BANCA D'ITALIA
EUROSISTEMA

Covid-19 Note
24 March 2021

MEASURING COVID-19 RESTRICTIONS IN ITALY DURING THE SECOND WAVE

FRANCESCO PAOLO CONTEDUCA[1]

Since the beginning of the pandemic, accurately measuring the level of restrictions in force in different countries has been a daunting task, both because of rapidly changing policies and the high degree of heterogeneity across and within countries. Especially during the second wave of the pandemic, several governments resorted to targeted measures, in an attempt to save lives while preserving the economy as much as possible. Italy is a perfect example of this, with the government enforcing a zone-system entailing different levels of restriction based on the severity of the epidemic in each region. This note tries to account for these aspects by improving the measure provided by the Oxford Coronavirus Government Response Tracker (OxCGRT) dataset, the most comprehensive source of data on governments' responses to the pandemic. Drawing on a novel dataset for Italy, which includes daily restrictions at the regional level, I show that, during the second wave, a modified version of the OxCGRT displays a higher correlation with widely-used mobility indicators than the original OxCGRT. Moreover, at the national level, the modified version of the index points to a lower level of restrictions (9 p.p. below on average).

Since its inception, the COVID-19 pandemic has harmed economic activity worldwide with heterogeneous effects across regions and countries. However, despite the stark increase in the death toll recorded in the Northern hemisphere during the second wave, economic indicators were surprisingly on the upside in the second half of 2020.[2] As the IMF noted in its last *World Economic Outlook Update* in January 2021 '[…] economic data released after the October 2020 WEO forecast suggest stronger-than-projected momentum on average across regions in the second half of 2020'.

Several factors may account for this. First, firms adapted to the 'new normal' by finding ways to address sudden supply chain disruptions, to ensure a safe workplace, or to distribute their goods and services. Second, the individual responses of the population may have changed. On the one hand, protective devices (such as face masks and hand sanitizers) have become widely used, so that the need for voluntary social distancing and sheltering has decreased. On the other hand, *lockdown fatigue* has kicked in and while people have probably gotten used to living with the risk of the pandemic, compliance with

[1] Bank of Italy. The views expressed in this note are my own and do not necessarily reflect the position of the Bank of Italy.

[2] https://www.imf.org/en/Publications/WEO/Issues/2021/01/26/2021-world-economic-outlook-update.

rules and voluntary restrictions to mobility and social interactions may have decreased. Third, governments' limitations have been more localized and/or targeted to specific activities compared with the first outbreak. While geographic differentiation of the policies was originally a feature of large countries with a federal government (e.g. Brazil and the US), several policymakers in other countries have since opted for regional measures and restrictions to limit the economic impact as much as possible. Furthermore, the new measures often apply only to some parts of the day (e.g. night curfews) or to certain days of the week (e.g. special provisions for weekends or holidays).

Disentangling these three channels of response is a challenging task, also given the interplay of the various factors. Regarding the policies now in force, due to geographical heterogeneity and the specificity of the provisions, it has become increasingly hard to keep track of the measures in place in each country. The most comprehensive dataset detailing the policy response is the Oxford COVID-19 Government Response Tracker (OxCGRT) maintained by the Blavatnik School of Government, University of Oxford (Hale et al. 2020).[3] The dataset has collected information on restrictions in 180 countries since January 2020 and aggregates them to build an indicator (henceforth, the OxCGRT index), which measures the stringency of the policies enacted. Despite its completeness, the data present some limitations (Conteduca et al. 2020). In particular, they do not consider the reach of subnational measures for almost all countries, except for adding a flag denoting whether the restriction is national or subnational where this is meaningful. This issue may be particularly relevant when rules differ substantially across regions within the same country. Some attempts to deal with this problem have been made for large countries such as the US[4] and Brazil,[5] whereas for other countries measures and data remain at the national level.

Due to the complexity of the regulatory framework, any comparison of the restrictions adopted during the first and second waves appears difficult and even, in some cases, inconsistent. In Italy, for example, during the nationwide lockdown in March 2020 the variable 'Workplace closing' was equal to 3 (the highest value, corresponding to 'require closing (or work from home) all-but-essential workplaces (e.g. grocery stores, doctors)'. In that period, the shutdown of businesses was pervasive and even manufacturing activities were halted. The same value was, however, recorded in November, despite the fact that the number of businesses which could not operate was limited. A similar discrepancy occurred with respect to the variable 'Stay at home requirements', which was equal to 2 (for the whole country, corresponding to 'require not leaving house with exceptions for daily exercise, grocery shopping, and

[3] https://www.bsg.ox.ac.uk/research/research-projects/coronavirus-government-response-tracker.

