0	0.14
Varese	Lombardy	80,677	0.05	0
Vigevano	Lombardy	63,571	0	0

C Other municipalities

Coronavirus hit many of the municipalities hard in Northern Italy. It is possible that some of them had signs of coronavirus before 21st February. In this paragraph, we look at Lodi and Codogno.[13] For both of them, we use the same model specification and the same criterion for selecting the units to include in the donor pool (i.e., between 50% more or less of the treated municipality population). The results are reported in Figure C.1. There is no evidence of a positive gap between the treated and counterfactual trends for Lodi (Panel (a)). Conversely, when looking at Codogno (Panel (b)), there seems to have been an increase in the number of deaths per 10,000 inhabitants, from late January. However, considering the small size of the municipality and the small number of deaths, additional evidence is needed to confirm the potential presence of coronavirus from the end of January.



(a) (b)

Figure C.1: Trends in number of cumulative deaths per 10,000 inhabitants in Lodi, and Codogno

[13]We do not look at Milan, as it is the second-largest Italian city and it would be difficult to find a valid counterfactual. Besides, in the placebo test we have already shown that Como experienced an increase in the mortality rate which is about a half of that experienced by Piacenza.

D Weights leave-one-out

Table D.1: Weights Leave-one-out

	Asti	Carpi	Cremona	Cuneo	Monza	Rimini	Trento	Treviso	Varese
ALESSANDRIA	0.17	0.04	0.04	0.05	0.06	0.02	0.05	0.04	0.04
ASTI	NA	0	0	0	0	0	0	0	0
BERGAMO	0	0	0.01	0.01	0.01	0.05	0.02	0.01	0.01
BOLZANO	0	0	0	0	0	0.03	0.01	0	0
BUSTO ARSIZIO	0	0	0	0	0	0	0	0	0
CARPI	0.05	NA	0.09	0.10	0.1	0.08	0.1	0.09	0.1
CESENA	0	0	0	0	0	0	0	0	0
CINISELLO B.	0	0	0	0	0	0	0	0	0
COMO	0.11	0	0.02	0.02	0.04	0.001	0.01	0.02	0.01
CUNEO	0.02	0.03	0.03	NA	0.03	0.01	0.08	0.03	0.03
CREMONA	0.12	0	NA	0	0	0	0	0	0
FAENZA	0	0.01	0.01	0.01	0	0.01	0	0.01	0.01
FERRARA	0	0	0.04	0.04	0.05	0.09	0.01	0.05	0.04
FORLI	0	0.12	0.07	0.07	0.07	0.25	0.03	0.07	0.07
GALLARATE	0.13	0	0.01	0.01	0	0.09	0.02	0.01	0
IMOLA	0	0.01	0.01	0.02	0.01	0.01	0.02	0.02	0.02
LA SPEZIA	0	0	0	0	0	0	0	0	0
LEGNANO	0	0	0	0	0	0.01	0	0	0
MONCALIERI	0	0	0	0	0	0	0	0	0
MONZA	0	0.13	0.10	0.10	NA	0.12	0.11	0.10	0.10
NOVARA	0	0.05	0.05	0.05	0.07	0.05	0.05	0.05	0.05
PAVIA	0	0	0	0	0	0	0	0	0
RIMINI	0.40	0.31	0.30	0.30	0.32	NA	0.39	0.29	0.31
SANREMO	0	0.06	0.07	0.08	0.07	0	0.07	0.07	0.07
SAVONA	0	0	0	0	0	0	0	0	0
SESTO S. GIOV.	0	0	0	0	0	0.01	0	0	0
TRENTO	0.01	0.11	0.11	0.12	0.12	0.24	NA	0.11	0.11
TREVISO	0	0	0.01	0.01	0.01	0.01	0.01	NA	0.01
UDINE	0	0	0	0	0	0	0	0	0
VARESE	0	0	0	0	0	0	0	0	NA
VIGEVANO	0	0.07	0.02	0.02	0.02	0.01	0.01	0.02	0.02

Notes: Column names indicate the municipalities excluded in those iterations.

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