Taxation, health system endowment and quality of institutions: a "social" perception across Europe

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Taxation, health system endowment and quality of institutions: a "social" perception across Europe

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Abstract

In this paper we analyze how the health system endowment and the quality of the institutions impact on a change of perception towards taxation. We conduct a sentiment analysis on French, Germans, Italians and Spanish users' tweets to understand if the impact of the current health emergency has modified the tax compliance of the citizens of the four biggest European Countries. We use a difference-in-differences estimation strategy, by comparing the average sentiment of individual tweets regarding taxation in different European NUTS-2 regions, before and after the spread of the Covid-19 pandemic. Our results highlight that in regions characterized by higher levels of health expenditure, people become more prone towards taxation with respect to the period before the widespread of covid-19. In addition, we show how a higher quality of institutions lead to a more positive perception of the same in relative and absolute terms and therefore a greater predisposition for a more progressive tax system.

Keywords: Taxation; Sentiment Analysis; Tax compliance; Health System Endowment; Quality of institutions; Covid-19 crisis.

JEL classification: H26, H51, D04, C81.

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1 Introduction and Literature Review

The deep global recession caused by the outbreak of Covid-19 health emergency has triggered all the world economies. There is a relevant area of debate about the consequences of this recent economic crisis, dominated by the discussion on the introduction of a wealth taxation and the need of a stronger income redistribution.

Income redistribution is one of the most controversial topic in economic literature. While economists and political scientists with a public choice orientation believe that redistribution processes are often a resultant of coercive processes (Schumpeter, 1947 [48]; Downs, 1957 [20]), others have increasingly worried about the potential negative consequences of inequality for economic performance and potential social distress (Piketty and Saez, 2006 [38]; Gasparini and Lustig, 2011 [25]; Piketty, 2014 [39]; Alvaredo et al., 2018 [4]). More recently, a lot of attention has been focused on the rise of inequalities due to the diffusion of globalization, the declining unions and the fall in the real value of the minimum wage (Kristal and Cohen, 2017 [32]) and, especially, to the skill- biased technological change (Benitez Larghi et al., 2015 [10]) or in light of improved data and methods relative to earlier literature (Jantti et al., 2020 [29]).

In general terms, the traditional trade-off between equality and efficiency in taxation is still at the center of the stage, and the society's redistributive preferences are anything but homogeneous. Indeed, although political institutions collectively determine redistributive policy, factors that shape individuals' choices are properly economic and political (Plotnick and Winters, 1985 [41]). For this reason, the announcements by different European governments on the potential need of an introduction of wealth taxation to support lowest income after the recent crisis has split the public opinions.[1]

From an empirical point of view, social media have proved to be a unique space in which sentiments are compared and updated. Twitter, for example, has become a valuable resource for analyzing trends and major events. Yu et al. (2013 [54]) show that tweets have a stronger relationship with stock-market performance than conventional media, though they emphasize that the impact of different types of social media varies significantly. Rill et al. (2014 [43]) design a system to detect emerging political trends on Twitter, anticipating more mainstream information channels during the parliamentary election of 2013 in Germany. Kusen and Strembeck (2018 [33]) provide a comprehensive sentiment analysis of the Twitter discussion related to the 2016 Austrian presidential elections and show that during political campaigns conveying emotional content is not always advantageous for the respective political candidate. They observe that these topics even emerged earlier in Twitter than in Google trends, showing a greater predisposition of twitter users to promptly express

[1] In particular, we refer to the political debate that took place in the following countries: Italy, France, Spain, Belgium and Portugal.

their opinions through the social network.

In a recent and methodological paper, Khedr et al. (2017 [30]) build a predictive model, based on sentiment analysis of financial news and historical stock market prices. This model provides better accuracy results than all previous studies by considering multiple types of news related to market and company with historical stock prices. More recently, Angelico et al. (2021 [5]) employ textual data and machine learning techniques to build new real-time measures of consumers' inflation expectations based on Italians' tweets.

Starting from these contributions, we build up our methodology to measure the level of sentiment, as a proxy of the perception of citizens. This allows us to investigate whether the covid-19 pandemic, as well as the subsequent economic crisis, is modifying the tax compliance of citizens of the four biggest European Countries by conducting a sentiment analysis on French, German, Italian and Spanish users' tweets. In particular, we focus on how much the quality of health system endowment during recessions impact on attitudes towards a taxation.

Several factors have driven wealth taxation over the long run in history. Limberg and Seelkopf (2021 [34]), among others, analyzing the historical drivers of wealth taxation, find out that recurrent taxes on net wealth are a more recent than other progressive taxes. They demonstrate that also in the past net wealth tax was mainly used as an "emergency tax" when countries faced huge economic contractions. Slemrod (2002 [49]) show empirical results that reveal how much tax cheating is lower in countries with more not-government-related trustworthiness. On this topic, Barone and Mocetti (2011 [7]) shed light on the relationship between the taxpayer and the public sector, understanding the main determinants of tax compliance as one of the major economic and political issue.

According to a consolidated "traditional" view, taxpayers decide whether and how much to evade taxes in the same way they would approach any risky decision or gamble (Allingham and Sandmo, 1972 [2]), since the risk of being detected is a relevant aspect in the group communication process when deciding on compliance (Fochmann et al., 2021 [24]). However, over the past decades most of the emphasis has been put upon the effects of factors as the threat of detection and punishment, the level of tax rates, the complexity of the tax code, and uncertainty about existing and future laws on taxation. A more recent stream of literature agrees that the tax compliance - i.e. the taxpayers' decision to pay tax regularly and in time - and its opposite tax evasion are not even resulting from a cost-benefit analysis, but rather determined by several personal and subjective factors, such as personal values, social norms and attitudes towards public institutions (Torgler, 2003 [51]). In a context characterized by a deep economic crisis, increasing the tax compliance of citizens may become a crucial objective of public fiscal policy. Recessions inevitably lead to a contraction of income and an increasing involuntary unemployment and this may impact on the prevalent

views on the welfare state (Heinemann, 2011 [27]).

Moreover, behavioral science evidence suggests that greater individual participation in the allocation and decision process will encourage an increased level of compliance. In fact it has been proved that the judgement of the redistribution mechanism, together with the role of government on expenditures, impact on the compliance behaviour. Individuals are less inclined to pay their taxes when they feel that they are not involved in government decisions and when allocation is perceived as unresponsive to taxpayers' wishes (Alm and Jackson, 1993 [3]). Alm et al. (1993 [3]) argue that tax compliance is higher when "taxes are spent in ways consistent with the preferences of the citizens" (p. 302), putting at the center of the stage the relevance of government program in which taxes are spent is crucial for tax payments. This issue has also been investigated in several laboratory experiments (Holler et al., 2008 [28]; Fochmann and Kroll, 2016 [23]; Doerrenber, 2015 [19]).

