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COVID-19: ECONOMIC EFFECTS AND HEALTH CARE PREPAREDNESS

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Abstract

The scope of this research is to determine whether and how the Coronavirus pandemic became an economic crisis, and what role health care systems played in this context. Being, Covid-19, a health emergency, medical facilities have played a crucial role in determining the risk associated with the virus and the extent of the crisis. Given the extreme contagiousness of the virus, medical infrastructures quickly became understaffed and underequipped as a result of the large number of infected people requiring advanced treatments. Thus, revealing their inadequacy.

In the early stages of the epidemic, restrictive measures were implemented in order to reduce contagions, so all non-essential economic activities were halted, determining a drastic recession.

I developed an econometric analysis to examine the relation between the economic crisis and the extent of the pandemic together with the limitations imposed. Results show that as the severity of the pandemic increases the economic recession increases as well, and that the restrictions worsen the economic outcomes.

An additional analysis is developed to estimate the role of health care efficiency. The model suggests the importance of health preparedness in dealing with a health crisis. The number of hospital beds is used as a proxy for health efficiency, and the results show that increasing the number of beds helps mitigate the severity of the economic crisis.

The conclusions drawn by the study highlight the crucial role medical facilities have, emphasizing the importance of restructuring and rethinking the current status quo. Investments and resource allocations should be carefully evaluated to achieve technical and allocative efficiency. Guidelines and protocols should be designed in order to take proactive rather than reactive actions in future similar scenarios and define global coordinated and coherent measures to assure timely and effective solutions.

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I. INTRODUCTION

The world has recently experienced the greatest modern health crisis: the Coronavirus pandemic. The global health concern has radically affected our lives, which have had to adapt to the changes necessary to face the emergency. The Covid-19 epidemic outbroke at the start of 2020 and it was characterized by the World Health Organization as a pandemic. Positive cases sharply rose in March 2020 to then decline in summer, defining the first wave. The second wave, on the other hand, occurred in autumn of the same year. Other fluctuations have occurred up to the present day, which I will analyse in detail in section IV. A. 2. The introduction of Covid-19 vaccines (section II. A.) marked a watershed moment in the crisis, helping to weaken the virus and, most importantly, protecting the most vulnerable from severe symptoms.

This pandemic has been particularly challenging because of certain characteristics that had never been observed in previous epidemics, as discussed in section II. B. The most notable feature has been the implementation of stringent measures, particularly in the initial phase, which forced the economy to freeze. Non-essential businesses and economic activities were halted, and people were invited to leave their homes only if absolutely necessary. This factor has obviously had a significant impact on the economy, leading to an economic crisis as a consequence of the pandemic.

The significant economic impact of the virus prompted me to investigate the relationship between the medical emergency and the economic shock experienced by various countries. In addition to the economic factors, I was particularly interested in researching how the various health care systems that were protagonists in this scenario dealt with the situation, as well as the relevance of their organization in such circumstances. It is difficult to assess health facility preparedness as there is no unique measure, as referred to in section III. A., but it is fundamental to state that countries should strive to provide the best level of medical service possible by allocating resources correctly and managing them efficiently.

During the crisis, one of the most pressing issues was health care saturation and the inability to assist all those in need. The system was under severe strain, and there was a high risk for it to collapse. Infected people who required advanced treatments not always received them and patients with other pathologies were put in standby, postponing and delaying visits and surgeries. Looking into the extreme stress put on facilities and their central role, my question was: did health care systems play a role in the economic crisis?

I therefore selected 27 states, most European Union countries (when data was available) and added similar OECD countries, namely: United States, United Kingdom, Finland, Norway, Canada and Japan; in order to conduct an analysis on them.

The two research questions I canvassed are:

Is there a relation between the economic and the health crisis?

What relevance did health care systems have in the pandemic?

In order to investigate the previously mentioned aspects, an econometric analysis (section IV.) was carried out. The unemployment rate, which reflects the economic impact, is the dependent variable. Other variables were taken into account, such as new cases and deaths, stringency measures and hospital beds. To answer the two questions, and thus determine the extent of the economic crisis caused by the health emergency and all related factors, two different models were developed.

The results showed that, as expected, the higher the strength of the pandemic, therefore the number of cases or deaths, the higher the negative economic impact, thus higher unemployment. Unemployment rate and the number of new positive cases turned out to be positively correlated. The stringency index, which defines the level of restrictions imposed by governments, is positively related to unemployment as well. Hence tighter restrictions caused unemployment to increase because economic activities were reduced and businesses suffered extensive damages, accordingly many were forced to close. (IV. B. 1.)

The second's model outcomes underlined the key role played by health care preparedness in mitigating the severity of the economic crisis. The number of beds was taken as proxy for health care efficiency, and the data shows that having a higher number of hospital beds per thousand people limited the increase in the unemployment rate. Thus, hospital beds are negatively related to unemployment. As an aftermath, adequate and organized medical facilities can play a crucial role in limiting the extent of the economic crisis caused by a pandemic. (IV. B. 2.)

An additional investigation was conducted on health expenditure (IV. D.) to determine whether investments affect economic outcomes such as hospital beds. The findings were unexpected, revealing that health spending is positively correlated with the unemployment rate. The results could have been influenced by an unobserved effect, or, the two variables capture different factors: hospital beds are strictly related to medical facility capacity, whereas spending is more general.

Countries were clearly unprepared to deal with a global crisis, medical resources were insufficient, and there were no clear guidelines or protocols to follow. Governments took independent decisions, determining a lack of coordination and coherence in their actions. In particular, the European Union should define common quality standards, in order to align the different health care systems and introduce guidelines to implement in case of a future pandemic, so that similar scenarios can be addressed in a consistent manner. However, the epidemic is global so it is important that all states are committed to a same vision. In this regard, the World Health Organization is coordinating global vaccine access to ensure that people in developing countries, where vaccines are more difficult

to obtain, receive at least one dose. It is fundamental that the percentage of vaccinated continues to increase to weaken the virus and bring the pandemic to an end.

Undoubtedly the Coronavirus has drastically impacted everyday life, and it will take time to return to the “normality” we knew prior to the crisis. However, many lessons can be drawn, the most important of which is the increased dedication required for health care systems and their efficiency.

II. CORONAVIRUS

A. Overview

On the 31st December 2019 the Chinese authorities alerted the World Health Organization of a cluster of pneumonia cases with an unknown cause, in the Chinese city of Wuhan. The new mysterious disease was determined to be a novel coronavirus initially referred to as 2019-nCoV. The virus turned out to be highly infective resulting in the rapid growth in the number of cases. Therefore, to contain the effect, the Chinese government placed Wuhan in lockdown. The highly contagious virus spread worldwide in about one month, thus the WHO declared a "public health emergency of international concern"[1], and not long after, it characterized the epidemic as a pandemic[2].

In March the infections rose exponentially, leading many countries to implement lockdown measures. A case worth mentioning is Italy. Lombardy, an Italian northern region, was extensively hit by the epidemic, reaching the deadliest Coronavirus hotspot worldwide[3]. The region experienced a huge number of severe cases needing hospitalization, whilst not having enough beds and personnel in health centres. This overwhelming burden suffered by the health system brought the government to implement extreme stringency measures, not only in Lombardy but in the whole country (see figure 1).

During the summer, global cases decreased, and restrictions were loosened, causing a subsequent increase of contagions in autumn 2020, resulting in a second wave of infection.[4]

[1]Press release, *WHO Director-General's statement on IHR Emergency Committee on Novel Coronavirus (2019-nCoV)*, (Jan. 30, 2020), https://www.who.int/director-general/speeches/detail/who-director-general-s-statement-on-ihr-emergency-committee-on-novel-coronavirus-(2019-ncov).

[2]Press release, *WHO Director-General's opening remarks at the media briefing on COVID-19*, (Mar. 11, 2020), https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020.

[3]Crispian Balmer, *A deluge of death in northern Italy*, REUTERS GRAPHICS, (Mar. 25, 2020), https://graphics.reuters.com/HEALTH-CORONAVIRUS-LOMBARDY/0100B5LT46P/index.html.

[4]Robin Muccari, *Coronavirus timeline: Tracking the critical moments of Covid-19*, NEWS, (Jan. 1, 2021), https://www.nbcnews.com/health/health-news/coronavirus-timeline-tracking-critical-moments-covid-19-n1154341. *Key moments of COVID-19 pandemic*, REUTERS, (Dec. 20, 2021), https://www.reuters.com/business/healthcare-pharmaceuticals/key-moments-covid-19-pandemic-2021-12-20/. *Rolling updates on coronavirus disease (COVID-19)*, WORLD HEALTH ORGANIZATION, (Jul. 31, 2020), https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen.

(Figure 1) Change in Italian Population Mobility From 17/02/20 To 01/07/20[5]

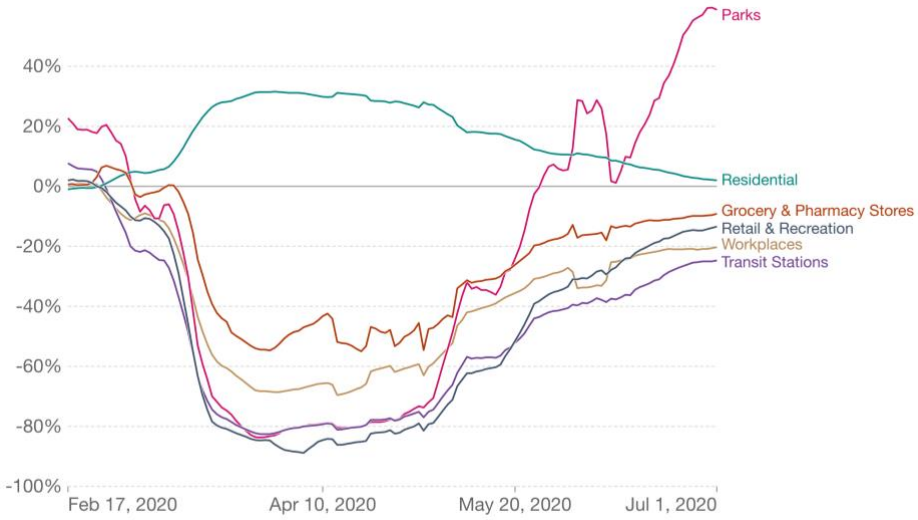
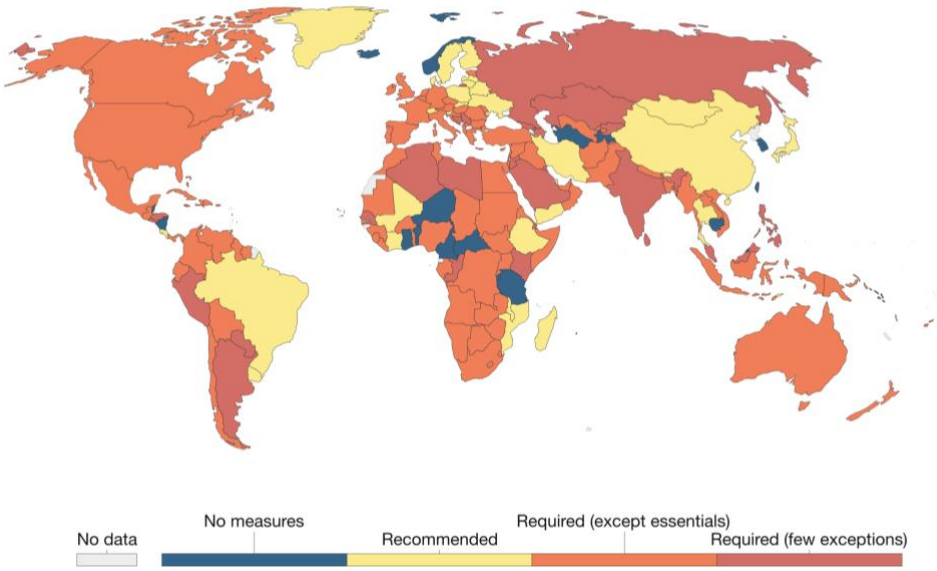


Figure 2 illustrates the global diffusion of stay-at-home measures. The data refers to the 20th April 2020, therefore in the first wave. It is noteworthy that approximately two months after the start of the pandemic, most governments implemented social distancing measures in order to limit the spread of the infection. Even when it was not mandatory, states strongly advised residents to leave their homes only when absolutely necessary.

