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## The 'Welcomed Lockdown' Hypothesis: When Do Mobility Restrictions Influence Mental Wellbeing?

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# The ‘Welcomed Lockdown’ Hypothesis: When Do Mobility Restrictions Influence Mental Wellbeing?

## Abstract

The COVID-19 pandemic and its mobility restrictions have been an external shock, influencing wellbeing. However, does risk exposure affect the welfare effect of lockdowns? This paper examines the ‘welcomed lockdown’ hypothesis, namely the extent to which there is a level of risk where mobility restrictions are not a hindrance to wellbeing. We exploit the differential timing of the effect of the pandemic across European countries, and the different stringency of lockdown to examine the effects on two mental health conditions, namely anxiety and depression. We examine whether differences in symptoms of anxiety and depression are explained by mortality and stringency of lockdown measures using an event study that draws on Coarsened Exact Matching (CEM), Difference-in-Difference (DiD) and Regression Discontinuity Design (RDD). Our estimates suggest an average increase in depression (3.95%) and anxiety (10%) symptoms relative to the mean level on the day that the lockdown took effect. However, such effects are wiped out when a country exhibits high mortality (‘pandemic category 5’). Hence, we conclude that in an environment of high mortality, lockdowns no longer give rise to a reduction in well-being consistent with the ‘welcome lockdown’ hypothesis.

JEL-Codes: I180.

Keywords: anxiety, depression, Covid-19, pandemic, lockdown.

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## 1. Introduction

Pandemics can exert important detrimental effects on individuals' mental wellbeing, as the risks of contagion can trigger anxiety concerns and depressive symptoms. However, these effects are only partly the direct result of exposure to COVID-19 risk (in this case, the risk of infection), but also due to the stringency of policy interventions. Policy restrictions include spatial lockdowns alongside a number of regulatory measures that restrict individual freedoms, such as the obligation to wear face masks in public places, the need for social distancing, temperature checks, use of hand gels. Each of these can protect against the risks of infection, but, at the same time, they act as *reminders of the severity of the pandemic*. This paper examines the extent of this impact using evidence from the first wave of COVID-19 pandemic.

COVID-19 has uniquely disrupted the wellbeing of individuals. First, unlike previous epidemics, it has spread at an unprecedentedly rapid speed, especially in European countries, which had barely a few weeks to react. Individuals could not learn from previous pandemics as they were localised overseas – mostly in East Asian countries. Second, policy measures that have been put in place to fight COVID-19 have been heterogeneous across European countries for a quasi-experiment to examine the effect of different policy stringency measures on wellbeing. This is possible as during COVID-19, infection numbers have been recorded and communicated to the general population when outbreaks have occurred.<sup>1</sup>

**[Insert Figure 1 about here]**

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<sup>1</sup> Millions of people could die if the coronavirus pandemic sees a second wave of infections. “The a, which behaved exactly like COVID-19: it went down in the summer and fiercely resumed in September and October, creating 50 million deceased during the second wave”. Available at: [https://edition.cnn.com/world/live-news/coronavirus-pandemic-06-26-20-intl/h\\_337aac61bfd759992dd23cd77cbd00ed](https://edition.cnn.com/world/live-news/coronavirus-pandemic-06-26-20-intl/h_337aac61bfd759992dd23cd77cbd00ed)

Previous studies have documented detrimental mental health effects of COVID-19 and policy restrictions. Banks and Xu (2020) document a reduction of mental wellbeing among those who had a mental disorder prior to COVID-19, and in contrast, other studies have explored the effects of lockdown, documenting a rise in mental distress compared to pre-pandemic levels (Sibley et al. 2020, Codagnone et al. 2020). However, previous studies are very much country-specific and do not interact with the effect of risk exposure combined with policy restrictions. We attempt to add to this discussion.

Figure 1 combines evidence of exposure to risk and stringency of government responses in 22 European countries on March 20th, 2020<sup>2</sup>. In almost all countries (with the noticeable fundamental exception of Sweden and the United Kingdom) the value of the Stringency Index (a composite measure based on indicators including prohibition of public meetings, total or partial school closures and workplace closures and introduction of travel restrictions bans within and between countries; see below) is large. Such aggregate results suggest that the spread of the pandemic and the associated mortality rates differ widely between countries.

This paper studies the ‘welcomed lockdown’ hypothesis, namely the extent to which there is a level of risk where mobility restrictions are not a hindrance to wellbeing. That is, we examine the wellbeing effects of mobility restrictions resulting from COVID-19, controlling for risk exposure (proxied by COVID-19 fatality rate). We examine whether differences in symptoms of anxiety and depression are explained by

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<sup>2</sup> Red figures depict mortality per million inhabitants, green circles denote the spread of the virus (confirmed cases per million inhabitants) and the height of the blue bricks indicate the value of the COVID-19 Government Response Stringency Index (abbreviated “Stringency Index”).

mortality and stringency of lockdown measures using several strategies including the Coarsened Exact Matching (CEM). This is an innovative matching methodology developed by Iacus et al. (2012). Previous work in the literature addressing similar research questions has attempted to address these identification problems by relying on propensity score matching (King and Nielsen, 2019). The use of a European sub-sample (22 countries) retrieved from an online survey conducted globally between March 20th and April 6th 2020 implies that the selection of the counterfactual is the crucial step for the correct quantification of the average treatment effect.

Our choice to use CEM is motivated by the fact that this method has been designed by the authors to provide an improvement over existing matching approaches in estimating causal inference by reducing any imbalance in covariates between treated and control units. CEM incorporates properties of the exact matching procedure, and in addition, it possesses a peculiar feature that distinguishes it from other matching methods in allowing the balance between treated and control groups to be chosen *ex-ante*, rather than having to be discovered *ex-post*. To our knowledge, this is the first work using the CEM to estimate the causal effect of the imposition of lockdowns due to the Covid-19 pandemic on mental health. Furthermore we use two additional strategies, namely a Difference-in-Difference (DiD) and Regression Discontinuity (RD) design.

On the day that lockdown takes effect, we estimate an increase in depression (2.76%) and anxiety (7.40%) symptoms relative to the mean level. However, the interaction of lockdown with high mortality (pandemic category 5) results in a considerable reduction in depression (-6.46%) and anxiety (-8.43%). Secondly, although the announcement of a pandemic as level 5 gives rise to an increase in the symptoms of

depression (2.16%) and anxiety (13.80%), a lockdown call in this context reduces anxiety by almost 20%.

## **2. Related literature**

### *Previous pandemics*

Evidence from several pandemics and epidemics across the world suggests impacts on mental health, in some cases long-lasting. Individuals infected with SARS (Severe Acute Respiratory Syndrome) in Hong-Kong exhibited a rise in moderate and severe mental disorders, such as anxiety and depression (Chit-Mak et al, 2009). Similarly, Kim et al. (2018) found that 70% of patients hospitalized for MERS (Middle East Respiratory Syndrome) in South Korea experienced a mental disorder whilst hospitalised, but 40% of those who were infected continued to use psychiatric medications after discharge. Maunder (2009) documents effects of lockdown for SARS, Pfefferbaum et al. (2012) for H1N1 and Jeong et al. (2016) for MERS. Some evidence implies that lockdown gives rise to feelings of boredom, frustration and isolation from the rest of the world (Blendon et al., 2004; Braunack-Mayer et al., 2013). Hawryluck et al. (2004) found that, during SARS quarantine in Canada, symptoms of post-traumatic stress disorder and depression were observed in 28.9% and 31.2% of respondents, and longer durations of quarantine were associated with increased prevalence of these symptoms<sup>3</sup>.

Individuals are more prone to comply with government recommendations if they believe that their behaviours have a relevant impact on society (Michie et al., 2011; Michie et al., 2020). Government recommendations run the risk of creating exacerbated fears of contagion and compulsive behaviours (Freeman et al., 2005). Fear of contagion

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<sup>3</sup> Such effects result in part from difficulties in obtaining supplies, problems in receiving medical treatment or for other reasons not related to the health emergency (Blendon et al., 2004; Wilken et al, 2017).



includes the fear of passing it on to other family members (Bai et al., 2004; Cava et al., 2005), and might extend beyond the duration of lockdown (Jeong et al., 2016). In the UK, during lockdown, 66% of individuals stated that they preferred not to watch the news because it negatively affected their mental health (YoungMinds, 2020).

#### *Lockdown due to Covid-19 outbreak*

The evidence of mental health effects of COVID-19 point out significant effects on mental well-being, but reveal wide heterogeneity. Brooks et al. (2020) conclude that most of the studies reviewed reported negative psychological effects, such as post-traumatic stress, confusion and anger. Using Google trends data for Europe and the United States, Brodeur et al. (2020) found a substantial increase in search intensity for boredom, loneliness, worry and sadness, although searches for stress, suicide and divorce, on the other hand, decreased. Adams-Prassl et al. (2020) compared US states that had established strict confinement with those that had not, finding a slight worsening of mental health indicators in the former.

In the UK, Pierce et al. (2020) observe that mental distress increase after one month of lockdown and Banks and Xu (2020) report greater negative effects for young adults and women, which already had lower levels of mental health prior to COVID-19, concluding that mental health inequalities have been increased by the pandemic. In New Zealand, Sibley et al. (2020) explored the immediate effects of confinement by comparing samples of New Zealanders assessed before and during the first 18 days of lockdown, finding that people in the pandemic lockdown group reported higher rates of mental distress compared to people in the pre-pandemic group before lockdown.

Some studies have shown that detrimental mental effects due to lockdown are concentrated in some population groups. Codagnone et al. (2020) estimate the extent to which the socio-economic background of a household can predict perceived stress and

anxiety using a multi-country (Italy, Spain and UK) survey, finding that around 42.8% of the population is at risk of adverse mental health effects due to the combination of lockdown and socio-economic vulnerability. Zhang et al. (2020) documents that those who stopped working during COVID-19 in China reported worse mental and physical health. Beland et al. (2020) confirmed similar results with evidence from Canada, and Gopal et al. (2020) and Etheridge and Spantig (2020) document an increase in anxiety and depression among women in India, and the UK respectively. In contrast, Planchuelo-Gómez et al. (2020) that the mental health worsening during the COVID-19 lockdown, eventually disappeared among older people.

Nonetheless, some studies document no worsening of mental health. Bu et al. (2020) no change in levels of loneliness during the strictest confinement in the UK. Similarly, Luchetti et al. (2020) reports no significant changes in the average loneliness across the three assessments in January to April. Finally, Foa et al. (2020) found that the negative effects associated with the outbreak of the pandemic were concentrated in the period before confinement began. Once confinement took effect, feelings of sadness, stress, and fear declined and happiness, optimism, and contentment increased. These results are in line with those recorded by 'Britain's mood', measured weekly (yougov.co.uk) according to which, between 26 March and 4 April 2020, the percentage of people reporting happiness increased from 26% to 29%, and more significantly, those reporting stress decreased from 48% to 39%. Fancourt et al. (2020) have reported a decrease in anxiety and depression levels over the first 20 weeks after the introduction of the confinement in England. Their data suggest that the highest levels of depression and anxiety occur in the early stages of lockdown, but decrease fairly rapidly as individuals adapt to the circumstances.

Lockdowns may have had mental health benefits, such as reduced workplace stress, increased autonomy for telecommuters or improved work-life balance (Greenhous et al., 2003). The use of digital communication, not only as a tool for information but also for leisure, may have helped to ease the burden of the lock-in itself, compared to previous epidemics where the fear of being disconnected from the world was more dramatic (Baker et al., 2016).

However, there is heterogeneity, especially worsts results are found among women and lower education and income, and individuals with pre-existing mental disorders at the beginning of the lockdown. Recchi et al. (2020) found an improvement in self-reported well-being in France during lockdown compared to previous years, with the exception of blue-collar workers and residents of the Paris area.

### **3. Data and empirical strategy**

#### **3.1 Data**

Our data come from a survey launched online through the website <https://COVID19-survey.org/> (Fetzer et al., 2020). The questionnaire was translated into 69 languages. The first call of the online survey was published via social media on 20<sup>th</sup> March 2020, through the accounts of people connected to traditional media (journalists, TV presenters) along with social media influencers, international and national NGOs and university networks. In the period between March 20<sup>th</sup> and April 6<sup>th</sup>, 103,153 questionnaires were collected from 178 countries.<sup>4</sup> All the information collected in the surveys is available without restrictions at <https://osf.io/3sn2k/>.<sup>5</sup>

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<sup>4</sup> Pierce et al. (2020) also use data from an only survey but with a shorter interview window (April 23rd-30th).

<sup>5</sup> We thank Fetzer et al. (2020) for the availability of the database and the description of the questionnaire.

We focus on 22 European countries,<sup>6</sup> which results in a final sample containing 48,434 observations. We have focused our attention on European countries because at the time of the survey, the pandemic was hitting the European continent harder than the Americas (250,516 confirmed cases in Europe vs. 60,834 in America; 11,986 deaths in Europe vs. 813 in America; WHO, 2021). Moreover, the countries had reasonably similar healthcare systems, at least when compared with the rest of the world.

To control for differences in age, gender, education and income between respondents and population in each country, we use weights in the descriptive statistics and estimations<sup>7</sup>.

#### *Dependent variables.*

First, we draw on a commonly employed depression Index obtained from eight of the questions of the PHQ-9 (Patient Health Questionnaire) that were included in the survey questionnaire; with the exception of suicidal idea which was not asked.<sup>8</sup> The Depression Index is calculated by adding the 8 items and rescaling to values between 0 and 100 (average interitem covariance: 283.55; alpha Cronbach: 0.8776). Secondly, we examine evidence from an Anxiety Index computed from the answers to following four

<sup>6</sup> Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, Ukraine, United Kingdom

<sup>7</sup> For each individual  $i$  a weight is assigned according to the category to which he or she belongs (age-sex-income-education-country):

$$weight_{i_{age,gender,income,educ,country}} = \frac{F_{age,gender,income,educ,country} \cdot N_{country}}{N_{age,gender,income,educ}}$$

$F_{age,gender,income,educ,country}$  is the fraction of the population for each category age-gender-income-education for each country (considering eleven categories were considered for age (18-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65+), country-level income quintiles and three categories for education (less than 8 years of education, between 9 and 14 years of education, more than 14 years of education));  $N_{country}$  is the number of observations in the country;  $N_{age,gender,income,educ}$  is the number of individuals in the survey for each combination age-gender-income-educ in each country. These weights give a higher weighting to categories where there are fewer observations in the survey and to categories corresponding to a larger fraction of the country's population.

<sup>8</sup> Information is available for the remaining 8 items: "little interest or pleasure in doing things", "feeling down or hopeless", "trouble falling asleep or staying asleep or sleeping too much", "feeling tired or having little energy", "poor appetite or overeating", feeling bad about oneself (or that you are a failure or have let yourself or your family down), "trouble concentrating on things, such as reading the newspaper or watching television" and "moving or speaking so slowly that other people could have noticed or so fidgety or restless that you have been moving a lot more than usual".

questions: "nervous when I think in current circumstances", "worried about my health", "worried about the health of my family" and "stressed about leaving my house". Each item is answered with a scale taking values between 0 and 5. The Anxiety Index was calculated by adding the four items and rescaling the total to lie between 0 and 100 (average interitem covariance: 219.80; Cronbach alpha: 0.8421). The depression scale is based on the PHQ-9 (Patient Health Questionnaire) validated by Kroenke et al. (2001), with the exception of the exclusion of the item relating to suicidal ideation. The anxiety scale has been validated by Kaapor and Tagat (2021).

#### *Treatment effects.*

Policy responses are depicted by two different variables. The first variable is the Oxford COVID-19 Government Response Tracker (denoted in the models as “Stringency Index”). This index takes values from 0 to 100 and summarizes information on several different common policy responses that governments have taken to respond to the pandemic, such as school closures and restrictions in movement. The complete description is reported as a footnote to Figure 1A of the Appendix.

The second variable measures the date when lockdown at home became effective (see Table A1 of the Appendix). We define a binary variable that takes the value 1 if, for the day on which the interviewee answered the survey, and lockdown is in force in their country of residence; and the value 0 otherwise.

Risk exposure is measured from “Our World in data”<sup>9</sup> for the number of confirmed cases, recovered patients and deaths per 1,000,000 inhabitants for each date and country. Holman et al., (2020) have reported an increase of acute stress and depressive symptoms as COVID-19 deaths and infected people increased across the United States (Holman et

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<sup>9</sup> <https://ourworldindata.org/coronavirus-data-explorer>

al., 2020). The main limitation of using epidemiological data is that there are differences among countries in terms of legislative provision, recording deaths, and reporting deaths and the number of confirmed cases is reporting is also related to testing capacity for COVID-19 (West et al., 2020). We seek to adjust for some of these differences through fixed effects.

Additionally, we use the Pandemic Severity Index: this is a binary variable that takes the value 1 if the case fatality rate (ratio between deaths and confirmed cases in percentage) is higher than 2%. The Pandemic Severity Index classifies epidemics into five categories, with category 5 being the highest (Department of Health and Human Services, 2007). As this category was achieved by the 1918 Spanish flue, the variable ‘Pandemic Category 5’ indicates if COVID-19 has reached the ‘worst-case’ scenario pandemic for each day and country.

### 3.2. Coarsened exact matching

Coarsened exact matching (CEM) is a matching strategy developed by Iacus et al. (2012), which reduces the impact of confoundings on observational causal inference. The strategy consists of simultaneously matching using a set of possible confounders which are "coarsened", reducing the number of possible matching values for a given covariate with the aim of increasing the number of matches achieved<sup>10</sup>.

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<sup>10</sup> CEM works as follows. First, it makes a copy of the set of covariates chosen for matching. Second, the variables are broken down into different meaningful strata (i.e., into equal intervals of the same size or into intervals of different dimension from each other), through user choice automatically or through the CEM algorithm. Third, a unique stratum is created for each observation and each observation is placed in a stratum. The strata created are reassigned to the original data set, and any strata that does not contain at least one treated and one control unit is removed. Thus, the treatment effect is based on the matching provided by the algorithm, since the difference between treated and control units is obtained from the difference in the outcome variable between units belonging to the same strata. Finally, the higher the coarsening (higher number of strata), the lower the imbalance, as well as the lower the number of matches provided by the CEM.

After applying the CEM method, a weighting variable is obtained to equalise the number of observations within the comparison groups, which takes values between 0 and 1. To check the balance of two comparison groups, the multivariate imbalance measure L1 is used, whose size depends on the dataset and the selected covariates, and which takes values between 0 (perfect overall balance) and 1 (maximum imbalance), i.e. a larger value represents a larger imbalance between two groups. When good matching occurs, a substantial reduction in L1 is obtained (Green et al., 2015).

In our study, CEM has been used to make the two groups of respondents to the online survey before and after the inception of policy restriction statistically equivalent, based on age, gender, marital status, years of education, income, number of people in the household and comorbidities<sup>11</sup>. An additional advantage of the CEM estimator over the standard matching procedure is that it allows us to control for unobserved time invariant factors. This implies that we assume that the outcome variables of interest of the treated and control units, in the absence of any treatment show the same growth trajectory, i.e., the parallel trend assumption of the DiD method.

Table A3 in the Appendix report the descriptive statistics for the Anxiety and Depression Indexes, as well as their respective items, cross-classified by implementation of lockdown policies and Pandemic Severity Index of category 5<sup>12</sup>. As expected, countries that do not exhibit lockdown measures alongside a low mortality rate present the lowest levels of anxiety and depression and their corresponding items. In contrast, countries where the pandemic has reached category 5 according to the Pandemic Severity Index,

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<sup>11</sup> Muenning et al. (2017) and Tetteh et al. (2019) have found that CEM is preferable to other matching procedures (e.g. propensity score matching) in terms of more efficient processing and reduced model dependence, variance and bias. Ripollone et al. (2015) also showed that optimal performance is warranted only when the vector of important confounders is relatively small (fewer than 10), which is fulfilled in our case.

<sup>12</sup> Table A3 also compares the Depression Index and Anxiety Index between the initial sample and the sample obtained after applying CEM.

but where no lockdown has been decreed show the highest levels for sleeping problems (47.33), troubles with concentrating (44.58), nervousness when thinking about current circumstances (75.06) and stress about leaving the house (82.39). Interestingly, countries with lockdown, but low mortality rate show moderately low levels of concern for family's health (60.93) and stress about leaving the house (76.01).

Finally, the survey provides information on socio-demographic characteristics<sup>13</sup>, though unfortunately, the survey does not collect information on household composition nor marital status and occupation. Table A4 documents comparable descriptive statistics for socio-demographic variables for the total sample and also for the four regional sub-samples<sup>14</sup>.

### **3.3 Empirical strategy**

Our empirical strategy combines evidence from three different methods, namely, we examine the evidence of an event study specification to exploit exogenous changes in policy measures over depression and anxiety levels. Next, we estimate a difference in differences (DiD) strategy where we compare individuals interviewed in countries and on dates that differ in the country-specific policy measures. Finally, we draw on a difference in discontinuity design (RDD) to estimate the effect of change in policy stringency.

#### *3.3.1 Event-study*

We estimate two event study specifications. First, to test the adaptation to lockdown we propose the following model:

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<sup>13</sup> These includes age, gender, marital status, number of years of education, number of household members, number of comorbidities (cardiovascular diseases, diabetes, hepatitis B, chronic obstructive pulmonary disease, chronic kidney diseases, and cancer) and monthly household income before taxes.

<sup>14</sup> Table A4 also compares the descriptive statistics between the initial sample and the sample obtained after applying CEM.



$$Y_{ict} = \sum_{j=-7}^{j=7} \gamma_{0k} D_{kc} L_{ct} + \gamma_1 P_{ct} + \sum_{j=-7}^{j=7} \gamma_{2k} D_{kc} L_{ct} P_{ct} + \gamma_3 X_{ict} + C_c + T_t + \epsilon_{ict} \quad (1)$$

where  $Y_{ict}$  refers to mental health of the individual  $i$  living in country  $c$ , who has answered the online survey on date  $t$ . Our dependent variable ( $Y_{ict}$ ) refers to either the PHQ-8 Depression Index (or its 8 items) or the Anxiety Index (or its 4 items).

$L_{ct}$  is a dummy variable taking the value 1 if a lockdown order has come into force for country  $c$  and day  $t$ , and 0 otherwise, and  $D_{kc}$  are dummy variables for the seven days before/after the lockdown became effective.<sup>15</sup>

$P_{ct}$  is a dummy variable taking the value 1 if the pandemic has reached category 5 according to the Pandemic Severity Index (i.e., the case fatality rate, which is the ratio between deaths and confirmed cases, is above 2%) for country  $c$  and day  $t$ , and 0 otherwise.

To control for differences in composition,  $X_{ict}$  refers to sociodemographic characteristics (age, gender, marital status, years of education, number of household members, income, number of comorbidities). Finally,  $C_c$  and  $T_t$  denote country fixed effects and day fixed effects. Robust standard errors clustered at the day levels are obtained. The eighth day before lockdown came into force is the reference period. The sum of the estimated coefficients  $\gamma_{0k} + \gamma_{2k} P_{ct}$  should be interpreted as the effect of being in the  $-j$ th day before or after lockdown was effective as compared to eight days before it.