Tax compliance is also affected by the role of the public sector and, in particular, of its (in)efficiency in providing public goods. Better institutions provide stronger incentives to comply with the law and, consequently, with taxes. Barone and Mocetti (2011 [7]) highlight the strength of the role of trust in public institutions, finding that the attitude towards paying taxes is better when resources are spent more efficiently. To this aim, it is important to focus on the perceived institutional quality. Torgler and Schneider (2009 [52]) , for instance, by investigating the relation between shadow economy, tax morale and institutional quality find out that a higher institutional quality lead to a smaller shadow economy. To the best of our knowledge, we are the first to attempt to provide an empirical assessment of the role of the health system endowment as a proxy of public good provision and as a measure of public expenditure efficiency that can pursue citizens towards a higher degree of compliance.

Our contribution aims to fill this gap in the literature, by focusing on different perception on a need of the welfare state during the pandemic crisis. To deepen this relation, we use a difference-in-differences (D-i-D) estimation strategy, that consists of comparing the average sentiment towards taxation as expressed by tweets in several European NUTS-2 regions with different health system endowments, before and after the widespread of the covid-19 pandemic. Our findings highlight how, after March 2020, people who live in regions with a high health system endowment become more favorable towards taxation.

These results are robust to the use of regional fixed effects that account for both observable and unobservable characteristics of each NUTS-2 region. In addition, to be sure of the correctness of our identification strategy, we control for a full set of regional controls covering various dimensions (geography, demographics, socio-economic context, among others). Following Durante et al. (2021) [22], we fit the controls into the model by interacting them with a pre/post pandemic dummy vari-

able.

This relation is more pronounced for citizens of those area characterized by an highest quality of institutions, while this is not verified where the quality of institutions is low. To measure it, we refer to the European Quality of Government Index (EQI), a composite indicator based on three main dimensions: quality, impartiality and corruption of institutions.

We check the validity of our results through various robustness tests. First, we repeat our analysis by randomly allocating the number of physicians per 100,000 population across NUTS-2 regions and, as expected, we find no effect. We also replicate the model both by using alternative measures of health system endowment and by removing extreme values from the sample. Moreover, the existence of parallel trends highlights how the results are not driven by pre-existing more favourable attitude towards wealth taxation in regions with a high level of health expenditure.

In terms of policy implications, a positive framing information from government and policy makers should allow a good perception of the way in which public finances are employed.

This paper is organized as follows: Section 2 shows the Data and the Descriptive Statistics; Section 3 presents the Identification Strategy; Section 4 carries out the empirical analysis, showing the Placebo Tests and the Robustness Checks; Section 5 presents the policy implications and concludes.

2 Data and Descriptive Statistics

Social media have notably increased their impact on communication and widespread of news over the last decade. Chadwick (2011 [15]), for instance, illustrates how we are moving from a traditional “news cycle” – dominated by journalists and professional sources – to a more complex “information cycle” – that integrates ordinary people into the ongoing construction and contestation of news.

The debate on taxation is not an exception: opinions and "sentiments" on this topic clearly emerge from the social media site Twitter. This social network counts of 152 million users that communicate and discuss whatever they like within a "tweet", i.e. a short text of 280 characters. These expressions reflect what individuals are thinking or feeling about a multitude of arguments, such as taxation perception (Durán-Vaca and Ballesteros-Ricaurte, 2020 [21]) and carbon taxation (Zhang et al., 2021 [55]).

As for Covid-19 related issues, Chen et al. (2020 [16]) create a Twitter data set, highlighting that as the pandemic continues to run its course, the amount of data available grow significantly. Basiri et al. (2021 [8]) find out that the sentiment in people’s tweets is correlated to the news and events that occurred in their countries, such as the number of newly infected cases, number of recoveries and deaths.

2.1 Tax compliance and Twitter

Tweets are collected using Python through Twitter API Academic Research product track[2] and we use them as a proxy of individual users' sentiments and interest about taxation. We collect tweets on a weekly basis, for the period 2018-2020, and we have obtained a data-set composed by 61,351 tweets. Tweets are retrieved with respect to these parameters: country of origin of the author's tweet, language of that country and the following keywords and hashtag: *property tax, taxes, #spread, progressive taxation, progressive taxation, public debt, fiscal equity, #taxtherich, inheritance tax*. These criteria have been applied for each of the relative countries' language.

To compute the level of sentiment, first we have cleaned data following these steps:

- Removing punctuation from textual data;
- Erasing common words unable to express a sentiment;
- Counting the positive and negative words in each tweet;
- Generating the average sentiment for tweets computed at the regional level.

The sentiment clustering has been constructed by classifying the tweet texts for positive and negative words sentiment lexicon, along the line of Philander and Zhong (2016 [40]). The sentiment classification at year t is given by the difference between the sum of positive words appearing in each tweet i aggregated at the regional level r, and negative words appearing in tweets (using the aforementioned criteria), divided by the total number of tweets. For each region r, the sentiment classification is computed as the ratio of overall positive tweets over the total tweets at time t.

Moreover, API Academic Research gave us the possibility to include all the following individual information: tweet id, author's id, text, geographical coordinates, location name (NUTS-2 region and city/town), author's username and author's bio. Then, we cluster them according to the regional provenience of the authors of each tweet (the level of observations is NUTS-2). Regional provenience is set by the Twitter API geographical reference, automatically provided by Twitter. We choose to not include retweets in our datasets.[3]

Table 1 shows the distribution of the number of tweets for every year, the average aggregate sentiment for country for every year and the level of observation of the analysis. At the aggregate level, the average sentiment is positive for France, Germany and Spain throughout the entire period of consideration, while Italian tweets

[2]For further details, see https://developer.twitter.com/en/docs/twitter-api.

[3]Re-tweets are repost of message posted by other users. Despite they contribute to the engagement of a tweet, we decide not to include them in our sample to avoid to consider a single opinion more times. Since the aim of our study is to investigate the variation of sentiments proxied by tweets across time, we do not distinguish between users with low/high number of followers.

are always negative. We aggregate the individual tweets at NUTS-2 level for France, Italy and Spain while for Germany NUTS-1 has been considered since it is comparable with NUTS-2 regions of other three countries.

Table 1: Reference sample, average sentiment of Twitter users and level of observations

Country	Year	Number of Tweets	Average Sentiment	Level of Observations
France	2018	1151	Positive	NUTS-2
	2019	2936	Positive	NUTS-2
	2020	1554	Positive	NUTS-2
Germany	2018	559	Positive	NUTS-1
	2019	3382	Positive	NUTS-1
	2020	3098	Positive	NUTS-1
Italy	2018	2655	Negative	NUTS-2
	2019	11870	Negative	NUTS-2
	2020	11216	Negative	NUTS-2
Spain	2018	7525	Positive	NUTS-2
	2019	6622	Positive	NUTS-2
	2020	6242	Positive	NUTS-2