(Figure 2) Stay-At-Home Requirements, 20th April 2020[6]



[5]*COVID-19: Google Mobility Trends*, OUR WORLD IN DATA, (Last updated 29 May 2022), https://ourworldindata.org/covid-google-mobility-trends. The data shows the change in the Italian's community movement in specific locations relative to the period before the pandemic.
[6]*Id.*

To face the pandemic pharmaceutical companies launched large vaccine clinical trials, in order to find a way to prevent further diffusion and deaths. In December 2020, the first doses of vaccines were administered in the US and in the EU, leading to a mass vaccination campaign. Initially only two doses per person were planned, but the surge of different variants of the virus determined the inoculation of additional vaccine shots in order to have extra coverage. Three doses are now regularly administered in many developed countries and four to individuals with particular health issues. Vaccine supply has been a challenge for the world, because not all countries have an equal access to them. Developing countries (mainly in Africa) have a low percentage of vaccinated population, whilst higher income countries have a great majority of citizens which have had two doses (see table 1). The absence of cohesion and coordination is delaying the world's recovery, allowing new variants to emerge. Latest updates of March 2022 state that 64.4% of the world's population has received at least a dose of vaccine, 11.26 billion doses have been administered since the start of the pandemic, but only 14.5% of low-income countries has received at least one dose[7].

The level of infections is rising especially in Asia and Europe, and some countries are now experiencing the highest level of infection and fatality rate, due to the new Omicron variant which has an elevated rate of infectiousness.[8] The pandemic is not over yet.

(Table 1) Continents' Vaccination Status[9]

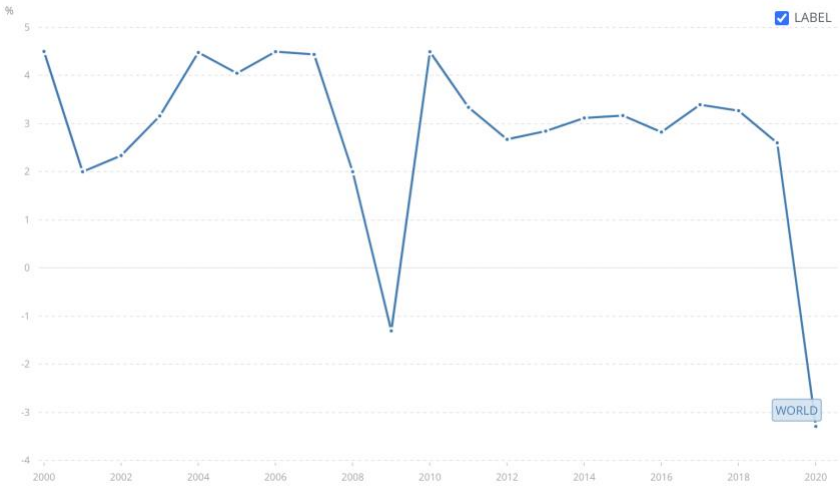
Continent	Number of doses supplied (million)	Number of courses supplied per 100 people	Percent with at least one dose administered	Percent fully vaccinated	Population (million)
Asia	8,428.0	90.6	71.0%	61.5%	4,652.6
Europe	1,557.5	86.9	64.3%	60.7%	896.6
North America	1,152.7	97.2	70.2%	60.9%	592.8
South America	968.7	111.6	78.9%	67.9%	434.0
Africa	761.7	27.8	16.1%	10.9%	1,371.7
Oceania	70.8	82.0	64.4%	59.6%	43.2

[7]*Coronavirus (COVID-19) Vaccinations*, OUR WORLD IN DATA, (Apr. 02, 2022), https://ourworldindata.org/covid-vaccinations.
[8]Press release, *WHO Director-General's opening remarks at the WHO press conference*, (Mar. 23, 2022), https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-who-press-conference-23-march-2022.
[9]*WTO-IMF COVID-19 Vaccine Trade Tracker*, WORLD TRADE ORGANIZATION, (Mar. 1, 2022), https://www.wto.org/english/tratop_e/covid19_e/vaccine_trade_tracker_e.htm

B. Unique characteristics of the pandemic

As previously mentioned, the first stages of the pandemic were characterized by lockdowns. This stringency measure was introduced by a large array of states in order to contain the spread of the virus. Lockdown entails that all non-essential activities are avoided, people must limit social gathering and go out only if strictly necessary. Hence, most of unessential businesses were closed and, when possible, employees practiced home office, in order to minimize risk of contagion. The economy was deliberately put on hold, to safeguard public health. However, this created multiple drawbacks because households and businesses have been subject to high uncertainty and income losses. As an aftermath GDP decline reached unseen levels in the second quarter of 2020 in numerous countries[10]. Figure 3 represents the world's annual percentage change in GDP. As the graph shows, the world has suffered a huge drop in GDP level in a short period of time. From a growth rate of 2.6% if fell to more that -3.3%. The impact was greater than that of the 2008 financial crisis.

(Figure 3) GDP Annual Percentage Growth[11]



To support citizens in the critical period they were living, governments acted to provide liquidity to households through tax payments deferral, fiscal interventions and unemployment benefits, remarkably increasing public debt. Additionally, industrial production suffered a huge shock due to transportation issues, related to imports and exports, and workers' concern for their health, thus refusing to work in precarious conditions. The highly globalized and integrated economies played a crucial role in the pandemic[12]. On one hand for the extreme interdependence between countries,

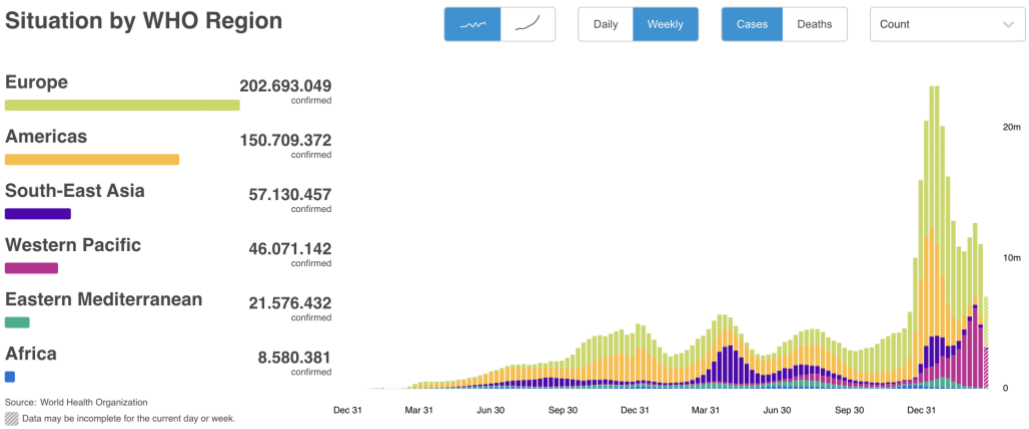
[10]Mendoza E. et al., *A Macroeconomic Model of Healthcare Saturation, Inequality and the Output-Pandemia Tradeoff*, (Nat'l Bureau of Econ. Rsch., Working Paper No. 28247, Feb. 2021).
[11]*GDP growth (annual %)*, THE WORLD BANK, https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG.
[12]Rungcharoenkitkul P., *Macroeconomic effects of COVID-19: A mid-term*, Vol.26(4), PACIFIC ECONOMIC REVIEW, p.439-458, (2021).

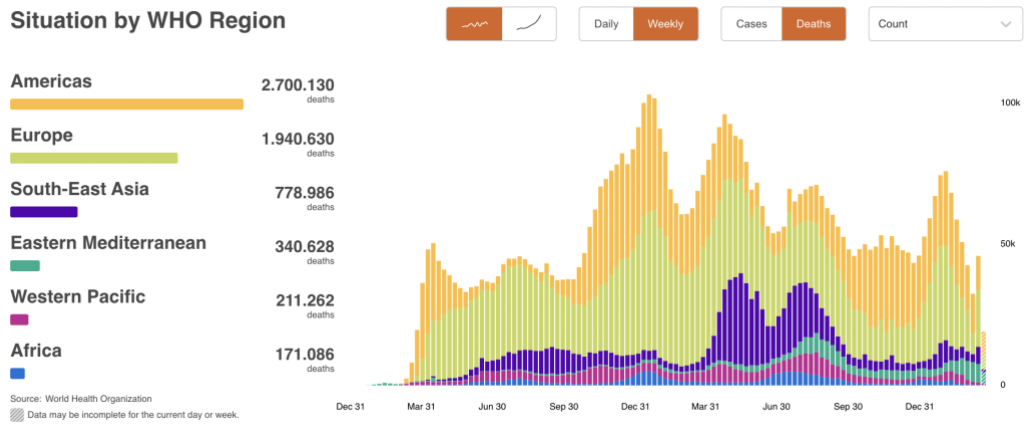
suggested by the large volumes of trade. On the other, the high number of travellers, for leisure or business activities, that have enhanced the spread of the virus around the globe.

In 2021 lockdown measures were eased, countries learned to live with the virus through protocols and protection measures, such as wearing masks and frequently sanitizing. With the introduction of vaccines, the probability of death caused by the infection is drastically reduced, hence the virus will become less aggressive for the majority of the vaccinated, therefore the stress on hospitals will be limited, allowing to go back to "normality". It is thus fundamental that the level of vaccination continues to rise to relieve pressure from the hospitals in order to turn to a new normal.[13]

Figure 4 represents the number of Covid-19 cases in the upper graph and deaths in the lower, from the start of the pandemic in 2019 to today. The two graphs show a similar trend, where the number of infections increase there is a proportional correspondence in number of fatalities. This correspondence is less visible after December 2021. In fact, the level of cases rose and the deaths did as well, however not as much as the infections. This confirms that vaccines are reducing the severity of the epidemic.

