



The COVID-19 crisis in the EU: the resilience of healthcare systems, government responses and their socio-economic effects

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Abstract

The global outbreak of COVID-19 forced EU governments to implement drastic confinement measures to contain the spread of the Coronavirus. These measures, however, come at a high economic cost. In this work, we analyze the resilience/preparedness of public health systems, the confinement measures introduced by governments, and their socio-economic effects. We also investigate the relationships between these elements by focusing on the EU Member States. We conduct an after-action review (AAR) study based on three indices. The first index indicates the preparedness of the countries' health systems to deal with a potential health shock resulting from the COVID-19 outbreak. The second index shows the strictness of confinement measures taken per Member State in spring 2020. Finally, the third index captures the expected socio-economic effects of such measures on each country for the year 2020. Our findings show that on average, countries with less prepared health systems implemented stricter confinement measures and that higher levels of stringency in the confinement measures are associated with stronger, negative, socio-economic impacts. However, the results differ across countries in the case of each index. Overall, the results call for health systems to be better prepared to handle public health crises and for a more coordinated EU approach to overcome divergences across countries.

Keywords COVID-19 · European Union · EU · Confinement measures · Socio-economic impact · Health systems

JEL Classification A13 · C43 · C90 · E60 · H5 · H6 · I18 · J2

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1 Introduction

Across the world, the rapid growth in the number of people infected with COVID-19 is causing large-scale loss of life and severe human suffering. The current pandemic represents the first time since the Influenza H1N1 pandemic in 1918–1919 that governments face a public health emergency without access to a vaccine (Ferguson et al. 2020). The exponential increase in the volume of active COVID-19 cases, patients in critical state and COVID-19 related deaths led to a surge in the demand for health services. This, combined with a potentially decreased availability of healthcare workers (due to infections of medical staff), exercised enormous pressure on the health systems in the EU Member States. The spread of the disease has resulted in a massive short-term economic disruption. It has put the EU economy in the deepest recession since World War II, with the EU economy forecasted to contract by 8.3% in 2020 and corresponding increases in unemployment (European Commission 2020f). While the global scientific community is continuously researching the virus, a cure to COVID-19 is expected not to be found before October 2021 (Scherbina 2020).

As the Coronavirus that causes the COVID-19 disease spread across Europe in March 2020, EU Member States had to assess the resilience/preparedness of their health systems in the face of a possible health shock. At the same time, they needed to consider measures in order to prevent their health systems from becoming overburdened with patients suffering from symptoms of the disease. In response, governments of the EU Member States have taken drastic measures to contain the spread of the virus and safeguard their citizens' health. These measures concentrated on ensuring public health and social distancing. They included, among others, closure of schools and non-essential businesses, prohibiting social gatherings and events, international travel restrictions and asking citizens to stay at home (Hale et al. 2020). While these and other coordinated restrictive measures were necessary to save lives, they have inevitable consequences for societies and economies and alter the lifestyle of both infected and non-infected citizens. To mitigate the adverse effects of the crisis, Member States have continuously stepped up efforts to support their economies. All EU countries have adopted discretionary fiscal stimulus packages to increase the capacity of their health systems and to support affected workers, sectors and business. Although these measures are temporary and targeted, they put significant pressure on public finances, possibly leading to increasing public indebtedness.

In this context, this paper analyzes the relationship between the preparedness of EU countries' healthcare systems to a potential health shock resulting from the COVID-19 outbreak, the confinement measures taken by their governments in response to the COVID-19 outbreak and their social and economic consequences. It presents the results of an after-action review study (AARs), which seeks to examine two things. The first objective is to explore whether the established resilience of healthcare systems in the different EU Member States can explain the strictness of the confinement measures. The second purpose is to analyze how these levels of confinement are likely to affect the economies and labor markets

of the individual Member States. The aim is to observe relationships and identify areas for improvement in healthcare systems preparedness and response activities.

Moreover, this paper aims to provide a policy outlook from an EU perspective, considering how the findings presented might feed into future EU policy and to what extent EU measures currently taken already reflect lessons that might be drawn from the results. These results provide insights that may serve as guidance for decision makers, when dealing with a public health crisis. To the authors' knowledge, there exists no academic research with a similar research focus and method covering the COVID-19 pandemic, as presented in this paper. As this paper is primarily about public decision making in the face of a health crisis, we first discuss insights from the academic literature in the next section, which indicate how a government may deal with such a situation. The same section presents our hypotheses as to how governments have taken their decisions in the face of the COVID-19 outbreak. In the subsequent section, we elaborate on the method and data used for testing these hypotheses, followed by a presentation of our findings. Finally, we discuss the implications of these findings in the EU context, and the paper concludes with policy advice.

2 Theoretical discussion and hypotheses

In a public health crisis, one of a government's main tasks is to manage the risks associated with the crisis in order to prevent adverse outcomes. In order to do so, it needs to take action and use a combination of the various policy options it has at its disposal. The problem is that a government may not always be fully aware of the situation it is facing. It may encounter a so-called 'known-unknown', defined by Merad and Trump (2020) as a risk "for which we dispose of few or contradictory pieces of knowledge and information". In this case, a government must acquire all relevant knowledge and information that it can obtain, in order to make effective decisions based on it. A government will likely turn to experts to inform itself on which strategy to follow, although more actors may be consulted. According to Merad and Trump (2020, p. 56), many scholars argue that "the development, analysis, and construction of expertise [as regards a health issue] are inherently shared, or 'co-developed' between identified experts, stakeholders, decision-makers, and the lay public".

Moreover, they suggest that when decision-making pertains to (among others) health, policy questions can be controversial, as "some stand to gain or lose based upon how risk is framed and a policy or method to address such risk is designed and implemented" (Merad and Trump 2020, p. 56). To illustrate the relevance of this in the case of confinement measures: while such measures as a response to a virus outbreak help to halt the spread of the virus and preserve citizens' health, forcing people to change their daily activities has a considerable impact on them at the same time. Confinement can be an unpleasant experience associated with psychological effects that can range from an increase in boredom, uncertainty, and stress to extreme cases that could even lead to suicide. Psychological effects are not only visible in the short-term but can also have long-lasting consequences (Brooks

et al. 2020). Furthermore, confinement measures also have impacts on people's livelihoods, of which the ultimate consequences cannot be fully known when the measures are taken. Thus, taking decisions in the face of a public health crisis is a challenge for governments, considering the problem of available knowledge and information, the multiplicity of stakeholders involved, and potential controversy and trade-offs of the decisions made.

Chan and Wong (2020) offer a framework developed by Leavell and Clark (1958), which allows for a better understanding of how a government may manage a health crisis. The framework suggests three levels of health prevention:

1. *Primary prevention* measures that prevent the onset of diseases at the source
2. *Secondary prevention* blocking the progression of a disease after its onset
3. *Tertiary prevention* rehabilitating patients suffering from an established disease to minimize complications and disabilities.

In the context of disaster preparedness, primary prevention addresses potential health risks beforehand in order to enhance resilience. Secondary prevention includes “blocking the spread of diseases and their adverse health impact”. As an example, Chan and Wong (2020) mention avoiding an increased burden of clinical consultations by proactively managing the health needs of people with chronic disease conditions; a measure that in approach can to some extent be likened to confinement measures taken in the context of the COVID-19 crisis. Finally, tertiary prevention aims to minimize the impact on and damage to human health post-disaster.

According to Ferguson et al. (2020), with an immediate health crisis to handle in the absence of a vaccine or effective drug treatment, governments have no other choice but to implement non-pharmaceutical interventions. They argue for two possible strategies for this, which are in line with the second level of health prevention proposed by Chan and Wong (2020): suppression and mitigation. While both aim at reducing the spread of the virus, their intensity is different, as suppression has the objective of reducing the reproduction number (R) below 1.¹ In contrast, mitigation policies do reduce R but not to below 1. As suppression policies are more effective in halting the spread of the virus, they are usually implemented in the first instance. In contrast, mitigation measures are recommended at a later stage to control the spread of the virus (Scherbina 2020).