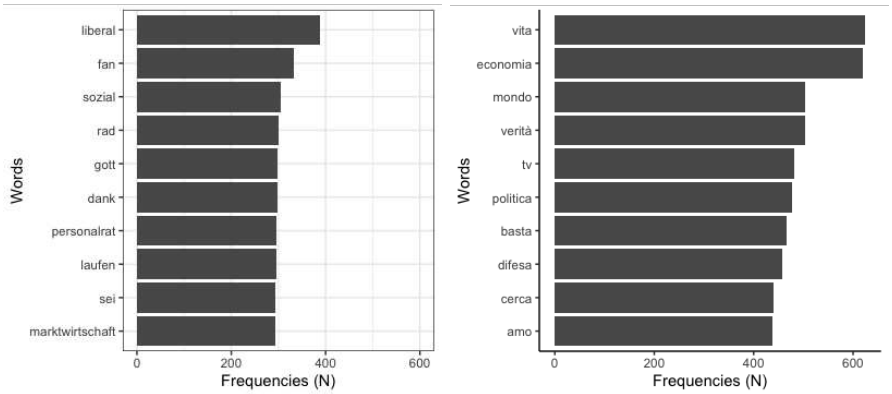
Notes: Table 1 shows for each year (from 2018 to 2020) and for each of the four countries (France, Germany, Spain and Italy) respectively the number of Tweets, Average Sentiment and the Level of Observations. *Source*: Twitter API Academic Research product track; data was processed by the authors.

2.2 Taxation in four countries

As previously discussed, Twitter is a social media that allows users to express what they think or believe about a multitude of arguments, from politics to economics or society. By looking at the biographies of users we can make some considerations on our sample.

Figure 1 shows the top 10 most used words in the bios of German and Italian authors. We find as instance "free market" (*"Marktwirtschaft"*), "liberal", "socialist" (*"sozial"*), "politics" (*"politica"*), "economy" (*"economia"*) suggesting a link between the authors' bio and an interest on socio-economic issues.

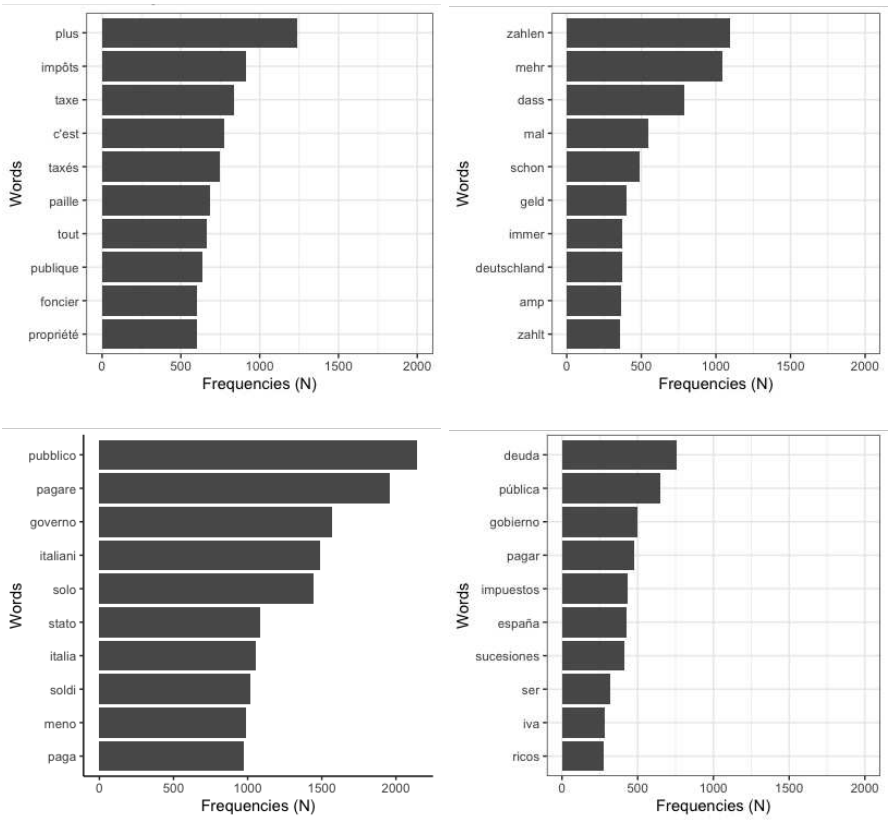
Figure 1: Most 10 frequent words in german users' bios (left panel) versus italian users' ones (right panel)



Source: *Twitter API Academic Research product track; Elaboration of the authors.*

Similarly, Figure 2 illustrates the 10 most frequent words for the four countries considered. Notice that all of the words are the same but in different languages, highlighting a common debate between countries when talking about taxation. Some words - "state", "debt", "pay", "government" - are common for all of the four countries.

Figure 2: Most 10 frequent words in french tweets (top left panel), german tweets (top right panel), italian tweets (bottom left panel), spain tweets (bottom right panel)

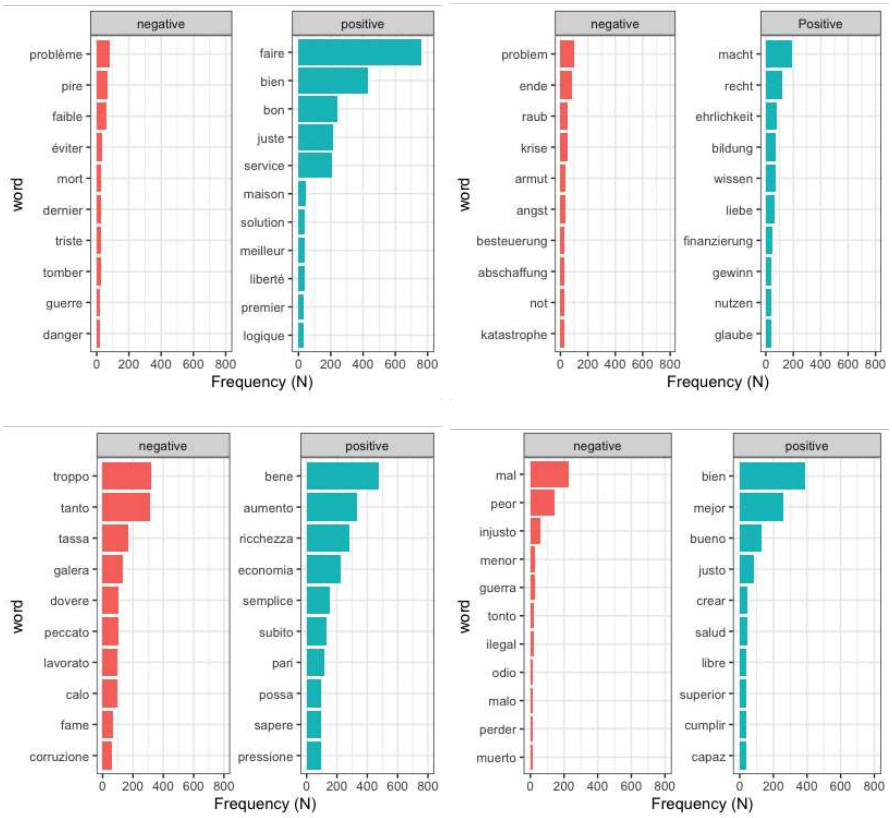


Source: *Twitter API Academic Research product track; Elaboration of the authors.*

Figure 3 counts the frequency of the most used positive and negative words for France, Germany, Italy and Spain. Overall, positive sentiments predominate. While

for French and Spanish case the difference is more pronounced, for the other two countries the gap is smaller. Notice that the statistics displayed in Figure 3 refer to a sentiment analysis computed on the whole sample of the four countries. A more detailed empirical investigation is presented in Section 3, where we account for a NUTS-2 level analysis and for time fixed effects.