[4] The data show that measures in the different states began to diverge substantially at the beginning of April. https://www.bsg.ox.ac.uk/sites/default/files/2020-08/2020-08-06%20Oxford%20COVID-19%20Government%20Response%20Tracker%20expanded%20to%20US%20states%20PRESS%20RELEASE.pdf.

[5] https://www.bsg.ox.ac.uk/sites/default/files/2020-11/2020-11-25-Brazil-policies-effectiveness-press-release-EN.pdf.

'essential' trips') after November 6, the same value the variable had between March 10 (beginning of the nationwide lockdown) and March 19. As a result, the restrictions during the second wave in some countries, including a number of EU countries, might be overestimated. Indeed, even if the values of the indicator in the second wave were close to those recorded during the strict lockdowns of the first wave, citizens' mobility, as measured by cellphone data, fell much less sharply (see Figure 1).[6]

Specifically, since November 6, the Italian government has implemented a zone-system[7] of regions based on indicators[8] of the epidemic risk. The classification of a region is revised every week according to the evolution of the epidemic in the area (Figure 2). Initially, there were three zones – ranging from yellow (the least restricted) to red (the most restricted), through orange. Subsequently,[9] policymakers introduced a white zone to allow for the possibility of a substantial lifting of restrictions in low-risk regions. Besides the measures adopted by the government, each region also adopted different provisions on school closures. The tendency toward localization of health measures is likely to increase in the coming weeks so that handling the OxCGRT national index for Italy may require even more care.[10]

Starting from the Oxford COVID-19 Government Response Tracker, I construct a new dataset of the measures enforced at the regional level in Italy covering the period from November 6 to March 1.[11] The data collected allow me to construct a stringency index at the regional level, which relies on information on the zones to which each region has been assigned, the regional laws, and press releases regarding school closures in the 19 Italian Regions and 2 Autonomous Provinces. More specifically, I re-code some of the variables of the OxCGRT dataset to account for the intensity of the restrictions peculiar to Italy (see Table 1). As in the OxCGRT index, for each region r, I use variable V_j to compute a sub-indicator I_j^r of the intensity of the policy measure j. In particular, $I_j^r = v_j^r / \overline{v_j}$, where v_j^r varies between

[6] The mobility data used for the analysis are the Google COVID-19 Mobility Reports. The data show how visits to places, grouped by categories, change in a given geographical region with respect to a baseline, which is the median value for the corresponding day of the week during the 5-week period 3 January – 6 February 2020. The dataset includes six different categories of mobility: grocery and pharmacy (including grocery markets, food warehouses, farmers' markets), parks (local and national parks, beaches, public gardens), transit stations (including subway, bus, and train stations), retail and recreation (including restaurants, cafes, shopping centers, museums), residential (places of residence), and workplaces. Please refer to https://www.google.com/covid19/mobility/data_documentation.html?hl=en for more information on the data.

[7] DPCM of 3 November 2020. https://www.gazzettaufficiale.it/eli/id/2020/11/04/20A06109/sg.

[8] Among the indicators computed at the regional level, basic reproduction numbers, numbers of notified symptomatic cases, numbers of cases needing hospital or ICU treatment, share of positive tests, and occupancy rates of hospital and ICU beds. https://i2.res.24o.it/pdf2010/Editrice/ILSOLE24ORE/ILSOLE24ORE/Online/_Oggetti_Embedded/Documenti/2020/11/05/13%20DM%2030042020%20_%20monitoraggio%20rischio%20sanitario.pdf.

[9] DPCM of 14 January 2020. https://www.gazzettaufficiale.it/eli/id/2021/01/15/21A00221/sg.

[10] For example, several provinces in Italy (e.g., Brescia, Perugia, Pescara, Chieti) were included in red zones due to the worsening of their epidemic prospects.

[11] Updates will follow in the coming weeks. Data are available upon request.