Confinement measures taken by governments are very useful to reduce the spread of a virus by stopping almost all regular activities in a society that involve close physical proximity of people. They do not only imply the separation of persons infected or with symptoms from others (isolation), but also the separation of persons who are not showing symptoms, but who may have been exposed to the virus (quarantine) (WHO 2020). Confinement measures do not only have effects in the (mostly) cities where they are imposed, but also outside these cities. To

¹ The reproduction number (R) is the average number of people that a person with a virus can infect. If the R is greater than 1, it means that an infected person will pass the virus on to more than 1 person. Hence, the epidemic will grow.

illustrate this, Fang et al. (2020) analyzed the confinement measures implemented in Wuhan (capital of Hubei province, China) at the beginning of the COVID-19 pandemic. First, they identified reductions in inflow (77%), outflow (56%), and within-Wuhan movements (54%). Following this, they applied a difference-in-differences (DID) model to explore the effects of confinement measures in a comprehensive manner. Their results indicate that if it were not for the introduction of a lockdown, the number of cases would have been higher by 65% outside the Hubei province and 53% higher in cities inside Hubei, not counting Wuhan itself (Fang et al. 2020).

Although confinement measures are an excellent way to suppress the spread of a virus, a government still faces a policy trade-off and tough decisions to make, as suggested above. On the one hand, focusing on the preservation of lives by extending confinement measures implies strong adverse economic effects. As regular interactions between economic actors are disrupted, value creation can no longer continue as before. This has a direct effect on businesses and workers deriving their revenue and income from this process, who can find themselves confronted with decreased or even dwindled resources. Governments themselves, as a result, will experience decreased tax revenues while, depending on countermeasures taken, increasing their expenditure. On the other hand, loosening restrictive measures alleviates the economic stress, but at the risk of an increase in infections and deaths.

To solve this puzzle, scholars present different solutions. Acemoglu et al. (2020) find that a targeted approach differentiating between risk groups yields better results than a uniform strategy. As the COVID-19 mortality risk for people over 65 is around 60 times greater than that of those aged 20–49, it would be worth treating both groups differently. They claim that applying lockdowns with different intensity and tailored to the risks of each age group, have less negative economic impacts than uniform lockdowns and reduce COVID-19 related deaths (Acemoglu et al. 2020). This argument suggests more policy options for governments, by which they could address a pandemic such as COVID-19. Scherbina (2020) proposes a cost–benefit approach, weighing the benefits of an additional week of confinement measures against the economic costs that they impose. Underlying both approaches, there are intrinsic ethical questions.

Governments can follow different policy approaches in practice to contain a pandemic in their country and internationally and this involves taking difficult decisions. Observing the response of EU governments to the outbreak of COVID-19, we assume that their primary aim was to contain the spread of the virus to preserve public health, at the national and international level. The measures that governments introduced generally reflected this. However, the variation in their stringency leads us to assume that some Member States were better prepared for the outbreak of a pandemic than others. This could be due to either specific qualities of individual healthcare systems, but also to country-specific characteristics, which make the spread of a virus more or less likely. Moreover, governments have likely taken the ramifications for their national economies into account in their decision-making. These considerations lead us to the following two hypotheses, which we test and analyze in this paper:

1. In those EU Member States where healthcare systems were less resilient to the outbreak of a pandemic, movements of citizens were restricted more;
2. Impacts of confinement measures on a society and economy are more substantial in those countries where confinement measures were stricter.

The following section describes the data and methodology through which we test these hypotheses.

3 Data and methodology

In order to test the hypotheses presented above, we constructed three indices, representing the preparedness of healthcare systems to deal with a potential health shock posed by the COVID-19 crisis, the stringency of confinement measures taken by EU governments and their socio-economic impacts respectively:

1. Health System Preparedness Index (HSPI)
2. Government Response Confinement Index (GRCI)
3. Socio-Economic Impact Index (SEII)

Each of these indices was built following the guidance in the *Handbook on Constructing Composite Indicators*, developed jointly by the European Commission (Joint Research Centre) and the Organization for Economic Co-operation and Development (OECD 2008). The accompanying COIN tool (Joint Research Centre 2020) was used for all data aggregation. All individual indicators were normalized to be measured on the same scale, ranging from 0 to 100. The normalization scores for each indicator were calculated using the min–max normalization method. This method normalizes indicators to have an identical range by subtracting the minimum value and dividing by the range of the indicator values and multiplying by 100. This ensures that all indicators measure performance monotonously and coherently. In mathematical terms, the normalized score (I_{qc}^t) for an indicator, q , for country c , at time t is given by:

$$I_{qc}^t = \frac{x_{qc}^t - \min_c(x_q^{t_0})}{\max_c(x_q^{t_0}) - \min_c(x_q^{t_0})}$$

where x_{qc}^t is the value of indicator q for country c at time t .

The normalized scores were combined into dimensions, and the indices for each country were constructed by combining these dimensions. It should be noted that equal weights were used for all indicators and all dimensions. Although it can be argued that using equal weights creates a distorted representation of the health system preparedness, confinement measures and socio-economic impacts in different Member States, this choice was made to avoid attributing weights that could

be considered arbitrary. The following sections will discuss each of the indices individually.

It should be noted that the indices were constructed using the best available data at the time of performing the study. There are, however, a few limitations of the method that should be taken into account. First, data had to be selected based on availability and relevance considered by the authors and the resulting indices cannot be seen as representing the full qualities of a healthcare system and its context, the confinement measures taken by the Member States, as well as the full impact of these measures on economies and labor markets. Second, historical data on socio-economic impacts was not always available at the time of performing our analysis. This means that outcomes in this area rely on reported and forecasted data, which involve a high amount of uncertainty. According to the European Commission's Spring 2020 Forecast, the economic impact of the COVID-19 pandemic is "likely to be highly complex and widely varied" (European Commission 2020a, p. 15). Third, data concerning a couple of crucial indicators was not made available at regular intervals in the past years. Therefore, data for some indicators dates back several years and in some cases, useful data for a particular indicator was missing entirely.²

3.1 Health system preparedness index

The HSPI aims to provide insights into the preparedness of health systems across the EU to respond to the challenges posed by the COVID-19 pandemic. The index combines data on six dimensions:

- I. Testing Capacity.
- II. Resources: Doctors.
- III. Resources: Nurses.
- IV. Resources: Beds.
- V. Health expenditure.
- VI. Structure of the population.

The COVID-19 outbreak has exposed the importance of having adaptable health systems. Lack of any sort of excess capacity can leave countries vulnerable to an unexpected surge in health care demand. Therefore, data on the availability of hospital beds, including intensive care and critical care beds, the availability of health care staff (doctors and nurses) and the level of healthcare expenditure are all crucial for monitoring and estimating the capacity of the healthcare systems to respond to a surge in COVID-19 related cases. At the same time, data on the structure of the population provides additional insights into the ability of a national health system to respond to the crisis, as it has been established that people of older age are particularly affected by the virus. Finally, data on testing capacity provides additional insights into the spread of the pandemic. In particular, the number of tests

² Full data descriptions are provided in the Appendix.

performed helps interpreting data on confirmed cases and provides a better understanding of how the pandemic progresses. It enables us to identify which countries are performing well and which are underreporting cases and deaths due to lower levels of testing. For this reason, it is important to know how much testing for COVID-19 a country does.

The HSPI consists of a score assigned to each country, indicating the overall preparedness of the country's health system. The index provides a simple way of comparing among different countries. It ranges from 0 (low preparedness) to 100 (high preparedness), with increasing values representing higher levels of preparedness. It should be noted that the index captures a snapshot of the state of health systems at the beginning of the COVID-19 pandemic (base capacity). Since then, many countries have expanded their base capacity to different degrees (e.g. additional beds, mobilizing volunteers or retired health care workers).

All data, except on testing capacity and resources in terms of beds, was obtained from the Eurostat database. Data on beds were gathered from Rhodes et al. (2012). Data on the testing capacity of the EU Member States were collected from the Coronavirus Pandemic (COVID-19) database (Roser et al. 2020). The latter shows the number of daily tests per 1000 persons (7-day rolling average). The database contains statistics on 86 countries globally and represents up-to-date information on several indicators related to the Covid-19 pandemic. Data on testing capacity is updated approximately twice per week and was constructed by collecting publicly available information published by official sources regularly. For the purpose of this study, we used data made available on 12 March 2020.³

3.2 Government response confinement index

The GRCI aims to capture the strictness of government confinement measures, which limit citizens' behavior in order to contain the spread of the Coronavirus. It consists of the following dimensions:

- I. School closing.
- II. Working place closure.
- III. Cancel of public events.
- IV. Restrictions on gatherings.
- V. Travel restrictions.⁴
- VI. Home confinement measures.

The index is based on the method and indicators used by the University of Oxford and Blavatnik School of Government for developing the Oxford COVID-19 Government Response Tracker (OxCGRT). This tracker "systematically collects information on several different common policy responses that governments have taken

³ Further data descriptions can be found in Appendix 1.