Figure 3: Contribution to sentiment of the 10 most frequent words in french tweets (top left panel), german tweets (top right panel), italian tweets (bottom left panel), spain tweets (bottom right panel)



Source: *Twitter API Academic Research product track; Elaboration of the authors.*

Table 2 below shows descriptive statistics with respect to the aforementioned variables included in the model. As for the control variables used in our dataset, we can distinguish four different group of variables, the majority[4] of which has been taken from Eurostat database (NUTS-2 level).[5] Demographic controls include population, population density, the percentage of people with tertiary education, the percentage of people over 75 years of age and the percentage of women. Geographic controls include latitude, ruggedness, area surface, distance from the coast and distance from Codogno, where the first outbreak of Covid-19 case happened in February

[4]All the variables reported in Table 2 are taken from Eurostat, except EQI index, obtained from the European Quality of Government Institute of the Gothenburg University, and the distance from Codogno and from the coast, calculated by the authors using Q-GIS software.

[5]The Nomenclature of territorial units for statistics (NUTS) classification is a system for dividing up the territory of the European Union. NUTS-1 correspond to the major socio-economic regions while NUTS-2 indicate basic regions for the application of regional policies.

2020. About this last variable, using Q-GIS software, we calculate the distance of each centroid of the NUTS-2 regions from the coast and from Codogno, the European epicentre of the pandemic. Then, we account for some internet related controls, more specifically the number of households with internet connection, as well as the amount of time spent on social network. Finally, as socio-economic variables we use per capita GDP, unemployment rate and high-tech employment rate. About these controls, we consider also another important element, that is the quality of Institutions, as proxied by the EQI index.[6]

Table 2: Descriptive Statistics

Variables	Mean	Std.Dev.	Min	Max	Obs.
Positive tweets	0.57	0.19	0	1	142
Physicians per 100,000 inhabitants (%) (NUTS-2)	390.52	74.54	259.75	629.07	142
EQI index	0.072	0.88	-2.09	1.31	142
Woman, share (NUTS-2)	104.73	2.34	99.2	109.3	142
Population, total (NUTS-2)	3,381,398	3,083,105	308,493	17,900,000	142
Population density (NUTS-2)	296.17	608.80	25.7	4,289.8	142
Tertiary education, share (NUTS-2)	19.07	7.01	7.4	34.6	142
People over 75 years of age (%) (NUTS-2)	0.11	0.02	0.07	0.16	142
Mortality rate (NUTS-2)	0.01	0.002	0.01	0.017	142
Distance from the coast (NUTS-2)	126.40	110.24	12.52	419.23	142
Latitude (NUTS-2)	45.30	4.90	28.34	54.18	142
Area (NUTS-2)	22,784.45	18.091.28	399.81	94,217.59	142
Ruggedness (NUTS-2)	1.41	1.00	0.05	3.80	142
Distance from Codogno (NUTS-2)	751.42	419.27	51.57	2,912.1	142
Social networks use (%) (NUTS-2)	48.52	7.59	30	63	142
Broadband(%) (NUTS-2)	87.45	5.37	74	97	142
Unemployment rate (20-64) (NUTS-2)	9.02	4.75	2.3	21.2	142
GDP per capita (NUTS-2)	1.20	1.357	0	6	142
High tech employment (rate) (NUTS-2)	3.14	1.48	0.8	7.9	142

Notes: Twitter data are extracted directly by the authors, in possession of the necessary API Academic Research product track. The majority of the other variables used in the analysis are from Eurostat, and relate to the pre-pandemic years (2018-2019) or, in the absence of data, to the last available year prior to the outbreak of the pandemic. The mortality rate variable is derived from Eurostat weekly data at the NUTS-2 level. For this and other variables, Eurostat provides data at the NUTS-2 level for all countries, except Germany, whose data are available only at the NUTS-1 level.

[6]The EQI index is a composite indicator based on three main dimensions: quality, impartiality and corruption of institutions. Concerning the quality dimension, the index captures the quality of the public system as reported in specific individual level questions. The impartiality pillar is based on the individuals' perception about the existence of some kind of advantages that some group of people obtain within the public sector. Finally, the corruption dimension relies on both perceived and experienced corruption. The importance of the EQI is stressed by its uniqueness as sub-regional indicator of the institutional quality. For further details, see https://www.gu.se/en/quality-government/qog-data/data- downloads/european-quality-of-government-index.

3 Identification strategy

The role of the State and of its (in)efficiency in providing public goods is crucial for individuals' tax compliance. Cummings et al. (2009 [17]) use an experimental setting to show that cross-cultural differences in tax compliance behavior find its roots in the individual perceptions of good governance.

Public health, a crucial determinant of government expenditure, is dealing with unprecedented challenges in its efforts to control and to limit the widespread Covid-19, with a sudden necessity to assist to a large number of patients. However, most countries or regions were not prepared to face this health emergency because of the lack of human and structural resources. Generally, the pandemic highlighted the unpreparedness of all health systems to face the situation (Mauro and Giancotti, 2021. [35]). A different health system strength may have lead to a different perception of the efficiency of the public authority and to its adequacy to afford an emergency and to a gap in the satisfaction for how public money has been spent, leading to a change of position towards taxation. We aim to investigate if this occurs also in the post-pandemic scenario under consideration.

To determine the role played by the health system endowment on the evolution of the consensus towards taxation (Y) we estimate several versions of the following equation, where r denotes NUTS-2 region at year t:

$$Y_{rt} = \beta\,(N^{o}Physicians_{r} \times Post_{t}) + \delta\, X_{r} \times Post_{t} + \eta\, Z_{rt} + \mu_{r} + \tau_{t} + \epsilon_{rt} \qquad (1)$$

where β is the coefficient of the interaction between the pandemic dummy variable ($Post_t$), which takes the value 1 in 2020, and the $N^{o}Physicians_r$ variable, which varies at the NUTS-2 level. This coefficient captures the differential change, in 2020 relative to 2019, in the consensus towards taxation of individuals living in regions characterized by a high level of local health system endowment compared to those who live in regions with low levels of local health system endowment.

X_r is a vector of time invariant variables defined at regional level (at NUTS-1 or NUTS-2 levels of aggregation, depending on the available information) accounting for different demographic, geographic, internet-related and socio-economic characteristics.[7] These regional controls measured in pre-pandemic period are interacted with the pandemic dummy ($Post_t$) in order to account for possible different evolution in the consensus towards taxation associated to regional characteristics that might be correlated with the level of health system endowment.