0 and $\overline{v_j}$, which is the maximum value that V_j can attain.[12] For school closures, I introduce a flag to embed the geographic scope of the measures (regional vs. sub-regional); in particular, I define the indicator as $I^r_{school} = \left(v^r{}_j - 0.5\left(1 - f^r_j\right)\right)/\overline{v_j}$, where f^r_j is a dummy that equals 1 if the measure v^r_j is regionwide and 0 otherwise.[13] I also take into account that some measures were in force only on some days of the week (for example, weekend closures of shops in malls selling non-essential goods or services). Then, I compute an indicator at the regional level by taking the simple average of the sub-indicators. Finally, to compute the modified version of the stringency index, I aggregate the regional indexes by taking a population-weighted average.[14]

Figure 3 shows the OxCGRT index and modified version described above since November 2020. The two indexes are close to each other at the beginning of the sample; however, as time goes by, the difference between the two series tends to increase in absolute value. Table 2 shows some summary statistics of the two indexes (starting from November 6). In particular, on average over the period considered, the OxCGRT index is about 9 points higher than the modified one. Moreover, the modified version displays richer dynamics than the OxCGRT index. The latter does not seem to capture the transition of the regions through different zones and stays rather constant, just a few points below the level reached in March and April 2020.

The modified index exhibits a larger correlation with the mobility data contained in the Google COVID-19 Community Mobility Reports than the OxCGRT index in the period (see Table 3). Furthermore, Table 3 shows that the correlation between the OxCGRT index and mobility was very high during the first wave (I consider the period between March 1 and June 30), and then dropped in the second wave. In absolute value, the correlation between the modified index and the mobility indicators during the second wave is generally lower than that recorded during the first wave between the OxCGRT index and the same mobility indicators. This may indicate that the relationship between the stringency of restrictions and mobility has changed slightly since the outbreak of the pandemic (for instance because of changes in the level of restrictions that are not captured by the index, or due to reduced compliance or changes in habits, as previously discussed).

[12] To ease the notation, I neglect the time index. However, each indicator is available at a daily frequency.

[13] Different weighting based on the share of the population involved and in line with Conteduca et al. (2020) can be computed. So far, the flag is equal to 0 for school closures at the province level.

[14] I use ISTAT population data for 2020. http://dati.istat.it/Index.aspx?DataSetCode=DCIS_POPRES1.