⁴ The indicators "restrictions on internal movement", "restrictions on international travel," and "close of public transport" have been combined into "travel restrictions."

to respond to the pandemic on 17 indicators such as school closures and travel restrictions” (Blavatnik School of Government & University of Oxford 2020). For this index, we used only the nine indicators of the “Containment and closure policies” group as the eight left belong to other categories that are not of interest for the GRCI. For the sake of consistency with the other indices presented in this paper, the indicators “Restrictions on international movement”, “Restriction on international travel”, and “Close of public transport” have been condensed to one—“Travel restrictions”. This has led to the six dimensions of the index presented above.⁵ For this study, we worked with the information available on 4 June 2020, which covered government measures taken during spring 2020.

The indicators provided by the OxCGRT are recorded on an ordinal scale from 0, meaning “no measure” to 2, 3, or 4 (depending on the indicator). According to the OxCGRT methodology, daily scores for each indicator are calculated by dividing the value of the indicator on any specific day by the maximum possible times 100. It is worth noting that all indicators account for the geographic scope of each policy, giving policies targeted to a specific region a lower weight.⁶ In this case, the same formula as mentioned above is used, but the daily value is multiplied by 0.5. Moreover, the OxCGRT gives scores of 0 in case data lacks any specific indicator. The database used for the OxCGRT is updated continuously and could change as data is added. Hence, the scores might differ depending according to the date of access to the data.

To construct the GRCI in this paper, we have averaged the daily scores (obtained from the OxCGRT) for each selected indicator per country from the first COVID-19 caused death⁷ until 31 May 2020. We selected this period of investigation, because after the cut-off date many countries started easing their confinement measures. For each indicator, the obtained average represents a final score. The adding up of six final scores (of the six dimensions listed above) for each country yields the GRCI for each country. In the same fashion as the HSPI, increasing values represent stricter confinement levels.

3.3 Socio-economic impact index (SEII)

The SEII aims to indicate how hard societies and economies in the EU are hit relative to one another by the COVID-19 crisis. It consists of the following dimensions:

- I. Gross Domestic Product.
- II. Unemployment.
- III. Wages.

⁵ Further data descriptions can be found in Appendix 2.

⁶ The indicator “International travel controls,” included in this analysis in “Travel restrictions,” is the only one not weighted given the controls are taken at the national level. Hence, no regional distinction is possible.

⁷ It should be noted that the collection of COVID-19 death related statistics is not uniform among Member States.

- IV. Unemployment benefit expenditure.
- V. Fiscal package.
- VI. Public Debt.

The SEII combines the data, which we believe best reflects the expected socio-economic impacts of the COVID-19 crisis for the year 2020. Gross domestic product serves as a measure of overall (paid) economic activity. A decline in GDP indicates a general decline in value-added and thus reflects a worsened financial situation of an array of economic actors. Where a drop in GDP coincides with job losses, the unemployment rate indicates the severity by which the health crisis hits workers in an economy. Even if few job losses result from the situation, decreased incomes of workers might be observed in terms of lower real employee compensation, as some firms see themselves forced to cut staff costs. In all EU countries, unemployment benefits serve to stabilize incomes and consumption automatically. At the same time, changes in the level of unemployment benefits paid out by the government imply changes in government expenditure and workers' income; an increase in unemployment benefit expenditure means an increase in public expenditure, due to the increasing number of beneficiaries, and a lower income for workers, due to job losses. In a crisis, many governments tend to introduce stimulus packages to prevent economic activity from falling too much. Fiscal packages include measures such as healthcare system support, compensations for the loss of earnings (for example through short-time work schemes) or income and tax deferrals. Although on the one hand, fiscal packages help to prevent worse economic outcomes, they represent an increased (tax) burden on society. Such fiscal packages generally do not include funds for the payment of unemployment benefits, so these are considered separately. Changes in public debt take into account changes in government expenditure not included in the other dimensions mentioned above. They also indicate the potential worsening of a country's borrowing position on capital markets, thus making it more difficult for the country to meet its financing needs.

As for the HSPI and GRCI indices, all individual indicators were measured on the same scale, ranging from 0 to 100, but in this case, a higher score indicates a more negative socio-economic impact. The six dimensions of the SEII mostly rely on data forecasted for 2020 by the European Commission in the 2020 Spring Forecast. Only the data underlying the component V does not stem from the Spring Forecast, for which data obtained from the International Monetary Fund (2020) and the International Labour Organisation (2020) were used.⁸ This still means that the SEII, for the most part, relies on the same assumptions as the Spring Forecast. These are that (1) the number of new COVID-19 infections remains under control after the loosening of confinement measures; (2) strict lockdowns are gradually lifted and will be replaced by targeted measures with a relatively minor economic impact; and, (3) policy measures are effective in protecting the economy (European Commission, 2020a). Given this, it is worth mentioning that forecasting under the circumstances posed by the COVID-19 outbreak has not been without difficulty, given the high

⁸ Further data descriptions can be found in Appendix 3.

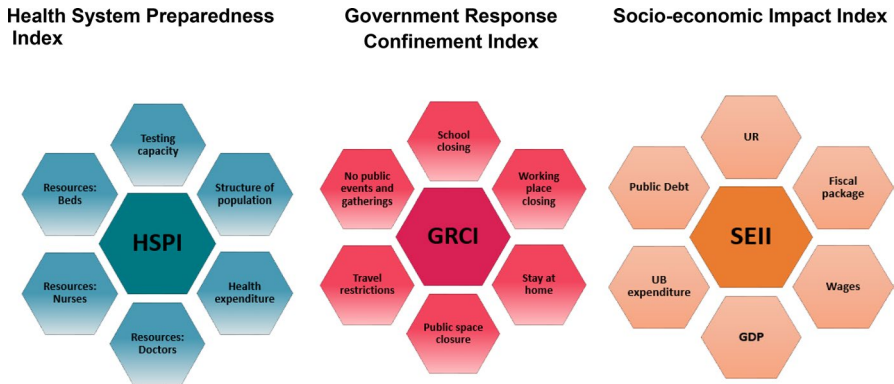


Fig. 1 Graphical representation of the three indices and their dimensions. Source: Authors' own elaboration

level of uncertainty and a lack of experience with a similar situation.⁹ Economic forecasters in the European Commission have relied, more than usual, on real-time data (such as electricity consumption) and on data about the spread of the virus to assess the economic circumstances. They have also built more on model-based scenario analyses to arrive at rough estimates. Still, as the Spring Forecast states, "interrupting forecasting activities (...) is not an option in a situation where informed policy decisions need to be taken" (European Commission, 2020a, p. 20) (see Fig. 1).

4 Results and analysis

4.1 Health systems preparedness

The HSPI shown in Fig. 2¹⁰ demonstrates that, at the beginning of the crisis, the level of preparedness of the health systems (on the basis of the dimensions considered in this study) to deal with the pandemic, varied considerably in the EU. France and Germany are at the top of the ranking followed by Austria and Slovenia. At the other side of the spectrum, the level of preparedness was the lowest in Croatia, Hungary, Portugal and Greece. Within the EU, France, Germany, Sweden, and Austria score higher in terms of healthcare expenditure whereas

⁹ "Fundamental uncertainty surrounds this forecast. The danger of a deeper and more protracted recession is very real. The point forecasts presented in this document should therefore be understood as just one among several possible scenarios. Different assumptions to those made here about the length of the lockdowns, the confinement measures still necessary in the period ahead, and the effectiveness of the policy response would lead to very different projections. Another surge in infections, for example, could reduce GDP by an additional 3 percentage points. The downside risks are thus particularly large." (European Commission 2020 Spring Forecast, page ix).

¹⁰ Figure 2 presents a comparison of the 6 dimensions of the HSPI index across the EU Member States. Each bar segment presents the normalized score of the corresponding dimension. The x-axis presents the value of the HSPI index (calculated as the average of the 6 stacked bar segments).