The second event-study model is used to test the effect of increasing fatality rate, we propose the following:

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<sup>15</sup> See table A1 for the day when lockdown became effective.

$$Y_{ict} = \sum_{j=-7}^{j=7} \delta_{0k} D_{kc} P + \delta_1 L_{ct} + \sum_{j=-7}^{j=7} \delta_{2k} D_{kc} L_{ct} P_{ct} + \delta_3 X_{ict} + C_c + T_t + \zeta_{ict} \quad (2)$$

where  $D_{kc}$  are dummy variables for the seven days before/after the category 5 pandemic level is reached and the other terms have the same interpretation as in previous model. The eighth day before lockdown came into force is the reference period. The estimated coefficients  $\delta_{0k} + \delta_{2k} P_{ct}$  should be interpreted as the effect of being in the  $-j$ th day before or after the day in which fatality rate exceeded 2% as compared to eight days before it.

### 3.3.2 Difference-in-difference specification

To disentangle the effect of policy measures on anxiety/depression alongside exposure to a pandemic shock we rely on a difference-in-difference specification that compares the mental wellbeing of individuals before/after lockdown and before/after the fatality rate reached level 5 in the Pandemic Severity Index. We propose the following DID model:

$$Y_{ict} = \beta_0 L_{ct} + \beta_1 P_{ct} + \beta_2 L_{ct} P_{ct} + \beta_3 X_{ict} + C_c + T_t + \varepsilon_{ict} \quad (3)$$

where  $Y_{ict}$  refers to mental health of the individual  $i$  living in country  $c$ , who has answered the online survey on date  $t$ .  $Y_{ict}$  denotes the PHQ-8 Depression Index (or its 8 items) or the Anxiety Index (or its 4 items), whilst  $L_{ct}$  is a dummy variable taking the value 1 if a lockdown order has come into force for country  $c$  and day  $t$ , and 0 otherwise.  $P_{ct}$  is a dummy variable taking the value 1 if the pandemic has reached category 5 according to the Pandemic Severity Index (i.e., the case fatality rate, which is the ratio between deaths and confirmed cases, is above 2%) for country  $c$  and day  $t$ , and 0 otherwise. Finally,  $X_{ict}$

refers to sociodemographic characteristics (age, gender, marital status, years of education, number of household members, income, number of comorbidities). We also include country fixed effects ( $C_c$ ) and day fixed effects ( $T_t$ ). We obtain robust standard errors clustered at the day level.

*Canonical estimation.* The canonical DiD model presumes the existence of two groups, the treated and the control group, two time periods. When a common trend assumption is satisfied, the two-way fixed effects estimator is a linear combination of treatment effects across treated units. However, such estimates can be biased when treatment effects change over time within treated units (Goodman-Bacon 2020). Treatment effect heterogeneity call for a series of alternative estimators (Callaway and Sant'Anna 2020, Sun and Abraham 2020). However, these estimators may have less statistical power than the pooled estimator, and Marcus and Sant'Anna, (2021) find that when facing a limited number of groups and time periods (as in our case), it may be reasonable to favour "weaker" version of the parallel trend assumption<sup>16</sup>.

#### *Estimating the lockdown effects.*

The main challenge in estimating the effect of lockdown is that there is a possibility that individuals may escape from it. However, in most of the countries the implementation was national-wide and not anticipated, and severe fines<sup>17</sup> were also imposed on those who failed to comply with lockdown orders.

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<sup>16</sup> As the weights are proportional to the residuals from a regression of treatment on country and day fixed effects, we have checked that the residuals from a regression of the outcome variable on region and day fixed effects are linearly related to the residuals from a regression of treatment on region and day fixed effects and the slope of this linear relationship does not differ between the treatment group and the comparison group (results available upon request).

<sup>17</sup> Fines jumped to €3,000 in Italy, March 25<sup>th</sup>. Retrieved from: <https://www.express.co.uk/news/world/1259781/coronavirus-latest-italy-fines-Giuseppe-Conte-boris-johnson-uk-lockdown-COVID-19>. Man jailed for violating lockdown rules in France, April 1<sup>st</sup>. Retrieved from: <https://www.rfi.fr/en/france/20200401-france-man-jailed-for-violating-lockdown-rules-easter-holidays-cancelled>

### *Estimating risk exposure effects.*

At the date the survey began, all countries had implemented restrictions on international mobility. Although it is possible that some individuals decided to move within the country to escape from *a higher mortality risk*.<sup>18</sup> Unfortunately, we do not have information about the region of residence, so we cannot control for this directly. Nor can we identify the effect of asymptomatic individuals or that for those with mild symptoms (Morens et al., 2020).

### *3.3.3. Regression discontinuity and differences in discontinuity design:*

The advantage of a regression discontinuity design (RDD) is that by evaluating the level of anxiety and depression around the cut-off date when lockdown came into force (or when the pandemic reached category 5), and comparing these levels for individuals who answered the survey just before and just after, it is possible to identify the causal effect of lockdown (or pandemic category 5) on the outcome variables.

Before the estimation we must verify two assumptions. First, that agents are not able to manipulate the running variable (or assignment variable). If the individuals were able to choose with exact precision the moment at which they complete the interview around the cut-off point, there would be a self-selection problem and, consequently, the characteristics of a local randomized trial would be invalidated. To test this assumption, we run the McCrary (2008) test on the running density function of the variable.

The second assumption refers to the *absence of other policy changes at the same cut-off*. If this is violated, the cross-sectional RD estimator would provide a biased

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<sup>18</sup> In the UK, where no lockdown was decreed, people were urged not to move house. <https://www.bbc.com/news/business-52051174>

estimate of the average treatment effect because the multiple confounding policies could not be disentangled from each other (Gremi et al., 2016). This second assumption is much more difficult to contrast than the first one, since the researcher must look for other policies that have taken place simultaneously. In our case, and as already mentioned for the DiD model, there were no elections during the entire period in which the online data were collected, nor were there any announcements of upcoming elections.

An additional consideration is that we observe whether the respondent completed the survey before or after the cut-off point, but we do not know how they would have behaved in the opposite state. Two potential threads may lead to this situation. First ‘optimality effects’, which take place when both the treatment and control groups react to a policy, based on the restrictions imposed by the new policy. Second, the so-called ‘Hawthorne effect’, which takes place when control group individuals modify their behaviour once they are followed up. These threats are important if individuals in the control group could anticipate an imminent political change (for example, that a lockdown was going to be announced), in which case their anxiety levels and depression would mimic the reaction of those in the treatment group. Hence, at the cut-off point, both the treatment and control groups would move, causing changes in the discontinuity for the outcome variables. To solve this problem, RD design is combined with the difference-in-difference approach.

We will estimate two different discontinuity designs: (1) to study the immediate effect of the lockdown, while considering the evolution of mortality; (2) to study the effect of the pandemic reaching category 5, while considering whether the country has approved lockdown. The DID-RD proposed for estimating the effect of lockdown is the following:

$$Y_{ict} = \theta_0 f(Y_{ict}) L_{ct} + \theta_1 P_{ct} + \theta_2 f(Y_{ict}) L_{ct} P_{ct} + \theta_3 X_{ict} + C_c + T_t + \varrho_{ict} \quad (4)$$

where  $Y_{ict}$  is the distance in days from the day the lockdown becomes effective: positive for the days after the lockdown, and negative for the days before the lockdown. Such a distance is computed for each individual  $i$  living in country  $c$  who answered the questionnaire on day  $t$ . The function  $f(.)$  is a polynomial of the distance in days, that allows for different effects left and right of the discontinuity. Although covariates are not necessary, we include them to reduce the variability in the estimation (Lee and Lemieux, 2020). The interaction  $\theta_2 f(Y_{ict}) L_{ct} P_{ct}$  captures the impact of an increase in mortality to category 5 in an environment where containment has already been ordered.

The DID-RD model proposed to study whether there are structural breaks due to the increase in fatality rate above 2% is as follows:

$$Y_{ict} = \theta_0 g(\Psi_{ict}) L_{ct} + \theta_1 P_{ct} + \theta_2 g(\Psi_{ict}) L_{ct} P_{ct} + \theta_3 X_{ict} + C_c + T_t + v_{ict} \quad (5)$$

where  $\Psi_{ict}$  is the distance in days from the day pandemic reached category 5 according to the Pandemic Severity Index: positive for days after this threshold is reached, negative for the days before it.<sup>19</sup> This distance is computed for each individual  $i$  living in country  $c$  who answered the questionnaire on day  $t$ . The function  $g(.)$  is a polynomial of the distance in days that allows for different effects on each side of the cut-off. The interaction  $\theta_2 g(\Psi_{ict}) L_{ct} P_{ct}$  measures the impact of containment in a situation of high mortality.

In estimating (4) and (5), we run a non-parametric local linear kernel regression not assuming any underlying functional form with a triangular kernel because this method reduces bias in kernel regression methods (Lee and Lemieux, 2020).

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<sup>19</sup> See Figure A3: cells in red and green correspond to days with fatality rate is above 2%.

Additionally, two fundamental issues must be addressed. The first is the choice of the polynomial applied to the variable running. The second is the choice of the bandwidth. Regarding the first issue, a certain degree of series smoothing eliminates the influence of outliers, but an inappropriate choice of the order of the polynomial may lead to an inadequate approach to the underlying data generating process. To choose the order of the polynomial, we follow the Akaike (AIC) information criterion along with the criterion proposed by Lee and Card (2008), which is based on the proximity between the estimated polynomial function and the true distribution of the running variable.<sup>20</sup>

### 3.4 Descriptive statistics

Figure A1 summarizes the distribution of the dependent and explanatory variables throughout the period of analysis (March 20<sup>th</sup> - April 6<sup>th</sup>) for the average of the 22 countries. With respect to the epidemiological variables, in Figure 1.1 we show the number of confirmed cases per million inhabitants on the left vertical axis, and the number of recoveries and deceased on the right vertical axis.<sup>21</sup> On average, throughout the entire period, the number of confirmed cases, recovered cases and deceased per million inhabitants were 386, 32.64 and 12.13, respectively. However, there is a wide dispersion by geographic region (Table A4), with a maximum in Southern Europe (782.96, 86.29 and 62.99, respectively) and a minimum in Eastern Europe (26.67, 1.27 and 0.31,

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<sup>20</sup> Although in theory a RD model only requires a very small window of observations, an excessively small number of observations can lead to unbiased, but inefficient estimates. Increasing the size of the window increases the estimation efficiency. Therefore, there is a trade-off between the efficiency and the unbiasedness of the estimates (Ludwig and Miller, 2007). As for the choice of the optimal bandwidth, we have relied on two methods: mean square error (MSE) optimal bandwidth which it is estimated by taking the minimum optimal bandwidth of the most common MSE-optimal procedures (Calonico et al., 2014) and the coverage error rate (CER) optimal bandwidth which is the minimum bandwidth of the different coverage error procedures (Calonico et al., 2018).

<sup>21</sup> There is a noticeable increase in the number of confirmed cases per million inhabitants (from 290.35 to 1,123.45), and similarly, a progressive increase in recoveries (from 15.63 to 290.83). For both variables, a maximum is found on March 5<sup>th</sup>. Deceased show a decreasing trend between March 20<sup>th</sup> and 29<sup>th</sup>, but an increasing trend afterwards until reaching 29.25 per million by the end of the period.

respectively). For this reason, the effect on depression/anxiety levels by geographic regions will be analysed later.

Figure 1.2 (in the Appendix Figure A1) depicts the evolution of the Depression Index, Anxiety Index and Stringency Index for the whole set of countries. As expected, we find an average increase in the Stringency Index from March 23<sup>th</sup> to April 1<sup>st</sup>. Throughout the entire period, the Anxiety Index is above the Depression Index, and both show parallel evolution at some moments (decrease on March 26<sup>th</sup> and increase on April 3<sup>rd</sup>).<sup>22</sup> Figures 1.3, 1.4 and 1.5 show the evolution of the items that make up the Anxiety Index and the Depression Index for the average of the countries.<sup>23</sup>

Figure A2 displays the average values of epidemiological variables and the average of the Stringency Index by geographic region. The figure reveals that: (i) the number of confirmed cases and recovered patients per 1,000,000 inhabitants peaks by April 2<sup>nd</sup> for Southern countries, decreases afterwards, but ultimately displays an upwards trend; (ii) the number of deaths per 1,000,000 inhabitants reveals a difference between Southern countries and the rest of regions; (iii) the highest levels of Stringency Index corresponds to Southern countries, although in comparison with the beginning of the interview period, Northern countries have experienced a considerable increase in the Stringency Index.

## 4. Results

### 4.1. Event study

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<sup>22</sup> There is also wide variability between regions (see Table A4). For example, the average Stringency Index is 45.66 in Northern Europe versus 84.28 in Eastern Europe, the Depression Index ranges from 45.03 (Bulgaria) to 37.93 (Finland), and the Anxiety Index ranges from 65.92 (Portugal) to 53.52 (Sweden).

<sup>23</sup> Among the anxiety items, the one corresponding to “stressed about leaving one's own house” (mean: 78.19) is above all the others, and among the depression items, those corresponding to “sleeping problems” (mean: 45.70) and “feeling tired” (mean: 48.60) show slightly higher values. At the opposite extreme we find “trouble for concentrating” (mean: 30.10). Table A5 shows the mean of each item by country and geographic region.



We estimate an event study specification including a number of controls<sup>24</sup>, day fixed effects and country fixed effects, robust standard errors including weights and clustered standard errors at the day level. Figure 2 and Table 1 report the results for considering the event of lockdown.

On the day the lockdown is effective, there is an increase in the levels of depression and anxiety of 1.638 and 5.953 points, respectively, which represents an increase by 3.95% and 9.99% with respect to the mean value, respectively. However, the effect of the interaction with pandemic of category 5 is negative in both cases. The resulting net effect is positive, although very small for depression (+0.89%) and negative for anxiety (-3.78%). These results imply that the immediate effect of lockdown over anxiety levels is negative if it occurs in a context of high mortality.

**[Insert Table 1 and Figure 2 about here]**

Figure B1 and Table B1 show the results of the event-study considering the moment in which the pandemic reaches category 5. The immediate effect is an increase in the level of depression (0.893 points) and anxiety (8.220 points), which represents an increase of 2.16% and 13.80% with respect to the average value, respectively. The effect of interaction with lockdown is negative in both cases, resulting in a reduction in the level of depression (-1.76% with respect to the mean value) and an increase in the level of anxiety (11.12% with respect to the mean value). Consequently, although increasing mortality rate shoots anxiety levels above those of depression, lockdown succeeds in reducing the increase in anxiety by almost 20%  $((-1.599/8.220)*100)$ .

The reason for this decrease in anxiety levels can be found at the core of threat-security theories (Gilbert, 2007). Living in an environment with a high mortality risk leads to a re-processing or re-interpretation of lockdown in terms of threat-defence that, from a

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<sup>24</sup> Controls include male, other gender, age and its squared, married, years of education and number of household members, having any comorbidity and number of comorbidities, household income quartile

neurophysiological point of view, takes place in the frontal cortex (Baumeister et al., 2001). In this context, complex thinking declines in favour of safety-prioritised decision-making. For this reason, lockdown may no longer be interpreted as a hindrance to individual freedom and the feeling of being safe at home is prioritised.

Our results are in line with those of Michie et al. (2011, 2020), who found that a better understanding of government recommendations encourages better compliance with them. We go a step further and also find that understanding the gravity of the situation reduces anxiety levels by internalising that staying at home is not an arbitrary imposition (or restriction of individual freedoms) but a protective measure for health.

#### *4.2. Differences in Differences estimates*

The difference-in-difference model has been estimated using five different specifications. M1 only includes binary variables for lockdown, pandemic of category 5, interaction between lockdown and pandemic of category 5, day fixed effects and country fixed effects. M2 includes the same explanatory variables as M1 and also male, other gender (omitted: women), age and its squared term. M3 includes the same explanatory variables as M2 and also married (omitted: single), years of education and number of household members (omitted: living alone). M4 includes the same explanatory variables as M3 and also having any comorbidity and number of comorbidities. M5 includes the same explanatory variables as M4 and also household income quartile (omitted: lowest quartile). Individual sample weights have been used to correct for differences in income, education, age and gender structure between the general population of the country and the corresponding sample. Estimated coefficients for Depression Index and Anxiety Index are shown on Table 2, and detailed estimations for all the items are reported on Tables C1 and C2.

[Insert Table 2 about here]

### *Depression*

According to the M5 specification, the Depression Index increases 1.242pp (2.76% compared to the mean value) if lockdown has been decreed and 2.908pp (7.02%) if the pandemic has reached level 5 according to the Pandemic Severity Index. However, the joint effect of both situations, that is, lockdown and high mortality, produces a *decrease* in the level of depression by 2.594pp, which implies a decrease of 6.26% compared to the sample mean<sup>25</sup>.

In relation to the items of the Depression Index, lockdown and pandemic of category 5 mainly increase the incidence of sleeping and concentration problems and also cause alterations in appetite. However, the interaction effect is negative and significant which may indicate that individuals rationalize that lockdown is necessary to suppress the pandemic, and this internalization process manifests in a decrease in symptoms associated with depressive processes<sup>26</sup>.

### *Anxiety*

Although lockdown increases anxiety level by 4.410pp (7.40% with respect to the mean value), a more intense effect is observed when the pandemic has reached level 5 (+5.810pp or +9.75%). Attending to the items of the Anxiety Index, a high mortality risk exacerbates nervousness (+12.770pp) and stress from leaving the house (+12.234pp). Lockdown causes relevant but not as intense anxiety side-effects. In particular, it

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<sup>25</sup> See Table A2 for mean and standard deviations of the Depression Index, Anxiety Index and their items.

<sup>26</sup> For example: sleeping problems decrease by 12.11% with respect to the sample mean; concentration problems decrease by 10.88%, appetite disorders decrease by 6.22%.

increases concern for family health increases (+4.257pp) and the stress of leaving home (+5.441pp).

The interaction effect is negative and significant for the Anxiety Index and provokes a decrease by 8.43% compared to the sample mean (0.10 standard deviation units). For the most relevant items, the degree of nervousness decreases by 11.88% with respect to the sample mean (0.13 standard deviation units) and the stress associated with leaving the house decreases by 11.75% (0.12 standard deviation units).

Comparing the effect of the interaction (Lockdown&Pand\_cat5) for Depression and Anxiety Indexes, it becomes evident that lockdown associated with a high mortality pandemic reduces anxiety levels more intensively (the effect is 1.93 times as compared to that of depression levels). This "relieving" effect of lockdown on anxiety has been found in other work, though not in a pandemic setting. Consistently, Eshel et al. (2020) found in the context of the Arab-Israeli conflict that the feeling of danger increased feelings of distress, but feeling safe at home decreased the feeling of anxiety.

Interestingly, a pandemic of category 5 increases concern about family health, but decreases concern for one's own health. As for the interaction effect, it decreases concern for the health of family members (-17.26%), but on the other hand, increases the degree of concern for one's own health, although with less intensity (5.31%). The first result could be interpreted as a symptom of altruism, in the sense that the individual prioritizes the concern for the health of the family over their own. The second result may indicate some sort of hypochondriacal behavioural triggered by lockdown.

To demonstrate the robustness of our findings, we conducted a test following the spirit of Oster (2019), which shows that a positive correlation between the R-squared and the absolute size of the coefficients indicates that omitted variables exert a downward bias

on the coefficient of interest. Figure B2 shows that as more control variables are included (i.e. more of the variation in the dependent variable is explained), the effect size increases. These results increase confidence in our estimates and at the same time justify the use of a comprehensive set of control variables.

### *Heterogeneous effects*

Tables 3 and 4 display the results of the difference-in-difference model conditioned on different socio-demographic characteristics (age, years of education, income, household size and geographic region<sup>27</sup>) for the Depression and Anxiety Index, respectively. For a better understanding of the results, we have computed the effects of the coefficient for lockdown and the interaction in terms of percentage with respect to the sample mean and in standard deviation units. The original estimated coefficients are reported on Table C3).

*Age.* Lockdown affects mainly the cohorts aged 40 and older, with a bigger impact on anxiety: between 4% and 7% for depression, between 10% and 11% for anxiety, compared to the average levels for each cohort. However, the effect of the interaction is significant and negative, and in some cases of a magnitude greater than that of the lockdown coefficient. For example: the level of depression decreases by 9.634% in the cohort of 51-60 years and the level of anxiety decreases by 13.133% in the cohort of over 60 years. It should also be noted that for the cohort younger than 30 years, lockdown causes an increase in anxiety of 2.678% with respect to its mean level, but the effect of the interaction implies a reduction of almost 6.3% (0.17 standard deviation units).

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<sup>27</sup> The difference-in-difference model has not been estimated for the subsample of Western European countries because for all countries and dates, lockdown had already become effective.

*Education.* In the group with the lowest level of education, lockdown increases the Anxiety Index by 10.156% compared to the average level, while the Depression Index increases by approximately one third of previous amount (2.721%). On the other hand, in the group with the highest level of education, the Depression Index increases by 6.692%, which is greater than the increase in the Anxiety Index (4.353%). Thus, it can be inferred that there exists a differential effect by educational level. Although both indexes increase for all educational levels, people with lower educational levels show a greater increase in anxiety problems, while for people with higher educational levels, depression problems are more pressing. The effects of the interaction show a reduction in the Depression Index in the highest educational group (-9.756%) and a decrease in Anxiety Index in the lowest educational group (-10.043%). Conversely, the lowest reduction in anxiety corresponds to the group with the highest level of education (-5.074%).

*Household income.* Considering the effect of lockdown on mental health by income quartiles, we appreciate an inverse  $\cap$ -shaped pattern in depression, but a  $\cup$ -shaped pattern in anxiety. In other words, households located at the ends of the distribution show smaller increases in depression levels, but higher increases in anxiety levels. In particular, lockdown increases anxiety by 8.027% (compared to the mean value) in households in the lowest income quartile, but only increases depression levels by 1.738%. The interaction effect implies a reduction in anxiety levels by 9.129% (8.318%) for the households with the lowest (highest) income level.

To verify the effect of household income level on levels of anxiety and depression, a difference-in-difference-in-difference model has been estimated by introducing interactions between lockdown, category 5 pandemic and income quartiles. The results are shown in Table C4. Taking the fourth quartile (highest) as a reference, it seems that households with the lowest income levels are the most vulnerable. The effect of lockdown

in a category 5 pandemic situation implies an increase of 4.74% (2.48%) in the level of depression (anxiety) in lowest income households, compared to the highest ones.

*Household size.* Lockdown causes an increase in the level of depression by 2% or 3% compared to the average levels. The increase in the level of anxiety is much greater: an increase of 8.225% for those who live alone and 9.556% for households with more than three members. The effect of the interaction is negative and compensates for increases due to the coefficient for lockdown. For example, for people living alone there is a decrease in the level of depression by 6.569% with respect to the average level (that is, more than twice the effect of lockdown). For households with more than three members, the Anxiety Index decreases by 10.234% with respect to the mean (higher, in absolute value, as compared to the effect of lockdown).

*Regions.* The analysis has not been carried out for the countries belonging to Western Europe because, throughout the period considered, all of them had already implemented lockdown. Lockdown considerably increases the level of depression and anxiety in the SE countries (26.971% and 13.596%, respectively, with respect to the mean value). In comparison, the level of depression only increases by 1.046% in the EE countries and the level of anxiety by 4.848% in the NE countries. The effect of the interaction is negative and significant for all regions.

