NEGATIVE EFFECTS OF HIGH PUBLIC DEBT FOR HEALTH PLANNING: LESSONS FROM COVID-19 PANDEMIC CRISIS IN EUROPE

Mario Coccia and Igor Benati

1Istituto di ricerca sulla crescita economica sostenibile Consiglio Nazionale delle Ricerche

Biblioteca

September 5, 2023

Abstract

The goal of this study is to analyze why some countries have had a high negative impact of COVID-19 pandemic crisis in terms of fatality rate compared to others. In particular, this study endeavors to verify whether statistical evidence supports the hypothesis that high general government gross debt in countries generates a structural vulnerability in socioeconomic and health systems to face emergencies, such as COVID-19 pandemic crisis. The research setting here analyzes the relationship between general government gross debt (as % GDP), healthcare expenditures per capita, and COVID-19 case fatality in an international context given by European countries. Empirical evidence reveals that European countries having lower COVID-19 fatality rate in 2020 (1.40%, indicated as group 1) had also lower government gross debt as % of GDP both in 2009 (50.79%) and 2019 (46.80%) than countries with higher fatality rate (2.83% given by group 2) that had 81.49% in 2009 and 67.22% in 2019. In addition, group 1 has from 2009 to 2019 a lower growth of government gross debt (% of GDP) given by 0.12 compared to group 2, which experienced a high growth of 0.29 generating a high burden for socioeconomic system and public finance. This structural situation leads countries of group 1 with lower COVID-19 fatality rates to support higher levels of health expenditure per capita (values higher than $3,100 per capita), whereas countries with a higher COVID-19 fatality rate have health expenditure per capita lower than previous group 1 (about $2,530 in 2009 and $2,600 in 2019) also for stringent austerity policies imposed by European Union. Estimated relationship shows that countries with 1% increase in the change of health expenditure per capita over 2009-2019 (predicted values considering in stage 1 the explanatory variable of government gross debt as % of GDP in 2009), it reduces the level of COVID-19 fatality rate by 2.63%. The contribution here expands the knowledge in these research topics by endeavoring to clarify primary causes of vulnerability of countries in crisis management driven by high levels of government gross debt, which deteriorate socioeconomic systems with stringent austerity policies that create constraints to increase health expenditures and improve health planning, reducing preparedness and resilience of countries to face crises similar to COVID-19 pandemic.
Abstract

The goal of this study is to analyze why some countries have had a high negative impact of COVID-19 pandemic crisis in terms of fatality rate compared to others. In particular, this study endeavors to verify whether statistical evidence supports the hypothesis that high general government gross debt in countries generates a structural vulnerability in socioeconomic and health systems to face emergencies, such as COVID-19 pandemic crisis. The research setting here analyzes the relationship between general government gross debt (as % GDP), healthcare expenditures per capita, and COVID-19 case fatality in an international context given by European countries. Empirical evidence reveals that European countries having lower COVID-19 fatality rate in 2020 (1.40%, indicated as group 1) had also lower government gross debt as % of GDP both in 2009 (50.79%) and 2019 (46.80%) than countries with higher fatality rate (2.83% given by group 2) that had 81.49% in 2009 and 67.22% in 2019. In addition, group 1 has from 2009 to 2019 a lower growth of government gross debt (% of GDP) given by 0.12 compared to group 2, which experienced a high growth of 0.29 generating a high burden for socioeconomic system and public finance. This structural situation leads countries of group 1 with lower COVID-19 fatality rates to support higher levels of health expenditure per capita (values higher than $3,100 per capita), whereas countries with a higher COVID-19 fatality rate have health expenditure per capita lower than previous group 1 (about $2,530 in 2009 and $2,600 in 2019) also for stringent austerity policies imposed by European Union. Estimated relationship shows that countries with 1% increase in the change of health expenditure per capita over 2009-2019 (predicted values considering in stage 1 the explanatory variable of government gross debt as % of GDP in 2009), it reduces the level of COVID-19 fatality rate by 2.63%. The contribution here expands the knowledge in these research topics by endeavoring to clarify primary causes of vulnerability of countries in crisis management driven by high levels of government gross debt, which deteriorate socioeconomic systems with stringent austerity policies that create constraints to increase health expenditures and improve health planning, reducing preparedness and resilience of countries to face crises similar to COVID-19 pandemic.