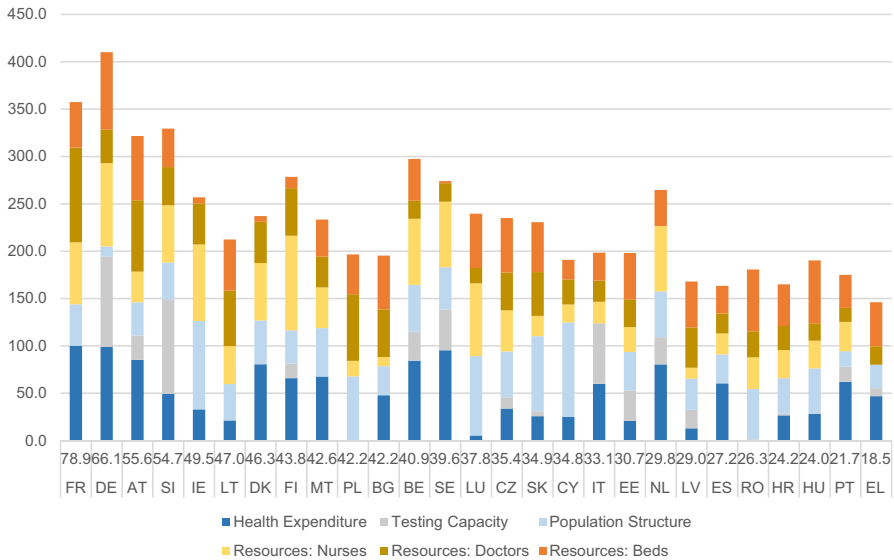


Fig. 2 Health system preparedness index and dimensions. Source: Authors' own elaboration

Latvia, Lithuania and Romania recorded the lowest values. In terms of testing capacity, Slovenia and Germany feature with the highest score as opposed to Poland and Hungary in which the lowest scores are observed. Four countries stand out in terms of high availability of nurses (Finland, Germany, Ireland and Luxembourg) and three (France, Austria and Poland) in terms of high availability of doctors.

On the other hand, the availability of nurses was the lowest in Latvia, Bulgaria and Greece. The availability of doctors was the lowest in Luxembourg, Portugal and the Netherlands. In terms of availability of hospital beds per 100,000 inhabitants, Germany features at the top of the ranking, followed by Austria, Hungary and Romania whereas Ireland, Denmark and Sweden register the lowest scores. As discussed in Sect. 3.1, the availability of resources plays a crucial role in preparing a country to deal with an increasing number of Covid-19 patients. The higher the availability of financial, medical and hospital beds resources, the less the strain on the national health system. At the same time, the higher the testing capacity, the higher the ability of a country to contain the virus. Finally, looking at the population structure, Italy has the population of the highest age relative to that of the other Member States, followed by Germany, Portugal and Greece. In contrast, the population is the youngest in Cyprus, followed by Ireland and Luxembourg. Given that older people were identified as a high-risk group in the Covid-19 crisis, the older the population, the higher the risk for the health system.

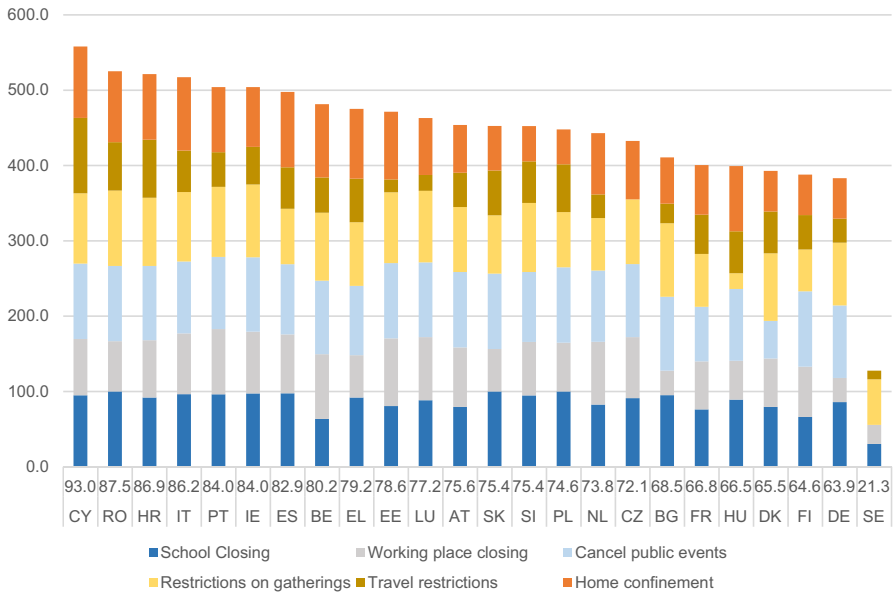


Fig. 3 Government Response Confinement Index and Dimensions. Source: Authors’ own elaboration

4.2 Government responses

The GRCI captures EU governments’ actions aimed at reducing the spread of the virus. Figure 3¹¹ shows the sum of the average scores of each dimension per country. Thus, higher bars indicate stricter government responses in terms of confinement measures. Cyprus, followed by Romania, Croatia, and Italy scored the highest levels of response in the sample. Relatively, Finland, Germany, and more prominently, Sweden adopted less strict measures. It is worth noting that, due to lack of data in the OxCGRT, Latvia, Lithuania and Malta are not present in the GRCI.

Analyzing specific dimensions, cancellation of public events was the measure with the highest score across all countries with an average score of 90. It is worth noting that due to lags in updating the data, this value might be even higher, as public gatherings represent a massive risk in terms of the Coronavirus spread and governments across the EU have banned these kinds of activities.¹² Another standard policy among countries was closing of schools and universities, as they are also locations where the virus can spread quickly. Three countries had the highest possible value across the whole period under investigation (Poland, Romania, and

¹¹ Figure 3 presents a comparison of the 6 dimensions of the GRCI index across the EU Member States. Each bar segment presents the normalized score of the corresponding dimension. The x-axis presents the value of the GRCI index (calculated as the average of the 6 stacked bar segments).

¹² When we accessed the data on June 4, 2020, Sweden has a score of zero for this indicator that may have been updated at a later stage. As the authors of the database assigned zero when there is no information available, this value might be outdated and underreporting the real value of the indicator.

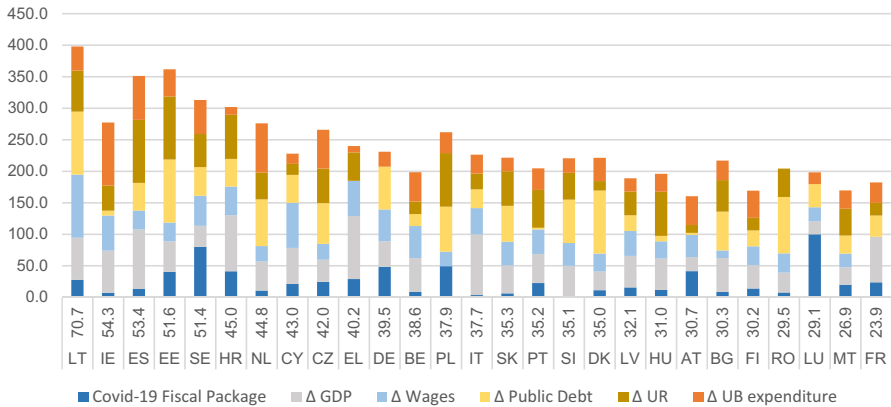


Fig. 4 Socio-economic Impact Index and Dimensions. Source: Authors' own elaboration

Slovakia), while the rest of the countries scored relatively high as well, yielding an average of 86. Sweden is the exception in this regard with a score of 30.

Other dimensions vary considerably throughout the Member States. For instance, while travel restrictions were stringent in Cyprus and Croatia, the governments in Luxembourg, the Netherlands, and Sweden imposed much less strict measures. Similarly, Spain and Italy implemented sturdy "stay at home" policies asking their citizens not to leave their houses, scoring 100 and 97, respectively, whereas, in Finland and Slovenia, governments were less strict with scores of 54 and 47, respectively. Finally, workplace closing also shows mixed results. Estonia and Portugal registered the higher values close to 90, whereas, on the other extreme Sweden, Denmark and Bulgaria scored around 30.

4.3 Socio-economic impacts

All impacts shown in Fig. 4¹³ are negative impacts; each of the bars represents higher expenditure on fiscal packages, higher GDP declines, more robust decreases in wages, higher public debt, higher unemployment and higher unemployment expenditure. The figure shows expected impacts for 2020. The size of the bars represents the impact relative to the other Member States. What all Member States have in common is that they are expected to experience adverse socio-economic outcomes in 2020. At the same time, the index shows that the outcomes are different per Member State. Whereas countries like Austria, Finland, France, Luxembourg, Latvia and Malta are likely to experience fewer negative consequences of the COVID-19 outbreak, especially Estonia, Spain, Lithuania and Sweden are likely to be hit more. The results also already show that national confinement measures cannot fully explain national socio-economic outcomes. This result is not surprising given the strong mutual (international)

¹³ Figure 4 presents a comparison of the 6 dimensions of the SEII index across the EU Member States. Each bar segment presents the normalized score of the corresponding dimension. The x-axis presents the value of the SEII index (calculated as the average of the 6 stacked bar segments).