(Figure 4) Number of Covid-19 Cases and Deaths[14]





[13] *Id.*

[14] *WHO Coronavirus (COVID-19) Dashboard*, WORLD HEALTH ORGANIZATion, https://covid19.who.int/

III. LITERATURE REVIEW

The Covid-19 pandemic turned out to have an important impact on the economy, as I have mentioned above. The world's economy as a whole has suffered the shock, each country has reacted differently determining the level of damage experienced. Governments facing the unknown virus had to make decisions taking into consideration the trade-off between health and economy, and the multiplicity of stakeholders involved. A variety of factors has determined the diverse outcomes of states, two of them are the efficiency of health care systems and the extent of lockdowns. Some argue that the latter is a consequence of the first; where preparedness was low, to prevent health care saturation and collapse, severe lockdowns were implemented to avoid the spread and the probability of citizens of needing advanced help.[15]

A. Health care efficiency

The number of doctors and nurses is a key factor to define health care performance. Intensive care patients, during the crisis, exceeded the average number, thus reallocation of health workers was necessary to assure patient's the correct treatment. A substantial number of medical personnel, usually dedicated to other activities, was redirected to Covid-19 units. The consequence was that non-urgent surgeries were postponed and treatment for other health issues were not appropriately considered. As an aftermath mortality rate increased drastically even because of non-Covid medical services.[16]

Another consequence of insufficient human resources is the absence of substitutes in case of infection, considering that hospitals and health facilities are hot spots in terms of risk of infection. In case of contagion, health workers had to undergo isolation, further increasing the need of human resources.

The lack of resources and shortage of capacity have increased the demand of essential health goods, resulting in higher relative prices of goods and services, worsening an already critical situation. Therefore, having an adequate preparedness in terms of financial and medical resources is

[15]Aristodemou, K. et al., *The COVID-19 crisis in the EU: the resilience of healthcare systems, government responses and their socio-economic effects*, 11, EURASIAN ECON REV, 251–281 (2021).
[16]*See* Mendoza E. et al., *supra* note 8.

crucial to limit negative effects. The quality of health care is a fundamental basis, but the real advantage is given by efficiency, namely, how resources and cost are handled in the process.[17]

In order to define a health care system efficient, it should be characterized by both technical and allocative efficiency.[18]

Technical efficiency is concerned with resources and health outcomes; hence it is achieved when the maximum level of output is produced with the minimum level of input. It is how the objectives are accomplished in order to optimize production. Therefore, it is closely related to cost effectiveness.

Allocative efficiency relates to how the different inputs interact with each other to reach the best outcome, providing the higher possible welfare to the community. The maximum allocative efficiency is gained when reallocating resources there is no increase in total benefits.[19]

In order to define the level of health care efficiency numerous indicators can be evaluated such as: number of human resources, number of ICU beds, health infrastructures, health expenditure. Accordingly, there are different evaluations of health care efficiency and preparedness, not always providing the same results.

The Global health security index (GHI) is an assessment and benchmark of health security and related capabilities of 195 countries.[20] Aristodemous et al.[21] have pursued a study identifying the level of health care preparedness of European countries, through a health system preparedness index. The two indexes are quite in line, even though there are some discrepancies. Aristodemous et al. suggest that the most prepared European countries are France, Germany, Slovenia and Austria. France, Slovenia and Germany are between the 11th and the 14th position in the world-wide assessment, but there are other European countries before them such as the Netherlands, Sweden and Denmark. The least prepared in the EU analysis were Greece, Portugal, Hungary and Croatia. In the GHI Portugal is ranked higher than Austria, which is within the top ranked in the European study.

Another evaluation of health care efficiency was brought out by Lupu & Tiganasu[22], presenting further differences. The analysis has been divided into first and second Covid wave. Taking into

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[17]Welfens P., *Macroeconomic and health care aspects of the coronavirus epidemic: EU, US and global perspectives*, INT ECON ECON POLICY, Welfens P., *Macroeconomic and health care aspects of the coronavirus epidemic: EU, US and global perspectives*, 17 (2), INT ECON ECON POLICY, 295-362, (2020).

[18]Shiell A., *Health economic evaluation*, 56 (2), JOURNAL OF EPIDEMIOLOGY AND COMMUNITY HEALTH, 85-88, (2002). Palmer S. and Torgerson D., *Economic notes: definitions of efficiency*, 318, BMJ, 1136, (1999). Kirigia J. et al., *Measurement of Technical Efficiency of Public Hospitalsin Kenya: Using Data Envelopment Analysis*, 26, JOURNAL OF MEDICAL SYSTEMS, 39-45, (2002).

[19]*Id.*

[20]ELIZABETH E. CAMERON ET AL., GLOBAL HEALTH SECURITY INDEX: BUILDING COLLECTIVE ACTION AND ACCOUNTABILITY, 5, 20-29, (2019). *See also* JESSICA A. BELL AND JESSICA B. NUZZO, GLOBAL HEALTH SECURITY (GHS) INDEX 2021, ADVANCING COLLECTIVE ACTION AND ACCOUNTABILITY AMID GLOBAL CRISIS, (2021). *See also* GHS INDEX, https://www.ghsindex.org/.

[21]*See* Aristodemou, K. et al., *supra* note 13.

[22]Lupu D. and Tiganasu R., *COVID-19 and the efficiency of health systems in Europe*, 12, HEALTH ECONOMICS REVIEW, (2022).

consideration the mean of the two values of efficiency calculated, the highest are those of Denmark, Finland and Estonia, which are respectively 8th, 10th and 29th in the GHI.
Hence there is no universal measure of health care preparedness or efficiency, but rather it depends on how it is defined.

B. Previous related studies

Different studies have been conducted to analyze how the difference in health care systems can influence the economy and the society.

The study performed by Mendoza et al.[23] assesses the statistical correlation between health system preparedness, lockdown stringency, Covid infection and death rate, with the GDP drop (the dependent variable). The results show that all the variables are significant. The proxies for health resources and the depth of stringency measures are critical in determining the extent of the recession, even more than Covid infection and death rate. In the analysis hospital beds have the largest positive impact on GDP growth. stringency is negatively correlated with GDP, therefore when severity of lockdowns increases it decreases.

In order to have an efficient system, as previously stated, costs and resources should be correctly allocated. Therefore, ceteris paribus, a more efficient health system should necessitate lower investments and have a better outcome in terms of mortality rate due to Covid. Blondel and Vranceanu[24] studied the relation between health expenditure and Covid mortality rate. In the analysis Covid-19 death rate is the depend variable, whilst health related indicators,[25] circulation of the virus and macroeconomic variables[26] are the independent ones. The unexpected results revealed that there is a positive relation between health expenditure and death rate, thus a higher expenditure will lead to a higher mortality rate. There could be an effect of an unobserved variable (unobserved efficiency of health care), an inadequate instrumental variable or a heterogeneity in Covid death reporting method. It may be intuitive to believe that a higher expenditure in health would lead to a higher number of resources and quality, thus increasing efficiency, but the contrary appears from the data. Other aspects could have determined the results such as the optimization of investments and the population average demand for services (level of diseases and mean age). These aspects may not have been correctly taken into account in the study.

[23] *See* Mendoza E. et al., *supra* note 8.
[24] Blondel S. and Vranceanu R., *COVID-19 mortality and health expenditures across European countries: the positive correlation puzzle*, (Working paper hal-02920258v2, Aug. 2020).
[25] Health indicators are: expenditure, age, hospital beds and medical doctors.
[26] Macroeconomic variables are: real GDP per capita, population and public debt percentage of GDP.

In an analysis prior to the outbreak of the pandemic, Darvas et al. had stated that: "countries reach different outcomes with the same levels of spending,"[27] due to their differences in other qualitative and quantitative health care systems' features. Furthermore, they concluded that, increasing low levels of spending will increase health outcomes, however once a certain level of expenditure is reached (around 2000-3000 health-specific purchasing power parity per capita), health outcome improvements are not frequently observable.

Referring back to Blondel and Vranceanu, the test confirms the powerful negative relation between resources and deaths, together with the essential role played by age, meaning that the elderly have a greater probability of death in case of contagion.

Estimating the drivers of efficiency, Lupu & Tiganasu have investigated the three Covid-19 periods[28] (first wave, relaxation period and second wave), in order to identify the difference in relevance of influencing factors, in the different phases.[29] In the first wave, efficiency is negatively related with comorbidity, population age and population density, highlighting the fact that a higher percentage of elderly is associated with a larger diffusion of sickness, negatively affecting the fight against Covid. In the relaxation phase, efficiency is positively correlated with government effectiveness, thus actions taken to contain the virus and to regulate everyday life, have had a decisive role. In the second wave, population density preserves its key role, whilst education is introduced. The amount of knowledge and experience gained in the earlier stages is crucial to face the pandemic in the correct way limiting trial and error.

It has been shown that, generally, per capita income is positively correlated with demand for health care services, therefore, a higher average health will generate a higher real GDP per capita.[30] Despite this, in the first months of the pandemic higher income countries have counted a higher number of deaths with respect to lower income ones, namely US, UK, Italy and Spain. This discrepancy could be explained by the fact that higher income citizens tend to travel more, for business and leisure purposes, to international as well as domestic destinations. Movements could have implemented the spread of the epidemic.[31] Moreover, stricter lockdowns were implemented in countries which were less prepared. During the first wave, the eastern European countries, which have weaker systems, introduced full lockdowns immediately. Western countries which were reluctant to the virus spread, delayed action and turned out to have larger effects despite their higher

[27]Darvas Z. et al., *The macroeconomic implications of healthcare*, Issue 11, BRUEGEL POLICY CONTRIBUTION, (2018).
[28]*See supra* Part I.a.
[29]*See* Lupu D. and Tiganasu R, *supra* note 20.
[30]*See* Welfens P., *supra* note 15.
[31]Giang T. et al., *COVID-19: A Relook at Healthcare Systems and Aged Populations*, 12 (10), SUSTAINABILITY, (2020).

preparedness. In the second wave, eastern states revealed their weakness and had a higher death rate caused by inadequate medical infrastructures and personnel.[32]

In addition, it has been found that stricter confinement measures influence the extent of socio-economic effects, in terms of GDP, wages, public debt, unemployment rate, fiscal packages and unemployment benefits.[33] Thus, impact on socio-economic factors was more consistent in countries where stricter lockdowns were implemented. These aspects underline specific weaknesses of individual countries, that were amplified due to the crisis, determining the intensity of damage suffered. Another aspect worth mentioning is that countries which had minor repercussions on socio-economic aspects tend to have a more prepared health system.

[32] *See* Lupu D. and Tiganasu R, *supra* note 20.
[33] *See* Aristodemou, K. et al., *supra* note 13.

IV. EMPIRICAL ANALYSIS

The Covid-19 pandemic, as formerly analyzed, has caused a significant economic shock. I am therefore going to canvass the relation between the health crisis and the economic one, to determine the actual impact it has had and is continuing to have. Additionally, I will examine if the extent of the epidemic varied across countries depending on their health care system adequacy and preparedness.