For SE countries, this negative effect almost cancels out the positive one for depression and is even higher for anxiety. For the NE countries, the effect of the interaction almost triples (in absolute value) the effect of lockdown associated with anxiety (-12.239% compared to 4.840%). For EE countries, the effect of interaction is 9 times greater (in absolute value) than the effect of lockdown associated with depression (-9.371% compared to 1.046%).

*Robustness check: the effect of the approval to prescribe chloroquine and hydroxychloroquine to hospitalized patients*

As a robustness check, we have studied the joint effect of lockdown and the US Food and Drug Administration (FDA) approval to prescribe chloroquine and hydroxychloroquine to patients hospitalised with Covi-19. This approval occurred on 28 March 2020 (Lenzer, 2020), but was reported in the media on 30 March 2020<sup>28</sup>. The underlying idea is that the availability of a drug may have affected mental health indicators. In the case of vaccines, Karayürek et al. (2021) and Pérez-Arce et al. (2021) found that the availability of a vaccine (even before being vaccinated) significantly reduced levels of mental distress. Therefore, we want to make sure that the observed effects on anxiety and depression levels are genuinely caused by lockdown policies. The following difference-in-difference model is estimated:

$$Y_{ict} = \beta_0 L_{ct} + \beta_1 HI_{ct} + \beta_2 L_{ct} HI_{ct} + \beta_3 X_{ict} + C_c + T_t + \varepsilon_{ict} \quad (6)$$

where  $Y_{ict}$  refers to mental health of the individual  $i$  living in country  $c$ , who has answered the online survey on date  $t$ .  $Y_{ict}$  denotes the Depression Index (or its 8 items) or the Anxiety Index (or its 4 items), whilst  $L_{ct}$  is a dummy variable taking the value 1 if a lockdown order has come into force for country  $c$  and day  $t$ , and 0 otherwise.  $HI_{ct}$  is a dummy variable taking the value 1 after approval of chloroquine and hydroxychloroquine (that is, from March 30th onwards) for country  $c$  and day  $t$ , and 0 otherwise.

The same sociodemographic characteristics ( $X_{ict}$ ) as in the previous models, country fixed effects ( $C_c$ ) and day fixed effects ( $T_t$ ), are also included. We obtain robust standard errors clustered at the day level.

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<sup>28</sup> [Coronavirus \(COVID-19\) Update: Daily Roundup March 30, 2020 | FDA](#); [FDA authorizes emergency use of unapproved drugs to treat coronavirus - The Washington Post](#); [March 30, 2020 coronavirus news \(cnn.com\)](#); [who-audio-emergencies-coronavirus-press-conference-full-30mar2020.pdf](#)



Table C5 and C6 show the estimations for the difference in difference model for lockdown and clinical approval to prescribe chloroquine and hydroxychloroquine. First, the magnitude and significance of lockdown is similar to that obtained in Table 2 for Depression and Anxiety Indexes (Tables C1 and C2 for the respective items). Therefore, the variable lockdown is capturing the genuine effect of lockdown on levels of anxiety and depression. Second, the variable hydroxychloroquine is not significant in any regression. Third, the interaction term is not significant neither for the Depression Index nor for any of its items. Finally, the interaction term is significant for the Anxiety Index (-6.47% with respect to the mean) and the items degree of worry about one's health and family's health and feeling stressed about leaving the home (-8.28%, -4.59% and -3.45% with respect to the means).

#### *4.3 Differences in Discontinuity estimates*

We begin our analysis by exploring the contemporaneous effect of confinement or high mortality through a battery of RD plots. These plots show a first-order polynomial of the adjusted variable above and below the cutoff (when the lockdown becomes effective (upper graphs) or when the pandemic reaches category 5 (lower graphs)), which aim to provide suggestive evidence on the possible existence of a discontinuity in the threshold (Calonico et al., 2015). The main thing to notice from these graphs is jump or the discontinuity around the cut-off, but no discontinuities are observed before or after.

**[Insert Figure 3 about here]**

As noted earlier, the running variable (days elapsed since lockdown or since pandemic reached category 5) will only be valid if it is not manipulated by individuals, which in this context implies that the online survey has been continuously completed since the outbreak of the pandemic. The McCrary density test does not identify any jump

in the running variable at the cut-off point ( $p < 0.001$ ) before/after lockdown became effective (upper Figure D1) and before/after pandemic reached category 5 (lower Figure D1, which confirms that there are no signs of manipulation (non-random sorting)).<sup>29</sup> Consequently, under the assumption that individuals respond to the online survey in a totally random way, any difference in the outcome variables is due to the effect of the lockdown (or the effect of the pandemic reaching category 5), and therefore, exposure to treatment is a deterministic function of the calendar day on which they answered the survey.

Another fundamental assumption of RD design is that baseline covariates should be balanced to preserve the characteristics of a natural experiment, that is, all observable and unobservable characteristics of individuals should have a similar distribution around the cut-off as the bandwidth gets narrower (Lee and Lemieux, 2010). This implies that the imposition of the lockdown or the increase in mortality should not affect the distribution of the covariates around the cut-off. To contrast this assumption, a RD model has been estimated in which each covariate acts as a dependent variable (with different bandwidth sizes). Results (available upon request) reject the hypothesis that the baseline covariates are unbalanced around the cut-off point.

Table 5 shows the results of the RD design using a local quadratic regression with a triangular kernel function (tables D1 and D2 for the items of the Depression Index and Anxiety Index). For each dependent variable, we show the sensitivity test to the bandwidth choice from two different bandwidths approaches (MSE and CER methods).

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<sup>29</sup> The McCrary's test consists in estimating the density function on either side of the cut-off point. Observing a discontinuous density at the cut-off provides evidence of manipulation. After computing the discontinuity at the cut-off point and its standard error, a t-test of no statistical significance is constructed, where the null hypotheses is no statistical evidence of discontinuity in the density function at the cut-off point. In our sample, we estimate the McCrary's test and we define as no manipulated survey respondents those individuals where there is no statistical evidence of discontinuity in the density function at the cut-off (i.e., McCrary's test of the null hypothesis fails to be rejected). McCrary test validates the empirical strategy (the test statistic is 0.991/0.740 for the upper figures and 0.867/0.619 for the lower figures).

As mentioned before, the inclusion of baseline covariates can reduce the variability of the estimates, but without affecting the estimation of the jump in discontinuity, regardless of the correlation with the outcome variables (Lee and Lemieux, 2010). As a robustness check, we also test the sensitivity of our results due to the inclusion of the baseline covariates and perform two falsification tests using two false thresholds (two days before and two days after the real cut-off points).

**[Insert Table 5 about here]**

Using the results from MSE estimation method, we observe that lockdown gives rise to an increase in the level of depression and anxiety (1.730 and 3.854, respectively; *4.17% and 6.47% with respect to the mean value*). Consistently with previous results, the effect of the interaction is negative, resulting in a reduction in the level of depression (-5.22% with respect to the mean value) and, to a much greater extent, a reduction in the level of anxiety (-11.36%).

The comparison of the interaction term (Lockdown\*Pan\_cat5) shows that, for both the Depression Index and Anxiety Index, the effect (in absolute value) is larger when the running variable is "days elapsed since lockdown" compared to "days elapsed since pandemic reached category 5" (-2.165 vs. -1.847 for depression; -6.768 vs. -2.205 for anxiety) which reveals that individuals internalise the need of a lockdown when they perceive better the threat of the pandemic.

Results from the CER method mirror those of the MSE method. A high mortality environment leads to an increase in the level of depression and anxiety (2.356 and 8.492, respectively). Although lockdown carries a certain mitigating effect on these increases, the resulting net effect is an increase in the level of depression (1.21% with respect to the

mean value) and the level of anxiety (10.55% with respect to the mean value). Therefore, the results of RD design are consistent with those obtained in event studies.<sup>30</sup>

Comparing the results with and without baseline covariates (including only fixed effects), we see no appreciable differences. These effects are robust across different bandwidth sizes, near the cut-off point. Importantly, we do not obtain significant results when using alternative false cut-offs.

When we turn to the items of the Depression Index (Table D1), we observe that lockdown increases problems relating to sleeping and concentrating (+6.63% and +7.65% with respect to mean values, respectively). But if simultaneously there is a high mortality risk, the resulting net effect becomes negative (-5.01% and -2.71% with respect to mean values, respectively).

On the other hand, when the pandemic reaches category 5, there is an increase in the probability of feeling down (7.25% increase with respect to the mean value), sleep problems (12.00%), appetite (7.37%) and concentration (13.80%). However, unlike the previous model, if a lockdown is simultaneously decreed, it does not provoke such a marked reduction in depressive symptoms.<sup>31</sup>

Table D2 shows the results of the RD design for each item of the Anxiety Index. Living in a confined situation fundamentally increases concern for the health of the family and the stress associated with leaving home (probably due to the fear of contagion). However, when it coincides with a category 5 pandemic situation, the effect on concern for the family fades, and the stress derived from having to go outside the home is greatly reduced. Therefore, lockdown measures are interpreted as a health protective measure.

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<sup>30</sup> It should be noted that a direct comparison cannot be made between the DID and RD design estimates. In the first case, all pre-lockdown observations (pre-pandemic of category 5) are compared with all post-lockdown observations (post-pandemic of category 5). In the second case, RD design captures the immediate effect in a few days around the cut-off point.

<sup>31</sup> For example, the interaction is not significant for sleep problems and the net effect continues to be positive for feeling down (3.76%), appetite problems (2.62%) and concentration problems (5.13%).

### *Limitations*

We are aware that this study has some limitations. Firstly, we relied on self-reporting by participants. It has not been possible to ascertain whether any medical diagnosis was made to participants after confinement, nor how pre-existent subclinical symptomatology in the weeks or months prior to confinement affected the responses collected in the survey. Secondly, it is not intended to provide data on health prevalence during the pandemic, i.e. the precise scale values cannot be taken as national averages of anxiety and depression during the pandemic. As the data collection was conducted through an online survey, participants who did not have access to the Internet at home were not represented. Therefore, if there is selection on fixed unobservables over time that differentiate internet users and non-users (e.g., that individuals who were more worried about the COVID-19 pandemic were disproportionately more likely to take or share this survey), we cannot differentiate the unobservable components of changes in mental health in internet users. To address this problem, observations have been weighted to improve their representativeness at the country level, according to respondents' gender, age, income and education. Additionally, to validate demonstrate the robustness of our findings, we have performed a test following the spirit of Oster (2019), which shows that a positive correlation between the R-squared and the absolute size of the coefficients indicates that omitted variables exert a downward bias on the coefficient of interest. Figure B2 show that as more control variables are included (i.e. more of the variation in the dependent variable is explained), the effect size increases. These results increase confidence in our estimates and at the same time justify the use of a comprehensive set of control variables.

## 5. Conclusions

Using data from March to April 2020 that identifies the effect of exposure to COVID-19 and lockdown stringency across a number of European countries, we have examined the so-called ‘welcomed lockdown hypothesis’, namely the extent to which there is a specific level of risk exposure whereby the effect of mobility restrictions improve or do not influence mental health. We have drawn on three specifications, namely an event study, a difference in differences (DiD) and differences in discontinuity designs to identify the effects. From a methodological perspective, our analysis highlights some interesting properties of the CGE, which should make it worthy of consideration when assessing the effectiveness of public policies using quasi-experimental data (i.e. online surveys).

Our findings show that whilst a ‘preventive’ lockdown in a low/moderate mortality environment increases in symptoms of depression and anxiety, in a high mortality setting (such as those in many countries during the first wave) it mitigates such negative effects, particularly on anxiety.

All efforts to overcome interpersonal isolation play an important role in times of high stress and strain (Folkman and Greer, 2000). There is evidence that having a telephone support line, staffed by psychiatric nurses, set up specifically for people in quarantine could be effective in providing them with a social network. For example, in both China and Korea, mental health professionals quickly and widely established online counselling services to provide free 24/7 services and online self-help intervention systems, including cognitive behavioural therapy for depression, anxiety and insomnia (Kwon and Lee, 2020; Liu et al., 2020).

The use of the media also plays an important role in disseminating information about the pandemic (Gao et al., 2020). Health policymakers should pay more attention to

depression and anxiety among the general population, and combat "infodemia" during the public health emergency.

Another possible strategy to minimise the negative effects of confinement on mental health would be to design optimal differential policies along the lines of those recommended by Acemoglu et al. (2021), taking into consideration not only the rate of infection, hospitalisation and fatality rate for different population groups but also differentiating between groups with higher or lower risk of negative effects on mental health.

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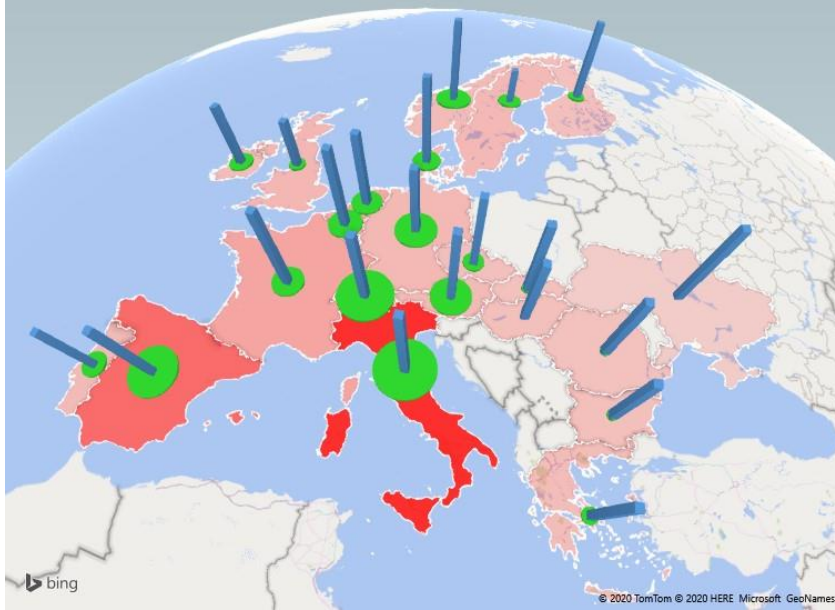
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## Tables and Figures

**Figure 1. Stringency Index (blue bricks) and risk exposure (green circles) and deaths per million (red areas)**  
**Date: March 20<sup>th</sup>, 2020**

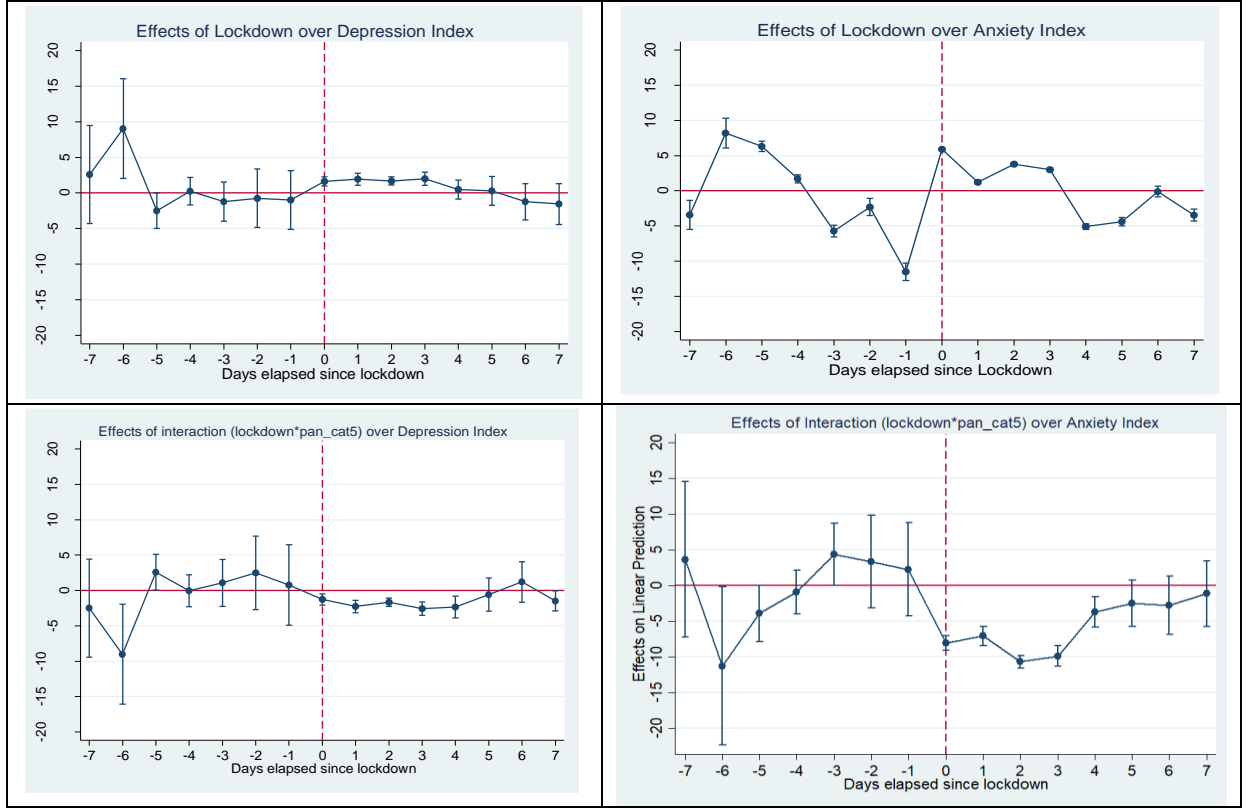


Red areas correspond to the mortality rate (deaths per 1,000,000 inhabitants). Higher colour intensity denotes higher mortality rate. Data come from <https://ourworldindata.org/coronavirus-data-explorer>

Green circles correspond to the exposure rate to COVID-19 (confirmed cases per 1,000,000 inhabitants). Larger diameter denotes higher exposure to the virus. Data come from <https://ourworldindata.org/coronavirus-data-explorer>

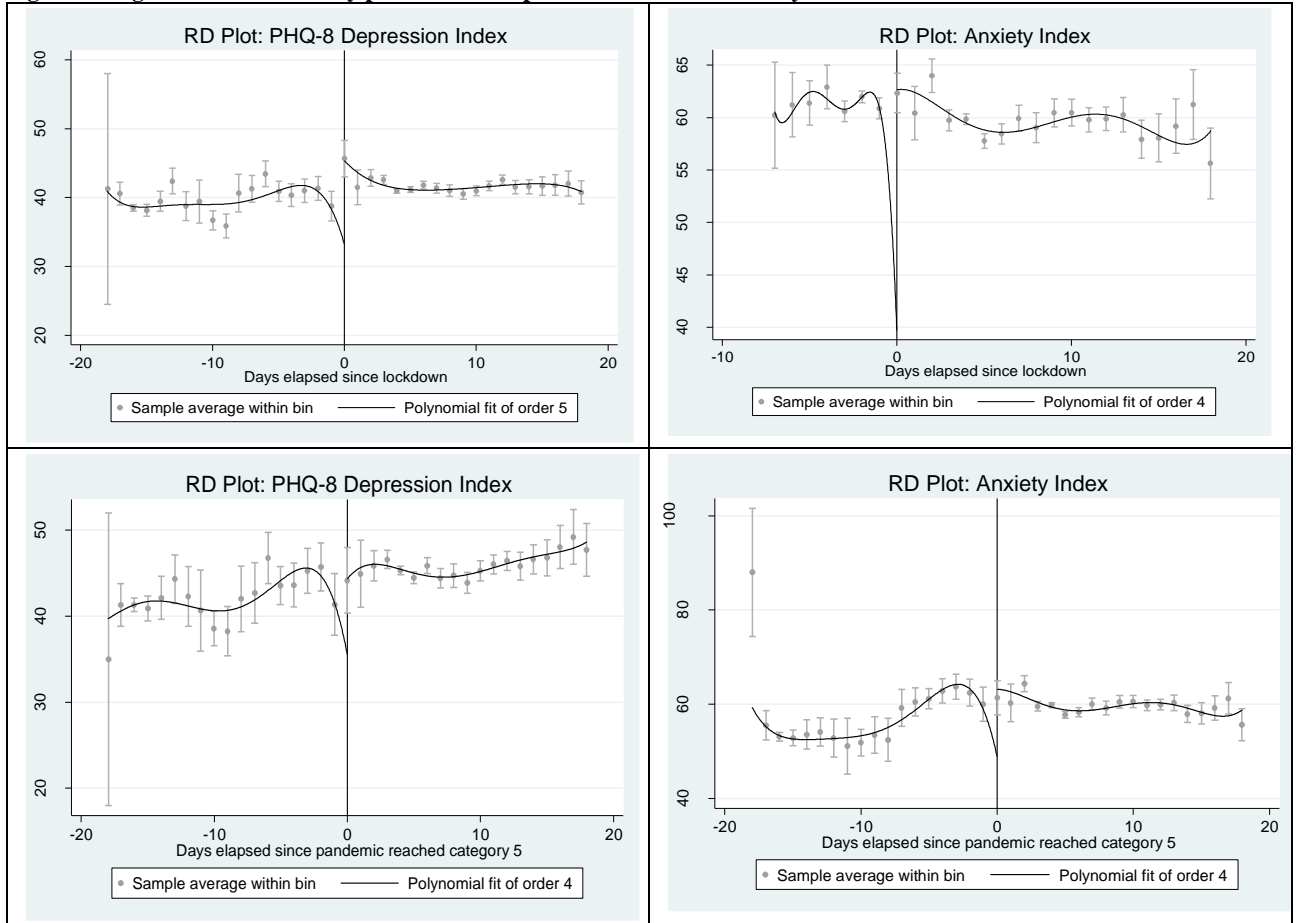
Blue Bricks corresponds to for COVID-19 Government Response Stringency Index (Stringency Index). Higher height denotes higher stringency. Data come from <https://www.bsg.ox.ac.uk/research/research-projects/oxford-COVID-19-government-response-tracker>

**Figure 2. Event study results. Effect of the days before/after lockdown and interaction between days before/after lockdown and pandemic of category 5 over Depression Index and Anxiety Index.**



Upper graphs show the estimated coefficients for  $\sum_{j=-7}^{j=7} \gamma_{0k} D_{kc} L_{ct}$  of equation 2 for Depression Index (left) and Anxiety Index (right). Lower graphs show the estimated coefficients for  $\sum_{j=-7}^{j=7} \gamma_{2k} D_{kc} L_{ct} P_{ct}$  of equation 2 for Depression Index (left) and Anxiety Index (right). See Table 3 for the detail of coefficients and standard deviations. Red dashed line used to signal the day when lockdown became effective.

**Figure 3. Regression Discontinuity plots for the Depression Index and Anxiety Index**



Kernel-weighted local polynomial smoothing discontinuity plot with a triangular kernel.

Upper graphs show discontinuity for PHQ-8 Depression Index and Anxiety Index around the day when lockdown became into force. Lower graphs show discontinuity for PHQ-8 Depression and Anxiety Index around the day when COVID-19 reached category 5 in the Pandemic Severity Index.