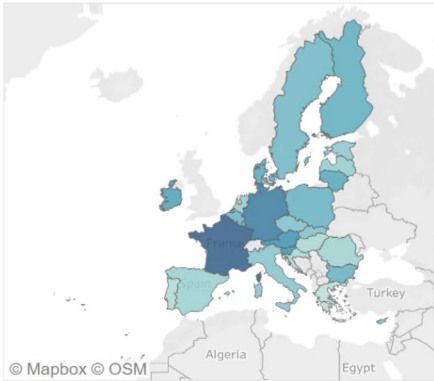
dependency of national economies and the fact that the COVID-19 pandemic hit countries everywhere around the world. It shows that national socio-economic impacts depend on specific weaknesses of individual countries to international developments. Especially in a crisis that hits globally, such impacts are amplified, and differences in outcomes between countries become apparent. As an example, although Sweden has followed a relatively mild confinement strategy, the SEII shows that the country is likely to be hit harder than almost all other EU Member States (except for Lithuania). Sweden scores relatively worse than many other Member States on each of the dimensions constituting the index. Still, confinement measures profoundly affect domestic production and consumption, which is why stricter national confinement measures are likely to have a stronger impact on individual societies and economies. This will be elaborated in the following section of the paper. Something to note is that the index presented below takes stock of the COVID-19 related socio-economic impacts per country, but that it does not say anything about the socio-economic resilience of individual Member States. It is likely that those Member States with a higher economic buffer, in general, are better able to manage adverse outcomes.

Looking at the different dimensions in detail, Sweden and Luxembourg stand out when it comes to the size of the COVID-19 fiscal package. These countries have reserved a relatively large amount of funds for dealing with the social and economic consequences of the COVID-19 outbreak. The reasons for this could be that their financial status allows them to reserve more funds relative to the other Member States, the risks perceived by their governments are higher or simply because the crisis hits these countries more strongly. In the Swedish case, at least the latter explanation seems confirmed by the SEII, but for Luxembourg, such an explanation looks less obvious. In the other Member States, the sizes of fiscal packages are smaller, especially in Ireland, Estonia, the Netherlands, Belgium, Italy, Slovakia, Slovenia, Bulgaria and Romania. Remaining countries fall in the middle.

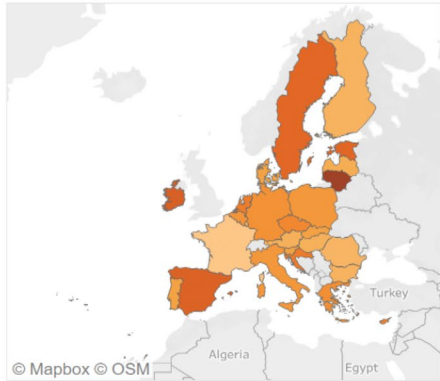
Countries are expected to be hit by GDP declines without exception, with the biggest predicted impacts in Spain, Croatia, Greece and Italy. Unsurprisingly, despite short-time work schemes instated in many Member States during confinement measures, all countries are expected to suffer from increased unemployment, with Spain, Estonia, Croatia and Poland likely to be the hardest hit. Relatively significant negative impacts on wages are expected in Lithuania and Cyprus. Substantial increases in public debt are estimated for Lithuania, Estonia, the Netherlands, Denmark and Romania, while Ireland, Belgium and Hungary are estimated to suffer relatively little in this respect. Member States with relatively generous spending on unemployment benefits and which are predicted to be hit by higher unemployment will likely see such spending rise more than other Member States. This is the case for Spain, Belgium and Austria in particular. In Croatia, Cyprus, Greece and Luxembourg, such spending is expected to remain relatively low.

The country maps below give another graphical representation of each of the countries' indices, relative to one another. It is clear that there are significant differences between countries as the different intensity of the colors shows in each of the

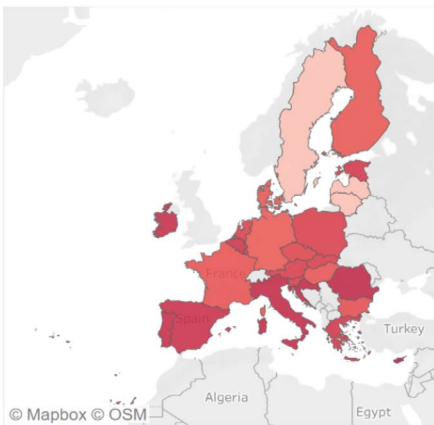
Health System Preparedness Index (HSPI)



Socio-economic Impact Index (SEII)



Government Response Confinement Index (GRCI)



HSPI



SEII



GRCI



Fig. 5 Country maps presenting the scores for the three indices: HSPI, SEII and GRCI (*HSPI*: higher scores indicate higher health system preparedness, *SEII*: higher scores indicate a more negative socio-economic impact, and *GRCI*: higher scores indicate stricter government response measures.). Source: Authors' own elaboration

three maps. In the following section, we analyze the relationships between the HSPI, GRCI and SEII (see Fig. 5).

4.4 Combining the indices

Overall, the HSPI is negatively associated with the stringency of measures adopted by the governments in the EU Member States (see Fig. 6 below). This result confirms our first hypothesis stating that Member States where healthcare systems were

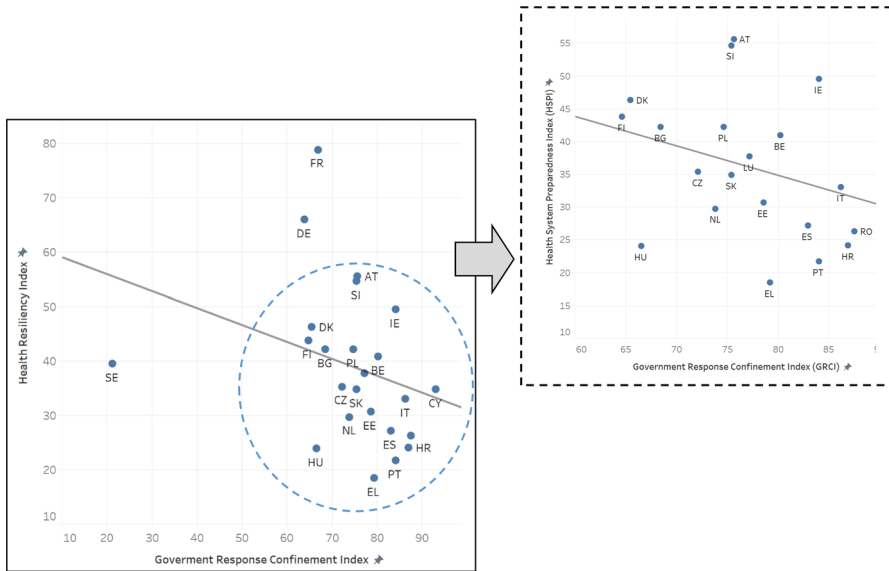


Fig. 6 HSPI versus GRCI (scatter plot). Source: Author’s own elaboration (no data for Latvia, Lithuania and Malta for GRCI)

less resilient to the outbreak of the pandemic, governments implemented more strict confinement measures.

Figure 6 shows the GRCI on the horizontal axis and the HSPI on the vertical axis. It also illustrates that stricter governments’ responses are mainly found in countries where the preparedness of the health systems is at lower levels. On the other hand, in France and Germany, while the level of resilience of the health system is high, the governments have taken strict confinement measures in response to the COVID-19 outbreak. Sweden is a clear outlier; while it is scoring moderately on the HSPI, it is associated with the least strict confinement measures.

A direct relationship can be observed between the estimated socio-economic developments for 2020 and the stringency of the measure adopted by EU governments. Hence, this supports our second hypothesis, stating that impacts of confinement measures on a society and economy are more substantial in those countries where confinement measures were stricter.