A. Variable Description

The study I have conducted refers to 27 OECD[34] countries that are: Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Luxemburg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, United States.
The selected countries include the vast majority of European Union members, depending on the data available, and other states that share similar characteristics.
A consistent number of measures is needed for each variable to correctly estimate the relations I have explained. Therefore, monthly data is the best option, considering that the pandemic started two years ago.
For each country the following data was collected and analyzed.

1. Economic Variable

The economic variable I have examined is the unemployment rate. The unemployment rate is the percentage of unemployed in the labor force. The unemployed are individuals who are not employed but are actively looking for a job and the labor force is the sum of employed and unemployed individuals. The unemployment rate, thus, is an indicator of the labor market performance.

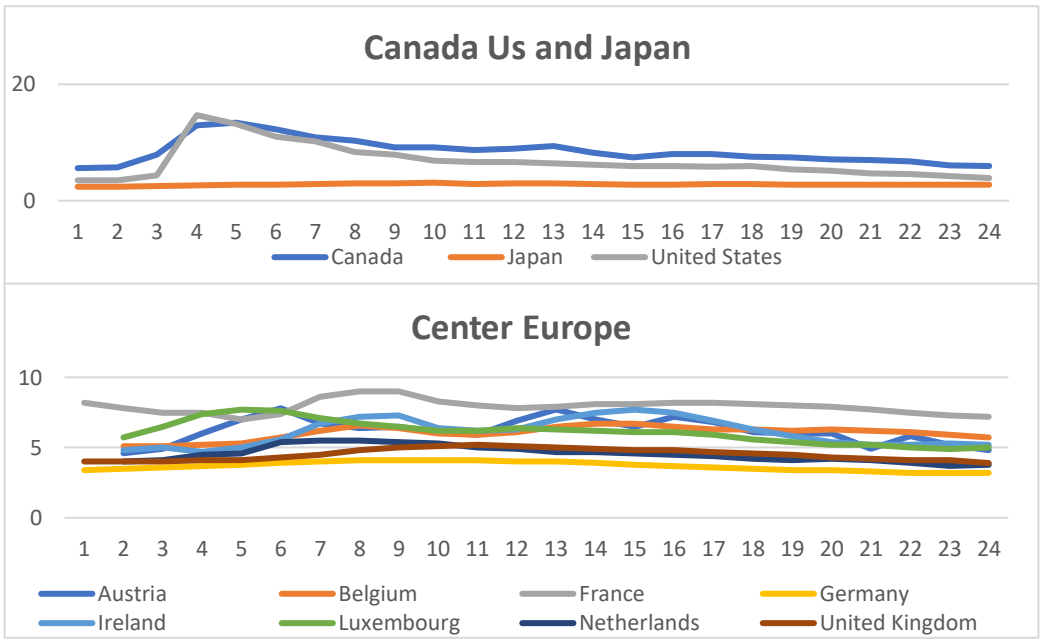
This variable is a valid proxy to evaluate the extent of the economic crisis, because, as referred to in section II. B., the implementation of stringency measures, such as lockdowns or movement limitations, has affected the production level. Numerous businesses were forced to close because of the restrictions, and others due to the reduced volumes of activities were forced to reduce inputs, such as human work force.

[34]OECD: Organization for Economic Co-operation and Development, is a group of 37 member countries, highly developed economies, that shape policies on development economic and social matters.

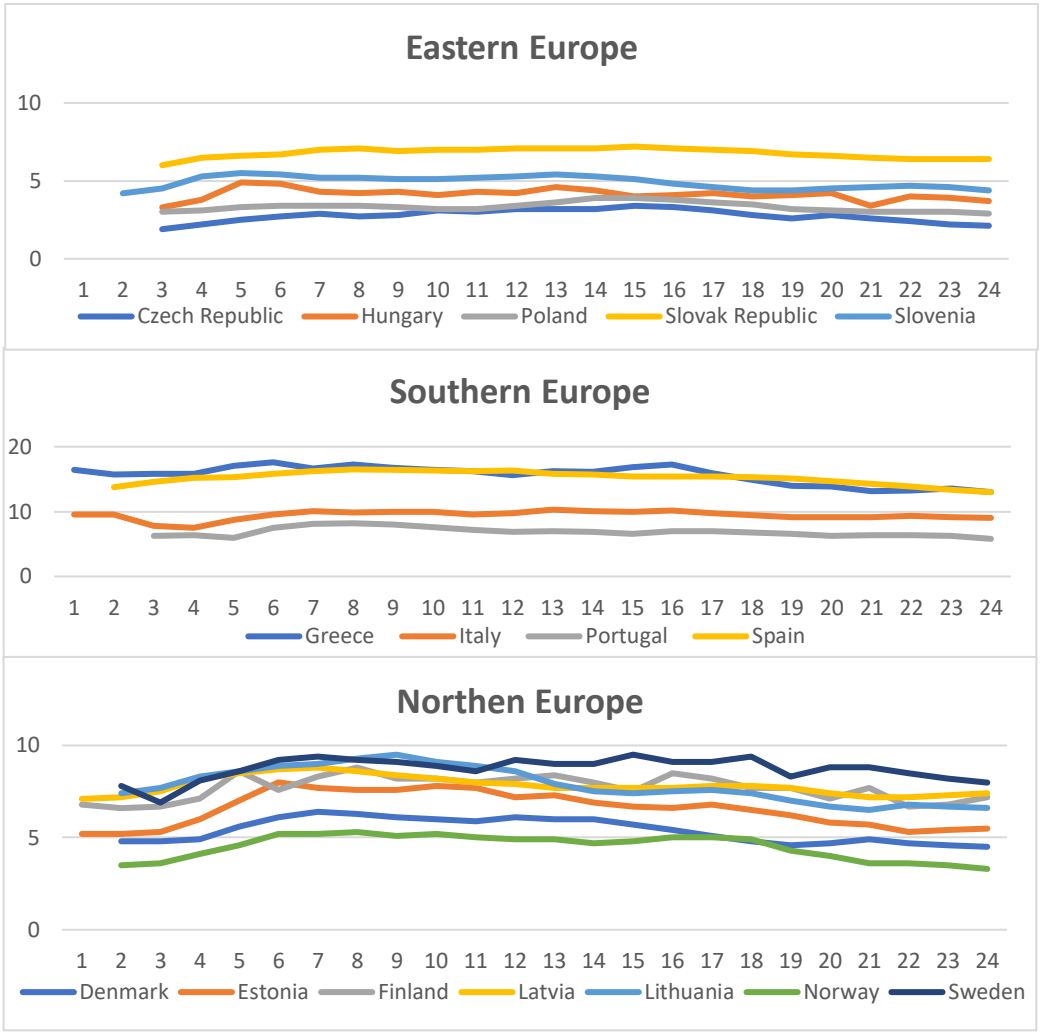
Monthly figures were available on the OECD database[35] for the different countries taken into consideration. The following tables represent the monthly unemployment rate per country, from January 2020 to December 2021. I have divided the countries based on geographical areas in order to have a clear view of the trends.

The data (see figure 5) shows that Spain and Greece as well as the United States and Canada have had the highest unemployment rates, that reached more than 15%. The countries which had lower rates were Japan, that had a very stable rate throughout the two years, and eastern European countries such as Czech Republic and Poland. In April 2020 the unemployment rate reached a peak in US and Canada, other countries experienced an increase later on in May and June, such as eastern and northern European countries and the United Kingdom. France witnessed a fall in the rate in May and a subsequent increase in August. Most central European states showed a second peak in the first quarter of 2021. At the end of the second year a decreasing trend is seen in the vast majority of countries.

(Figure 5) Unemployment Rate From 01/2020 To 12/2021



[35]OECD STATISTICS: https://stats.oecd.org/.



2. Number of New Cases and New Deaths

To evaluate the intensity of the pandemic, I have used the number of new cases and deaths. The number of new cases measures the number of new individuals that resulted positive to Covid tests. The number of new deaths is the number of deceased Covid-positive individuals.

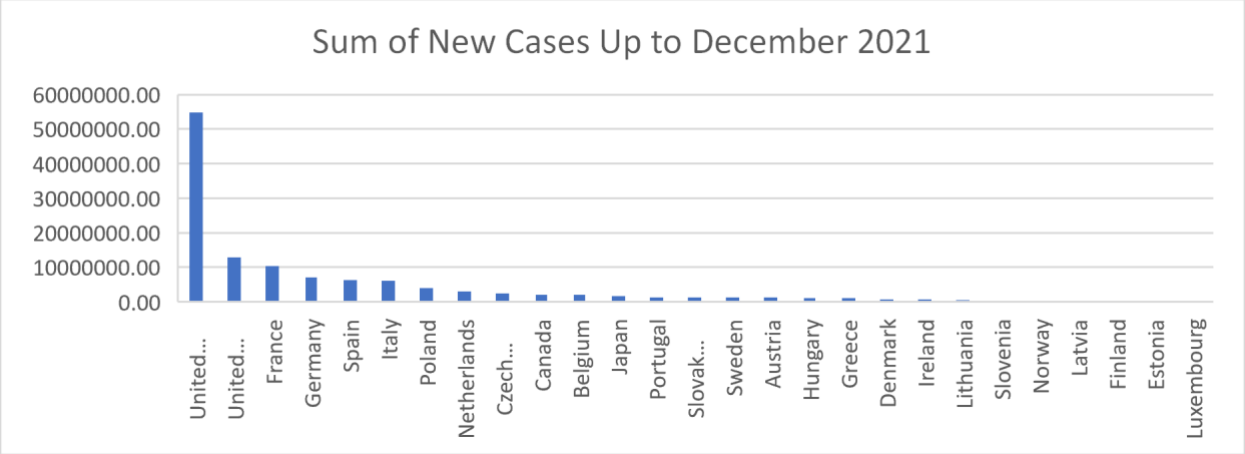
Daily data was available, therefore the new cases per day were summed in order to have monthly figures to interact with the economic variable. The same applies to the number of deaths. The data was retrieved from Our World in Data's Covid-19 database[36].