[7]Demographic controls include, among others: population, population density, the percentage of people with tertiary education, the percentage of people over 75 years of age, the percentage of women. Geographic controls refer to latitude, ruggedness, area surface, distance from the coast and distance from Codogno, where the first outbreak of Covid-19 case happened in February 2020. Internet related controls are the number of households with internet connection, as well as the amount of time spent on social network. Socio-economic ones are per capita GDP, unemployment rate, high-tech employment rate and the EQI index. For further details, see the Data and Descriptive Statistics section.

As for the time-invariant controls, vector Z_{rt} includes the regional mortality rate, that is a time varying regional NUTS-2 characteristic which takes into account the impact of the pandemic. Finally, μ_c and τ_t are NUTS-2 region and time fixed effects respectively. μ_c control for any time-invariant unobservable heterogeneity that could be correlated with both the consensus towards taxation and the health system endowment, while τ_t is the 2020 dummy that accounts for macroeconomic shocks that are common to all individuals.

The identification assumption that enables us to interpret β causally in Eq. (1) is that, conditionally on controls, as well as regional time varying controls Z_{rt} and regional fixed effects, the change in consensus towards taxation in 2020 in regions with a good health system is not related to factors others than those we control for $(X_r \times Post_t)$ interaction term. Moreover, we extensively test the robustness of our identification strategy. We do so both checking that consensus towards taxation was not on a different trend in low versus high-health system endowment regions in the pre-pandemic period (parallel trends assumption over the 2018-2019 period) and making a placebo test that supports our empirical results.

4 Empirical results

Table 3 shows the estimates of the effects given by the first wave of the Covid-19 pandemic on the attitude towards taxation in European regions with different levels of health system endowment. As anticipated in the previous sections, our sample consists of four countries: Italy, France, Germany and Spain.

More precisely, the first column shows a specification without controls, but including a full set of NUTS-2 and time fixed effects. Columns (2) to (6) report estimates which progressively take into account an increasingly wide set of controls. More specifically, demographic controls, geographic controls, internet-related controls and socio-economic controls (measured in 2019, or in the last available year before the pandemic) enter the model interacted with the pandemic dummy variable (before/after the pandemic) in order to account for possible evolutions in the consensus towards taxation related to regional characteristics that should be correlated with the number of physicians.[8]

From an aggregated interpretation of Table 3, *N° Physicians*Post* coefficient is significantly positive, suggesting that the pandemic has raised aggregate positive tweets towards redistribution, especially in regions with an higher number of physi-

[8]Among other geographical controls, we include a geodetic distance between the centroids of each NUTS-2 regions and the Italian pandemic epicentre (expressed in Km). In fact, Italy was the first country in Europe where the Covid-19 pandemic broke out. However, since the pandemic resulted in many restrictions on the movement of people, especially between different states, we replicated all analyses using as a control the distance of each NUTS-2 centroid from the national epicentre of the pandemic. Even in this set-up, the results remain unchanged.

Table 3: Impact of Covid-19 pandemic on the consensus towards taxation across regions with different health system endowment

Dep. Var: Positive tweets (%)	(1)	(2)	(3)	(4)	(5)	(6)
*N° Physicians*Post*	0.1021**	0.0974**	0.0987**	0.0969**	0.0972**	0.0862**
	(0.0417)	(0.0420)	(0.0457)	(0.0428)	(0.0428)	(0.0415)
NUTS-2 FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Demographic controls * Post		yes	yes	yes	yes	yes
Mortality rate (TV)			yes	yes	yes	yes
Geographic controls * Post				yes	yes	yes
Internet-related controls * Post					yes	yes
Socio-economic controls * Post						yes
Observations	142	142	142	142	142	142
R-square	0.7651	0.7754	0.7758	0.7961	0.7972	0.8075

Notes: The variable *N° Physicians*Post* is the diff-in-diff interaction term between the number of physicians at NUTS-2 region level (2018) and the pandemic dummy. TV stands for time varying. Demographic controls include: population, percentage of graduates, percentage of over 75s, percentage of men/women, population density. Geographic controls include: latitude, ruggedness, area surface, distance from the coast and distance from Codogno. Internet related controls are the number of households with internet connection,as well as the amount of time spent on social network. Socio-economic controls include: GDP per capita, EQI index, unemployment rate and the share of high tech firms. Standard errors are clustered at NUTS-2 region level. * significant at 10%, ** significant at 5%, *** significant at 1%.

cians, thus characterized by a higher healthcare expenditure. The coefficient is stable and significant (at a 5% level of confidence) between all the different specifications. The coefficient of the most complete specification reported in Table 3 column (6) shows an increase in positive tweets towards taxation of 8.3% in regions with a very high number of physicians per thousand inhabitants (75th percentile) compared to regions with a low number of physicians (25th percentile).[9]

Moreover, to assess the stability of our results, along the line of Guiso et al. (2017 [26]), we repeat the analysis using as main independent variable the interaction between the post-pandemic dummy and a dichotomous variable, namely a dummy variable equal to one if the number of physicians is above the 75th percentile, and zero otherwise (see Appendix A). Overall, results are still the same.[10]

To better explore the drivers of this result, we investigate whether the impact of the pandemic on perceptions towards taxation expressed via twitter differs in regions with high or low level of institutional quality. Concerning the quality of institutions, we consider the data of the 2017 EQI which is elaborated by the European Quality of

[9]The differential in terms of positive tweets was calculated by multiplying the coefficient reported in Table 3 column (6) by the difference between the number of physicians per 100,000 inhabitants at the 75th and 25th percentile of the distribution. Thus, the number commented in the main text should be read as the difference in the dynamics of positive tweets in 2020 compared to 2019 between those living in regions with high and low health system endowment.

[10]Furthermore, we replicated our main specification using as main independent variable the number of hospital beds per 100,000 inhabitants interacted with the post-pandemic variable, another proxy that effectively summarises the capacity of the health system to deal with the pandemic. Overall, the results are in line with our main findings. Results are available upon request.

Government Institute of Gothenburg University, funded by the European Commission[11] at the NUTS-2 level. This indicator, which is based on large citizens survey about the three dimensions, was firstly published in 2010 and then updated in 2013, 2017 and 2021. The different versions of the indicator are strongly correlated with each other. Anyway, since our research is focused on the time span 2018-2020, in this heterogeneous analysis we refer to the 2017 release.

Table 4 shows, in split sample, the impact of the Covid-19 pandemic on the consensus towards taxation between regions with different health system endowment for regions with low and high quality of institutions respectively. Both specifications in the table are complete with the full set of controls, as the main specification reported in column (6) of Table 3.