Figure 7 shows the SEII on the horizontal axis and the GRCI on the vertical axis. It clearly suggests that the stricter the confinement measures in a Member State, the stronger the expected socio-economic impact. Sweden has been excluded from this analysis due to its meagre GRCI score. Moreover, the figure shows that some countries with a relatively less adverse expected socio-economic impact (e.g. France, Germany, Bulgaria and Finland) are also countries in which the health system was better prepared, at the beginning of the crisis, to deal with the outbreak of the pandemic. The size of the circles indicates this, as the bigger the circle, the more prepared a health system of a country. At the same time, the socio-economic effect is

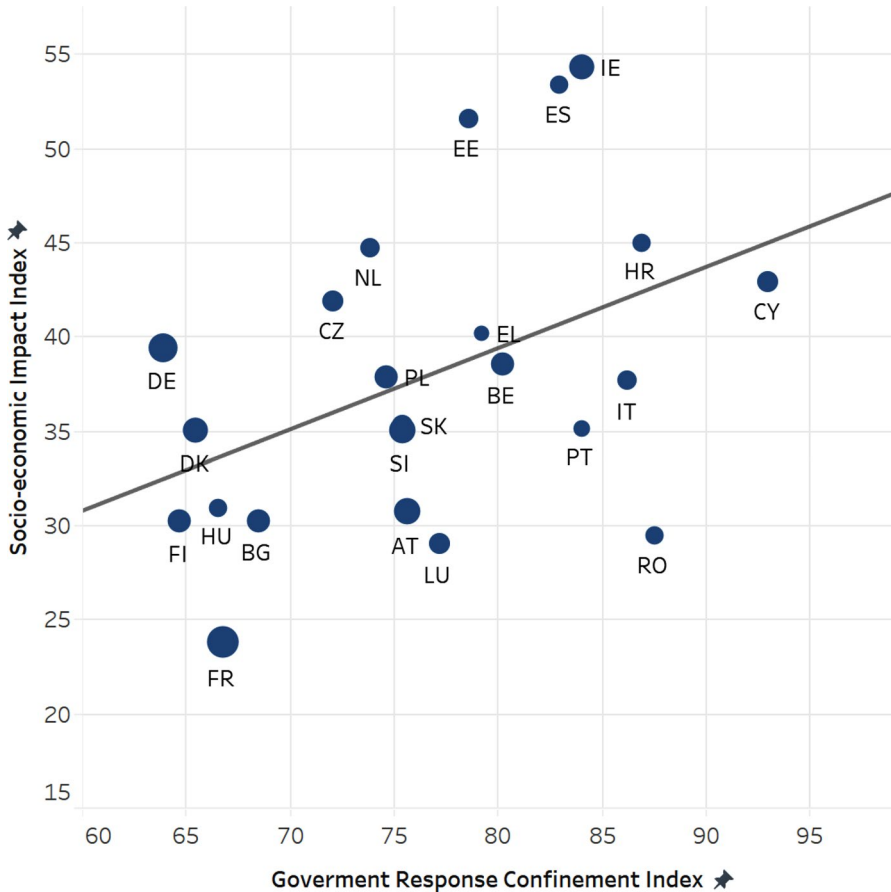


Fig. 7 SEII versus GRCI (scatter plot). Source: Authors' own elaboration. Note: The size of the circle shows the HSPI. No data for Latvia, Lithuania and Malta for GRCI. Sweden has been excluded from the plot

expected to be more adverse in countries with a low level of health system preparedness (e.g. Croatia, Hungary, Portugal, and Greece).

To further analyze the performance of the countries relative to other Member States, we have classified them into five performance groups, based on their average performance scores. These clusters of Member States were created using the k-means clustering algorithm. This is the most comprehensive used unsupervised learning algorithm. It is a simple way to classify a given data set into k user-defined number of clusters, fixed a priori. The algorithm identifies k number of centroids, and then allocates every data point to the nearest cluster while keeping the centroids as small as possible. Table 1 presents the resulting clusters for the three indices created in this study.

The results indicate that, at the beginning of the crisis, the health systems in France, Germany, Austria and Slovenia were better prepared to deal with the

Table 1 Clusters of Member States Source: Authors' own elaboration

Index	Cluster	Countries	Mean
Health System Preparedness Index	HSPI_1	FR, DE, AT, SI	63
	HSPI_2	BG, DK, FI, IE, LT, MT, PL, BE, SE	43
	HSPI_3	LU, CZ, SK, CY, IT	35
	HSPI_4	EE, NL, LV, ES, RO	28
	HSPI_5	HR, HU, PT, EL	22
Socio-economic Impact Index	SEII_1	LT	71
	SEII_2	IE, ES, EE, SE	52
	SEII_3	HR, NL, CY, CZ	44
	SEII_4	EL, DE, BE, PL, IT, SK, PT, SI, DK	37
	SEII_5	LV, HU, AT, BG, FI, RO, LU, MT, FR	29
Government Response Confinement Index	GRCI_1	CY, RO, HR, IT, IE, PT, ES, BE	86
	GRCI_2	EL, EE, LU, AT, SK, SI, PL, NL	77
	GRCI_3	CZ, BG	70
	GRCI_4	FR, HU, DK, FI, DE	65
	GRCI_5	SE	21

outbreak of the pandemic than those of other Member States. In France, the high HSPI score is driven by a relatively high health expenditure and availability of doctors (both were the highest in the EU) and by the relatively high score in the availability of nurses. In Germany, the good score on preparedness is driven by high health expenditure, high testing capacity and the high availability of nurses and hospital beds. Similar to France, in Austria, the relatively high HSPI score is also driven by health expenditure and availability of doctors. Its relatively high score in the availability of hospital beds also affects its HSPI score. Austria also has the highest score on testing capacity in the EU, and its score in terms of availability of nurses is high. It should be mentioned that all the countries that feature in this first cluster scored

relatively low in terms of population structure, indicating a high score in the share of older persons in the country.

Our analysis indicates that health systems were less prepared for the pandemic in Greece, Portugal, Hungary and Croatia. Greece scored low in terms of all indicators, except for health expenditure and availability of beds, where the score was just below the EU average. Portugal, despite its relatively high health expenditure, also scored low for testing capacity and availability of doctors and had a relatively low score for the availability of nurses and hospital beds. This, combined with an observed high share of older persons, was the driving force behind the low HSPI score in Portugal. Finally, in Hungary and Croatia, the low HSPI score results from the low score in financial and medical staff resources, as well as the low testing capacity. This is also the case in Romania, but it does not feature in the first cluster because of its relatively higher score in the population structure dimension.

Regarding government responses to the pandemic, the scores for the GRCI index confirm that the responses of EU governments to the COVID-19 outbreak were drastic. Except for Sweden, the GRCI score for all the countries is relatively high, with very high scores (above 75) observed in more than half of the Member States for which data is available.

The upper clustering results for the GRCI in Table 1 contain the countries where the most stringent measures were adopted, and it includes Cyprus, Romania, Croatia, Italy, Ireland, Portugal, Spain and Belgium. In Cyprus, a very high score (above 90) is observed as regards almost all dimensions, except for the working place closure dimension, where a slightly lower score is observed (75). Romania, Croatia, Italy, Ireland, Portugal and Spain all score very high in terms of school closings, cancellation of public events and home confinement. Most of these countries also score highly (above 90) on restrictions to public events, except Spain, where a relatively smaller score is observed (74). Italy, Portugal, Croatia, Ireland and Spain scored relatively high on workplace closing (scores above 76) whereas Romania scored relatively lower (67). All the countries in this cluster scored relatively lower scores on travel restrictions with only half of them registering scores above the average.

At the lower end of the distribution, Sweden features as the only country in the last cluster. Sweden scored the lowest value in the EU on cancellation of public events and home confinement and a very low score in working place closures and travel restriction. The only dimension on which Sweden scored relatively high was the restriction of gatherings (score 60). Bulgaria, France, Hungary, Denmark, Finland and Germany form another group with high, but still, relatively lower, GRCI scores. For Germany, the lower score arises due to the relatively low scores in working place closing, travel restrictions (both below the average score) and the moderate score in home confinement which was just above average. In Bulgaria, whereas an extremely high score (above 90) is observed for school closing, cancellation of public event and restriction on gathering, the low scores (below 35) on workplace closing and travel restrictions decrease the GRCI. Similarly, Hungary also scores high on school closing and cancellation of public events but also as regards travel restrictions. However, the low score on the restriction of gatherings and the average scores in the remaining dimensions influence the overall GRCI score. Finland scored average on almost all dimensions, except for cancellation of public events, where

it has the highest score in the EU. Similarly, in Denmark, while an average score is observed in most dimensions, a relatively high score is observed in both school closing and restrictions of gatherings.