In the histograms below, I have represented overall cases from the start of the pandemic to December 2021 and the mean population, in order to view the infectiousness in relation with the size of the population. The United States count the highest number of cases, 54.8 million, and population as well, 330 million. Japan has a considerable population, 130 million, but the number of cases was

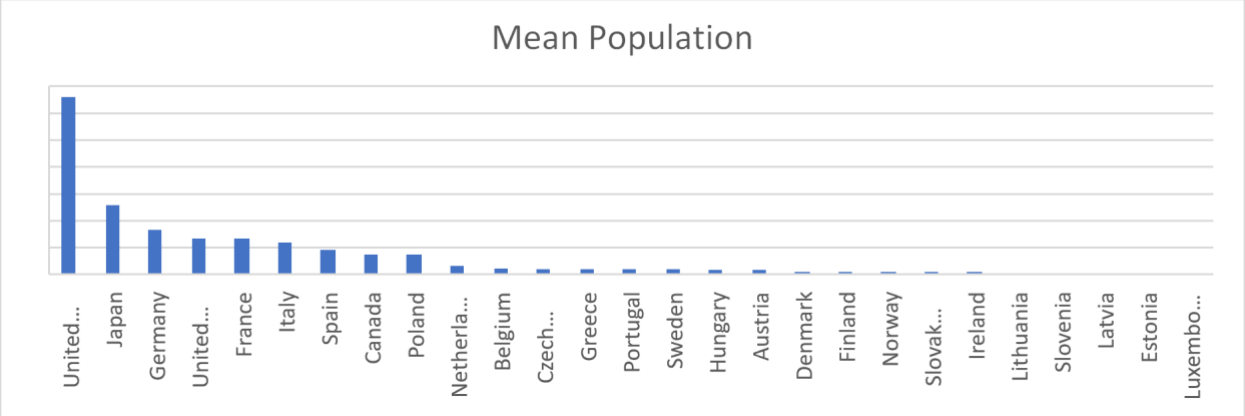
[36] OUR WORLD IN DATA, *Coronavirus Pandemic (COVID-19)*, https://ourworldindata.org/coronavirus#explore-the-global-situation.

limited, 1.7 million, with respect to the other countries analyzed. France and the United Kingdom reached and exceeded 10 million cases, whilst the remaining states counted lower infections.

(Figure 6) Total Cases From 01/2020 To 12/2021

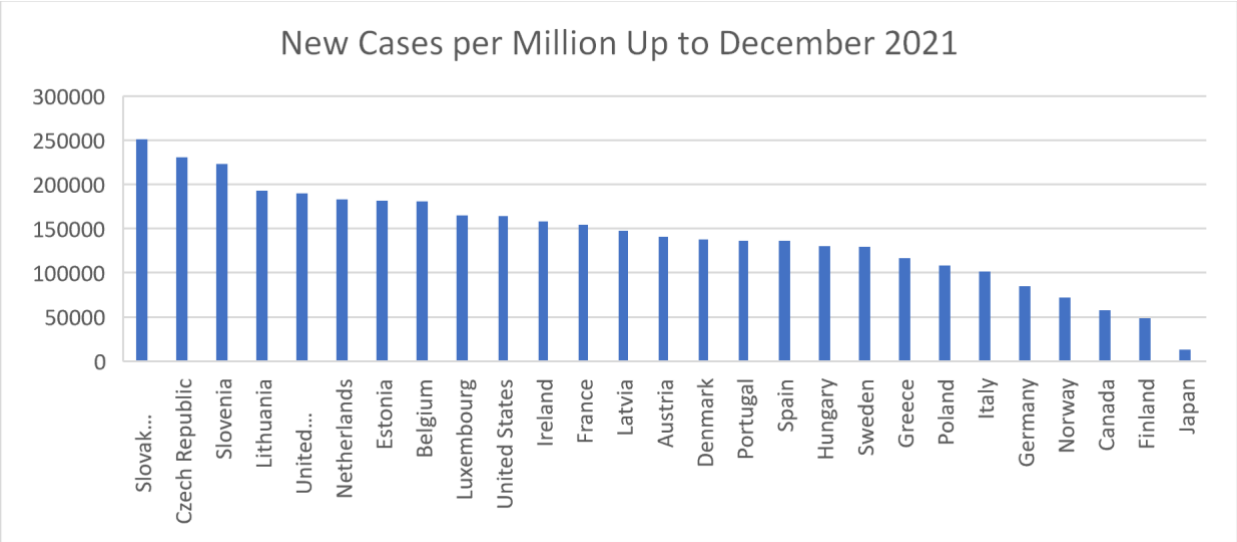


(Figure 7) Mean Population



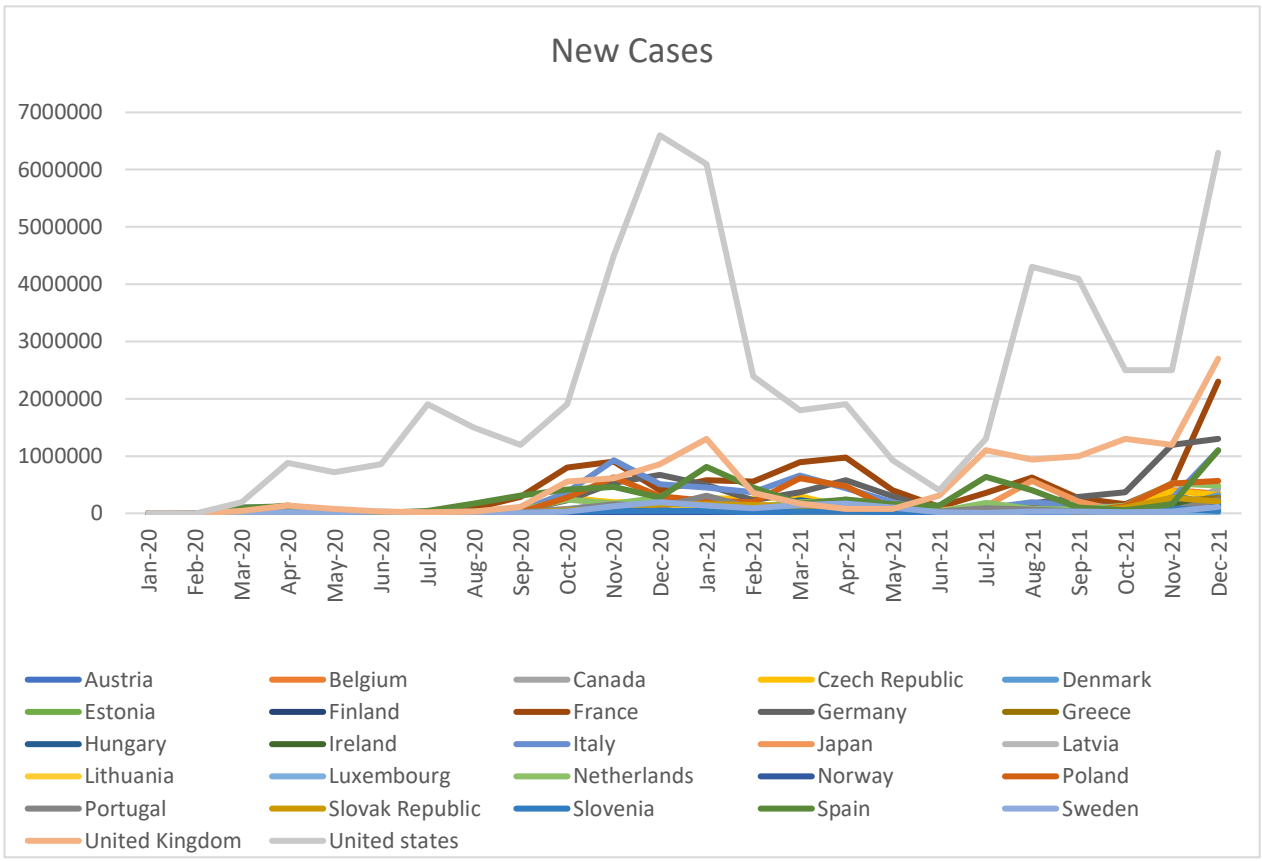
Taking into consideration the number of new cases per million, therefore normalized for the population, the infectiousness and the strength of the virus on each country can be analyzed more accurately. Figure 8 shows that the most hit country has been the Slovak Republic and the least is Japan, that as previously underlined has a large population with relatively low cases, and thus has had a low level of infectiousness with respect to the other states. The United States, on the other hand, counts the highest number of total cases having the most extensive population, nevertheless it is not the most hit country when taking into consideration cases normalized for the population, namely it takes the fifth position (see figure 8) counting about 164 thousand cases per million individuals.

(Figure 8) New Cases per Million From 01/2020 To 12/2021

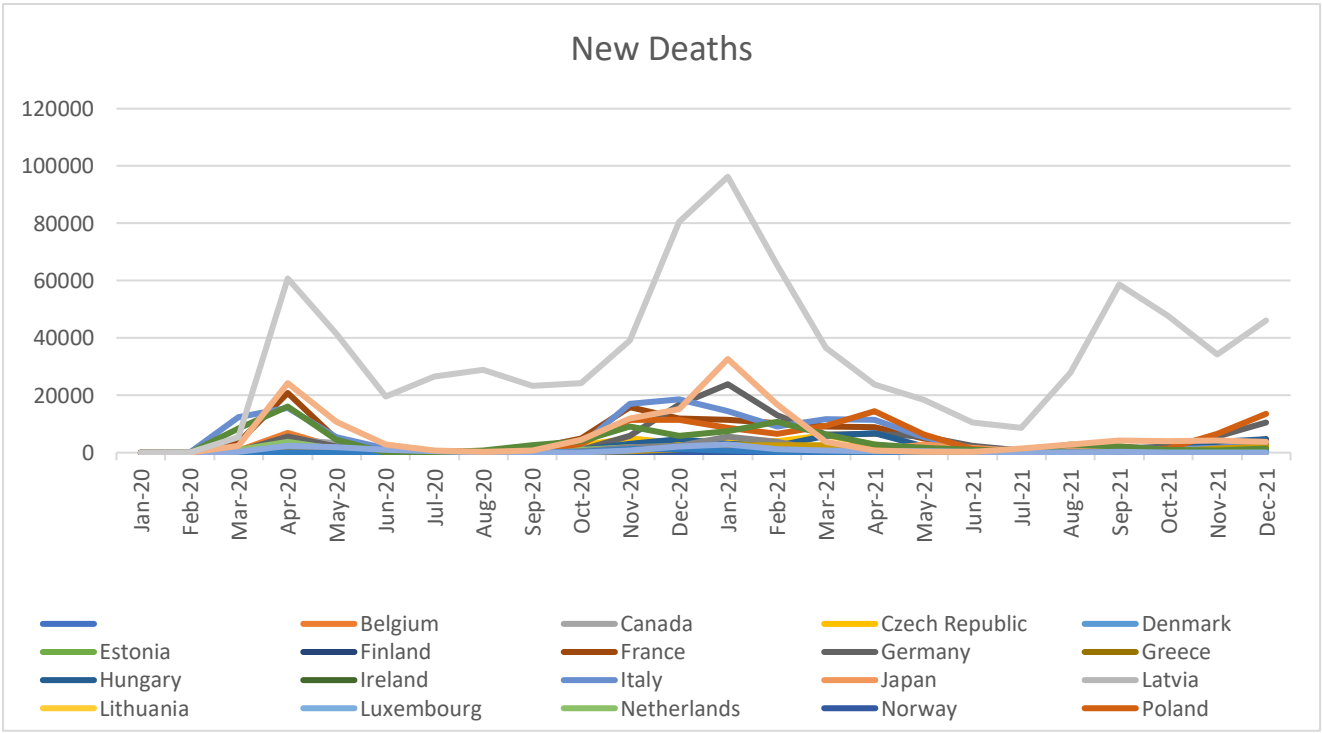


Figures 9 and 10 show the total new cases and new deaths of each country in the sample for each month. The number of positive individuals is considerably higher than deaths, however they follow a similar trend. The first peak was in April where 88 thousand people were infected in the US and 60 thousand deceased. March to May was defined the first wave, where the virus spread rapidly, and deaths grew exponentially. In summer 2020 cases and deaths fell. In September the second wave started, hitting maximum levels of daily new cases in most countries. Deaths sharply rose as well in the last quarter of 2020. The spread of the virus marginally diminished in summer 2021, particularly in June, to surge again at the end of 2021. Deaths, on the other hand, gradually declined in May 2021, and stabilized at low rates. At the end of the year United states, Poland and Hungary experienced an increasing trend in deaths, but the rest of the countries did not.