Table 4: Impact of Covid-19 pandemic on consensus towards taxation across regions with different health system endowment for different EQI

Dep. Var: Positive tweets (%)	low EQI	high EQI
	(1)	(2)
N^{o} Physicians*Post	0.0149	0.3136*
	(0.0335)	(0.1667)
NUTS-2 FE	yes	yes
Year FE	yes	yes
Demographic controls * Post	yes	yes
Mortality rate (TV)	yes	yes
Geographic controls * Post	yes	yes
Internet-related controls * Post	yes	yes
Socio-economic controls * Post	yes	yes
Observations	72	70
R-squared	0.9420	0.8399

Notes: The variable N^{o} Physicians*Post is the diff-in-diff interaction term between the number of physicians at NUTS-2 region level (2018) and the pandemic dummy. TV stands for time varying. Demographic controls include: population, percentage of graduates, percentage of over 75s, percentage of men/women, population density. Geographic controls include: latitude, ruggedness, area surface, distance from the coast and distance from Codogno. Internet related controls are the number of households with internet connection,as well as the amount of time spent on social network. Socio-economic controls include: GDP per capita, unemployment rate and the share of high tech firms. Standard errors are clustered at NUTS-2 region level. * significant at 10%, ** significant at 5%, *** significant at 1%.

[11]For sake of completeness, see https://www.gu.se/en/quality-government/qog-data/data-downloads/european-quality-of-government-index.

Judging by both the significance and the magnitude of the coefficient reported in column (2) of Table 4, the investigated issue appears to be much stronger in the sub-sample of regions with high quality of institutions compared to the overall sample, while there seems to be no significant effect in the sub-sample of regions with low quality of institutions. In addition, the N^o *Physicians*Post* coefficient reported in column (2) of Table 4 points out an increase in positive tweets towards taxation of 30.1% in regions with a high number of physicians per thousand inhabitants (75th percentile) compared to regions with a low number of physicians (25th percentile). The effect of the pandemic appears to be more than threefold than that found in our main specification (as indicated in column (6) of Table 3).[12] This difference may be explained by the fact that in regions with low quality of institutions people are, overall, less favorable to increasing taxation, since already in the pre-pandemic period low quality of institutions has a positive correlation with lower trust in them. To this aim, the EQI index seems to be the appropriate indicator to capture this phenomenon as it is a composite indicator that takes into account corruption, quality and impartiality of institutions. Thus, people living in these areas tend to attribute less importance to the performance of the health system in combating the pandemic related to the aforementioned taxation choices (as a proxy by what they tweet). Said in other words, the poor reputation of the institutions cannot be offset by a better or worse approach to curbing the pandemic. Conversely, where institutions are stronger, i.e. less corrupt, more impartial and of higher quality, individuals tend to be guided by the quality of the local health system, the most important issue at the time, in their choice of taxation and redistribution.

A point should be raised: while it is recognised that fiscal capacity is crucial for financing the political measures of a state, the origins and the relevant differences across countries are less clear. To understand this issue, the pillars of EQI are worth to be investigated. The quality of government is defined as the impartiality and efficiency of the public institutions through which the output side of government is organized (Rothstein and Teorell, 2008 [44]). As previously mentioned, the quality of government has an impact not only on social outcomes, but also on attitudes towards welfare policies. We have stressed that in regions characterised by a high EQI score, citizens are more favorable towards taxation. This result is consistent with the existing literature that investigates the relationship between quality of institutions, impartiality, corruption and taxation. Svallfors (2013 [50]), for instance, deeply analyses the perceptions of government impartiality and efficiency, finding that they actually influence the attitudes towards taxes and social spending in different ways. Firstly, where institutions are perceived to be more fair and efficient, citizens are are found to be inclined to support extensive welfare policies and provide resources for

[12]This result seems to be in line with Bottasso et al. (2022 [11]), who find an increase in political trust after the first pandemic wave in European regions with high quality institutions compared to regions with low quality ones.

them. Moreover, they also increase the support among redistributive policies. Also people's willingness to pay environmental taxes varies according to the quality of government (Davidovic et al., 2020 [18]), with people that are more concerned about environmental issues are more willing if they live in countries characterised by high quality of government. Also in this context, the quality of institutions matter. Ricciuti et al. (2018 [42]) analyse on the long-run impact of political institutions, distinguishing between the accountability and transparency of fiscal institutions (impartiality) and their effectiveness in extracting revenues. They evidence how the effect of political institutions on tax effort is substantial, both on income tax and total tax revenues.

Developing robust tax systems that are effective, efficient, and equitable is very important for sustaining legitimate and effective states with resilient fiscal social contracts and good tax morale (Brock, 2014 [13]). Corruption causes the widespread of the informal sector, eroding the potential tax base (Schneider and Denste, 2000 [46]). In addition, it is well-know in the literature that the diffusion of corruption at different levels fosters an increase of tax evasion, damaging the culture of compliance (Aghion et al., 2016 [1]), affecting also household businesses' tax compliance (Trung Le et al., 2020 [53]). The existing negative relationship between corruption and taxation is justified by the influence that corruption plays on tax compliance. To this aim, as suggested by Baum et al. (2017 [9]) it should be considered the strengthen of institutions as a way to increase tax compliance.

4.1 Parallel Trends, placebo and robustness checks

To validate our empirical approach, we ran a battery of placebo and robustness checks. Furthermore, we investigate the validity of the parallel trend assumption.

Indeed, the diff-in-diff research design and our identification strategy are valid under the assumption of a common trend in tweets towards taxation between treatment and comparison groups before the outbreak of the Covid-19 pandemic. Since in our case all regions are considered as "treated" and what changes is the intensity of treatment, we split the regions according to the health system endowment. Thus, our treatment group consists of regions within the four European countries analysed that have a number of physicians per 100,000 inhabitants above the aggregate average, whereas the control group consists of regions that have a number of physicians per 100,000 inhabitants below the aggregate average.[13]

The graph on the left hand side of Figure 4 shows the trend for pro-tax tweets weighted by the number of total tweets in that region for the period 2018 to 2020. The blue line depicts the trend for the treatment group, while the dashed green line depicts the trend for the control group. The right hand side graph in Figure 4 investigates the same issue, but assuming a different definition of treatment and control group. Basically, the treatment group considers those who are in the second quartile of the distribution regarding the number of physicians per 100,000 inhabitants, while the control group considers the fourth quartile. In both graphs of Figure 4 the path of consensus towards taxation in the pre-pandemic period, as proxied by the number of positive tweets over the total number of tweets related to the issue, is very similar with respect to the treatment and the control groups.

What emerges is that the number of positive tweets from regions characterised by a number of physicians below the average has decreased after the widespread of the pandemic, while people has become more prone towards taxation where more physicians per 100,000 inhabitants are present. This result is in line with what has been highlighted from a consistent part of the literature on tax compliance. As previously mentioned, the problem of tax compliance seems much too complex to be explained by a pure standard economic approach. Following the neoclassical framework, Allingham and Salmo (1972 [2]) assume that taxpayers are rational agents whose choice behavior conforms to the Von Neumann-Morgenstern theorem, with rational agents trying to maximize the utility of their taxable income. However, predictions of the standard economic model, tested with empirical analysis, laboratory experiments and surveys, are far to be clear and homogeneous. For this reason, tax compliance has also gained the attention of research in economic psychology.