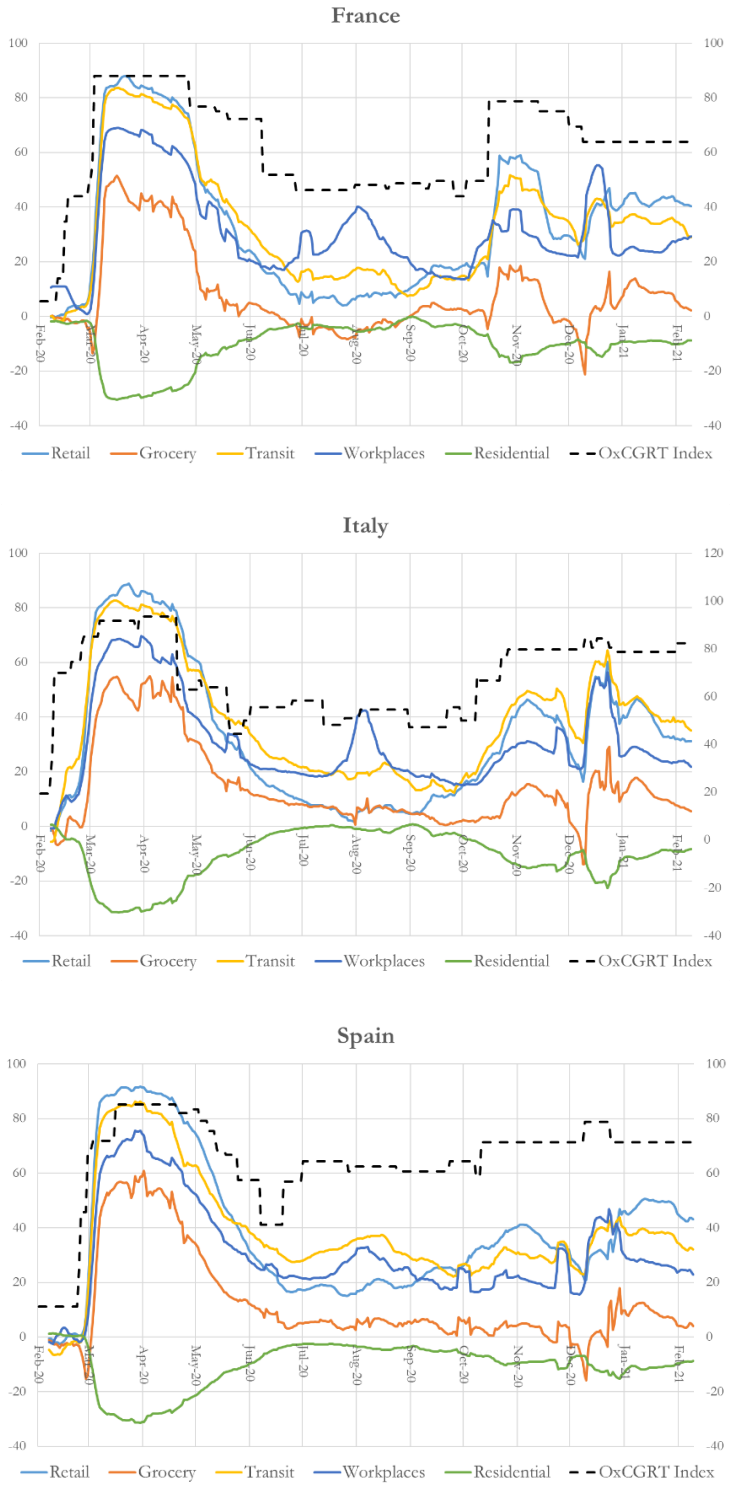
References

Conteduca, F., Mancini, M., Rossi, L., & Tonelli, F. (2020). 'Fighting COVID-19: Measuring the Restrictiveness of Government Policies', Banca d'Italia, Covid-19 Note. https://www.bancaditalia.it/pubblicazioni/note-covid-19/2020/Nota_Lockdown_circolazione.pdf.

Hale, T., Angrist, N., Boby, T., Cameron-Blake, E., Hallas, L., Kira, B., Majumdar, S., Petherick, A., Phillips, T., Tatlow, H., & Webster, S. (2020). '*Variation in government responses to COVID-19 BSG* Working Paper Series Providing access to the latest policy-relevant research.' https://www.bsg.ox.ac.uk/sites/default/files/2020-12/BSG-WP-2020-032-v10.pdf.

Figures

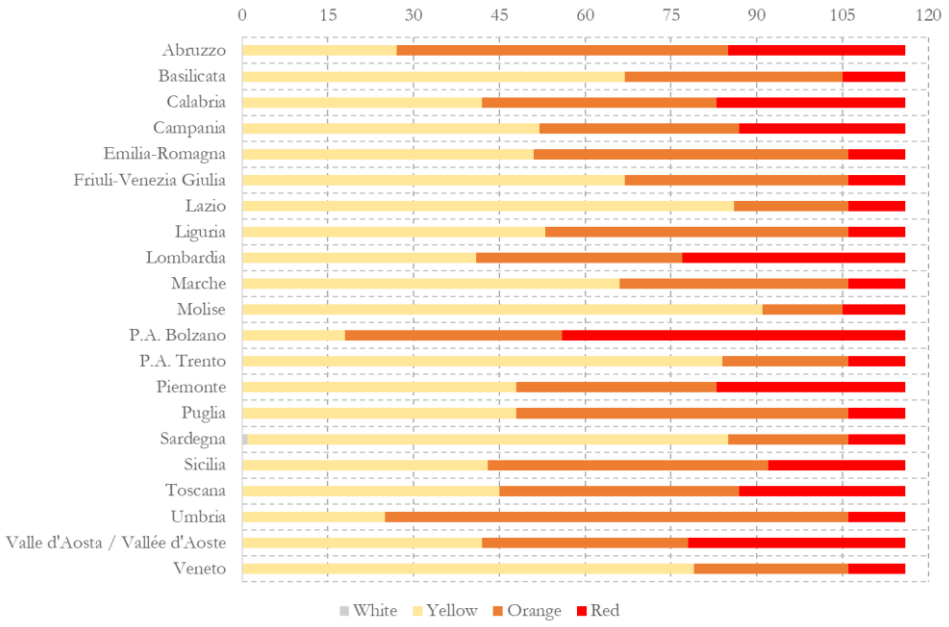
Figure 1. Oxford Government Response Tracker Stringency Index and Google Community Mobility indexes (1)



Source: OxCGRT, Google COVID-19 Community Mobility Reports and author's calculations.