(Figure 9) Monthly New Cases for Individual Countries



(Figure 10) Monthly New Deaths for Individual Countries



3. Stringency index

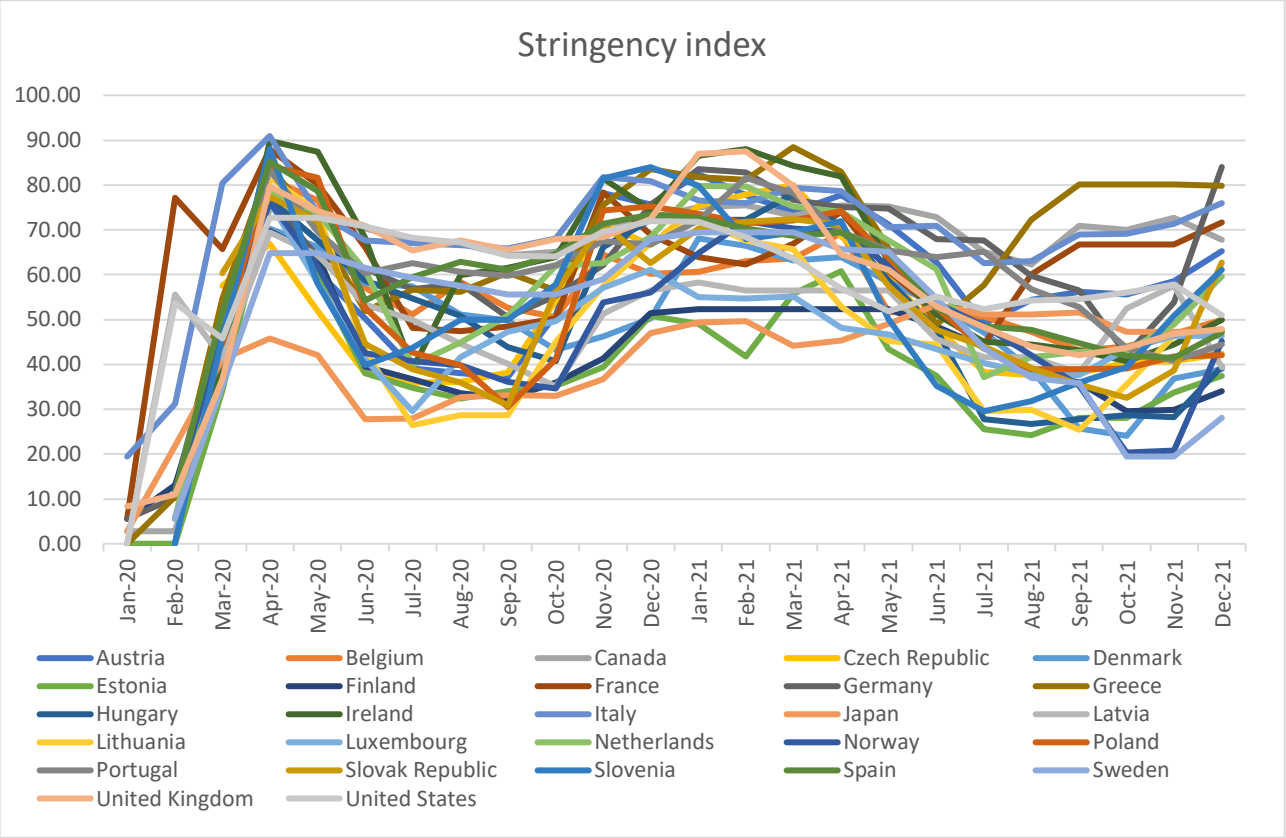
The stringency index is a measure that defines the extent of policies taken by governments to contain the spread of the virus. One of the main issues deriving from the disease was the strong stress applied on health care systems. A portion of the numerous infected people needed hospitalization and medical centers were not ready for the large overflow of patients. Number of beds and medical personnel were lower than demanded, therefore an enormous strain was put on medical facilities. Therefore, to avoid the collapse of health systems, governments deployed policies to limit the spread of the virus in order to reduce the pressure on them.

The index is calculated by The Oxford Coronavirus Government Response Tracker project[37]. It depends on nine response metrics: school closures; workplace closures; cancellation of public events; restrictions on public gatherings; closures of public transport; stay-at-home requirements; public information campaigns; restrictions on internal movements; and international travel controls. It is calculated as the mean of the nine indicators and it can take values from 0 to 100, the higher the value the higher the stringency measures.

Restrictions were applied to all of the countries considered, from January or February and rocketed, reaching maximum levels for most countries, in March and April. Slovenia and Ireland have the highest score reaching 90 and Sweden is the European country with the lowest measures taken, scoring about 65. Japan stands out for the low limitations, in March it scored around 45. Restrictive policies were loosened in the third quarter of 2020 and soared back up between the end of the first year and the start of the second. The values steadily declined in the second half of 2021 for most states, some exceptions are: Greece, Canada, Italy and France. In December the values were significantly increasing again.

[37]OxCGRT, *Covid-policy-tracker*, https://github.com/OxCGRT/covid-policy-tracker/blob/master/documentation/index_methodology.md.

(Figure 11) Monthly Stringency Index for Individual Countries



4. Hospital Beds

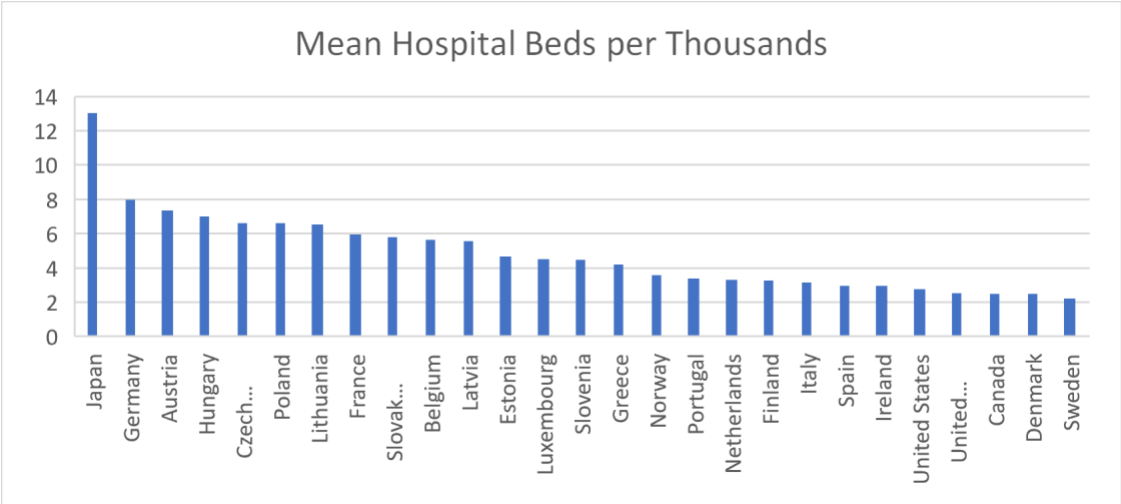
As discussed in section II. A., health care efficiency and preparedness can be evaluated in different ways and there is no canonical method to do so. In my analysis, as proxy of health care effectiveness I have defined the number of hospital beds[38]. The variable represents the number of hospital beds per thousands and it is time invariant, that implies that the value is constant for each country.

In order to examine health care role in the crisis, this variable in the regression will be interacted with the number of cases, this will be discussed in detail later (in section IV. B. 2.).

The data in figure 12 reveals that Japan has a very high number of beds per thousand compared to the other countries, around 13, whilst Sweden has the least, just above 2. Spain, Ireland, US, UK and Canada scored between 2 and 3. Most of the remaining countries have values between 4 and 8.

[38] *See supra* note 34.

(Figure 12) Mean Hospital Beds per Thousand for Individual Countries



B. Model Analysis

In this study I am going to analyze two different questions.
The first is if the extent of the economic crisis depends on the magnitude of the pandemic and therefore on the restriction measures that had to be implemented due to the health issue.
The second is if the economic recession was mitigated by the preparedness of health care systems and therefore their efficiency.

1. Economic and Health Crisis

The econometric model used in order to investigate the relation between the health and economic crisis is the following:

(Equation 1) $Y_{m,a,c} = \beta_0 + \beta_1 ln\_new\_cases_{m,a,c} + \beta_2 stringency\_index_{m,a,c} + \lambda_m + \lambda_a + \lambda_c + \varepsilon$

The dependent variable is the economic one, that is unemployment rate, referred to as *unemp_rate.* Through the econometric analysis, the impact of the pandemic on the rate will be canvassed. *ln_new_cases* represents the independent variable referring to the number of cases, that identifies the strength of the pandemic. A logarithm has been applied to the initial variable *new_cases_per_million* in order to normalize the data. The second independent variable is the *stringency_index* that

determines the level of restriction measures, as discussed above in section IV. A. 3. The mentioned variables all have three dimensions: *m*, *a* and *c* respectively month, year and country.

m, *a*, and *c* are included in the regression as dummy variables, namely that take values 0 and 1. They define subgroups of the sample, because they assume value 0 when they indicate the control group and 1 if they indicate the tested group, therefore defining categorical effects. *m* and *a* define the time fixed effects, whilst *c* the country fixed effects.

In order to examine the economic impact, the coefficients β_1 and β_2 will be estimated through the regression. They identify respectively the impact of new positive individuals and of limitations imposed by the government on unemployment rate.

The data (see table 2) illustrates that β_1, the coefficient referred to *ln_new_cases* is positive and statistically significant. This implies that the increase of new cases will determine the higher level of unemployment rate. Therefore, the economic shock is affected by the diffusion of the virus.

The second coefficient β_2 is positive and statistically significant as well. This implies that the higher the stringency measures, the higher the unemployment rate.

The results are as expected. The extent of the pandemic has largely influenced the economic outcomes, and where restrictions were higher the economy faced larger consequences because the economy was put on hold.

To support the results another analysis was developed, considering a different variable to define the strength of the epidemic, new deaths per million. The model is defined as follows:

(Equation 2) $$Y_{m,a,c} = \beta_0 + \beta_1 ln\_new\_deaths_{m,a,c} + \beta_2 stringency\_index_{m,a,c} + \lambda_m + \lambda_a + \lambda_c + \varepsilon$$

The logarithmic function was applied on deaths as well in order to normalize the data, as previously done with ln_new_cases.