**Table 1. Event study results. Estimated coefficients for days before/after lockdown became effective and interaction between day before/after lockdown became effective and pandemic of category 5.**

	Depression Index		Anxiety Index	
	Effect of days before/after lockdown became effective	Effect of days before/after lockdown became effective and pandemic category 5	Effect of days before/after lockdown became effective	Effect of days before/after lockdown became effective and pandemic category 5
Day -7	2.616 (3.522)	-2.481 (3.553)	-3.408*** (1.051)	3.696 (5.591)
Day -6	9.115 (3.593)	-8.927*** (3.623)	8.260*** (1.071)	-11.261** (5.692)
Day -5	-2.486 (1.272)	2.902 (1.292)	6.365*** (0.380)	-3.899 (2.014)
Day -4	0.256 (0.981)	-0.037 (1.161)	1.711*** (0.290)	-0.906 (1.552)
Day -3	-1.219 (1.412)	1.072 (1.693)	-5.673*** (0.420)	4.343 (2.235)
Day -2	-0.734 (2.094)	2.500 (2.657)	-2.296*** (0.630)	3.329 (3.321)
Day -1	-0.975 (2.114)	0.780 (2.918)	-11.363*** (0.630)	2.236 (3.351)
Day lockdown became effective	1.638*** (0.330)	-1.269*** (0.410)	5.953*** (0.100)	-8.208*** (0.590)
Day +1	1.945*** (0.440)	-2.260*** (0.450)	1.230*** (0.130)	-7.000*** (0.690)
Day +2	1.701*** (0.290)	-1.659*** (0.300)	3.803*** (0.090)	-10.583*** (0.460)
Day +3	1.995*** (0.470)	-2.581*** (0.480)	3.000*** (0.140)	-9.747*** (0.741)
Day +4	0.485 (0.680)	-2.349 (0.791)	-5.067*** (0.200)	-3.708*** (1.081)
Day +5	0.298 (1.031)	-0.567 (1.201)	-4.374*** (0.310)	-1.971 (1.633)
Day +6	-1.230 (1.312)	1.209 (1.462)	-0.102 (0.390)	-2.595 (2.064)
Day +7	-1.556 (1.472)	-1.468 (0.731)	-3.435*** (0.440)	-4.194*** (1.121)

All models include the following explanatory variables: man, other gender (omitted: women), age and its square, number of years of education and its square, married (omitted: single), specific-country quartile income (omitted: lowest quartile), number of household members (omitted: living alone), number of comorbidities, country fixed effects, day fixed effects. Individual sample weights have been used to correct for differences in income, education, age and gender structure between the general population of the country and the corresponding sample. Robust standard errors. \*\*\*, \*\* and \* denote statistical significance at the 1%, 5% and 10% level.

**Table 2. Difference in difference model. PHQ-8 Depression Index and Anxiety Index**

	PHQ-8 Depression Index					Anxiety Index				
	M1	M2	M3	M4	M5	M1	M2	M3	M4	M5
Lockdown	1.245*** (0.213)	1.235*** (0.213)	1.207*** (0.213)	1.158*** (0.212)	1.242*** (0.213)	4.383*** (0.365)	4.430*** (0.365)	4.401*** (0.365)	4.164*** (0.365)	4.410*** (0.365)
Pandemic_cat5	2.851*** (0.217)	2.922*** (0.217)	2.911*** (0.217)	2.983*** (0.216)	2.908*** (0.217)	5.916*** (0.371)	5.830*** (0.372)	5.809*** (0.372)	5.872*** (0.372)	5.810*** (0.372)
Lockdown&Pand_cat5	-2.582*** (0.283)	-2.670*** (0.282)	-2.639*** (0.283)	-2.608*** (0.281)	-2.594*** (0.282)	-5.153*** (0.483)	-5.069*** (0.483)	-5.040*** (0.484)	-5.017*** (0.483)	-5.018*** (0.484)
Constant	61.003*** (0.820)	59.226*** (0.837)	59.350*** (0.863)	58.714*** (0.858)	58.630*** (0.863)	64.967*** (1.365)	64.567*** (1.400)	64.115*** (1.443)	63.641*** (1.441)	63.806*** (1.445)
N	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840
R <sup>2</sup>	0.274	0.283	0.283	0.294	0.287	0.213	0.214	0.214	0.217	0.214
F	149.047	159.057	143.696	156.373	138.119	23.024	22.064	20.255	23.074	18.901
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

M1 includes lockdown, pandemic of category 5, interaction between lockdown and pandemic of category 5, day fixed effects and country fixed effects. M2 includes the same explanatory variables than M1 and also male, other gender (omitted: women), age and its squared. M3 includes the same explanatory variables than M2 and also married (omitted: single), years of education and number of household members (omitted: living alone). M4 includes the same explanatory variables than M3 and also having any comorbidity and number of comorbidities. M5 includes the same explanatory variables than M4 and also household income quartile (omitted: lowest quartile). Individual sample weights have been used to correct for differences in income, education, age and gender structure between the general population of the country and the corresponding sample. Robust standard errors. \*\*\*, \*\* and \* denote statistical significance at the 1%, 5% and 10% level.

Lockdown is a binary variable that takes the value one from the day the lockdown becomes effective, and 0 before.

Pandemic category 5 is a binary variable if the case fatality rate is higher or equal than 2 per cent. The case fatality rate is the percentage of deceased with respect to confirmed cases. The category 5 corresponds to the highest level of the Pandemic Severity Index.

<https://www.cdc.gov/media/pdf/mitigationslides.pdf>

**Table 3. Effect of lockdown and interaction between lockdown and pandemic of category 5 conditioned on sociodemographic characteristics over PHQ-8 Depression Index: percentage with respect to sample mean and standard deviation units.**

	PHQ-8 Depression Index		Lockdown coef.  Table C3	Effect of lockdown over Depression Index		Interaction coef.  Table C3	Effect of interaction between lockdown and Pan_cat5 over Depression Index	
	Mean	In std. dev. units		With respect to sample mean (%)	In std. dev. units		With respect to sample mean (%)	In std. dev. units
<b>Age</b>								
<=30 years	47.65	15.86	0.304	0.638	0.012	-1.444	-3.030	-0.068
31-40 years	44.09	14.53	0.322	0.730	0.009	-1.645	-3.731	-0.060
41-50 years	41.48	13.91	1.895	4.568	0.053	-3.552	-8.563	-0.139
51-60 years	39.63	13.36	2.794	7.050	0.102	-3.818	-9.634	-0.187
>60 years	36.42	12.05	1.884	5.173	0.098	-2.995	-8.224	-0.206
<b>Education</b>								
<=5 years	43.41	14.76	1.181	2.721	0.068	-1.013	-2.334	-0.090
6-10 years	42.66	14.36	1.424	3.338	0.029	-2.325	-5.450	-0.062
11-15 years	42.80	14.45	2.846	6.650	0.180	0.387	0.904	0.032
16-20 years	43.43	15.27	1.558	3.587	0.045	-3.283	-7.559	-0.134
>20 years	43.11	14.89	2.885	6.692	0.137	-4.206	-9.756	-0.243
<b>Income</b>								
Lowest quartile	46.10	16.19	0.801	1.738	0.023	-2.436	-5.284	-0.091
Second quartile	42.77	14.20	1.769	4.136	0.050	-2.018	-4.718	-0.077
Third quartile	41.71	13.96	1.507	3.613	0.044	-3.632	-8.708	-0.141
Highest quartile	41.04	13.67	0.891	2.171	0.027	-2.112	-5.146	-0.083
<b>Household size</b>								
One	45.17	15.51	1.262	2.794	0.042	-2.967	-6.569	-0.132
Two	42.42	14.38	1.103	2.600	0.028	-2.528	-5.959	-0.084
Three	42.81	14.59	1.171	2.735	0.039	-1.901	-4.441	-0.083
More than 3	42.11	14.34	1.302	3.092	0.035	-2.772	-6.583	-0.100
<b>Region</b>								
Eastern Europe	43.88	15.10	0.459	1.046	0.004	-4.112	-9.371	-0.329
Northern Europe	42.37	15.06	1.074	2.535	0.031	-2.932	-6.920	-0.245
Southern Europe	44.30	15.08	11.948	26.971	2.464	-9.688	-21.869	-1.425

Estimated coefficients obtained in the difference-in-difference model (see Table C3) are expressed in terms of percentage with respect to the sample mean and in standard deviation units. For this purpose, the first two columns of the table show the mean and std. dev. of the PHQ-8 Depression Index conditioned on each sociodemographic characteristic.

The difference-in-difference model has not been estimated for the subsample of Western European countries because for all countries and dates, lockdown had already become effective.

**Table 4. Effect of lockdown and interaction between lockdown and pandemic of category 5 conditioned on sociodemographic characteristics over Anxiety Index: percentage with respect to sample mean and standard deviation units.**

	Anxiety Index		Lockdown coef. Table C3	Effect of lockdown over Anxiety Index		Interaction coef. Table C3	Effect of interaction between lockdown and Pan_cat5 over Anxiety Index	
	Mean	Std. Dev.		With respect to sample mean (%)	In std. dev. units		With respect to sample mean (%)	In std. dev. units
<b>Age</b>								
<=30 years	63.49	24.42	1.725	2.678	0.066	-4,166	-6,288	-0,190
31-40 years	64.04	23.89	1.697	2.695	0.047	-2,415	-3,681	-0,087
41-50 years	62.20	24.20	6.338	10.836	0.191	-6,449	-9,699	-0,237
51-60 years	60.73	24.47	6.229	10.896	0.243	-5,962	-9,233	-0,276
>60 years	60.86	24.64	6.424	11.234	0.356	-8,760	-13,133	-0,549
<b>Education</b>								
<=5 years	62.66	24.44	6.004	10.156	0.386	-6,748	-10,043	-0,575
6-10 years	62.83	24.25	3.685	6.081	0.080	-5,140	-7,761	-0,134
11-15 years	63.11	24.05	3.775	6.208	0.262	-5,867	-8,751	-0,469
16-20 years	61.59	24.31	4.978	8.485	0.156	-6,445	-9,791	-0,255
>20 years	64.09	24.22	2.716	4.353	0.139	-3,365	-5,074	-0,192
<b>Income</b>								
Lowest quartile	63.50	24.50	4.861	8.027	0.149	-6,179	-9,129	-0,224
Second quartile	62.62	24.16	3.944	6.547	0.119	-4,266	-6,522	-0,160
Third quartile	62.63	24.23	3.578	5.917	0.112	-4,883	-7,417	-0,185
Highest quartile	62.00	24.15	4.338	7.300	0.140	-5,455	-8,318	-0,208
<b>Household size</b>								
One	62.15	24.54	4.874	8.225	0.172	-5,083	-7,763	-0,218
Two	63.05	24.19	3.210	5.255	0.086	-4,636	-7,012	-0,151
Three	63.10	24.06	3.408	5.585	0.122	-4,505	-6,818	-0,198
More than 3	62.37	24.30	5.642	9.556	0.166	-6,852	-10,234	-0,238
<b>Region</b>								
Eastern Europe	62.57	24.86	5.123	8.606	0.263	-0,342	-0,545	-0,001
Northern Europe	61.94	24.62	2.913	4.840	0.090	-8,338	-12,339	-1,148
Southern Europe	65.87	24.67	8.272	13.596	0.833	-10,996	-14,858	-0,947

Estimated coefficients obtained in the difference-in-difference model (see Table C3) are expressed in terms of percentage with respect to the sample mean and in standard deviation units. For this purpose, the first two columns of the table show the mean and std. dev. of the Anxiety Index conditioned on each sociodemographic characteristic.

The difference-in-difference model has not been estimated for the subsample of Western European countries because for all countries and dates, lockdown had already become effective.

**Table 5. RD design. Difference in regression discontinuity for PHQ-8 Depression Index and Anxiety Index**

	MSE optimal	CER optimal	Without covariates	Alternative bandwidth		False threshold	
				6 DAYS	4 DAYS	2 days before	2 days after
<b>Running variable: Days elapsed since lockdown</b>							
PHQ-Depression Index							
Lockdown	1.730*** (0.341)	1.741*** (0.331)	1.736*** (0.321)	1.727*** (0.351)	1.719*** (0.341)	1.951 (2.050)	1,635 (1,533)
Lockdown*Pan_cat5	-2.165*** (0.725)	-2.174*** (0.705)	-2.168*** (0.685)	-2.155*** (0.725)	-2.149*** (0.735)	-0.899 (1.574)	-1,022 (1,605)
N	19.762	19.762	19.762	22.240	15.242	8.984	22,616
Bandwidth	5	5	5	6	4	5	5
Anxiety Index							
Lockdown	3.854*** (0.928)	3.863*** (0.949)	3.849*** (0.918)	3.835*** (0.939)	3.826*** (0.949)	3.739 (2.573)	3,336 (2,363)
Lockdown*Pan_cat5	-6.768*** (1.657)	-6.780*** (1.677)	-6.769*** (1.636)	-6.762*** (1.615)	-6.757*** (1.595)	-4.868 (3.708)	-6,128 (4,670)
N	19.762	19.762	19.762	22.240	15.242	8.984	22,616
Bandwidth	5	5	5	6	4	5	5
<b>Running variable: Days elapsed since pandemic reached category 5</b>							
PHQ-Depression Index							
Pan_cat5	2.352*** (0.654)	2.356*** (0.674)	2.342*** (0.685)	2.305*** (0.705)	2.303*** (0.715)	2.279 (1.533)	2,369 (1,523)
Lockdown*Pan_cat5	-1.847*** (0.573)	-1.855*** (0.583)	-1.841*** (0.593)	-1.826*** (0.614)	-1.823*** (0.624)	-1.227 (2.426)	-1,470 (2,165)
Obs. Left	19.762	19.762	19.762	22.240	15.242	8.984	22,616
Bandwidth	5	5	5	6	4	5	5
Anxiety Index							
Pan_cat5	8.487*** (0.949)	8.492*** (0.939)	8.475*** (0.959)	8.458*** (0.979)	8.451*** (1.000)	6.298 (4.659)	5,450 (3,934)
Lockdown*Pan_cat5	-2.205*** (0.492)	-2.209*** (0.503)	-2.198*** (0.503)	-2.173*** (0.482)	-2.166*** (0.553)	-2.140 (1.564)	1,699 (1,225)
N	19.762	19.762	19.762	22.240	15.242	8.984	22,616
Bandwidth	5	5	5	6	4	5	5

Mean square error (MSE): optimal bandwidth is estimated by taking the minimum optimal bandwidth of the most common MSE-optimal procedures. Coverage error (CER): optimal bandwidth is the minimum bandwidth of the different coverage error procedures following Calonico et al. (2018). Robust standard errors. \*\*\*, \*\* and \* denote statistical significance at the 1%, 5% and 10% level.

## Appendix A

**Figure A1. Epidemiological variables of COVID-19, PHQ-8 Depression Index, Anxiety Index and Stringency Index between March 20<sup>th</sup> and April 6<sup>th</sup>.**



Figure 1.1 represents the number of confirmed COVID-19 cases, recovered cases and deceased per 1,000,000 inhabitants.

Figure 1.2 represents the PHQ-8 Depression Index, Anxiety Index and Stringency Index (COVID-19 Government Response Stringency Index). Source: <https://COVID19-survey.org/results.html> for Depression Index (PHQ-8) and Anxiety Index; <https://www.bsg.ox.ac.uk/research/research-projects/oxford-COVID-19-government-response-tracker> for Stringency Index.

Figure 1.3 represents the four items of the Anxiety Index.

Figure 1.4 represents items 1 to 4 of the PHQ-8 Depression Index.

Figure 1.5 represents items 5 to 8 of the PHQ-8 Depression Index.

Individual sample weights have been used to correct for differences in income, education, age and gender structure between the general population of the country and the corresponding sample.

The Stringency Index is a composite measure obtained by additive score of nine indicators measured on an ordinal scale, and rescaled afterwards in order to vary from 0 to 100. The nine items included are the following ones:

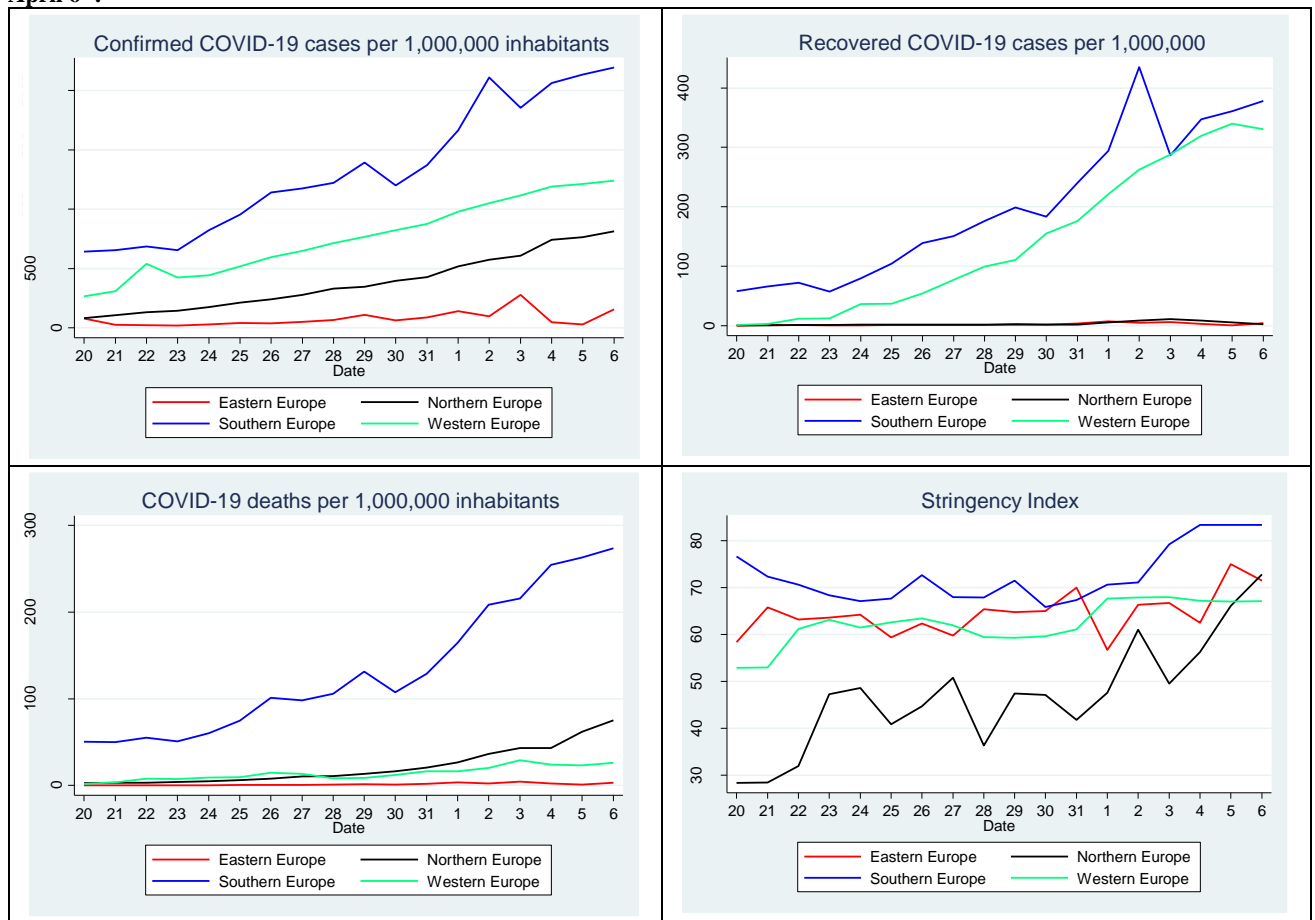
1. School closing (0: no measures; 1: recommend closing; 2: require closing); Workplace closures (0: no measures; 1: recommend closing; 2: require closing for some sectors or categories of workers; 3: require closing all but essential workplaces).
2. Cancel public events (0: no measures; 1: recommend cancelling; 2: require cancelling); restrictions on gatherings (0: no restrictions; 1: restrictions on gatherings above 1,000 people; 2: restrictions on gatherings between 100 and 1,000 people; 3: restrictions on gatherings between 10 and 100 people; 4: restrictions on gatherings of less than 10 people).
3. Close public transport (0: no measures; 1: recommend closing or significantly reduce volume or transport available; 2: require closing or prohibit most citizens from using it).

4. Public information campaigns (0: no public information campaign; 1: public officials urging caution about COVID-19; 2: coordinated public information campaign across traditional and social media).
5. Stay at home (0: no measures; 1: recommend not leaving house; 2: require not leaving house with exceptions for daily exercise, grocery shopping and essential trips; 3: require not leaving house with minimal exceptions).
6. Restrictions on internal movement (0: no measures; 1: recommend movement restriction; 2: restrict movement).
7. International travel controls (0: no measures; 1: screening; 2: quarantine arrivals from high-risk regions; 3: ban on high-risk regions; 4: total border closure).
8. Testing policy (0: no testing policy; 1: only those who have symptoms and meet specific criteria, such as, key workers, admitted to hospital, came into contact with a known case or returned from overseas; 2: testing anyone showing COVID-19 symptoms; 3: open public testing).
9. Contact tracing (0: no contact tracing; 1: limited contact tracing, that is not done for all cases; 2: comprehensive contact tracing, that is, done for all cases).

Depression Index (PHQ-8) is obtained as the sum of 8 items (little interest or pleasure in doing things, feeling down or hopeless, trouble falling asleep or sleeping too much, feeling tired or with little energy, poor appetite or overeating, feeling bad about oneself, trouble concentrating on things such as reading the newspaper or watching television, moving or speaking slowly or fidgety), each of them taking values between 0 and 100. The final sum is also re-scaled to take values between 0 and 100.

Anxiety Index is obtained as the sum of 4 items (nervous when thinking in current circumstances; worried about one's health; worried about the health of family members; stressed about leaving one's house), each of them taking values between 0 and 100. The final sum is also re-scaled to take values between 0 and 100.

**Figure A2. Epidemiological variables of COVID-19 and Stringency Index by regions between March 20<sup>th</sup> and April 6<sup>th</sup>.**



Source: Own work using data from: (i) Coronavirus Pandemic Data Explorer <https://ourworldindata.org/coronavirus-data-explorer> for confirmed cases, recovered cases and deceased per 1,000,000 inhabitants (ii) <https://www.bsg.ox.ac.uk/research/research-projects/oxford-COVID-19-government-response-tracker> for COVID-19 Government Response Stringency Index (Stringency Index). Eastern Europe: Bulgaria, Czech Republic, Hungary, Romania, Slovakia and Ukraine. Northern Europe: Denmark, Finland, Ireland, Norway, Sweden and United Kingdom. Southern Europe: Greece, Italy, Portugal and Spain. Western Europe: Austria, Belgium, France, Germany, Netherlands and Switzerland.