According to the analysis, the effect on the socio-economic conditions is expected to be particularly adverse in Lithuania, which scored, by far, the highest value in the SEII indicator. This is driven by the relatively high increase expected in unemployment and in the public debt in 2020 and the high decrease expected in GDP and compensation of employees in the same year. Ireland, Spain, Estonia and Sweden form the second group in which a relatively adverse impact on the labor market is expected. In Ireland, this is mainly driven by the increased expenditure in unemployment benefits and the expected decrease in GDP. The same factors, together with a high-expected increase in unemployment, drive the expected deterioration in the socio-economic conditions. In Estonia, the expected negative socio-economic effect can be primarily attributed to the expected increase in unemployment and public debt. In Sweden, the negative effect is mostly driven by the big size of the fiscal package and to a moderate extent by the expected increase in unemployment and the related expenditure for unemployment benefits.

When looking at the SEII, the average effect on socio-economic conditions is not expected to be strong in Latvia, Hungary, Austria, Bulgaria, Finland, Romania, Luxembourg, Malta and France. However, additional insights emerge when looking at the individual indicators in this group. In France, a low score is observed in all indicators except GDP, suggesting a contraction of the economy expected in 2020. Notably, France is expected to register the highest contraction in GDP in the EU in 2020. In Bulgaria and Romania, while a low average score can be observed, the high scores of the public debt indicators show that a relatively high increase in public debt can be expected in 2020. Besides, in both countries, a moderate increase in unemployment is expected, while in Bulgaria it can be accompanied by a decrease in economic activity. Austria, Finland, Latvia and Malta score low in all the individual indicators, with below-average values for all indicators. In Luxembourg, the large size of the fiscal package in 2020 (the highest in the EU) seems to contain the negative effect on the labor market and the related expenditure and, perhaps, helps to control the contraction of the economy.

5 Discussion and conclusion

In 2020, the COVID-19 outbreak led to an unprecedented public health crisis in all the EU Member States. Amid this crisis, governments were called to take measures to address the emerging challenges, based on the best available knowledge and information. In a context of high uncertainty, policymakers opted to implement confinement measures, with varying levels of strictness. However, the implementation of these preventive measures came with adverse consequences in terms of limiting personal freedoms, associated health risks and socio-economic impacts. Thus, a difficult policy trade-off emerged between taking confinement measures and maintaining a process of economic value creation.

Despite the high level of uncertainty surrounding several aspects of the pandemic, it is safe to assume that, before deciding on the type of confinement measures and during their implementation, policy makers took into account the preparedness of their health system to effectively deal with an increasing inflow of infected persons and evaluated the risks such measures would pose to social and economic stability. To study the relationships between these aspects in this paper, we developed three indices that represent respectively: the preparedness of health systems to face the COVID-19 crisis, the strictness of the confinement measures taken by governments and the expected socio-economic impacts on EU countries in 2020. Although these indices do not represent the full underlying realities, they enable us to explore relationships among these aspects in individual Member States and perform comparisons across different countries. Based on this, we can draw some broad conclusions about the relationships between health systems, confinement and socio-economic impacts in the EU.

Overall, we found that stricter confinement measures can be traced back to lower levels of health system preparedness. This confirms our first hypothesis stating that in those EU Member States where healthcare systems were less resilient to the outbreak of a pandemic, governments implemented more strict confinement measures. We also found a relationship linking stricter confinement measures to potentially more adverse socio-economic effects. This confirms our second hypothesis, stating that impacts of confinement measures on the society and economy are more substantial in those countries where confinement measures were stricter. At the same time, some countries with relatively less adverse expected socio-economic impacts are also countries in which health systems seemed better prepared at the beginning of the COVID-19 outbreak. Our analysis further indicates that, at the beginning of the crisis, the EU Member States exhibited a high level of variety in terms of preparedness of their health systems. They differed somewhat less in terms of preventive health measures taken: although differences among Member States could be clearly observed, almost all Member States instated strict confinement measures.

Our results confirm the assumption that the preparedness of the health system is essential for individual countries to respond to the challenges of a public health crisis. It allows to deal effectively with a sudden spike in health care demand and prevents socio-economic costs resulting from nation-wide confinement measures driven by uncertainty. Although uncertainty in a public health crisis will always remain, health system preparedness is a factor that countries can actively manage. When governments have well-prepared health systems (with sufficient resources and testing capacity) at their disposal, they will be able to face a public health crisis, such as the COVID-19 outbreak, with more confidence. This involves ensuring sufficient resources, both financial and physical, for example care beds and medical staff. Such an approach could be combined with confinement measures that could be limited, for example to particular geographical areas, based on the spread of the virus.

However, obtaining and maintaining a prepared health system with resources in stand-by mode and taking confinement measures (even if targeted) is costly. As already discussed in this paper, some countries have less capacity to bear the economic burden of preventive health strategies than others. In the EU, some Member States were able to introduce generous fiscal stimulus packages, while others were

less able to do this, due to a lower level of available fiscal buffers and/or worse borrowing conditions due to lower credit ratings. The feasibility and generosity of long-term support measures for workers and businesses thus differs per country. This calls for an efficient use of resources at the national level, for example by sharing more resources where possible. Alternatively, one could envisage creating a ‘reserve’ of health care resources, that can be quickly mobilized in case of a crisis and maintaining a reserve capacity of supplies.

Although healthcare services fall under the responsibility of national authorities, their capacity to address health care needs can be impacted by EU policies. EU action in the area of public health strengthens and complements national policies, aimed at improving public health, preventing the spread of illness and diseases, the loss of lives and restraining sources of danger to public health. The options for EU action range from encouraging reforms in Member States, to promoting research and improving the complementarity of health services in cross-border areas. According to the European Commission’s country-specific recommendations adopted in May 2020 “continued action is required to limit and control the spread of the pandemic, strengthen the resilience of the national health systems, mitigate the socio-economic consequences through supportive measures for business and households, and to ensure adequate health and safety conditions at the workplace with a view to resuming economic activity.” (European Commission 2020b, p. 2).

An example of such action at the EU level is the continuous monitoring of the COVID-19 pandemic by the European Centre for Disease Prevention and Control, an EU agency aimed specifically at strengthening Europe’s defences against infectious diseases. The European Commission has also funded new research projects, focused on outbreak preparedness and response (European Commission 2020c). Although the EU does not have the competence to manage national health services and medical care directly, it can coordinate national health systems at the EU level and support improvement of health systems through investments. Moreover, the EU can address potential adverse economic effects of a public health crisis. As an illustration of these points, in April 2020, the European Commission and the European Council presented a Roadmap towards lifting COVID-19 containment measures, based on the principles of science and public health, as well as coordination and solidarity between Member States (European Commission and European Council 2020). Already before, shortly after the COVID-19 outbreak, the EU adopted a proposal for the introduction of so-called ‘Green Lanes’ to maintain the European supply chain network by facilitating freight transport to ensure the continuous flow of goods across the EU during the pandemic (European Commission 2020d).

Moreover, the European Commission and European Council have recently adopted a comprehensive recovery plan in response to the COVID-19 crisis, which will provide large-scale financial support to reforms and investments undertaken by Member States (European Commission, 2020e). This plan will help reinforce the public health sector, among other policy objectives, and will help mitigate the socio-economic impact of COVID-19 in the EU through a 750 billion euros instrument. The financing under this instrument will help Member States to strengthen the capacity of their national health systems, facilitating the transition towards higher levels of preparedness for future public health crises. They also have the potential

to assist Member States to address social and economic challenges, in areas such as education, skills, employment, competitiveness and productivity.

The outbreak of the coronavirus pandemic has dramatically changed people's daily lives but also the socio-economic outlook for the years to come. At the same time, the crisis has highlighted the importance of social investment, and in particular crucial segments of the public sector, including health, research and education. To be able to come out of the crisis stronger and better equipped for the future, a coordinated and comprehensive strategy is necessary with strong efforts at both the national and the EU level. The foundations of this approach are already in place. What remains now is to ensure that the momentum will be maintained, and strengthened if necessary, so that the efforts will result in stronger and more resilient societies and economies.