In this case, as represented in table 2, the relation between deaths and unemployment, β_1, remains positive but is not statistically significant. Despite not being significant, the relation underlined, between economy and health, is positive both considering deaths and cases, therefore it can be stated that the health crisis has a negative impact on the economy.

(Table 2) Economic and Health Crisis' Regression Solutions

Dependent Variable:	*Unemp_rate*	*Unemp_rate*
ln_new _cases	0.147 (0.034) ***	
ln_new_deaths		0.055 (0.047)
Stringency_index	0.010 (0.003) **	0.011 (0.040) **
Fixed effects		
Country FE	Yes	Yes
Month FE	Yes	Yes
Year FE	Yes	Yes

(* 10% significance level, ** 5% significance level, ***1% significance level. No symbol is found where the value was not statistically significant, therefore the significance level was higher than 10%, being less accurate but useful to understand the impact of deaths that follow the same trend as those of cases)

2. Relevance of Health Care Preparedness

The model used to examine the second question, namely, if health care systems' preparedness has limited the economic impacts of the pandemic, is as follows:

$$\textit{(Equation 3)}\ Y_{m,a,c} = \beta_0 + \beta_1 ln\_new\_cases_{\ m,a,c} + \beta_2 new\_cases\_beds_c + \beta_3 stringency\_index_{m,a,c} + \lambda_m + \lambda_a + \lambda_c + \varepsilon$$

The dependent variable is, as formerly, *unemp_rate* defining the extent of the economic shock. The first and the last independent variables are defined as above (section IV. B. 1.). In this model a new variable appears: new_cases_beds. This variable is an interaction between *ln_new_cases* and *ln_hospital_beds_per_thousand*.

The variable *hospital_beds_per_thousand* is a constant characteristic of each country, hence it has no time dimension, yet only the country one. In order to capture the effect of health facility preparedness in relation with the magnitude of the virus on the economy, the interaction term was considered. Such aspect is represented by β_2.

The results (see table 3) reveal that consistently with the previous regression, new cases are positively related with unemployment, such as stringency measures. Both β_1 and β_3 are statistically significant. β_2 is significant as well, however it is negative. This entails that a higher number of beds reduces the unemployment rate. In other words, the higher spread of the virus, therefore the extent of the pandemic, negatively affects the economy, for instance increases the unemployment rate, and the latter is mitigated if the number of beds is considerable. Hospital beds are a proxy for health care preparedness in the model, thus confirming the hypothesis that a more prepared health system limits the economic shock caused by the epidemic.

As for the previous case (section IV. B. 1.), I will analyze the same model referring to deaths instead of cases.

$$\textit{(Equation 4)}\ Y_{m,a,c} = \beta_0 + \beta_1 ln\_new\_deaths_{\,m,a,c} + \beta_2 new\_deaths\_beds_c + \beta_3 stringency\_index_{m,a,c} + \lambda_m + \lambda_a + \lambda_c + \varepsilon$$

In this case neither β_1 nor β_2 are statistically significant (see table 3), but the coefficients have the same sign as in the model which considers new cases. Even if the analysis is not robust enough, the outcome is aligned with the previous results. Stating the importance of health care efficiency in limiting the negative impacts of the health crisis.

(Table 3) Relevance of Health Care Preparedness' Regression Solutions

Dependent Variable:	*Unemp_rate*	*Unemp_rate*
ln_new _cases	0.226 (0.061) ***	
ln_new_deaths		0.093 (0.149)
New_cases_beds	-0.053 (0.030)*	
New_deaths_beds		-0.024 (0.073)

Stringency_index	0.0097 (0.0033) **	0.0115 (0.004) **
Fixed effects		
Country FE	Yes	Yes
Month FE	Yes	Yes
Year FE	Yes	Yes

(* 10% significance level, ** 5% significance level, ***1% significance level. No symbol is found where the value was not statistically significant, therefore the significance level was higher than 10%, being less accurate but useful to understand the impact of deaths that follow the same trend as those of cases)

C. Quantifications

Table 3 summarizes the results of the health care relevance analysis. We can therefore state that β_1 in equation 3 is equal to 0.226 and that β_2 is -0.053. In order to quantify the effect of health care on the economic shock, thus the semi elasticity of unemployment, the marginal effect can be used. The marginal effect is:

$$\textit{(Equation 6)}\quad ME = \beta_1 + \beta_2\, ln\_beds$$

(*ln_beds* is the logarithmic function of the interaction variable *new_cases_beds*, analyzed in section IV. B. 2.)

The mean marginal effect, therfore the effect on the mean of *ln_beds* in each country, is 0.1475, found by substituting the value of the mean in equation 6. Hence a between countries one-standard deviation increases unemployment rate by 0.20 bp. Such effect is not the same across countries and depends on the availability of hospital beds.

(Table 4) Marginal Effect per Country

	Hospital Beds per Thousand	ln_beds	Marginal Effect
Sweden	2.22	0.7975	0.1837
Canada	2.50	0.9163	0.1774
Denmark	2.50	0.9163	0.1774
United Kingdom	2.54	0.9322	0.1766
United States	2.77	1.0188	0.1720
Ireland	2.96	1.0852	0.1685
Spain	2.97	1.0886	0.1683
Italy	3.18	1.1569	0.1647

Finland	3.28	1.1878	0.1630
Netherlands	3.32	1.2000	0.1624
Portugal	3.39	1.2208	0.1613
Norway	3.60	1.2809	0.1581
Greece	4.21	1.4375	0.1498
Slovenia	4.50	1.5041	0.1463
Luxembourg	4.51	1.5063	0.1462
Estonia	4.69	1.5454	0.1441
Latvia	5.57	1.7174	0.1350
Belgium	5.64	1.7299	0.1343
Slovak Republic	5.82	1.7613	0.1327
France	5.98	1.7884	0.1312
Lithuania	6.56	1.8810	0.1263
Poland	6.62	1.8901	0.1258
Czech Republic	6.63	1.8916	0.1257
Hungary	7.02	1.9488	0.1227
Austria	7.37	1.9974	0.1201
Germany	8.00	2.0794	0.1158
Japan	13.05	2.5688	0.0899

Table 4 shows the number of hospital beds per thousand for each country and the variable *ln_beds* that has been used to calculate the marginal effect. The data reveals that as the number of hospital beds increases the marginal effect decreases, as expected, given the negative relation between unemployment and new_cases_beds. Namely, where the number of hospital beds is higher there will be a lower effect on the economy, thus the economic shock will be greater where hospital beds are less. Hence, once again, having a health care system capable to face unpredicted events and an adequate number of resources, can significantly reduce the damages suffered by a country.

The standard deviation of *ln_new_cases*, for the sample countries, is 1.3912. Therefore, if the health shock is kept constant, namely the health shock is determined by the standard deviation, the change in unemployment can be measured through the marginal effect. If we take into account Sweden having the least number of *ln_beds* (0.7975) and Japan, having the highest (2.5688), the change in unemployment given the standard deviations will be respectively 0.2556 for Sweden and 0.1251 for Japan, given by the product of the marginal effect and the fixed standard deviation. Sweden, which has a lower number of beds, will suffer a higher unemployment rate change, whilst Japan will experience a lower change in the economic variable.

D. Health Care Expenditure

In order to further understand the importance of having efficient medical resources, I have analyzed the relation of health expenditure of the countries taken into consideration. The data is taken from the OECD statistics database[39], where yearly measures up to 2019 were available. I have taken the mean of ten years in order to estimate the investments that each country has made in the period prior to the pandemic. The mean values were them taken constant in the model applied. The logarithm of the health expenditure variable was interacted with *ln_new_cases*, to define the following model:

$$\text{(Equation 7)}\quad Y_{m,a,c} = \beta_0 + \beta_1 ln\_new\_cases_{\,m,a,c} + \beta_2 new\_cases\_exp_c + \beta_3 stringency\_index_{m,a,c} + \lambda_m + \lambda_a + \lambda_c + \varepsilon$$

The unemployment rate, as in the models above, is the dependent variable. *ln_new_cases* represents the health crisis, the *stringency_index* refers to the limitations imposed by governments and *new_cases_exp* is the interacted variable which defines health expenditure. Table 5 summarizes the results that have been obtained. In this case, health spending is positively correlated with unemployment, implying that countries with higher health spending will be hit harder by the economic downturn. The outcome is not as expected; in fact, it contradicts the previous model, in which hospital beds were negatively related to the unemployment rate.

However, the results are consistent with the study conducted by Blondel and Vranceanu, which is mentioned in section III. B. Their study looked at the relationship between health expenditure and the Covid-19 mortality rate. The observed effect was that health expenditure and Covid deaths were positively correlated, implying that countries with higher health investments would have a higher Coronavirus death rate. The results could be due to unobserved variables or external effects that were not properly considered.

Another explanation could be that the number of beds is directly related to the health crisis, because, as extensively explained, one of the main issues during the pandemic was having enough place for all the patients in need, therefore beds were crucial in this perspective. Health expenditure, on the other hand, is a broader variable that encompasses many different aspects. "Health expenditure includes all expenditures for the provision of health services, family planning activities, nutrition activities and emergency aid designated for health."[40] It is the sum of public and private spending therefore it could be too general to evaluate its impact on the Covid-19 crisis.

[39] *See supra* note 35.
[40] Health expenditure, WORLD HEALTH ORGANIZATION, https://www.who.int/data/nutrition/nlis/info/health-expenditure.

Another explanation could be that higher health care spending leads to more modern equipment and methods. Thus, the increased number of cases is due to a greater number of tests available, in more developed systems, as well as more specific and adequate pandemic monitoring techniques.

(Table 5) Health Care Expenditure

Dependent Variable:	*Unemp_rate*
ln_new _cases	-0.626 (0.282) **
New_cases_exp	0.093 (0.034)***
Stringency_index	0.008 (0.004) **
Fixed effects	
Country FE	Yes
Month FE	Yes
Year FE	Yes

(* 10% significance level, ** 5% significance level, ***1% significance level.)

CONCLUSION V

In this study I have analyzed the Covid-19 crisis in some of its aspects. My aim was firstly to canvass the relation between the health and the economic emergency, and secondly to investigate the relevance of medical facilities in such context.

In the analysis I considered 27 OECD countries from January 2020 to December 2021 and examined monthly data of unemployment rate and daily data of Covid related indicators, such as: new cases, new deaths and stringency index.

Relating to the first research question, the hypothesis that the economic shock was positively related to the extent of the pandemic and to the stringency measures, turned out to be correct. Unemployment rate is positively related to new cases and stringency index. Therefore, the health crisis turned out to be an economic crisis as well, and in order to contain the number of victims, limitation measures were implemented, worsening the already critical economic situation.

Many epidemics have characterized human history, some of the more recent ones are the influenza pandemic of 1918, SARS in 2003 and Ebola in 2014. Then, as now, one of the unanswered questions is whether the major economic impact is provided directly by the illness, resulting in the loss of lives and a reduction in production capacity, or rather by the policy implementations that limit economic activities. The latter defines the output-pandemic tradeoff; therefore, is the cure better than the medicine?[41]

As mentioned above, one of the most crucial aspects of this pandemic is the saturation of health care systems. Facilities were severely challenged because of resource shortage and capacity constraints. Thus, to avoid the system collapsing it has been necessary to implement restrictions to limit the pressure on health structures, and to limit the deaths that would have incurred because of the lack of assistance, due to the saturation.