**Figure A3. Combination of lockdown measures and fatality rate by date and country**

	March												April					
	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6
Austria																		
Belgium																		
Bulgaria																		
Czech Republic																		
Denmark																		
Finland																		
France																		
Germany																		
Greece																		
Hungary																		
Ireland																		
Italy																		
Netherlands																		
Norway																		
Portugal																		
Romania																		
Slovakia																		
Spain																		
Sweden																		
Switzerland																		
Ukraine																		
United Kingdom																		

White	No lockdown and fatality rate lower than 2%.
Yellow	Lockdown has become effective and fatality rate lower than 2%
Green	No lockdown, but fatality rate higher or equal than 2%.
Red	Lockdown has become effective and fatality rate higher or equal than 2%

Information from lockdown dates obtained from <https://auravision.ai/COVID19-lockdown-tracker/>. The case fatality rate is the percentage of deceased with respect to confirmed cases. The category 5 corresponds to the highest level of the Pandemic Severity Index. Information of confirmed cases and deceased per 1,000,000 inhabitants obtained from <https://ourworldindata.org/coronavirus-data-explorer>

**Table A1. Dates lockdown became effective**

Country	Day lockdown became effective	Stringency Index before lockdown	Stringency Index after lockdown
Austria	March 16th	57.27	84.79
Belgium	March 18th	53.04	75.26
Bulgaria	March 13th	29.49	71.83
Czech Republic	March 16th	48.02	67.59
Denmark	March 13th	79.49	84.12
Finland	March 16th	47.48	71.55
France	March 17th	53.17	89.41
Germany	March 17th	46.30	71.83
Greece	March 23th	57.27	76.32
Hungary	March 28th	59.78	78.44
Ireland	March 27th	57.40	79.63
Italy	March 9th	64.44	83.46
Netherlands	March 16th	48.80	74.86
Norway	March 12th	16.93	72.48
Portugal	March 19th	44.31	62.57
Romania	March 25th	67.06	80.95
Slovakia	March 16th	56.48	82.14
Spain	March 14th	47.10	71.69
Sweden	No lockdown	Stringency Index varies between 32.4 and 45.36	
Switzerland	March 17th	27.38	79.49
Ukraine	March 17th	51.59	92.06
United Kingdom	March 24th	37.83	75.13

Source: Own work using <https://ourworldindata.org/grapher/COVID-stringency-index> (for Stringency Index) and <https://auravision.ai/COVID19-lockdown-tracker/> (for lockdown dates).

**Table. A2. L1 statistic before and after CEM (coarsened exact matching method)**

	Initial sample	Sample after CEM
Man	0.110(−0.142)	1.8e-14 (2.2e-14)
Age	0.022(0.022)	2.4e-14 (2.4e-14)
Years of education	0.224(0.248)	2.4e-14 (−6.8e-14)
Married	0.049(−0.049)	4.4e-16 (2.2e-16)
Single	0.097(0.098)	1.2e-14(2.0e-14)
Household size	0.224(−0.248)	9.2e-16(1.4e-14)
Number of comorbidities	0.080(0.012)	4.2e-16(4.4e-14)
Income quartile: 1st	0.049(0.056)	1.7e-14(−2.9e-14)
Income quartile: 2nd	0.022(−0.022)	9.4e-14(9.9e-14)
Income quartile: 3rd	0.107(0.112)	6.7e-16(8.0e-14)
Income quartile: 4th	0.185(0.190)	7.4e-16(7.8e-14)
Multivariate $L_1$	0.781	6.404e-16
N	48,434	44,840
Matched	-	44,840 (91.54%)
Unmatched	-	4,097 (8.46%)

Difference in means between parenthesis.

**Table A3. Descriptive statistics for PHQ-8 Depression Index and Anxiety index conditioned on lockdown and Pandemic Severity Index**

			All sample		Lockdown=0	Lockdown=1	Lockdown=0	Lockdown=1
			Mean	Std. Dev.	Pandemic Category 5=0	Pandemic Category 5=0	Pandemic Category 5=1	Pandemic Category 5=1
<b>Initial sample</b>								
Depression Index			41.25	14.63	39.35	41.19	41.80	41.82
1.	Little interest or pleasure in doing things		43.53	21.87	43.23	44.68	42.30	43.29
2.	Feeling down		42.38	20.68	40.91	41.42	43.73	43.23
3.	Trouble falling asleep or sleeping too much		45.49	23.39	42.27	45.41	47.11	45.58
4.	Feeling tired or having little energy		48.37	22.06	48.18	48.81	48.58	47.45
5.	Poor appetite or overeating		41.15	22.32	38.95	41.11	41.27	42.38
6.	Feeling bad about oneself		36.20	19.64	34.25	35.44	37.07	37.60
7.	Trouble concentrating on things		42.78	22.67	38.44	42.28	44.38	44.28
8.	Moving or speaking too slowly or too fidgety		30.10	13.66	28.58	30.35	29.99	30.74
Anxiety Index			59.20	24.15	55.61	59.24	60.55	59.61
1.	Nervous when thinking about current circumstances		66.54	23.06	64.42	61.77	74.50	66.13
2.	Worried about one's health		59.98	22.26	59.17	60.99	58.40	60.68
3.	Worried about family's health		61.07	23.13	57.67	60.56	62.55	62.15
4.	Stressed about leaving the house		77.59	26.21	71.86	75.44	81.72	79.63
N			48,434		6,417	18,208	13,175	10,634
<b>Sample after CEM</b>								
Depression Index			41.42	14.65	39.50	41.36	41.97	41.99
9.	Little interest or pleasure in doing things		43.72	21.92	43.42	44.88	42.48	43.48
10.	Feeling down		42.56	20.72	41.08	41.59	43.92	43.42
11.	Trouble falling asleep or sleeping too much		45.70	23.44	42.45	45.62	47.33	45.79
12.	Feeling tired or having little energy		48.60	22.11	48.41	49.05	48.82	47.68
13.	Poor appetite or overeating		41.32	22.37	39.10	41.28	41.44	42.56
14.	Feeling bad about oneself		36.33	19.68	34.37	35.57	37.21	37.74
15.	Trouble concentrating on things		42.96	22.72	38.59	42.46	44.58	44.48
16.	Moving or speaking too slowly or too fidgety		30.19	13.68	28.66	30.44	30.08	30.83
Anxiety Index			59.55	24.21	55.92	59.59	60.92	59.97
5.	Nervous when thinking about current circumstances		66.98	23.11	64.83	62.15	75.06	66.57
6.	Worried about one's health		60.34	22.31	59.52	61.36	58.74	61.05
7.	Worried about family's health		61.44	23.18	58.00	60.93	62.94	62.54
8.	Stressed about leaving the house		78.19	26.28	72.38	76.01	82.39	80.26
N			44,840		5,874	17,172	12,060	9,734

Source: Own work using data from <https://COVID19-survey.org/results.html>

For the computation of the descriptive statistics, individual sample weights have been used to correct for differences in income, education, age and gender structure between the general population of the country and the corresponding sample.

**Table A4. Individual characteristics by region**

	Initial sample					Sample after CEM				
	All sample	Eastern Europe	Northern Europe	Southern Europe	Western Europe	All sample	Eastern Europe	Northern Europe	Southern Europe	Western Europe
Gender										
Man	44.76	35.29	43.17	47.77	47.34	44.96	35.41	43.36	48.00	47.56
Women	54.30	64.31	55.75	51.67	51.65	54.59	64.72	56.06	51.94	51.92
Other	0.94	0.41	1.07	0.56	1.01	0.94	0.41	1.07	0.56	1.01
Age	41.15 (12.65)	34.22 (10.05)	43.93 (12.68)	41.34 (12.87)	39.71 (12.27)	41.32 (12.63)	34.34 (10.04)	44.12 (12.66)	41.51 (12.85)	39.87 (12.25)
Number of years of education	15.77 (5.08)	16.14 (3.39)	16.45 (4.39)	17.80 (4.31)	14.53 (5.81)	15.79 (5.08)	16.17 (3.39)	16.48 (4.39)	17.83 (4.31)	14.55 (5.81)
Marital status										
Married	63.28	56.79	67.14	57.11	62.27	63.68	57.11	67.59	57.44	62.66
Single	36.72	43.21	32.86	42.89	37.73	36.85	43.40	32.97	43.07	37.87
Household size										
Living alone	19.65	16.17	18.36	15.33	22.65	19.69	16.20	18.39	15.35	22.70
2 people	34.25	31.56	35.44	31.08	34.53	34.37	31.66	35.57	31.18	34.65
3 people	19.37	26.64	17.84	23.29	18.59	19.41	26.71	17.87	23.34	18.62
More than 3 people	26.73	25.64	28.36	30.30	24.23	26.80	25.71	28.44	30.39	24.29
Specific country income quartile										
1 <sup>st</sup> quartile (lowest)	25.84	26.28	25.28	29.74	25.29	25.91	26.35	25.34	29.83	25.35
2 <sup>nd</sup> quartile	25.58	25.96	25.35	21.05	26.90	25.65	26.03	25.41	21.09	26.97
3 <sup>rd</sup> quartile	24.90	25.23	24.61	25.02	25.08	24.96	25.29	24.67	25.08	25.14
4 <sup>th</sup> quartile (highest)	23.69	22.53	24.75	24.19	22.72	23.75	22.58	24.81	24.25	22.77
Has comorbidities <sup>A</sup>	12.31	14.76	9.55	11.49	14.75	12.33	14.78	9.56	11.50	14.77
Number of comorbidities (conditioned on having at least one)	2.17 (0.48)	2.12 (0.40)	2.16 (0.45)	2.18 (0.50)	2.19 (0.49)	2.17 (0.48)	2.12 (0.40)	2.16 (0.45)	2.18 (0.50)	2.19 (0.49)
N	48,434	3,697	19,259	4,997	20,072	44,840	3,356	18,043	4,600	18,841
%		7.63	39.76	10.32	41.44		7.48	40.24	10.26	42.02

Source: Own work using data from <https://COVID19-survey.org/results.html>

Standard errors between parenthesis.

<sup>A</sup> Cardiovascular diseases, diabetes, hepatitis B, chronic obstructive pulmonary disease, chronic kidney diseases, and cancer.Eastern Europe: Bulgaria, Czech Republic, Hungary, Romania, Slovakia and Ukraine.Northern Europe: Denmark, Finland, Ireland, Norway, Sweden and United Kingdom.Southern Europe: Greece, Italy, Portugal and Spain.Western Europe: Austria, Belgium, France, Germany, Netherlands and Switzerland.

Income refers to monthly household income before taxes. Income quartiles have been computed for each country after adjusting by the square root of household size. Individual sample weights have been used to correct for differences in income, education, age and gender structure between the general population of the country and the corresponding sample.

**Table A5. Descriptive statistics by country**

	N			COVID cases per 1.000.000 inhab			Anxiety index	PHQ-8 Depression index	Stringency index
	Initial sample	Sample after CEM	%	Confirmed	Recovered	Deceased			
Austria	1,074	980	91,25	486.22 220.05	9.76 30.91	2.97 3.28	60.06 22.76	41.22 13.83	84.79 0.00
Belgium	569	511	89,81	374.15 228.95	36.33 39.94	11.75 15.81	59.44 24.48	41.71 14.61	83.60 0.00
Bulgaria	329	295	89,67	33.38 10.55	0.96 0.75	0.71 0.29	60.18 26.09	45.03 16.43	75.02 0.11
Czech Rep.	267	247	92,51	135.53 62.69	1.02 1.29	0.51 0.95	56.41 25.19	41.85 14.53	79.27 1.43
Denmark	506	468	92,49	271.82 46.06	1.81 9.38	3.50 2.52	56.96 25.69	39.79 13.67	84.12 0.00
Finland	635	575	90,55	125.05 30.82	1.99 0.00	0.51 0.41	55.17 24.30	37.93 13.28	74.38 0.19
France	2,721	2,425	89,12	326.88 153.11	44.97 35.30	16.85 14.62	60.69 24.33	42.06 14.71	89.41 0.00
Germany	10,097	9,677	95,84	564.57 286.54	86.11 98.57	4.92 4.86	59.33 23.49	41.93 13.97	70.64 3.51
Greece	328	280	85,37	70.36 19.82	2.51 1.11	2.01 0.92	60.18 24.01	43.98 15.15	84.28 5.59
Hungary	239	224	93,72	15.90 9.86	1.64 0.87	0.77 0.41	62.22 24.59	44.54 14.06	74.42 1.59
Ireland	711	660	92,83	237.07 135.89	1.26 0.34	2.25 3.94	61.13 21.83	41.50 14.99	60.48 8.56
Italy	1,849	1,721	93,08	1,034.82 241.86	123.70 45.44	99.24 34.19	61.18 23.28	44.68 14.63	93.25 0.00
Netherlands	1,423	1,345	94,52	304.73 153.75	1.26 3.80	16.25 16.20	55.78 23.71	39.43 13.68	75.25 1.63
Norway	302	289	95,70	504.58 140.86	0.73 0.97	2.31 1.90	59.42 22.91	38.78 12.54	76.51 1.63

Portugal	550	511	92,91	217.23 <i>142.58</i>	1.24 <i>1.34</i>	3.02 <i>3.57</i>	65.92 <i>22.98</i>	43.18 <i>16.96</i>	62.57 <i>0.00</i>
Romania	801	747	93,26	28.41 <i>16.21</i>	3.53 <i>1.42</i>	0.38 <i>0.64</i>	64.16 <i>23.33</i>	40.90 <i>15.01</i>	80.22 <i>2.17</i>
Slovakia	609	529	86,86	35.25 <i>3.19</i>	1.32 <i>0.40</i>	0.20 <i>0.05</i>	58.63 <i>24.39</i>	41.12 <i>13.79</i>	82.14 <i>0.00</i>
Spain	2,270	2,088	91,98	817.85 <i>342.84</i>	88.53 <i>83.92</i>	56.81 <i>33.95</i>	62.87 <i>26.01</i>	40.73 <i>14.65</i>	78.07 <i>2.20</i>
Sweden	5,853	5,632	96,22	223.62 <i>65.92</i>	1.77 <i>1.14</i>	4.17 <i>4.14</i>	53.52 <i>26.24</i>	38.87 <i>13.73</i>	32.64 <i>1.22</i>
Switzerland	4,188	3,903	93,19	926.21 <i>186.21</i>	21.94 <i>48.47</i>	12.78 <i>5.94</i>	60.53 <i>23.13</i>	40.57 <i>13.78</i>	79.49 <i>0.00</i>
Ukraine	1,452	1,314	90,50	2.36 <i>3.56</i>	0.06 <i>0.08</i>	0.10 <i>0.10</i>	57.07 <i>25.05</i>	42.62 <i>15.43</i>	92.06 <i>0.00</i>
United Kingdom	11,252	10,419	92,60	102.31 <i>61.84</i>	1.12 <i>0.34</i>	5.37 <i>5.47</i>	61.78 <i>23.30</i>	42.16 <i>15.73</i>	47.32 <i>18.23</i>
Eastern Europe	3,697	3,356	90,78	26.67 <i>38.41</i>	1.27 <i>1.55</i>	0.31 <i>0.48</i>	59.43 <i>24.80</i>	42.29 <i>15.07</i>	84.28 <i>6.72</i>
Northern Europe	19,259	18,043	93,69	155.66 <i>101.18</i>	1.36 <i>1.70</i>	4.63 <i>4.98</i>	58.86 <i>24.56</i>	40.88 <i>15.03</i>	45.66 <i>18.43</i>
Southern Europe	4,997	4,600	92,06	782.96 <i>412.16</i>	86.29 <i>75.76</i>	62.99 <i>45.84</i>	62.40 <i>24.61</i>	42.67 <i>15.05</i>	82.39 <i>9.99</i>
Western Europe	20,072	18,841	93,87	579.79 <i>313.56</i>	55.63 <i>81.83</i>	9.07 <i>10.00</i>	59.55 <i>23.57</i>	41.45 <i>14.04</i>	76.48 <i>7.30</i>
Total	48,434	44,840	92,58	386.00 <i>354.86</i>	32.64 <i>65.99</i>	12.13 <i>23.94</i>	59.55 <i>24.21</i>	41.42 <i>14.65</i>	65.52 <i>20.92</i>

Source: Own work using data from: (i) <https://COVID19-survey.org/results.html> for Depression Index (PHQ-8) and Anxiety Index; (ii) Coronavirus Pandemic Data Explorer <https://ourworldindata.org/coronavirus-data-explorer> for confirmed cases, recovered cases and deceased per 1,000,000 inhabitants (iii) <https://www.bsg.ox.ac.uk/research/research-projects/oxford-COVID-19-government-response-tracker> for COVID-19 Government Response Stringency Index (Stringency Index).

Eastern Europe: Bulgaria, Czech Republic, Hungary, Romania, Slovakia and Ukraine. Northern Europe: Denmark, Finland, Ireland, Norway, Sweden and United Kingdom. Southern Europe: Greece, Italy, Portugal and Spain. Western Europe: Austria, Belgium, France, Germany, Netherlands and Switzerland.

Standard deviation in italics. Individual sample weights have been used to correct for differences in income, education, age and gender structure between the general population of the country and the corresponding sample.

**Table A6. Descriptive statistics by country. Continuation**

	Items for Depression Index (PHQ-8)								Items for Anxiety Index			
	Little interest in things	Feeling down	Sleeping problems	Feeling tired	Appetite problems	Feeling bad about oneself	Trouble concentr.	Speaking problems	Nervous and restless	Worried about one's health	Worried about family's health	Stressed leaving house
Austria	44.63 <i>20.86</i>	41.77 <i>19.94</i>	44.64 <i>21.53</i>	47.76 <i>20.14</i>	40.95 <i>22.01</i>	35.15 <i>18.47</i>	43.67 <i>21.81</i>	30.82 <i>14.17</i>	59.62 <i>23.07</i>	61.43 <i>20.73</i>	58.59 <i>23.09</i>	71.94 <i>22.09</i>
Belgium	43.04 <i>21.40</i>	41.87 <i>20.06</i>	45.24 <i>23.76</i>	49.94 <i>22.86</i>	41.65 <i>22.40</i>	36.51 <i>19.13</i>	44.62 <i>22.47</i>	30.49 <i>14.42</i>	64.31 <i>22.24</i>	61.93 <i>21.88</i>	59.54 <i>22.94</i>	77.67 <i>22.17</i>
Bulgaria	48.92 <i>25.31</i>	50.02 <i>24.87</i>	47.80 <i>25.02</i>	52.79 <i>24.12</i>	43.96 <i>24.27</i>	38.60 <i>22.64</i>	46.11 <i>23.93</i>	31.63 <i>16.34</i>	72.18 <i>24.15</i>	59.50 <i>24.94</i>	62.33 <i>25.75</i>	85.90 <i>22.44</i>
Czech Rep.	46.14 <i>23.26</i>	42.88 <i>20.90</i>	43.92 <i>24.31</i>	48.74 <i>22.74</i>	42.88 <i>22.75</i>	37.87 <i>20.53</i>	42.97 <i>21.88</i>	29.01 <i>11.42</i>	64.23 <i>22.03</i>	61.12 <i>20.47</i>	59.68 <i>22.88</i>	73.41 <i>22.97</i>
Denmark	43.44 <i>22.85</i>	39.08 <i>18.95</i>	42.72 <i>22.30</i>	48.50 <i>23.13</i>	39.08 <i>21.53</i>	35.40 <i>19.32</i>	40.08 <i>22.13</i>	29.64 <i>12.16</i>	66.88 <i>20.38</i>	65.56 <i>21.38</i>	59.92 <i>24.38</i>	75.11 <i>22.22</i>
Finland	39.64 <i>20.52</i>	38.77 <i>18.97</i>	39.44 <i>20.08</i>	44.89 <i>20.83</i>	37.58 <i>19.87</i>	33.69 <i>17.43</i>	40.88 <i>21.99</i>	28.27 <i>10.92</i>	60.91 <i>21.81</i>	64.19 <i>21.91</i>	61.25 <i>21.64</i>	73.16 <i>22.26</i>
France	42.69 <i>21.48</i>	41.75 <i>20.20</i>	46.78 <i>23.92</i>	48.29 <i>21.94</i>	43.56 <i>23.56</i>	37.98 <i>20.86</i>	44.41 <i>23.35</i>	30.66 <i>14.76</i>	64.65 <i>22.98</i>	61.05 <i>21.99</i>	59.56 <i>23.61</i>	77.68 <i>21.93</i>
Germany	45.45 <i>20.90</i>	42.16 <i>19.66</i>	46.48 <i>22.71</i>	49.90 <i>21.01</i>	41.07 <i>21.47</i>	35.61 <i>18.92</i>	43.49 <i>21.87</i>	30.96 <i>14.07</i>	60.00 <i>22.64</i>	61.67 <i>20.94</i>	60.35 <i>22.58</i>	73.85 <i>22.48</i>
Greece	51.11 <i>24.52</i>	49.71 <i>23.46</i>	44.02 <i>23.81</i>	47.55 <i>21.52</i>	45.64 <i>24.28</i>	37.94 <i>21.73</i>	42.94 <i>23.16</i>	32.42 <i>15.66</i>	65.48 <i>23.78</i>	58.94 <i>24.78</i>	60.54 <i>23.70</i>	82.94 <i>21.86</i>
Hungary	48.20 <i>22.62</i>	51.41 <i>21.33</i>	45.28 <i>23.53</i>	52.57 <i>22.39</i>	42.44 <i>21.61</i>	40.96 <i>22.36</i>	45.82 <i>24.24</i>	29.16 <i>11.31</i>	68.49 <i>23.07</i>	55.96 <i>25.29</i>	59.00 <i>24.48</i>	87.79 <i>19.38</i>
Ireland	41.73 <i>21.84</i>	42.16 <i>21.00</i>	45.81 <i>23.47</i>	47.23 <i>22.19</i>	43.23 <i>24.14</i>	37.34 <i>20.16</i>	44.32 <i>23.18</i>	29.87 <i>13.62</i>	74.47 <i>22.32</i>	60.99 <i>21.40</i>	64.29 <i>21.43</i>	85.21 <i>20.73</i>
Italy	47.23 <i>21.42</i>	47.81 <i>20.48</i>	49.01 <i>24.39</i>	49.56 <i>21.09</i>	45.79 <i>24.07</i>	38.51 <i>20.02</i>	47.19 <i>23.27</i>	31.91 <i>15.44</i>	66.24 <i>21.89</i>	56.38 <i>23.32</i>	60.06 <i>21.11</i>	76.48 <i>21.97</i>
Netherlands	40.78 <i>21.09</i>	39.31 <i>19.16</i>	42.98 <i>22.18</i>	46.54 <i>21.80</i>	38.18 <i>20.53</i>	33.95 <i>17.13</i>	44.37 <i>23.93</i>	29.03 <i>12.04</i>	65.27 <i>21.29</i>	62.55 <i>21.90</i>	58.11 <i>23.60</i>	75.74 <i>22.23</i>
Norway	41.30 <i>20.31</i>	40.14 <i>20.03</i>	42.98 <i>22.09</i>	47.75 <i>21.17</i>	39.14 <i>19.40</i>	34.23 <i>17.44</i>	36.98 <i>19.01</i>	27.39 <i>8.58</i>	66.06 <i>17.55</i>	61.90 <i>19.03</i>	59.96 <i>24.57</i>	68.95 <i>18.90</i>
Portugal	44.62 <i>22.44</i>	44.65 <i>21.99</i>	46.72 <i>23.92</i>	46.72 <i>23.09</i>	47.13 <i>25.07</i>	38.09 <i>21.90</i>	44.05 <i>23.18</i>	33.11 <i>17.16</i>	72.77 <i>23.06</i>	58.49 <i>23.37</i>	65.92 <i>21.64</i>	89.00 <i>19.03</i>
Romania	46.41 <i>23.70</i>	43.35 <i>21.54</i>	44.26 <i>23.01</i>	44.52 <i>21.15</i>	43.32 <i>23.19</i>	34.83 <i>19.45</i>	38.91 <i>20.58</i>	31.12 <i>14.56</i>	69.33 <i>21.47</i>	58.32 <i>23.32</i>	62.71 <i>22.44</i>	81.27 <i>22.48</i>
Slovakia	46.74 <i>23.41</i>	38.11 <i>19.12</i>	41.75 <i>21.94</i>	48.67 <i>22.21</i>	39.94 <i>21.87</i>	42.87 <i>21.79</i>	42.87 <i>22.68</i>	27.58 <i>10.59</i>	65.15 <i>21.54</i>	59.20 <i>23.26</i>	59.63 <i>22.95</i>	83.61 <i>20.97</i>
Spain	43.04 <i>21.91</i>	40.59 <i>19.30</i>	44.09 <i>22.47</i>	43.67 <i>20.24</i>	42.60 <i>22.21</i>	36.28 <i>19.01</i>	44.06 <i>23.20</i>	31.16 <i>14.63</i>	70.51 <i>22.34</i>	63.60 <i>23.17</i>	62.95 <i>23.06</i>	83.47 <i>21.06</i>
Sweden	42.51 <i>22.79</i>	40.50 <i>20.62</i>	41.44 <i>21.92</i>	49.50 <i>22.65</i>	37.39 <i>20.35</i>	33.81 <i>18.08</i>	37.40 <i>20.00</i>	28.04 <i>10.57</i>	62.54 <i>21.53</i>	59.73 <i>20.73</i>	56.49 <i>24.59</i>	68.65 <i>22.22</i>
Switzerland	42.60 <i>21.52</i>	40.80 <i>19.78</i>	45.62 <i>22.83</i>	48.40 <i>21.55</i>	42.18 <i>22.30</i>	34.41 <i>17.63</i>	40.26 <i>21.17</i>	29.96 <i>12.93</i>	65.07 <i>21.83</i>	60.37 <i>21.87</i>	62.52 <i>22.11</i>	80.25 <i>21.51</i>
Ukraine	40.05 <i>22.30</i>	49.26 <i>23.79</i>	45.42 <i>24.86</i>	49.71 <i>24.42</i>	41.09 <i>23.41</i>	42.66 <i>24.34</i>	41.60 <i>23.50</i>	30.91 <i>14.71</i>	66.29 <i>23.21</i>	61.39 <i>24.15</i>	76.67 <i>23.86</i>	90.46 <i>18.87</i>
United Kingdom	41.63 <i>21.98</i>	43.86 <i>21.58</i>	48.13 <i>24.82</i>	48.59 <i>23.12</i>	41.70 <i>23.14</i>	37.40 <i>20.64</i>	45.40 <i>24.24</i>	30.22 <i>14.15</i>	77.00 <i>22.25</i>	58.54 <i>23.61</i>	63.85 <i>22.28</i>	83.85 <i>21.33</i>
Eastern Europe	44.28 <i>23.41</i>	45.89 <i>22.76</i>	44.66 <i>23.93</i>	48.81 <i>23.23</i>	41.85 <i>23.06</i>	40.18 <i>22.60</i>	42.00 <i>22.82</i>	30.22 <i>13.87</i>	67.29 <i>22.66</i>	59.82 <i>23.77</i>	67.19 <i>24.75</i>	85.53 <i>21.28</i>
Northern Europe	41.87 <i>22.18</i>	42.43 <i>21.17</i>	45.50 <i>23.89</i>	48.67 <i>22.86</i>	40.21 <i>22.26</i>	36.08 <i>19.77</i>	42.51 <i>23.07</i>	29.43 <i>12.96</i>	71.54 <i>22.94</i>	59.42 <i>22.56</i>	61.38 <i>23.28</i>	78.46 <i>22.71</i>
Southern Europe	45.29 <i>22.10</i>	44.30 <i>20.64</i>	46.19 <i>23.55</i>	46.44 <i>21.13</i>	44.48 <i>23.43</i>	37.41 <i>19.93</i>	45.14 <i>23.27</i>	31.73 <i>15.30</i>	68.85 <i>22.48</i>	60.06 <i>23.59</i>	62.05 <i>22.32</i>	81.45 <i>21.64</i>
Western Europe	44.04 <i>21.19</i>	41.59 <i>19.76</i>	45.96 <i>22.85</i>	49.02 <i>21.34</i>	41.44 <i>21.96</i>	35.57 <i>18.83</i>	43.04 <i>22.14</i>	30.55 <i>13.83</i>	62.16 <i>22.57</i>	61.37 <i>21.37</i>	60.42 <i>22.77</i>	75.85 <i>22.32</i>
Total	43.34 <i>21.92</i>	42.56 <i>20.72</i>	45.70 <i>23.44</i>	48.60 <i>22.11</i>	41.32 <i>22.37</i>	36.33 <i>19.68</i>	42.96 <i>22.72</i>	30.19 <i>13.68</i>	66.98 <i>23.11</i>	60.34 <i>22.31</i>	61.44 <i>23.18</i>	78.19 <i>22.50</i>