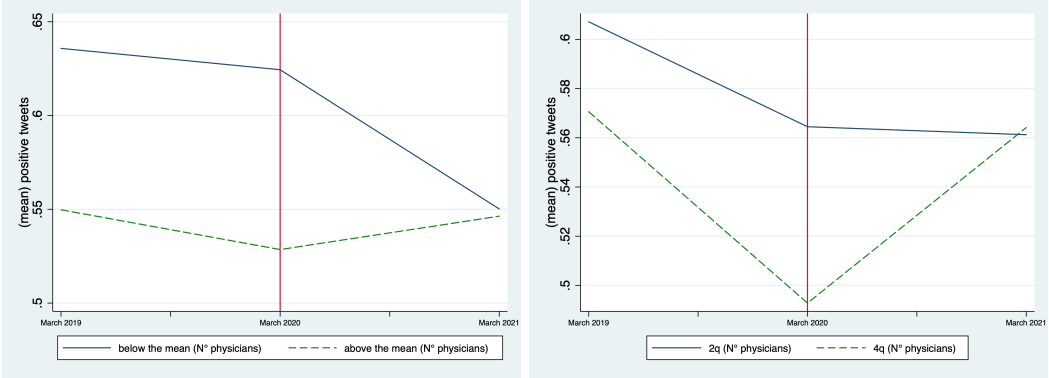
This stream of literature highlight, among other contributions, how in a context where taxpayers trust the authorities of their state, other variables, such as knowl-

[13] By "aggregate average" we indicate the regional average of health system endowment, considering all the regions within the European countries included in the analysis.

edge, attitudes, moral appeals, fairness and democracy, gain in importance in addition to those considered in the mainstream economic studies (Kirchler et al., 2007 [31]). Selway (2021 [47]), for instance, consider the the number of physicians as a proxy of public good provision in health. Their finding suggests that high level of public goods provision has also contributed to impressive economic growth. In turn, Rodriguez-Pose and Burlina (2021 [45]) find that excess mortality in the first six months of the pandemic is mainly concentrated in regions characterised by, among other things, "underfunded" health care systems. Moreover, Braithwaite (2003 [12]) suggests that taxpayers are pushed by different motivations in paying their taxes. While some may choose to comply due to their commitment with the community, others may opt for tax evasion as sort of game playing with the state.

In addition, a reduction of the social distance between taxpayers and tax authorities leads individuals to a more favorable attitude towards taxation. Casal et al. (2016 [14]) in an experiment find out that compliance was higher in the context avoiding tax framing. Information about participants' contributions has proved to be either clearly related to the tax context or related to government public expenditures, resulting that tax compliance is significantly higher when participants had voice on contributions. It follows that in this context people tend to evaluate the entire performance of the government through its performance in health.

Figure 4: Parallel trend analysis

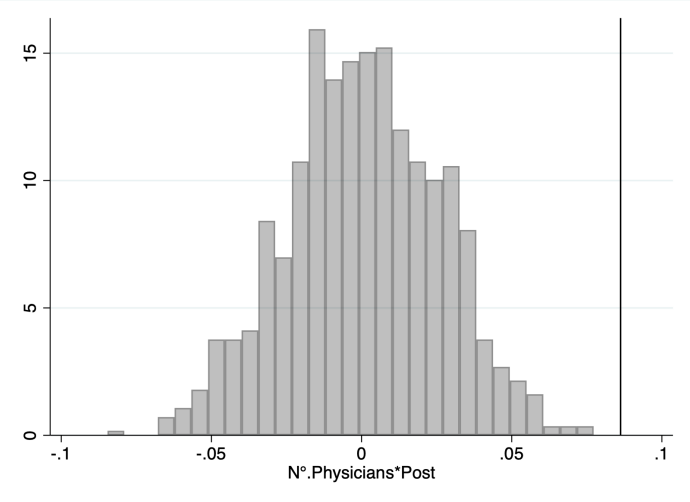


Notes: Mean number of physicians index for the pre-pandemic period (2018 - 2020), as well as the quartiles of the distribution, are based on Eurostat 2018 and Twitter data.

As previously discussed, to further test the validity of our research design, we also performed a placebo analysis. That is, we randomly assign the dependent variable, i.e. positive tweets towards taxation (%), across regions and keeping constant the number of treated and control regions. Figure 5 below shows the frequency of N^o *Physicians*Post* estimated coefficients obtained from replicating the column specification (6), Table 3, after randomly distributing the dependent variable. We replicated this placebo 1,000 times. As emerges from Figure 5, the largest number of estimated coefficients show a value of our main independent variable equal to zero. Therefore, among the more than one thousand replicated placebo regressions, not

once assumed the value of *N° Physicians*Post* coefficient found in the main analysis, which is shown with the black vertical line. This placebo analysis therefore provides further evidence in support of the validity of our results. Moreover, in Appendix A, by testing any unbalancedness of the controls (Table A.1) and assessing the stability of the results by excluding some extreme values from the sample (Table A.2), we provide further evidence of the validity of our research design.

Figure 5: Random allocation of positive tweets (%) towards taxation across regions



Notes: The estimate reported in Figure 5 is made by taking our main equation as the base equation. The dependent variable is the positive tweets variable (weighted on total tweets), while *N° Physicians*Post* is the diff-in-diff interaction term between the health system endowment index and the pandemic dummy, divided by one hundred to normalize the indicator. Controls include: demographic controls (population, percentage of graduates, percentage of over 75s, percentage of men/women and population density), geographic controls (latitude, ruggedness, area surface, distance from the coast and distance from Codogno), internet related controls (the number of households with internet connection and the amount of time spent on social network) and socio-economic controls (GDP per capita, EQI index, the share of high tech firms and the unemployment rate). The y-axis indicates the probability density function of the estimated coefficients. The black vertical line is placed in correspondence of the "true" estimated value of the coefficient, reported in column (6) of Table 2. (*N° Physicians*Post* = 0.0862**).

5 Conclusions

Over the last decades a constant increasing social and political discussions on the need of more redistributive policies has taken place in Western economies. In the light of this debate, this article evaluates the impact of Covid-19 pandemic and the consequent economic crisis on citizens' perception towards taxation.

We evaluate the role that the health system endowment plays in the four biggest countries of the European Union: France, Germany, Italy and Spain. As a measure of perception of attitudes towards taxation we consider a simple social sentiment analysis on different keywords related to the topic.

To examine the role played by the quality of the health system on this debate, we use a difference-in-differences estimation strategy, which consists of comparing the average sentiment as reported by tweets from individuals living in NUTS-2 regions with high/low level of healthcare system endowments, before and after the spread of the Covid-19 pandemic.

Two results are worth stressing. First, in regions characterized by higher levels of health expenditure, implying already high levels of welfare, citizens become more prone towards taxation with respect to the period before the widespread of Covid-19. So, during the emergency period, the ability to curb the pandemic with public spending on health care seems to have been the real game changer with respect to citizens' propensity to taxation. Secondly, this favorable attitude is more present for those area with high quality of institutions, while it vanishes where the quality of institutions is low. Where institutions are stronger, more impartial and of higher quality, individuals' tax compliance tend to be more sensitive to how the health expenditure is managed. This suggest that a widespread support for public policies depends to a large extent on the quality of the institutions of regions in which they are delivered.