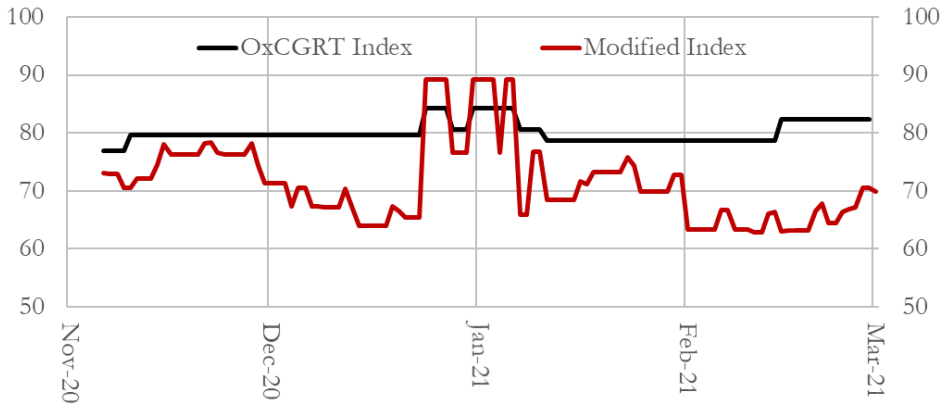
(1) An increase in the OxCGRT indicates stricter government restrictions. Mobility indexes are computed as a 7-day moving average and represented with the inverted sign (an increase in the graph represents a *mobility reduction*) for the sake of readability. The mobility index associated with each category describes how visits to places change in a given geographical region with respect to a baseline, which is the median value for the corresponding day of the week during the 5-week period 3 January – 6 February 2020.

Figure 2. Number of days enforced by type of zone



Source: author's calculations. Starting date: 6 November 2020.

Figure 3. OxCGRT index vs. modified version (1)



Source: OxCGRT and author's calculations.

(1) An increase in the OxCGRT index and in the modified index indicates stricter government restrictions.

Tables

Table 1. Description of the variables used to compute the Modified Stringency Index

Name of the variable V_j	Level v_j	Level (description)
C1_Shops*	0	No restrictions
	1	Limited restrictions (e.g. the number of people allowed in shops)
	2	Limited closures (e.g. selling of non-essential goods not allowed in malls)
	3	Ban on non-essential goods
C2_Bars_Restaurants*	0	No restrictions
	1	Dine-in allowed at some times of the day
	2	Dine-in not-allowed
C3_Cancel public events	0	No restrictions
	1	Limited ban on public events
	2	Ban on all public events
C4_Restrictions on gatherings	0	No restrictions
	1	Gatherings of over 1,000 people.
	2	Gatherings of up-to 1,000 people.
	3	Gatherings of up-to 100 people.
	4	Gatherings of up-to 10 people.
C5_Close public transport	0	No restrictions
	1	Reduced capacity
	2	Shutdown of public transport
C6_Stay at home requirements	0	No restrictions
	1	Recommend sheltering
	2	Mandatory sheltering (excluded essential activities)
	3	Mandatory sheltering
C7_Restrictions on internal movement	0	No restrictions
	1	Curfew
	2	Curfew, no movement between regions
	3	Curfew, no movement between municipalities
	4	Curfew, no movement within a municipality
C8_International travel controls	0	No restrictions
	1	Require negative test
	2	Mandatory quarantine
	3	Entry ban on some countries
	4	Entry ban on all countries
C9_School Closures**	0	No restrictions
	1	Limited closures or restrictions
	2	Distance learning for some schools
	3	Distance learning for most schools
	4	Distance learning for all schools
H1_Public information campaigns	0	No restrictions
	1	Public campaigns on some media
	2	Coordinated campaigns on all media

Note: * denotes variables that are not included in the OxCGRT dataset. ** denotes variables with a flag to indicate the geographic scope (regional vs. local). Other variables may contain a re-coding with respect to the OxCGRT.

Table 2. Descriptive statistics of the OxCGRT and modified indexes

	Percentiles									mean	std. dev	N
	0.01	*0.05*	*0.10*	*0.25*	*0.50*	*0.75*	*0.90*	*0.95*	*0.99*			
OxCGRT index	76.85	78.70	78.70	78.70	79.63	80.56	82.41	84.26	84.26	80.09	1.84	115
Modified index	62.80	63.21	63.36	66.41	70.56	76.27	78.21	89.17	89.17	71.45	7.10	116

Source: OxCGRT and author's calculations. Summary statistics computed from 6 November 2020.

Table 3. Correlation between mobility and stringency indexes

	Retail	Grocery	Parks	Transit	Workplaces	Residential
Period	**OxCGRT index**					
2020/3/1 – 2020/6/30	-0.7518	-0.6660	-0.8647	-0.8472	-0.7612	0.8420
2020/11/6 – 2021/2/28	-0.3451	-0.2342	-0.2905	-0.4760	-0.5490	0.5142
	Modified index					
2020/11/6 – 2021/2/28	-0.7594	-0.4993	-0.6820	-0.8349	-0.6663	0.7941

Source: OxCGRT, Google COVID-19 Community Mobility Reports and author's calculations.