Source: Own work using data from <https://COVID19-survey.org/results.html>. Standard deviation in italics.

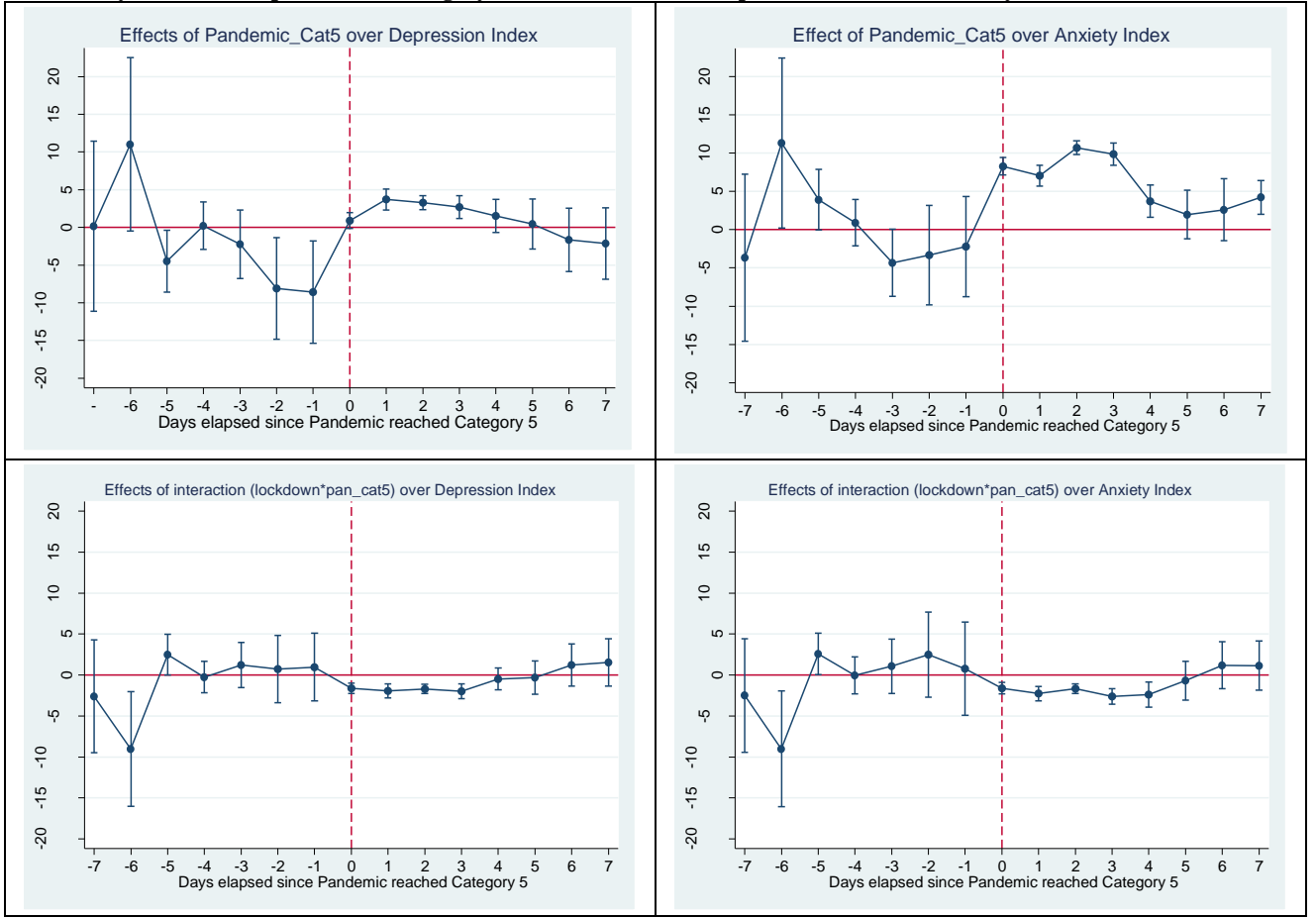
Items for PHQ-8 Depression Index and for Anxiety Index take values between 0 and 100.

Eastern Europe: Bulgaria, Czech Republic, Hungary, Romania, Slovakia and Ukraine. Northern Europe: Denmark, Finland, Ireland, Norway, Sweden and United Kingdom. Southern Europe: Greece, Italy, Portugal and Spain. Western Europe: Austria, Belgium, France, Germany, Netherlands and Switzerland.

Individual sample weights have been used to correct for differences in income, education, age and gender structure between the general population of the country and the corresponding sample.

## Appendix B

**Figure B1. Event study results. Effect of the days before/after pandemic reached category 5 and interaction between days before/after pandemic of category 5 and lockdown over Depression Index and Anxiety Index.**

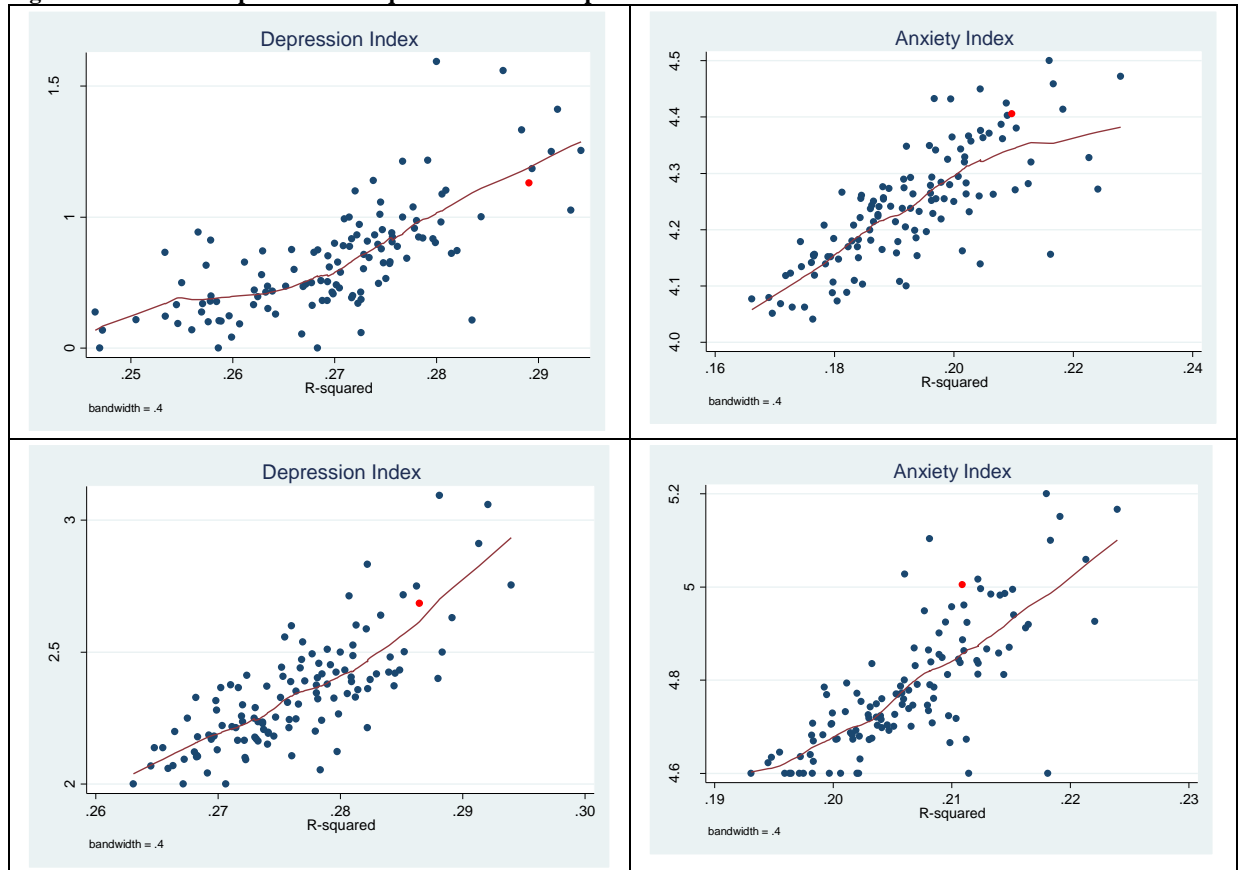


Upper graphs show the estimated coefficients for  $\sum_{j=-7}^{j=7} \delta_{0k} D_{kc} P$  of equation 2 for Depression Index (left) and Anxiety Index (right).

Lower graphs show the estimated coefficients for  $\sum_{j=-7}^{j=7} \delta_{2k} D_{kc} L_{ct} P_{ct}$  of equation 2 for Depression Index (left) and Anxiety Index (right). See Table 5 for the detail of coefficients and standard deviations.

Red dashed line used to signal the day when pandemic reached category 5 according to the Pandemic Severity Index.

**Figure B2. Relationship between R-squared and model specification**



This figure shows 4 different scatterplots. In the y-axis, we represent the absolute value of the lockdown coefficient (upper) and interaction between lockdown and pandemic of category 5 (lower) (y-axis). In the x-axis we represent the model R-squared (x-axis). Dependent variables is Depression Index (left figures) and Anxiety Index (right figures). The absolute value of the lockdown coefficient (or the interaction between lockdown and pandemic of category 5) and the R-squared result of the respective outcome on different combinations among the explanatory variables (sex, age, years of education, marital status, income, number of household members, comorbidities, country fixed effects and day fixed effects). The maroon line represents a locally weighted regression Robust standard errors are obtained at the day level. The specification reported in the paper (M5) is coloured in red.



**Table B1. Event study results. Estimated coefficients for days before/after pandemic reached category 5 and interaction between day before/after pandemic reached category 5 and lockdown.**

	Depression Index		Anxiety Index	
	Effect of days before/after pandemic reached category 5	Effect of days before/after pandemic reached category 5 and lockdown	Effect of days before/after pandemic reached category 5	Effect of days before/after pandemic reached category 5 and lockdown
Day -7	0.153 (5.926)	-2.575 (3.572)	-3.614 (5.715)	-2.459 (3.603)
Day -6	11.021 (6.032)	-9.025** (3.644)	11.343** (5.820)	-9.104** (3.675)
Day -5	-4.472* (2.112)	2.523 (1.278)	3.991 (2.030)	2.626** (1.298)
Day -4	0.229 (1.623)	-0.256 (0.985)	0.911 (1.562)	-0.040 (1.167)
Day -3	-2.217 (2.337)	1.227 (1.420)	-4.231 (2.255)	1.075 (1.704)
Day -2	-7.766 (3.489)	0.738 (2.112)	-3.263 (3.365)	2.523 (2.685)
Day -1	-8.510** (3.520)	0.981 (2.132)	-2.206 (3.396)	0.781 (2.952)
Day pandemic reached Cat. 5	0.893*** (0.331)	-1.622*** (0.331)	8.220*** (0.592)	-1.599*** (0.351)
Day +1	3.766*** (0.723)	-1.922*** (0.441)	7.299*** (0.692)	-2.239*** (0.451)
Day +2	3.326*** (0.481)	-1.684*** (0.290)	10.769*** (0.461)	-1.643*** (0.300)
Day +3	2.735*** (0.763)	-1.971*** (0.471)	9.929*** (0.743)	-2.567*** (0.481)
Day +4	1.535 (1.126)	-0.484 (0.682)	3.791*** (1.086)	-2.350 (0.793)
Day +5	0.461 (1.714)	-0.298 (1.035)	1.995 (1.643)	-0.690 (1.217)
Day +6	-1.623 (2.163)	1.240 (1.319)	2.636 (2.081)	1.209 (1.471)
Day +7	-2.127 (2.449)	1.570 (1.481)	4.301 (1.126)	1.159 (1.552)

All models include the following explanatory variables: man, other gender (omitted: women), age and its square, number of years of education and its square, married (omitted: single), specific-country quartile income (omitted: lowest quartile), number of household members (omitted: living alone), number of comorbidities, country fixed effects, day fixed effects. Individual sample weights have been used to correct for differences in income, education, age and gender structure between the general population of the country and the corresponding sample. Robust standard errors. \*\*\*, \*\* and \* denote statistical significance at the 1%, 5% and 10% level.

## Appendix C

**Table C1. Difference in difference model. Items of the PHQ-8 Depression Index**

	Item 1: Little interest or pleasure in doing things					Item 2: Feeling down				
	M1	M2	M3	M4	M5	M1	M2	M3	M4	M5
Lockdown	0.012 (0.327)	-0.026 (0.327)	-0.037 (0.327)	-0.046 (0.327)	-0.039 (0.327)	-0.113 (0.306)	-0.109 (0.305)	-0.164 (0.305)	-0.110 (0.305)	-0.123 (0.305)
Pandemic_cat5	-1.118*** (0.333)	-1.000*** (0.333)	-1.016*** (0.333)	-1.01*** (0.333)	-1.019*** (0.333)	3.366 (0.311)	3.420 (0.311)	3.406 (0.311)	3.477 (0.310)	3.403 (0.311)
Lockdown&Pand_cat5	-0.553 (0.433)	-0.711 (0.433)	-0.651 (0.433)	-0.623 (0.433)	-0.594 (0.433)	-2.012 (0.405)	-2.082 (0.404)	-2.032 (0.405)	-2.000 (0.404)	-1.970 (0.404)
Constant	67.921*** (1.257)	66.185*** (1.287)	66.511*** (1.327)	65.976*** (1.325)	65.669*** (1.329)	67.288*** (1.172)	65.101*** (1.201)	65.607*** (1.238)	64.970*** (1.235)	64.645*** (1.239)
N	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840
R <sup>2</sup>	0.232	0.238	0.238	0.242	0.240	0.257	0.262	0.262	0.267	0.265
F	55.525	63.573	57.991	60.004	56.474	108.769	111.664	101.471	104.872	97.745
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Item 3: Trouble falling asleep or sleeping too much					Item 4: Feeling tired or having little energy				
	M1	M2	M3	M4	M5	M1	M2	M3	M4	M5
Lockdown	3.363*** (0.350)	3.326*** (0.350)	3.288*** (0.350)	2.946*** (0.349)	3.324*** (0.350)	-0.272 (0.328)	-0.334 (0.328)	-0.338 (0.328)	-0.666 (0.327)	-0.307 (0.328)
Pandemic_cat5	5.934*** (0.357)	6.056*** (0.357)	6.035*** (0.357)	6.132*** (0.355)	6.029*** (0.356)	0.704*** (0.334)	0.834*** (0.335)	0.848*** (0.335)	0.943*** (0.333)	0.848*** (0.334)
Lockdown&Pand_cat5	-5.472*** (0.463)	-5.600*** (0.463)	-5.547*** (0.464)	-5.510*** (0.462)	-5.510*** (0.464)	-2.298*** (0.434)	-2.451*** (0.435)	-2.479*** (0.435)	-2.434*** (0.433)	-2.420*** (0.435)
Constant	59.475*** (1.347)	57.946*** (1.380)	57.901*** (1.423)	57.131*** (1.418)	57.272*** (1.425)	68.769*** (1.261)	68.672*** (1.293)	69.291*** (1.333)	68.354*** (1.327)	68.413*** (1.335)
N	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840
R <sup>2</sup>	0.232	0.236	0.236	0.243	0.238	0.244	0.246	0.246	0.255	0.248
F	55.526	60.112	54.807	62.408	52.143	80.363	79.072	72.027	83.085	68.911
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Item 5: Poor appetite or overeating					Item 6: Feeling bad about oneself				
	M1	M2	M3	M4	M5	M1	M2	M3	M4	M5
Lockdown	1.919*** (0.331)	1.825*** (0.330)	1.819*** (0.331)	1.526*** (0.330)	1.847*** (0.331)	0.437 (0.292)	0.440 (0.292)	0.469 (0.292)	0.477 (0.292)	0.519 (0.291)
Pandemic_cat5	3.119*** (0.337)	3.332*** (0.337)	3.344*** (0.337)	3.427*** (0.336)	3.342*** (0.337)	3.038*** (0.298)	3.094*** (0.297)	3.098*** (0.298)	3.161*** (0.297)	3.093*** (0.297)
Lockdown&Pand_cat5	-2.341*** (0.438)	-2.584*** (0.438)	-2.598*** (0.438)	-2.562*** (0.437)	-2.559*** (0.438)	-1.510*** (0.386)	-1.584*** (0.386)	-1.622*** (0.386)	-1.594*** (0.385)	-1.555*** (0.385)
Constant	59.374*** (1.273)	58.678*** (1.302)	59.247*** (1.343)	58.530*** (1.338)	58.641*** (1.345)	59.184*** (1.121)	57.064*** (1.148)	56.545*** (1.184)	55.993*** (1.181)	55.520*** (1.184)
N	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840
R <sup>2</sup>	0.249	0.256	0.256	0.262	0.257	0.243	0.249	0.249	0.254	0.253
F	91.047	98.815	89.581	94.696	83.574	79.344	84.700	77.026	80.161	77.325
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Item 7: Trouble concentrating on things					Item 8: Moving or speaking too slowly or too fidgety				
	M1	M2	M3	M4	M5	M1	M2	M3	M4	M5
Lockdown	3.503*** (0.335)	3.671*** (0.334)	3.566*** (0.335)	3.356*** (0.335)	3.606*** (0.334)	1.264*** (0.205)	1.247*** (0.205)	1.248*** (0.205)	1.073*** (0.205)	1.268*** (0.205)
Pandemic_cat5	6.762*** (0.342)	6.578*** (0.341)	6.532*** (0.341)	6.591*** (0.340)	6.523*** (0.341)	1.429 (0.209)	1.468*** (0.209)	1.450*** (0.209)	1.500*** (0.209)	1.448*** (0.209)
Lockdown&Pand_cat5	-4.974*** (0.444)	-4.817*** (0.443)	-4.682*** (0.443)	-4.659*** (0.443)	-4.656*** (0.443)	-1.248 (0.272)	-1.296*** (0.272)	-1.277*** (0.273)	-1.253*** (0.272)	-1.255*** (0.273)
Constant	64.265*** (1.289)	58.651*** (1.318)	59.033*** (1.358)	58.552*** (1.357)	58.531*** (1.361)	42.174*** (0.786)	41.904*** (0.807)	41.100*** (0.832)	40.633*** (0.830)	40.769*** (0.834)
N	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840
R <sup>2</sup>	0.254	0.262	0.263	0.266	0.264	0.219	0.220	0.220	0.228	0.222
F	102.138	111.861	103.039	101.714	96.382	33.662	33.075	30.561	38.334	29.776
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Lockdown is a binary variable that takes the value one from the day the lockdown becomes effective, and 0 before.