In terms of policy implications, we highlight that with an efficient public expenditure (i.e. a higher health system endowment), people becomes more favorable towards redistributive policies. As Midgley (1999 [36]) suggests, social development offers an alternative perspective on redistribution, emphasizing how resource are allocated and preferring social programs that are investment oriented, since they encourage economic participation and make a positive contribution to development. Next European economic and social challenges will require a certain degree of redistribution, that needs to be supported by citizens. To push people to be more prone towards these measures, a positive framing information from government and policy makers should allow a good awareness of the way in which public finances are employed.

Future research should evaluate the effect of the tax moral on the level of persistence in the degree of positive (negative) public opinion as well as in the perception of institutions.

Appendix A

A.1 Additional placebo and robustness checks

In this section we provide some robustness checks with the aim of further testing the validity of the model and, consequently, of our results. Table A.1 shows the first placebo test. Specifically, following the approach of Pei et al. (2019) [37], we re-estimate our baseline model using as dependent variable the main variables used as controls in our analysis (one by one). In this way, we should be able to assess any unbalancedness of the variables used as control. That is, if the balancing property holds, we should find for the interaction term all coefficients equal to zero. As evident from the coefficients reported in Table A.1, all the main controls used as dependent variables (placebo outcomes) do not show a connection with our *N°.Physicians*Post* interaction variable.

Table A.1: Test of main covariate balance

Dependent Variable:	Popul.	Elderly	Sex	Mortal.	Coast Dist.	Codogno Dist.	Unemp.	EQI	GDP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
*N°.Physicians*Post*	-816,812.3986	0.1672	0.1749	-0.0001	-23.9944	13.2086	-0.3895	-0.0258	-0.0000
	(558,453.6797)	(0.1078)	(0.5023)	(0.0002)	(20.2060)	(76.6073)	(0.4367)	(0.0989)	(0.0000)
NUTS-2 FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Demographic controls * Post	yes	yes	yes	yes	yes	yes	yes	yes	yes
Mortality rate (TV)	yes	yes	yes	yes	yes	yes	yes	yes	yes
Geographic controls * Post	yes	yes	yes	yes	yes	yes	yes	yes	yes
Internet-related controls * Post	yes	yes	yes	yes	yes	yes	yes	yes	yes
Socio-economic controls * Post	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	142	142	142	142	142	142	142	142	142

Notes: The variable *N.Physicians*Post* is the diff-in-diff interaction term between the number of physicians at NUTS-2 region level (2018) and the pandemic dummy. TV stands for time varying. Demographic controls include: population, percentage of graduates, percentage of over 75s, percentage of men/women, population density. Geographic controls include: latitude, ruggedness, area surface, distance from the coast and distance from Codogno. Internet related controls are the number of households with internet connection,as well as the amount of time spent on social network. Socio-economic controls include: GDP per capita, EQI index, unemployment rate and the share of high tech firms. Standard errors are clustered at NUTS-2 region level. * significant at 10%, ** significant at 5%, *** significant at 1%.

In table A.2 we report some replications of our main specification (column (6), Table 2) repeated on some specific subsamples. In column (1) we remove from the sample the 1% of observations with the highest/lowest number of physicians per 100,000 inhabitants, in column (2) the 1% of observations with the highest/lowest GDP per capita and finally in column (3) the 1% of observations with the highest/lowest mortality rate.

As evidenced by the interpretation of the estimated coefficients, all slightly higher than our main coefficient but substantially unchanged and always statistically significant (5%), this robustness test again confirms the stability of our results.

Table A.2: Robustness check to extreme values

Dep. Var: Positive tweets (%)	(1)	(2)	(3)
*N°.Physicians*Post*	0.0947**	0.0876**	0.0911**
	(0.0420)	(0.0418)	(0.0426)
NUTS-2 FE	yes	yes	yes
Year FE	yes	yes	yes
Demographic controls * Post	yes	yes	yes
Mortality rate (TV)	yes	yes	yes
Geographic controls * Post	yes	yes	yes
Internet-related controls * Post	yes	yes	yes
Socio-economic controls * Post	yes	yes	yes
Observations	138	138	136
R-squared	0.8093	0.8063	0.8127

Notes: The variable N.Physicians*Post is the diff-in-diff interaction term between the number of physicians at NUTS-2 region level (2018) and the pandemic dummy. TV stands for time varying. Demographic controls include: population, percentage of graduates, percentage of over 75s, percentage of men/women, population density. Geographic controls include: latitude, ruggedness, area surface, distance from the coast and distance from Codogno. Internet related controls are the number of households with internet connection,as well as the amount of time spent on social network. Socio-economic controls include: GDP per capita, EQI index, unemployment rate and the share of high tech firms. Standard errors are clustered at NUTS-2 region level. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A.3 shows a supplementary robustness check. Following Guiso et al.(2017) [26] we repeat our main analysis using as main independent variable the interaction between the post-pandemic dummy and a dichotomous variable, namely a dummy variable equal to one if the number of physicians (NUTS-2 level) is above the 75th percentile, and zero otherwise.

The specifications from column (1) to column (6) replicate the structure of our main table (Table 3, main text), thus progressively including in the analysis a growing number of controls. A joint interpretation of the several coefficients showed in Table A.3 evidences robust and stable coefficient. The coefficient of the most complete specification shown in column (6) suggests that, in regions with a very high number of physicians per thousand inhabitants, positive tweets increased by about 10.2% compared to regions with medium to low number oh physicians.

Table A.3: Robustness to alternative measure of health system endowment

Dep. Var: Positive tweets (%)	(1)	(2)	(3)	(4)	(5)	(6)
*Top 75th N°.Physicians*Post*	0.1191**	0.1053*	0.1094*	0.1066*	0.1104**	0.1062**
	(0.0511)	(0.0542)	(0.0596)	(0.0563)	(0.0511)	(0.0486)
NUTS-2 FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Demographic controls * Post		yes	yes	yes	yes	yes
Mortality rate (TV)			yes	yes	yes	yes
Geographic controls * Post				yes	yes	yes
Internet-related controls * Post					yes	yes
Socio-economic controls * Post						yes
Observations	142	142	142	142	142	142
R-squared	0.7434	0.7522	0.7514	0.7747	0.7763	0.7895

Notes: The variable Top 75th N°.Physicians*Post is the diff-in-diff interaction term between the post-pandemic dummy and a dichotomous variable, equal to one if the number of physicians is above the 75th percentile, and zero otherwise. TV stands for time varying. Demographic controls include: population, percentage of graduates, percentage of over 75s, percentage of men/women, population density. Geographic controls include: latitude, ruggedness, area surface, distance from the coast and distance from Codogno. Internet related controls are the number of households with internet connection,as well as the amount of time spent on social network. Socio-economic controls include: GDP per capita, EQI index, the share of high tech firms and the unemployment rate. Standard errors are clustered at NUTS-2 region level. * significant at 10%, ** significant at 5%, *** significant at 1%.

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