A well-prepared health care system is fundamental for the economic and social outcomes. As the results of the second research question suggest, the health efficiency can reduce the extent of the economic impact. Investigating the relation between unemployment rate and hospital beds, interacted with the number of cases and subsequently with deaths, results have shown that the two are negatively correlated, hence with the increase in hospital beds the unemployment rate decreases. Medical facilities, therefore, mitigate the negative consequence that the virus spread has on the economy. The same analysis was conducted with health expenditure instead of hospital beds, but the outcome is the opposite, unemployment rate and health care expenditure are positively correlated. Health spending

[41] *See* Rungcharoenkitkul P., *supra* note 9.

may be a more general variable that does not account for the importance of treatment availability for patients in need during the pandemic.

An efficient system could bring numerous advantages: individuals are cured quickly and efficiently, reducing the number of people waiting for help; having a larger number of medical personnel could limit the virus's spread by separating Covid-related employees from non-Covid employees; Some facilities could be entirely dedicated to positive people, avoiding contact with negative patients, without limiting or delaying other treatments. Another aspect of effective systems relates to the number of tests performed, in order to isolate positive people before they infect others. Finally, technological equipment, such as ventilators and CT-scans, play a pivotal role because of their frequent use to assist patients with severe symptoms.

An additional aspect that emerged during the pandemic and increased efficiency in health systems regards the reduction of face-to-face medical consultations, necessitating the development of new patient-assistance strategies. As a result, telemedicine emerged as a viable alternative that reduced physical contact while maintaining the quality and accessibility of essential health services. Health systems have introduced regulatory flexibility to encourage the adoption and implementation of this method, with support from providers and technological suppliers. Thus, telemedicine is destined to grow, necessitating an accountable governance system that includes providing quality care, as well as protecting providers and patients from negative outcomes. This technique largely impacts the efficiency of a health system, namely many people felt unsafe and lost during the pandemic due to unclear and delayed information, so they went to emergency rooms when the first possible Covid-19 symptoms appeared. Therefore, emergency rooms became overcrowded, adding up to the already dire conditions of health facilities, emphasizing the lack of a filter between clients and health care providers. Hence, telemedicine entails remotely supporting patients, visiting and consulting with them, and sharing all information and documentation.[42]

The World Health Organization supports the implementation of international health norms and regulations mainly on threats to health. Pandemic preparedness is an integral component of threats to human health and therefore, the WHO, has strongly advised states to implement pandemic plans in order to safeguard well-being, at the begging of the twenty-first century, after the rise of many illnesses. Pandemic preparedness is a continuous process of planning, exercising, revising, and putting response plans into action.[43] A pandemic preparedness plan is more than just a response plan for when an emergency occurs, it rather defines general guidelines on how to act. Stefania Salmaso,

[42]*Implementing telemedicine services during COVID-19 : guiding principles and considerations for a stepwise approach*, WORLD HEALTH ORGANIZATION, (2020).
[43]*Pandemic preparedness*, WORLD HEALTH ORGANIZATION, https://www.euro.who.int/en/health-topics/communicable-diseases/influenza/pandemic-influenza/pandemic-preparedness.

an epidemiologist, defined it as an orchestral score in which many distinct elements must combine to determine a coordinate and harmonic outcome.[44]

The Coronavirus has tested preparedness plans, revealing significant gaps and inadequacy. Accordingly, pandemic outcomes demonstrate that countries are not prepared for health emergencies, even after the past ones, and that the system requires extensive restructuring. The important factor is not the amount of medical resources endowment, but how they are used. In addition to posing challenges in terms of access and affordability of medical assistance, the epidemic has cast doubt on health policies that should be implemented in response to current and future emergencies.[45]

Moreover, countries should rely on proactive rather than reactive actions; immediate and adequate measures should be implemented with state coordination, especially in Europe. To combat the crisis, European countries should have had a unified vision and strategy, despite having highly heterogenous levels of global health, to diminish the consequences of the shock. The level of possible investments to allocate in health care differ among the countries and some cannot bear the economic burden, this considered, the EU should provide some guidelines in order to have comparable systems and complementary policies, so to react homogeneously in future scenarios.[46]

Even though the European commission lacks the competences and capacity to directly control medical care, it can coordinate and support health systems through a variety of parallel means. To limit the virus spread and loss of life, the Union should encourage members to innovate and share new technologies and knowledge. Accordingly, the European Commission has responded to the emergency on multiple fronts in order to support the weaker members. Firstly, it limited non-essential travel in the first phases of the crisis. Secondly, through advanced agreements with vaccine manufacturers, the EU has coordinated a collaborative effort to ensure the production of a sufficient quantity of safe and effective Covid-19 vaccines. Thus, the Union has signed eight agreements with vaccine developers to ensure that members have a robust vaccine portfolio. Furthermore, the EU is coordinating a global effort to achieve universal access to vaccines with member states and the World Health Organization, because a successful breakthrough necessitates the involvement and responsibility of all actors: society, institutions, policies, and regulatory frameworks. Finally, a recovery plan was developed for Europe to assist citizens, businesses, and countries in recovering from the economic downturn caused by the Covid pandemic, boosting growth in the years to come. On the 21st July 2020, leaders agreed on a €1824 billion overall budget for 2021-2027, combining the multiannual financial framework (MFF) and the Next Generation EU (NGEU), consisting in €750

[44] *Piano pandemico influenzale 2021-2023*, MINISTERO DELLA SALUTE, (Feb. 2021), https://www.salute.gov.it/portale/influenza/dettaglioContenutiInfluenza.jsp?area=influenza&id=722&lingua=italiano&menu=vuoto.
[45] *See* Lupu D. and Tiganasu R, *supra* note 20.
[46] *See* Aristodemou, K. et al., *supra* note 13.

billion, to rebuild the European Union after the crisis and supports investment in green and digital transitions.[47]

In the EU, epidemic protection investment could become a new field of common co-financing. It is critical to emphasize that epidemic protection contains elements of international interest, therefore necessitating coordination not only within the EU but globally. To achieve pandemic preparedness, it is critical to first define a clear plan that guides actions in an emergency, and then to have sufficient and efficient resources. It would be a waste of resources to increase ICU beds in normal circumstances because they would be unnecessary and thus not used. It is difficult to draw a line between being prepared and wasting resources. The solution is to establish protocols that govern the rapid conversion of resources in the event of an emergency. Conversion readiness, for example, occurs when a room or unit can quickly adapt to become an intensive care unit, or the infrastructure is easily adaptable to function as an intensive care unit without interfering with other units or rooms. Other characteristics of a quick conversion method can be: restructuring medical personnel and units to increase capacity; build strong relations with graduate medical education; and have electronic records.[48]

Health systems should be studied more carefully because of the relevance in many topics relating to productivity, effective workforce and aging societies, useful for international comparison. Cooperation, not only in the European Union by internationally, of health policies and formalized patterns should be established as guidance when needed. Welfens suggests an interdisciplinary research network on efficient and innovative health systems, partly financially sustained by the G-20, allowing free research networks.[49]

The pandemic has been a determinant event that allowed to deeply analyze the flaws and the shortcomings of health systems, having the potential to trigger profound changes and reforms. Being an ecosystem with many interdependent factors, policies to implement have to take in consideration all stakeholders involved, examining all the possible outcomes, hence making change complex and slow.

Central governments began to play a more active role in guiding the sector through setting a clear direction in health care policies.[50] For instance, during the pandemic numerous countries enhanced "centralized-decentralization" reforms, combining strong central oversight with opportunities for

[47]*COVID-19 coronavirus pandemic: the EU's response*, EUROPEAN COUNCIL, https://www.consilium.europa.eu/en/policies/coronavirus/.
[48]Goolsarran et al., *The transformation of hospital medicine to tackle the COVID-19 pandemic crisis*, 10 (6), JOURNAL OF COMMUNITY HOSPITAL INTERNAL MEDICINE PERSPECTIVES, 501–503, (2020).
[49]*See* Welfens P., *supra* note 15.
[50]Bali A. et al., *Health policy and COVID-19: path dependency and trajectory*, 41 (1), POLICY AND SOCIETY, 83–95, (2022).

local initiative and innovation, in order to promote coordination.[51] This implies that central governments established arrangements in order to delegate tasks across agencies at various levels of government and ensuring accountability mechanisms. Minimum standards for services across the countries were set while allowing local governments adequate autonomy in judgement and decision making.

Another aspect regarding the importance of governments in the crisis is the difference in private and public medical service. The pandemic has highlighted the importance of a robust public health system. Private hospitals are not financially motivated to invest in public health services such as infection control. Moreover, private providers lack the incentive to invest in excess capacity required to deal with public health crises, having as main achievement financial profits.[52] Despite severe resource constraints, public health care facilities were the first responders and reference point in many countries when Covid-19 broke out. On the other hand, many private hospitals took advantage of the crisis and charged exorbitant prices for Covid treatment, making health care unaffordable and forcing patients to rely on the public system.[53]

The current pandemic has increased the need for stricter regulations while also creating favorable conditions for their implementation. To protect citizens' health and safety, governments would need to favor more coercive measures than persuasion. For instance, many countries implemented regulations to speed up vaccine approval and have enacted stringent regulations governing who can or must receive vaccines, as well as the types of test certificates required to visit public places and travel. While some countries have expressed opposition to the restrictions, most societies complied with them. The new approach to the imposition of restrictions could have long-term consequences for other aspects of health care as well.[54]

A highly disruptive pandemic remains a possibility in the twenty-first century, as it has in previous ones, and underestimating such an event has come at a high cost. This experience calls for enhancing global health preparedness and planning procedures and protocols for future threats in order to be ready. Targeted and prompt policies maximize effectiveness rather than indiscriminate lock-down measures that completely freeze economic activities, but they can be an opportunity only when carried out effectively. At the beginning of the Coronavirus crisis strict measures were necessary for the circumstances.

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[51]Bali A. & Ramesh M., *Assessing health reform: Studying tool appropriateness & critical capacities*, 38 (1), POLICY AND SOCIETY, 148–166, (2019).

[52]Woo J., Policy capacity and Singapore's response to the COVID-19 pandemic, 39(3), POLICY AND SOCIETY, 345–362, (2020).

[53]Williams D. et al., *The failure of private health services: COVID-19 induced crises in low- and middle-income country health systems*, 16(8–9), GLOBAL PUBLIC HEALTH, 1320–1333, (2021).

[54]*See* Bali A. et al., *supra* note 38.

In conclusion epidemic outbreaks have characterized history and will continue to do so in the future. Covid-19 has resulted in an unexpected increase in research and development, which should be sustained in order to address social determinants of health and medical measures for future health crisis. Hence, states should invest in sufficient and efficient resources, improving the ability to face similar events with more confidence and minimize the negative impacts.