6 Appendix 1. Health System Preparedness Index—Data descriptions

Dimension	Indicator	Definition	Source	Reference year
Testing capacity	Testing capacity	Total Covid-19 tests per thousand	Coronavirus Pandemic (COVID-19) database	2020
Population structure	Median age	The median age of the country's population	Eurostat	2019
	People older than 65	Share of people are older than 65 as a % of the total population	Eurostat	2019
	People older than 70	Share of people are older than 70 as a % of the total population	Eurostat	2019
Doctors	Doctors	Practicing doctors Per 100 000 inhabitants	Eurostat	2016–2017
Nurses	Nurses	Practicing nurses per 1 000 population	Eurostat	2016–2017
Hospital Beds	Hospital beds	Hospital beds per 100 000 inhabitants	Eurostat	2017
	ICU and CCB beds	ICU and CCB beds per 100 000 inhabitants	Rhodes et al. (2012)	2012

Dimension	Indicator	Definition	Source	Reference year
Healthcare expenditure	Healthcare expenditure	Healthcare expenditure as a % of GDP	Eurostat	2017

- *Testing Capacity* The World Health Organization defines a confirmed case as “a person with laboratory confirmation of COVID-19 infection” Verelst et al. (2020). However, each confirmation of a case is based on a test. Reliable data on testing is therefore necessary to assess the reliability of the data that informs us about the spread of the pandemic: the data on cases and deaths. Data on the testing is collected in the Coronavirus Pandemic (COVID-19) database and it is continuously updated. However, it should be noted that the number of tests does not refer to the same in each country. One difference is that some countries report the number of people tested, others report the number of tests (which can be higher if the same person is tested more than once) while other countries report their testing data in a way that leaves it unclear what the test count refers to exactly.¹⁴ More information on data collected in each country can be found on <https://ourworldindata.org/coronavirus-testing#source-information-country-by-country>.
- *Doctors* Physicians (medical doctors) as defined by ISCO 88 (code 2221) apply preventive and curative measures, improve or develop concepts, theories and operational methods and conduct research in the area of medicine and health care. Physicians may be counted according to different concepts such as "practising", "professionally active" or "licensed to practice". Practising physicians provide services directly to patients.
- *Nurses* Practising nurses are those working in the health-care sector (primary and secondary care), including public health institutes and the health insurance institutes.
- *Hospital beds* Hospital beds provide information on health care capacities, i.e. on the maximum number of patients who can be treated by hospitals. Total hospital beds are all hospital beds which are regularly maintained and staffed and immediately available for the care of admitted patients; both occupied and unoccupied beds are covered. Hospitals are defined according to the classification of health care providers of the System of Health Accounts (SHA); all public and private hospitals should be covered.
- *ICU and CCB beds* Intensive care unit (ICU) or critical care unit (CCU) is a special department of a hospital or health care facility that provides intensive treatment medicine. For severe patients with risk of organ(s) failure, patients are provided intensive care unit beds (aka ICU bed) or critical care beds (CCB).

¹⁴ More information on data collected in each country can be found on <https://ourworldindata.org/coronavirus-testing#source-information-country-by-country>.

- *Healthcare expenditure* In these times of Corona virus, it is interesting to know how much is spent on health care. The most recent statistics on current health-care expenditure (public and private) show how expenditure on healthcare varies across the MS of the European Union (EU).

7 Appendix 2. Government response confinement index—Data descriptions

Dimension	Indicator	Definition	Source	Reference year
School closing	School closing	Record closing of schools and universities	Oxford COVID-19 Government Response Tracker	2020
Working place closing	Working place closing	Record closing of workplaces	Oxford COVID-19 Government Response Tracker	2020
Cancel of public events	Cancel of public events	Record cancelling public events	Oxford COVID-19 Government Response Tracker	2020
Gathering restrictions	Gathering restrictions	Record limits on private gatherings	Oxford COVID-19 Government Response Tracker	2020
Travel restrictions	Restrictions on internal movement	Record restrictions on internal movement between cities/regions	Oxford COVID-19 Government Response Tracker	2020
	Restrictions on international travel	Record restrictions on international travel. It applies for foreign travelers, not citizens	Oxford COVID-19 Government Response Tracker	2020
	Close of public transport	Record closing of public transport	Oxford COVID-19 Government Response Tracker	2020
Home confinement	Home confinement	Record of “shelter-in-place” and otherwise confine to the home	Oxford COVID-19 Government Response Tracker	2020

- *School closing* Schools and universities are contexts in which the virus can spread very easily, therefore governments opted to close them. The original scales elaborated by Oxford COVID-19 Government Response Tracker are the following:

- 0—no measure.
 - 1—recommend closing.
 - 3—require closing (all levels).
- .
- *Working place closing.* Governments forced most of the businesses to close or adopting teleworking when possible. Naturally, essential workplaces were the exception as they continue operating under enhanced safety measures in most cases. The original scales elaborated by Oxford COVID-19 Government Response Tracker are the following:
 - 0—no measures.
 - 1—recommend closing (or recommend teleworking).
 - 2—require closing (or teleworking) for some sectors.
 - 3—require closing (or teleworking) for all-but-essential workplaces.
 - *Cancel public events.* Most of countries have cancelled public activities that required the physical presence of people from the beginning of the outbreak. These include from sport and leisure events to international conferences. The original scales elaborated by Oxford COVID-19 Government Response Tracker are the following:
 - 0—no measures.
 - 1—recommend cancelling.
 - 2—require cancelling.
 - *Gathering restrictions.* Private gatherings of people in their homes or public spaces have also been restricted. There is great variation across time and country, as they were among the first measures to be eased. The original scales elaborated by Oxford COVID-19 Government Response Tracker are the following:
 - 0—no restrictions.
 - 1—restrictions on very large events (+ 1000 people).
 - 2—restrictions on gatherings between 101 and 1000 people.
 - 3—restrictions on gatherings between 11 and 100 people
 - 4—restrictions on gatherings of 10 people or less.
 - *Restrictions on internal movement.* Some countries introduced measures restricting citizens' mobility between different regions. As the outbreaks

emerged in cities, governments opted for contain the virus and avoid its spread to other areas of the country.. The original scales elaborated by Oxford COVID-19 Government Response Tracker are the following:

- 0—no measures.
 - 1—recommend not to travel between regions/cities.
 - 2—internal movement restrictions in place.
- *Restrictions on international travel.* Governments implemented restrictions on travelers from specific countries or regions with high risk of infection. These measures vary in degree of strictness and were applied to both nationals and immigrants. The original scales elaborated by Oxford COVID-19 Government Response Tracker are the following:
 - 0—no restrictions.
 - 1—screening arrivals.
 - 2—quarantine arrivals from some or all regions.
 - 3—ban arrivals from some regions.
 - 4—ban on all regions or total border closure
 - *Close public transport.* Most of public transport means were closed at the outbreak and slowly returned to normality under new health and safety measures. The original scales elaborated by Oxford COVID-19 Government Response Tracker are the following:
 - 0—no measures.
 - 1—recommend closing.
 - 2—require closing.
 - *Home confinement* Citizens were asked to remain at home with some exceptions depending to the country. The original scales elaborated by Oxford COVID-19 Government Response Tracker are the following:
 - 0—no measures.
 - 1—recommend not leaving house.
 - 2—require not leaving house with exceptions for daily exercise, shopping.
 - 3—require not leaving house with minimal exceptions.

8 Appendix 3. Socio-economic impact index—Data descriptions

Dimension	Indicator	Definition	Source	Reference year
Economic value added	GDP	Forecasted % real GDP change	European Commission 2020 Spring Forecast ^a	2020
Unemployment	Unemployment rate	Forecasted percentage points change in the unemployment rate (age group 15–74)	European Commission 2020 Spring Forecast ^a	2020
Unemployment benefit expenditure	Unemployment benefit expenditure	Estimated change in unemployment benefits spending as % of total government expenditure	Eurostat + European Commission 2020 Spring Forecast ^a	2017, 2020
Wages	Employee compensation	Forecasted percentage points change in real employee compensation (GDP deflator) in the national currency	European Commission 2020 Spring Forecast ^a	2020
Public debt	Consolidated gross debt	Forecasted % change in consolidated gross debt	European Commission 2020 Spring Forecast ^a	2020
Fiscal package		Total sum (euros) of fiscal measures taken by governments in response to the COVID-19 crisis, as reported by the International Monetary Fund and the International Labour Organisation between April 30 and 4 June, as a percentage of national GDP and excluding loan guarantees	International Monetary Fund + International Labour Organisation	2020

^aUsing the definitions and latest figures available from national sources. Data reporting for the different EU countries is based on the European System of National and Regional Accounts system - ESA 2010 (Eurostat 2013). The forecasts are based on data available up to 23 April 2020.

- *Unemployment benefit expenditure* Eurostat data on unemployment benefit expenditure from 2017 (the last year for which such data was available) was extrapolated to 2019, assuming a linear relationship between the change in unemployment and unemployment benefit expenditure. The figure obtained for 2019 was multiplied by the change in unemployment forecasted for 2020.

- *Fiscal package* Includes fiscal measures introduced by governments in response to the COVID-19 outbreak. Loan guarantees were excluded from this, because their activation is uncertain and this makes it harder to compare socio-economic impacts among MS.

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