Pandemic category 5: is a binary variable if the case fatality rate is higher or equal than 2 per cent. The case fatality rate is the percentage of deceased with respect to confirmed cases. The category 5 corresponds to the highest level of the Pandemic Severity Index. <https://www.cdc.gov/media/pdf/mitigationslides.pdf>

M1 includes lockdown, pandemic of category 5, interaction between lockdown and pandemic of category 5, day fixed effects and country fixed effects. M2 includes the same explanatory variables than M1 and also male, other gender (omitted: women), age and its squared. M3 includes the same explanatory variables than M2 and also married (omitted: single), years of education and number of household members (omitted: living alone). M4 includes the same explanatory variables than M3 and also having any comorbidity and number of comorbidities. M5 includes the same explanatory variables than M4 and also household income quartile (omitted: lowest quartile). Individual sample weights have been used to correct for differences in income, education, age and gender structure between the general population of the country and the corresponding sample. Robust standard errors. \*\*\*, \*\* and \* denote statistical significance at the 1%, 5% and 10% level.

**Table C2. Difference in difference model. Items of the Anxiety Index**

	Item 1: Nervous when thinking about current circumstances					Item 2: Worried about one's health				
	M1	M2	M3	M4	M5	M1	M2	M3	M4	M5
Lockdown	-0.588	-0.499	-0.428	-0.536	-0.417	0.830***	0.864***	0.850***	0.852***	0.840***

Pandemic_cat5	(0.336) 12.928*** (0.343)	(0.336) 12.738*** (0.343)	(0.337) 12.772*** (0.343)	(0.336) 12.807*** (0.343)	(0.335) 12.770*** (0.341)	(0.335) -1.432*** (0.340)	(0.335) -1.466*** (0.342)	(0.336) -1.474*** (0.342)	(0.335) -1.502*** (0.342)	(0.335) -1.474 (0.341)
Lockdown&Pand_cat5	-7.157*** (0.444)	-6.997*** (0.444)	-7.083*** (0.444)	-7.072*** (0.444)	-7.072*** (0.442)	1.133*** (0.442)	1.171*** (0.443)	1.202*** (0.443)	1.185*** (0.443)	1.186*** (0.444)
Constant	44.211*** (1.298)	47.432*** (1.337)	46.707*** (1.337)	46.227*** (1.340)	46.241*** (1.261)	44.430*** (1.294)	46.446*** (1.333)	46.477*** (1.333)	47.602*** (1.336)	47.476*** (1.354)
N	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840
R <sup>2</sup>	0.273	0.274	0.274	0.275	0.275	0.210	0.211	0.211	0.212	0.211
F	94.666	78.134	80.244	83.917	81.981	80.170	89.538	87.717	88.285	86.417
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Item 3: Worried about family's health						Item 4: Stressed about leaving the house				
	M1	M2	M3	M4	M5	M1	M2	M3	M4	M5
Lockdown	4.298*** (0.348)	4.278*** (0.348)	4.243*** (0.347)	3.800*** (0.348)	4.257*** (0.331)	5.400*** (0.332)	5.432*** (0.332)	5.422*** (0.332)	5.194*** (0.332)	5.441*** (0.332)
Pandemic_cat5	6.006*** (0.355)	6.022*** (0.355)	6.009*** (0.353)	6.130*** (0.355)	6.007*** (0.338)	12.360*** (0.338)	12.304*** (0.338)	12.234*** (0.338)	12.299*** (0.338)	12.234*** (0.338)
Lockdown&Pand_cat5	-4.028*** (0.460)	-4.040*** (0.460)	-4.016*** (0.458)	-3.973*** (0.460)	-4.001*** (0.437)	-7.117*** (0.438)	-7.069*** (0.438)	-7.033*** (0.438)	-7.014*** (0.438)	-7.002*** (0.439)
Constant	59.946*** (1.343)	51.618*** (1.384)	51.719*** (1.377)	60.036*** (1.387)	61.232*** (1.249)	76.037*** (1.282)	75.214*** (1.320)	79.235*** (1.319)	78.346*** (1.323)	70.140*** (1.325)
N	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840	44,840
R <sup>2</sup>	0.211	0.211	0.211	0.222	0.212	0.247	0.247	0.248	0.251	0.249
F	22.220	18.287	19.288	39.875	17.854	43.390	30.745	40.357	50.835	41.237
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Lockdown is a binary variable that takes the value one from the day the lockdown becomes effective, and 0 before.

Pandemic category 5: is a binary variable if the case fatality rate is higher or equal than 2 per cent. The case fatality rate is the percentage of deceased with respect to confirmed cases. The category 5 corresponds to the highest level of the Pandemic Severity Index. <https://www.cdc.gov/media/pdf/mitigation/slides.pdf>

M1 includes lockdown, pandemic of category 5, interaction between lockdown and pandemic of category 5, day fixed effects and country fixed effects. M2 includes the same explanatory variables than M1 and also male, other gender (omitted: women), age and its squared. M3 includes the same explanatory variables than M2 and also married (omitted: single), years of education and number of household members (omitted: living alone). M4 includes the same explanatory variables than M3 and also having any comorbidity and number of comorbidities. M5 includes the same explanatory variables than M4 and also household income quartile (omitted: lowest quartile). Individual sample weights have been used to correct for differences in income, education, age and gender structure between the general population of the country and the corresponding sample. Robust standard errors. \*\*\*, \*\* and \* denote statistical significance at the 1%, 5% and 10% level.

**Table C3. Heterogeneity in the difference in difference model for Depression Index and Anxiety Index**

Age	PHQ-8 Depression Index					Anxiety Index				
	<=30 years	31-40 years	41-50 years	51-60 years	>60 years	<=30 years	31-40 years	41-50 years	51-60 years	>60 years
Lockdown	0.304 (0.607)	0.322 (0.388)	1.895*** (0.391)	2.794*** (0.487)	1.884*** (0.626)	1.7 (0.950)	1.726*** (0.648)	6.740*** (0.686)	6.617*** (0.898)	6.837*** (1.283)
Pandemic_cat5	2.014*** (0.647)	2.408*** (0.412)	3.317*** (0.393)	3.639*** (0.471)	2.350 (0.570)	4.473*** (1.011)	2.913*** (0.686)	7.839*** (0.690)	7.318*** (0.868)	7.578*** (1.170)
Lockdown&Pand_cat5	-1.444*** (0.744)	-1.645*** (0.527)	-3.552*** (0.543)	-3.818*** (0.654)	-2.995*** (0.827)	-3.992*** (1.163)	-2.357*** (0.877)	-6.033*** (0.952)	-5.607*** (1.204)	-7.993*** (1.691)
Constant	60.277*** (7.737)	62.399*** (16.253)	64.200*** (22.955)	67.047*** (12.030)	64.387*** (10.675)	60.744*** (11.506)	61.327*** (22.474)	61.245*** (23.357)	61.224*** (21.962)	62.727*** (18.789)
N	9,932	12,976	10,360	6,812	3,511	9,932	12,976	10,360	6,812	3,511
R <sup>2</sup>	0.057	0.046	0.045	0.050	0.045	0.017	0.012	0.019	0.025	0.023
F	21.853	25.586	19.155	13.139	5.981	5.434	5.476	7.092	5.912	2.894
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Years of education	PHQ-8 Depression Index					Anxiety Index				
	<=5 years	6-10 years	11-15 years	16-20 years	>20 years	<=5 years	6-10 years	11-15 years	16-20 years	>20 years
Lockdown	1.181 (0.846)	1.424*** (0.290)	2.846*** (0.913)	1.558*** (0.437)	2.885*** (0.708)	6.364*** (1.484)	3.821*** (0.506)	3.918*** (1.607)	5.226*** (0.724)	2.790*** (1.206)
Pandemic_cat5	1.039 (1.252)	3.137*** (0.281)	0.323 (1.059)	3.128*** (0.457)	3.703*** (0.684)	7.903*** (2.077)	5.746*** (0.492)	7.745*** (1.801)	5.323*** (0.757)	4.302*** (1.139)
Lockdown&Pand_cat5	-1.013 (1.316)	-2.325*** (0.383)	0.387 (1.201)	-3.283*** (0.623)	-4.206*** (0.861)	-6.293*** (2.234)	-4.876*** (0.667)	-5.523*** (2.043)	-6.030*** (1.029)	-3.252*** (1.431)
Constant	60.758*** (3.685)	59.802*** (1.604)	63.950*** (3.532)	62.931*** (2.181)	61.713*** (3.653)	53.747*** (6.138)	59.051*** (2.773)	55.492*** (5.894)	52.109*** (3.568)	53.243*** (5.947)
N	3,199	22,041	3,220	9,965	5,166	3,199	22,041	3,220	9,965	5,166
R <sup>2</sup>	0.088	0.089	0.077	0.098	0.081	0.018	0.016	0.016	0.015	0.025
F	11.317	70.496	10.099	45.686	18.214	1.937	12.574	1.856	5.007	4.710
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Income quartile	PHQ-8 Depression Index					Anxiety Index				
	Lowest quartile	Second quartile	Third quartile	Highest quartile		Lowest quartile	Second quartile	Third quartile	Highest quartile	
Lockdown	0.801** (0.461)	1.769*** (0.404)	1.507*** (0.411)	0.891** (0.412)		5.097*** (0.718)	4.100*** (0.703)	3.706*** (0.734)	4.526*** (0.748)	
Pandemic_cat5	2.858*** (0.474)	1.696*** (0.420)	3.922*** (0.418)	2.995*** (0.413)		6.377*** (0.737)	4.512*** (0.730)	5.751*** (0.746)	5.999*** (0.750)	
Lockdown&Pand_cat5	-2.436*** (0.608)	-2.018*** (0.545)	-3.632*** (0.541)	-2.112*** (0.539)		-5.797*** (0.946)	-4.084*** (0.946)	-4.645*** (0.965)	-5.157*** (0.976)	
Constant	53.647*** (1.533)	57.026*** (1.835)	53.102*** (1.816)	58.399*** (1.836)		60.163*** (2.371)	61.801*** (3.153)	62.218*** (3.421)	64.131*** (3.290)	
N	11,264	11,149	10,852	10,325		11,264	11,149	10,852	10,325	
R <sup>2</sup>	0.077	0.063	0.078	0.079		0.015	0.013	0.016	0.018	
F	41.489	35.700	43.611	43.063		6.056	5.815	6.741	7.492	
p	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	
Household members	PHQ-8 Depression Index					Anxiety Index				
	One	Two	Three	More than 3		One	Two	Three	More than 3	
Lockdown	1.262*** (0.511)	1.103*** (0.362)	1.171*** (0.489)	1.302*** (0.387)		5.112*** (0.828)	3.313*** (0.628)	3.524*** (0.834)	5.960*** (0.678)	
Pandemic_cat5	2.571*** (0.545)	2.947*** (0.364)	2.391*** (0.499)	3.202*** (0.389)		5.908*** (0.881)	5.382*** (0.633)	5.214*** (0.852)	6.610*** (0.683)	
Lockdown&Pand_cat5	-2.967*** (0.688)	-2.528*** (0.476)	-1.901*** (0.634)	-2.772*** (0.517)		-4.825*** (1.111)	-4.421*** (0.826)	-4.302*** (1.105)	-6.383*** (0.906)	
Constant	57.893*** (1.933)	51.253*** (1.430)	57.778*** (2.018)	52.497*** (1.585)		66.482*** (3.098)	61.747*** (2.465)	64.977*** (3.405)	61.871*** (2.752)	
N	8,566	14,929	8,445	11,651		8,566	14,929	8,445	11,651	
R <sup>2</sup>	0.067	0.085	0.093	0.092		0.016	0.014	0.016	0.019	
F	26.670	54.045	41.986	52.942		5.056	8.413	5.401	7.792	
p	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	
Region	PHQ-8 Depression Index					Anxiety Index				
	Eastern Europe	Northern Europe	Southern Europe			Eastern Europe	Northern Europe	Southern Europe		
Lockdown	0.459*** (0.138)	1.074*** (0.438)	11.948*** (3.110)			5.385*** (1.216)	2.998*** (0.738)	8.956*** (2.294)		
Pandemic_cat5	4.390*** (1.038)	3.357*** (0.249)	13.192*** (3.128)			1.518*** (0.646)	7.816*** (0.420)	14.781*** (2.324)		
Lockdown&Pand_cat5	-4.112*** (1.209)	-2.932*** (1.259)	-9.688*** (2.218)			-0.341*** (0.042)	-7.643*** (3.698)	-9.787*** (2.387)		
Constant	58.937*** (9.613)	57.644*** (1.529)	56.268*** (6.937)			23.085*** (14.744)	62.611*** (2.557)	67.418*** (11.191)		
N	3,328	17,333	4,497			3,327	17,333	4,497		
R <sup>2</sup>	0.071	0.093	0.110			0.043	0.027	0.022		
F	8.648	65.706	22.896			4.962	19.691	3.651		
p	0.000	0.000	0.000			0.000	0.000	0.000		

Lockdown is a binary variable that takes the value one from the day the lockdown becomes effective, and 0 before.

Pandemic category 5: is a binary variable if the case fatality rate is higher or equal than 2 per cent. The case fatality rate is the percentage of deceased with respect to confirmed cases. The category 5 corresponds to the highest level of the Pandemic Severity Index. <https://www.cdc.gov/media/pdf/mitigation/slides.pdf>

Robust standard errors. \*\*\*, \*\* and \* denote statistical significance at the 1%, 5% and 10% level.

**Table C4. Estimated coefficients for difference-in-difference-in-difference model: effect of lockdown, pandemic category 5 and income quartile.**

	Dif-in-dif-in-dif model with lockdown, pandemic cat. 5 and income	
	Depression Index	Anxiety Index
Income quartil (4th quartil= highest: omitted)		
First (lowest)	2.822*** (0.506)	2.635*** (0.171)
Second	4.078*** (0.499)	-0.314*** (0.119)
Third	3.854*** (0.305)	0.114*** (0.031)
Lockdown	1.247*** (0.227)	4.509*** (0.397)
Pandemic Category 5	2.944*** (0.305)	5.917*** (0.322)
Lockdown & Pan_Cat 5	-2.475*** (0.270)	-5.143*** (0.406)
Lockdown & 1st income quartil	2.563*** (0.311)	0.945*** (0.332)
Lockdown & 2nd income quartil	-1.425*** (0.302)	0.262*** (0.102)
Lockdown & 3rd income quartil	0.344 (0.302)	-0.657 (0.519)
Pan_Cat 5 & 1st income quartil	2.538*** (0.350)	1.555*** (0.603)
Pan_Cat 5 & 2nd income quartil	-0.267 (0.346)	-0.036 (0.596)
Pan_Cat 5 & 3rd income quartil	0.751 (0.550)	0.306 (0.218)
Lockdown & Pan_Cat 5 & 1st income quartil	2.948*** (0.602)	1.577*** (0.730)
Lockdown & Pan_Cat 5 & 2nd income quartil	-0.948 (0.604)	-0.588 (0.305)
Lockdown & Pan_Cat 5 & 3rd income quartil	1.344 (1.629)	0.464 (0.268)
Constant	53.722*** (0.875)	58.859*** (0.296)
N	44,840	44,840
R2	0.387	0.315
F	116.742	16.293
p	0.000	0.000

Lockdown is a binary variable that takes the value one from the day the lockdown becomes effective, and 0 before.

Pandemic category 5: is a binary variable if the case fatality rate is higher or equal than 2 per cent. The case fatality rate is the percentage of deceased with respect to confirmed cases. The category 5 corresponds to the highest level of the Pandemic Severity Index. <https://www.cdc.gov/media/pdf/mitigation/slides.pdf>

Income quartiles are obtained from adjusted household income before taxes (dividing by the square root of household size).

Change of hour is a binary the value 1 after the hour change (that is, from March 29th onwards) and 0 otherwise.

All regression include gender, age and its squared, being married, years of education, number of household members, having any comorbidity and number of comorbidities, day fixed effects and country fixed effects. Robust standard errors. \*\*\*, \*\* and \* denote statistical significance at the 1%, 5% and 10% level.

**Table C5. Difference in difference model for PHQ-8 Depression Index and its items. Effect of lockdown and and FDA approval of chloroquine and hydroxychloroquine for clinical patients**

	PHQ-8 Depression Index					Item 1: Little interest or pleasure in doing things				
	M1	M2	M3	M4	M5	M1	M2	M3	M4	M5
Lockdown	1.564*** (0.142)	1.270*** (0.241)	1.271*** (0.240)	1.268*** (0.240)	1.283*** (0.239)	-0.070 (0.314)	-0.067 (0.312)	-0.068 (0.312)	-0.069 (0.212)	-0.050 (0.211)
Hydroxychloroquine	30.138 (19.377)	26.279 (19.200)	25.457 (19.196)	25.313 (19.191)	23.252 (19.152)	8.679 (17.072)	3.146 (16.991)	2.470 (16.991)	2.545 (16.991)	-0.575 (16.972)
Lockdown* Hydroxychloroquine	-0.735 (1.130)	-0.434 (1.117)	-0.457 (1.117)	-0.004 (1.121)	-0.645 (1.115)	0.916 (1.717)	1.294 (1.705)	1.278 (1.705)	1.072 (1.711)	1.039 (1.703)
Constant	24.807*** (0.517)	24.965*** (0.517)	24.982*** (0.525)	25.000*** (0.606)	25.000*** (0.531)	24.817*** (0.779)	24.984*** (0.783)	24.992*** (0.795)	24.976*** (0.916)	24.997*** (0.803)
N	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434
R <sup>2</sup>	0.273	0.282	0.282	0.293	0.286	0.231	0.237	0.231	0.241	0.239
F	114.357	120.095	111.208	118.575	107.865	49.961	56.379	51.947	53.556	50.728
p	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Item 2: Feeling down					Item 3: Trouble falling asleep or sleeping too much				
	M1	M2	M3	M4	M5	M1	M2	M3	M4	M5
Lockdown	-0.211 (0.202)	-0.198 (0.201)	-0.196 (0.200)	-0.101 (0.201)	-0.184 (0.200)	2.956*** (0.327)	3.179*** (0.324)	3.178*** (0.322)	3.186*** (0.320)	3.168*** (0.320)
Hydroxychloroquine	16.844 (26.119)	11.898 (25.976)	10.740 (25.971)	10.508 (25.966)	7.663 (25.929)	7.457 (17.822)	3.094 (17.778)	2.691 (17.778)	2.249 (17.770)	0.313 (17.769)
Lockdown* Hydroxychloroquine	-3.786 (2.613)	-3.471 (2.601)	-3.498 (2.601)	-3.620 (2.607)	-3.717 (2.599)	4.871 (3.828)	5.193 (3.820)	5.182 (3.820)	5.173 (3.826)	4.990 (3.820)
Constant	24.949*** (0.733)	24.996*** (0.736)	24.984*** (0.747)	24.881*** (0.861)	24.919*** (0.755)	24.994*** (0.827)	24.901*** (0.833)	24.887*** (0.847)	24.474*** (0.975)	24.795*** (0.857)
N	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434
R <sup>2</sup>	0.256	0.261	0.261	0.266	0.264	0.231	0.235	0.235	0.242	0.237
F	89.177	91.106	84.229	86.550	81.653	49.962	53.642	49.379	55.462	47.207
p	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Item 4: Feeling tired or having little energy					Item 5: Poor appetite or overeating				
	M1	M2	M3	M4	M5	M1	M2	M3	M4	M5
Lockdown	-0.261 (0.319)	-0.259 (0.318)	-0.258 (0.316)	-0.259 (0.314)	-0.250 (0.314)	3.245*** (0.326)	2.967*** (0.325)	2.968*** (0.321)	2.959*** (0.319)	2.977*** (0.315)
Hydroxychloroquine	43.086 (27.520)	40.474 (27.458)	39.830 (27.456)	39.796 (27.457)	37.942 (27.431)	54.348 (17.214)	51.012 (17.138)	50.459 (17.137)	50.136 (17.125)	49.114 (17.128)
Lockdown* Hydroxychloroquine	0.477 (1.722)	0.718 (1.717)	0.698 (1.717)	0.824 (1.724)	0.487 (1.715)	-2.452 (1.738)	-2.113 (1.728)	-2.134 (1.726)	-0.794 (1.732)	-2.272 (1.726)
Constant	24.881*** (0.781)	24.706*** (0.788)	24.651*** (0.800)	24.601*** (0.922)	24.487*** (0.808)	24.744*** (0.788)	24.956*** (0.792)	24.974*** (0.804)	24.915*** (0.926)	24.997*** (0.813)
N	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434
R <sup>2</sup>	0.343	0.345	0.345	0.354	0.347	0.348	0.355	0.355	0.361	0.356
F	69.181	68.224	62.921	71.185	60.533	76.937	82.397	75.891	79.520	71.544
p	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Item 6: Feeling bad about oneself					Item 7: Trouble concentrating on things				
	M1	M2	M3	M4	M5	M1	M2	M3	M4	M5
Lockdown	0.457 (0.251)	0.479 (0.250)	0.482 (0.250)	0.481 (0.250)	0.498 (0.250)	3.746*** (0.340)	3.453*** (0.339)	3.454*** (0.336)	3.453*** (0.329)	3.468*** (0.329)
Hydroxychloroquine	25.223 (25.110)	20.747 (24.966)	18.935 (24.950)	18.895 (24.950)	15.646 (24.894)	44.923 (17.452)	40.789 (17.369)	40.410 (17.368)	40.378 (17.368)	38.740 (17.359)
Lockdown* Hydroxychloroquine	-4.012 (2.536)	-3.708 (2.526)	-3.753 (2.524)	-3.643 (2.530)	-3.994 (2.520)	-0.613 (1.772)	-0.231 (1.759)	-0.245 (1.759)	-0.124 (1.767)	-0.390 (1.759)
Constant	23.924*** (0.698)	24.423*** (0.702)	24.580*** (0.712)	24.629*** (0.821)	24.780*** (0.719)	25.000*** (0.802)	24.890*** (0.806)	24.870*** (0.819)	24.839*** (0.945)	24.774*** (0.828)
N	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434
R <sup>2</sup>	0.142	0.148	0.148	0.153	0.152	0.153	0.161	0.162	0.165	0.163
F	68.426	72.366	66.698	69.031	66.921	84.686	91.237	85.303	84.396	80.702
p	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Item 8: Moving or speaking too slowly or too fidgety									
	M1	M2	M3	M4	M5					
Lockdown	1.810*** (0.225)	1.716*** (0.229)	1.718*** (0.233)	1.716*** (0.234)	1.725*** (0.234)					
Hydroxychloroquine	29.657 (18.392)	28.179 (18.364)	27.214 (18.356)	27.141 (18.354)	25.961 (18.341)					
Lockdown* Hydroxychloroquine	1.480 (1.064)	1.603 (1.062)	1.574 (1.062)	1.520 (1.066)	1.451 (1.062)					
Constant	21.919*** (0.488)	22.249*** (0.493)	22.456*** (0.499)	22.697*** (0.577)	22.688*** (0.505)					
N	48,434	48,434	48,434	48,434	48,434					
R <sup>2</sup>	0.119	0.120	0.120	0.127	0.122					
F	31.536	31.021	28.799	35.600	28.102					
p	0.0000	0.0000	0.0000	0.0000	0.0000					

Lockdown is a binary variable that takes the value one from the day the lockdown becomes effective, and 0 before.

Hydroxychloroquine is a binary variable that takes the value 1 after the FDA approval of chloroquine and hydroxychloroquine for clinical patients (that is, from March 30th onwards) for country c and day t, and 0 before.

M1 includes lockdown, pandemic of category 5, interaction between lockdown and pandemic of category 5, day fixed effects and country fixed effects. M2 includes the same explanatory variables than M1 and also male, other gender (omitted: women), age and its squared. M3 includes the same explanatory variables than M2 and also married (omitted: single), years of education and number of household members (omitted: living alone). M4 includes the same explanatory variables than M3 and also having any comorbidity and number of comorbidities. M5 includes the same explanatory variables than M4 and also household income quartile (omitted:

lowest quartile). Individual sample weights have been used to correct for differences in income, education, age and gender structure between the general population of the country and the corresponding sample. Robust standard errors. \*\*\*, \*\* and \* denote statistical significance at the 1%, 5% and 10% level.

**Table C6. Difference in difference model for Anxiety Index and its items. Effect of lockdown and FDA approval of chloroquine and hydroxychloroquine for clinical patients**

	Anxiety Index					Item 1: Nervous when thinking about current circumstances				
	M1	M2	M3	M4	M5	M1	M2	M3	M4	M5
Lockdown	4.398*** (0.339)	4.414*** (0.338)	4.415*** (0.337)	4.406*** (0.336)	4.417*** (0.336)	-0.527 (0.327)	-0.560 (0.324)	-0.558 (0.324)	-0.576 (0.320)	-0.556 (0.321)
Hydroxychloroquine	-6.024 (29.695)	-5.676 (29.695)	-6.267 (29.695)	-6.802 (29.676)	-7.091 (29.694)	-7.388 (17.482)	-6.062 (17.479)	-7.208 (17.477)	-8.146 (17.444)	-7.462 (17.477)
Lockdown* Hydroxychloroquine	-3.900*** (1.482)	-3.875*** (1.482)	-3.860*** (1.482)	-3.830*** (1.487)	-3.775*** (1.482)	0.511 (1.776)	0.430 (1.776)	0.402 (1.776)	2.885 (1.778)	0.412 (1.776)
Constant	22.944*** (0.859)	22.994*** (0.868)	22.907*** (0.881)	21.410*** (0.887)	22.793*** (0.892)	18.837*** (0.804)	19.165*** (0.813)	18.878*** (0.826)	14.412*** (0.951)	18.823*** (0.836)
N	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434
R <sup>2</sup>	0.213	0.214	0.214	0.217	0.214	0.272	0.273	0.273	0.274	0.274
F	22.010	21.132	19.467	22.056	18.213	112.205	107.874	100.125	96.156	93.138
p	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Item 2: Worried about one's health					Item 3: Worried about family's health				
	M1	M2	M3	M4	M5	M1	M2	M3	M4	M5
Lockdown	0.989*** (0.327)	0.930*** (0.321)	0.930*** (0.317)	0.927*** (0.317)	0.929*** (0.317)	4.354*** (0.336)	4.416*** (0.329)	4.416*** (0.328)	4.408*** (0.326)	4.418*** (0.326)
Hydroxychloroquine	-4.195 (7.808)	-4.607 (7.803)	-4.733 (7.804)	-4.261 (7.793)	-4.137 (7.803)	1.309 (10.772)	2.573 (10.769)	2.636 (10.769)	2.210 (10.762)	1.973 (10.769)
Lockdown* Hydroxychloroquine	-5.048*** (1.744)	-4.984*** (1.744)	-4.985*** (1.744)	-5.004*** (1.751)	-4.968*** (1.744)	-2.686*** (0.820)	-2.767*** (0.820)	-2.765*** (0.820)	2.380*** (0.824)	-2.806*** (0.820)
Constant	24.603*** (0.791)	24.523*** (0.800)	24.515*** (0.812)	24.868*** (0.936)	24.545*** (0.822)	23.603*** (0.823)	23.757*** (0.833)	23.765*** (0.846)	22.788*** (0.974)	23.692*** (0.857)
N	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434	48,434
R <sup>2</sup>	0.210	0.211	0.211	0.212	0.211	0.211	0.211	0.211	0.222	0.212
F	16.913	16.457	15.122	15.542	14.150	18.367	17.641	16.275	29.612	15.224
p	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Item 4: Stressed about leaving the house									
	M1	M2	M3	M4	M5					
Lockdown	5.021*** (0.357)	5.033*** (0.357)	5.031*** (0.356)	5.049*** (0.353)	5.030*** (0.356)					
Hydroxychloroquine	-3.229 (8.415)	-3.518 (8.415)	-3.168 (8.384)	-3.436 (8.328)	-3.288 (8.384)					
Lockdown* Hydroxychloroquine	-2.655*** (0.455)	-2.641*** (0.455)	-2.672*** (0.453)	-2.534*** (0.428)	-2.680*** (0.453)					
Constant	16.855*** (0.211)	16.782*** (0.213)	16.358*** (0.216)	10.176*** (0.234)	16.328*** (0.218)					
N	48,434	48,434	48,434	48,434	48,434					
R <sup>2</sup>	0.246	0.246	0.247	0.250	0.248					
F	73.403	69.203	65.585	65.755	61.378					
p	0.0000	0.0000	0.0000	0.0000	0.0000					

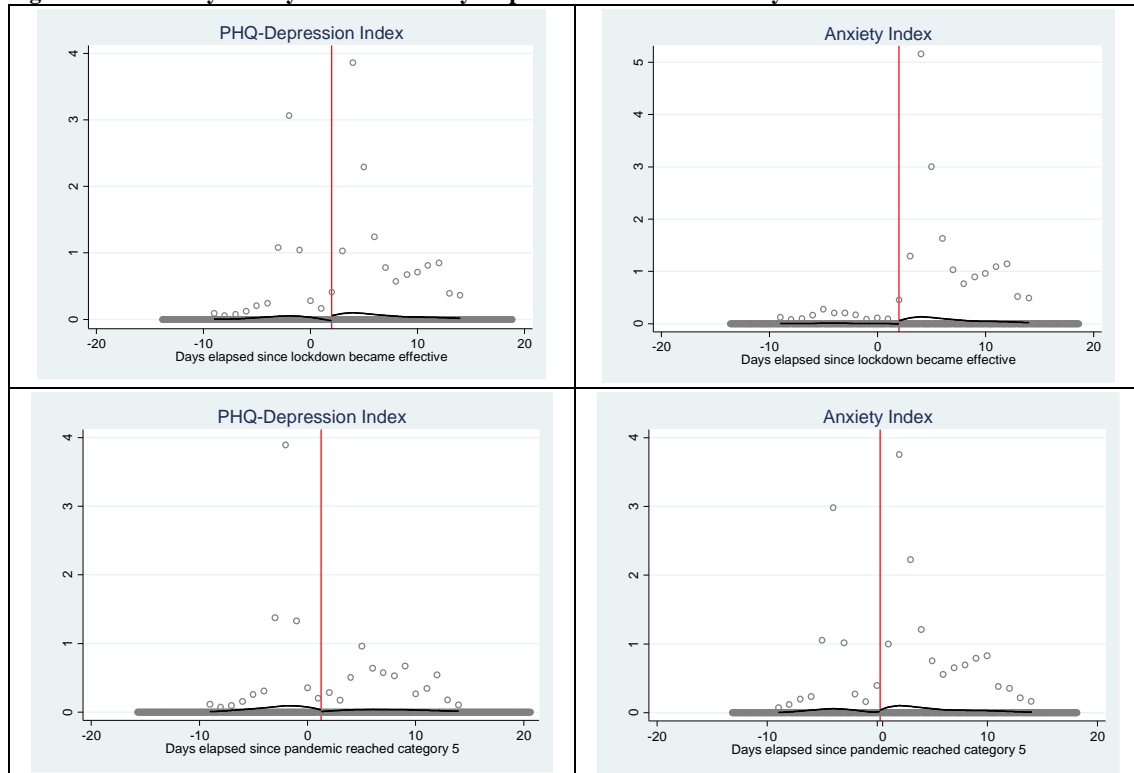
Lockdown is a binary variable that takes the value one from the day the lockdown becomes effective, and 0 before.

Hydroxychloroquine is a binary variable that takes the value 1 after the FDA approval of chloroquine and hydroxychloroquine or clinical patients (that is, from March 30th onwards) for country c and day t, and 0 before.

M1 includes lockdown, pandemic of category 5, interaction between lockdown and pandemic of category 5, day fixed effects and country fixed effects. M2 includes the same explanatory variables than M1 and also male, other gender (omitted: women), age and its squared. M3 includes the same explanatory variables than M2 and also married (omitted: single), years of education and number of household members (omitted: living alone). M4 includes the same explanatory variables than M3 and also having any comorbidity and number of comorbidities. M5 includes the same explanatory variables than M4 and also household income quartile (omitted: lowest quartile). Individual sample weights have been used to correct for differences in income, education, age and gender structure between the general population of the country and the corresponding sample. Robust standard errors. \*\*\*, \*\* and \* denote statistical significance at the 1%, 5% and 10% level.

## Appendix D

**Figure D1. McCrary density function of daily responses to the online survey**



Note: The vertical axis shows the McCrary density function of the days elapsed since lockdown became effective (upper figures) or days elapsed since pandemic reached category 5 (lower figures). The white circles are the mean of the dependent variable for a given value of days before/after lockdown (or pandemic reached category 5). The black lines are the predicted probabilities for the outcome variable on the treatment variable and a quadratic polynomial in terms of days before/after cut-off point. The red vertical line indicates the day when lockdown became effective or when pandemic reached category 5. Therefore, negative values on the horizontal axis denote interviews performed before lockdown became effective (or before pandemic reached category 5), whereas positive values on the horizontal axis denote interviews after lockdown became effective (or after pandemic reached category 5).



**Table D1. RD design. Difference in regression discontinuity. Items of the PHQ-Depression Index**

	MSE optimal	CER optimal	Without covariates	Alternative bandwidth		False threshold	
				6 DAYS	4 DAYS	2 days before	2 days after
<b>Running variable: Days elapsed since lockdown</b>							
Item 1: Little interest or pleasure in doing things							
Lockdown	-0.035 (0.298)	-0.036 (0.304)	-0.034 (0.289)	-0.033 (0.280)	-0.033 (0.275)	-0.038 (0.366)	-0.039 (0.373)
Lockdown*Pan_cat5	-0.544 (0.394)	-0.555 (0.402)	-0.528 (0.381)	-0.512 (0.370)	-0.502 (0.363)	-0.588 (4.173)	-0.599 (4.261)
Item 2: Feeling down							
Lockdown	-0.112 (0.278)	-0.114 (0.283)	-0.109 (0.269)	-0.105 (0.261)	-0.103 (0.256)	-0.121 (0.341)	-0.123 (0.348)
Lockdown*Pan_cat5	-1.826*** (0.367)	-1.863*** (0.374)	-1.771*** (0.356)	-1.718*** (0.345)	-1.684*** (0.338)	-1.971 (3.882)	-2.011 (3.963)
Item 3: Trouble falling asleep or sleeping too much							
Lockdown	3.016*** (0.319)	3.078*** (0.325)	2.923*** (0.309)	2.833*** (0.300)	2.775*** (0.294)	3.265 (2.448)	3.332 (2.456)
Lockdown*Pan_cat5	-5.297*** (0.422)	-5.402*** (0.431)	-5.139*** (0.410)	-4.986*** (0.398)	-4.886*** (0.390)	-5.718 (4.486)	-5.832 (4.579)
Item 4: Feeling tired or having little energy							
Lockdown	-0.279 (0.299)	-0.285 (0.305)	-0.271 (0.290)	-0.263 (0.281)	-0.257 (0.275)	-0.302 (0.367)	-0.308 (0.374)
Lockdown*Pan_cat5	-2.254*** (0.396)	-2.299*** (0.404)	-2.186*** (0.383)	-2.120*** (0.372)	-2.079*** (0.364)	-2.433 (4.193)	-2.482 (4.281)
Item 5: Poor appetite or overeating							
Lockdown	1.678*** (0.301)	1.712*** (0.307)	1.627*** (0.292)	1.577*** (0.284)	1.545*** (0.278)	1.815 (0.370)	1.851 (0.378)
Lockdown*Pan_cat5	-2.385*** (0.399)	-2.433*** (0.407)	-2.315*** (0.386)	-2.245*** (0.374)	-2.200*** (0.367)	-2.576 (4.224)	-2.627 (4.311)
Item 6: Feeling bad about oneself							
Lockdown	0.472** (0.215)	0.481** (0.210)	0.457** (0.217)	0.444** (0.219)	0.435** (0.214)	0.510 (0.326)	0.520 (0.332)
Lockdown*Pan_cat5	-1.436*** (0.350)	-1.465*** (0.357)	-1.393*** (0.340)	-1.351*** (0.330)	-1.324*** (0.323)	-1.551 (3.703)	-1.581 (3.779)
Item 7: Trouble concentrating on things							
Lockdown	3.272*** (0.304)	3.340*** (0.310)	3.171*** (0.295)	3.073*** (0.286)	3.009*** (0.280)	3.542 (2.374)	3.616 (2.381)
Lockdown*Pan_cat5	-4.435*** (0.403)	-4.523*** (0.411)	-4.303*** (0.391)	-4.174*** (0.379)	-4.091*** (0.371)	-4.789 (4.274)	-4.884 (4.363)
Item 8: Moving or speaking too slowly or too fidgety							
Lockdown	1.152*** (0.187)	1.176*** (0.190)	1.117*** (0.181)	1.083*** (0.176)	1.062*** (0.172)	1.245 (2.230)	1.271 (1.235)
Lockdown*Pan_cat5	-1.156*** (0.249)	-1.179*** (0.253)	-1.121*** (0.241)	-1.087*** (0.234)	-1.065*** (0.229)	-1.247 (2.596)	-1.272 (2.650)
<b>Running variable: Days elapsed since pandemic reached category 5</b>							
Item 1: Little interest or pleasure in doing things							
Pan_cat5	-0.928*** (0.303)	-0.947*** (0.309)	-0.901*** (0.294)	-0.874*** (0.285)	-0.857*** (0.280)	-1.002 (3.187)	-1.022 (3.252)
Lockdown*Pan_cat5	-0.445 (0.322)	-0.454 (0.328)	-0.432 (0.312)	-0.419 (0.303)	-0.411 (0.297)	-0.481 (3.391)	-0.490 (3.460)
Item 2: Feeling down							
Pan_cat5	3.088*** (0.283)	3.150*** (0.289)	2.993*** (0.275)	2.900*** (0.266)	2.840*** (0.261)	3.342 (2.969)	3.411 (3.031)
Lockdown*Pan_cat5	-1.495*** (0.300)	-1.524*** (0.306)	-1.450*** (0.291)	-1.406*** (0.283)	-1.378*** (0.277)	-1.613 (3.156)	-1.646 (3.221)
Item 3: Trouble falling asleep or sleeping too much							
Pan_cat5	5.460*** (0.324)	5.574*** (0.331)	5.289*** (0.314)	5.123*** (0.305)	5.015*** (0.299)	5.920 (3.414)	6.045 (3.485)
Lockdown*Pan_cat5	-4.338*** (0.345)	-4.424*** (0.352)	-4.208*** (0.335)	-4.083*** (0.325)	-4.002*** (0.318)	-4.684 (3.643)	-4.777 (3.718)
Item 4: Feeling tired or having little energy							
Pan_cat5	0.771*** (0.304)	0.787*** (0.310)	0.748*** (0.295)	0.725*** (0.286)	0.711*** (0.280)	0.834 (3.196)	0.850 (3.262)
Lockdown*Pan_cat5	-1.845*** (0.323)	-1.881*** (0.330)	-1.790*** (0.314)	-1.736*** (0.304)	-1.701*** (0.298)	-1.992 (3.407)	-2.032 (3.477)
Item 5: Poor appetite or overeating							
Pan_cat5	3.033*** (0.307)	3.095*** (0.313)	2.939*** (0.298)	2.849*** (0.289)	2.790*** (0.283)	3.282 (3.226)	3.350 (3.292)
Lockdown*Pan_cat5	-1.953*** (0.326)	-1.992*** (0.332)	-1.894*** (0.316)	-1.838*** (0.306)	-1.801*** (0.300)	-2.109 (3.431)	-2.150 (3.502)
Item 6: Feeling bad about oneself							
Pan_cat5	2.808*** (0.270)	2.865*** (0.276)	2.721*** (0.262)	2.637*** (0.254)	2.584*** (0.249)	3.038 (2.832)	3.101 (2.890)
Lockdown*Pan_cat5	-1.175*** (0.287)	-1.199*** (0.293)	-1.140*** (0.278)	-1.106*** (0.270)	-1.084*** (0.265)	-1.268 (3.011)	-1.294 (3.072)
Item 7: Trouble concentrating on things							
Pan_cat5	5.905*** (0.310)	6.029*** (0.317)	5.718*** (0.301)	5.538*** (0.292)	5.422*** (0.286)	6.404 (6.651)	6.539 (6.792)
Lockdown*Pan_cat5	-3.632*** (0.329)	-3.704*** (0.336)	-3.523*** (0.319)	-3.418*** (0.310)	-3.350*** (0.304)	-3.922 (3.472)	-4.000 (3.543)
Item 8: Moving or speaking too slowly or too fidgety							
Pan_cat5	1.316***	1.343***	1.276***	1.238***	1.212***	1.423	1.453

Lockdown*Pan_cat5	(0.190) -0.945*** (0.203)	(0.194) -0.964*** (0.207)	(0.184) -0.917*** (0.196)	(0.179) -0.889*** (0.191)	(0.175) -0.872*** (0.187)	(1.984) -1.021 (2.115)	(2.024) -1.041 (2.158)
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Mean square error (MSE): optimal bandwidth is estimated by taking the minimum optimal bandwidth of the most common MSE-optimal procedures. Coverage error (CER): optimal bandwidth is the minimum bandwidth of the different coverage error procedures following Calonico et al. (2018). Optimal bandwidth= 5 days. Robust standard errors. \*\*\*, \*\* and \* denote statistical significance at the 1%, 5% and 10% level.

**Table D2. RD design. Difference in regression discontinuity. Items of the Anxiety Index**

	MSE optimal	CER optimal	Without covariates	Alternative bandwidth		False threshold	
				6 DAYS	4 DAYS	2 days before	2 days after
<b>Running variable: Days elapsed since lockdown</b>							
Item 1: Nervous when thinking about current circumstances							
Lockdown	-0.380 (0.308)	-0.387 (0.314)	-0.369 (0.298)	-0.358 (0.290)	-0.351 (0.284)	-0.410 (0.378)	-0.418 (0.386)
Lockdown*Pan_cat5	-6.921*** (0.408)	-7.058*** (0.416)	-6.715*** (0.396)	-6.515*** (0.383)	-6.386*** (0.375)	-7.470 (4.324)	-7.619 (4.414)
Item 2: Worried about one's health							
Lockdown	0.764*** (0.307)	0.779*** (0.313)	0.740*** (0.298)	0.718*** (0.289)	0.704*** (0.283)	0.826 (0.577)	0.842 (0.585)
Lockdown*Pan_cat5	1.068*** (0.407)	1.089*** (0.415)	1.036*** (0.395)	1.004*** (0.382)	0.984*** (0.374)	1.153 (4.315)	1.176 (4.404)
Item 3: Worried about family's health							
Lockdown	3.861*** (0.319)	3.940*** (0.325)	3.740*** (0.309)	3.625*** (0.300)	3.550*** (0.294)	4.182 (3.355)	4.268 (3.424)
Lockdown*Pan_cat5	-3.785*** (0.422)	-3.860*** (0.431)	-3.671*** (0.410)	-3.562*** (0.398)	-3.491*** (0.390)	-4.086 (4.486)	-4.167 (4.579)
Item 4: Stressed about leaving the house							
Lockdown	4.929*** (0.304)	5.033*** (0.310)	4.774*** (0.295)	4.625*** (0.286)	4.529*** (0.280)	5.342 (3.196)	5.455 (3.262)
Lockdown*Pan_cat5	-6.846*** (0.402)	-6.983*** (0.410)	-6.642*** (0.390)	-6.445*** (0.378)	-6.317*** (0.370)	-8.408 (4.964)	-8.574 (4.353)
<b>Running variable: Days elapsed since pandemic reached category 5</b>							
Item 1: Nervous when thinking about current circumstances							
Pan_cat5	11.513*** (0.314)	11.765*** (0.320)	11.136*** (0.305)	10.772*** (0.296)	10.538*** (0.290)	12.528 (31.174)	12.804 (32.106)
Lockdown*Pan_cat5	-5.669*** (0.333)	-5.783*** (0.340)	-5.500*** (0.323)	-5.336*** (0.313)	-5.230*** (0.307)	-6.121 (3.512)	-6.243* (3.585)
Item 2: Worried about one's health							
Pan_cat5	-1.342*** (0.313)	-1.370*** (0.319)	-1.304*** (0.304)	-1.265*** (0.295)	-1.239*** (0.289)	-1.448 (3.295)	-1.478 (3.363)
Lockdown*Pan_cat5	0.874*** (0.332)	0.891*** (0.339)	0.847*** (0.322)	0.822*** (0.313)	0.806*** (0.307)	0.943 (3.504)	0.962 (3.577)
Item 3: Worried about family's health							
Pan_cat5	5.439*** (0.325)	5.554*** (0.331)	5.269*** (0.315)	5.104*** (0.306)	4.996*** (0.300)	5.898 (3.424)	6.023 (3.494)
Lockdown*Pan_cat5	-3.098*** (0.345)	-3.161*** (0.352)	-3.006*** (0.335)	-2.916*** (0.325)	-2.858*** (0.318)	-3.346 (3.643)	-3.412 (3.718)
Item 4: Stressed about leaving the house							
Pan_cat5	10.129*** (0.309)	10.334*** (0.316)	9.822*** (0.300)	9.525*** (0.291)	9.333*** (0.285)	12.487 (7.668)	12.739 (7.933)
Lockdown*Pan_cat5	-5.609*** (0.329)	-5.720*** (0.335)	-5.441*** (0.319)	-5.279*** (0.309)	-5.174*** (0.303)	-6.890 (5.637)	-7.027 (5.712)

Mean square error (MSE): optimal bandwidth is estimated by taking the minimum optimal bandwidth of the most common MSE-optimal procedures. Coverage error (CER): optimal bandwidth is the minimum bandwidth of the different coverage error procedures following Calonico et al. (2018). Optimal bandwidth= 5 days. Robust standard errors. \*\*\*, \*\* and \* denote statistical significance at the 1%, 5% and 10% level.