Keywords: COVID-19; Government debt; Public debt; Health policy; Health Planning; Public health policy; Country risk; Crisis management; Pandemic crisis; System Resilience; Europe. Sovereign Debt, Growth, Fiscal consolidation, Europe.

Highlights

• High public debt generates vulnerabilities in health systems to face emergencies
• Countries with lower COVID-19 fatality had also lower levels of public debt
• 1% growth in health expenditure per capita, reduces COVID-19 fatality by 2.63%
• High public debt deteriorates health planning to face pandemic crises

"Ethic statement - Not applicable"

Acknowledgements: Thanks to participants to internal seminar CNR for helpful comments.

Introduction

The COVID-19 pandemic, since the first months of 2020, has generated a negative impact on health systems and economies worldwide, driven by manifold environmental, social and economic factors, causing high numbers of COVID-19 related infected individuals and deaths, and negative economic and social consequences (Abel and Gietel-Basten, 2020; Bontempi et al., 2021; Coccia 2020, 2021, 2022, 2023; Goolsbee and Syverson, 2021; Núñez-Delgado et al., 2021; Tisdell, 2020). COVID-19 pandemic crisis, from 2020 to 2023, show differences in COVID-19 deaths between countries worldwide and also between European countries having inter-related socioeconomic systems (JHU, 2023). Scholars examine several factors that can contribute to these differences in COVID-19 fatality rates across different regions and/or nations (Shakor et al., 2021; Sorci et al., 2020; Khan et al, 2020). Some papers suggest that countries with better healthcare systems and
greater access of people to medical devices, such as medical ventilators (Coccia, 2023), are better equipped to manage new airborne diseases, such as COVID-19, to reduce fatality rate (Coccia, 2021, 2022, 2023, 2023a; Magazzino et al., 2022). However, one of the fundamental problems is to explain why some countries have a better health system and higher health expenditures that play a critical role to face COVID-19 pandemic crisis and mitigate case fatality rates (CFR), the proportion of COVID-19 deaths among all individuals diagnosed with this new infectious disease over a certain period of time. This study here focuses on European countries because they have homogenous and inter-related socioeconomic systems and stable structural indicators for robust and reliable statistical analyses and appropriate comparative analyses of the effects of COVID-19 in society. The contribution here endeavors to explain whether and how high levels of public debt affect the vulnerability and/or resilience of health system in countries to face an unforeseen crisis, such as COVID-19 pandemic. In particular, this study endeavors to clarify the following research questions:

1. Do higher levels of government debt reduce, associated with other factors, resilience of health systems that increase systemic vulnerability and COVID-19 fatality rate?

2. What are countries that have shown, at beginning of pandemic wave, better preparation and resilience to face unforeseen COVID-19 pandemic crisis with consequential minimization of fatality rates?

The purpose of the present study is to see whether statistical evidence supports the hypothesis that a lower resilience of health system with consequential higher COVID-19 fatality between European countries can be explained by a high burden of government debt and if so to form some quantitative analyses and estimates of the relation between public debt, health expenditures and COVID-19 fatality rate.

### Study design and methodology

#### Sample

Our study is based on 27 countries of the European Union (EU) that have a similar socioeconomic structure and represent a homogenous sample for robust statistical analyses. In particular, the sample includes the following European countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden.

#### Variables

This study analyzes variables concerning structural indicators of the economic system and health system in European countries in specific years (2009 and 2019) to assess the change before the COVID-19 pandemic crisis (started in February 2020) and their relationship with case fatality ratio of the COVID-19 in 2020, at beginning of pandemic crisis, when effective drugs and therapeutic treatment lacks. Table 1 shows the variables under study.

#### Table 1. Variables and sources

<table>
<thead>
<tr>
<th>Variable, Acronym, source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total health care expenditures per capita in current US$, 2009 and 2019. WHO (2023)</td>
</tr>
<tr>
<td>General government gross debt, Annual - Percentage of gross domestic product (GDP) in 2009 and 2019 (Eurostat, 2023)</td>
</tr>
<tr>
<td>Case fatality rate on 30 December 2020, JHU (2023)</td>
</tr>
</tbody>
</table>
Working hypothesis and data analysis procedure

The purpose of the present study is to see whether statistical evidence supports the working hypothesis that the rate of COVID-19 fatality in European countries can be explained by the level of General government gross debt (as % of GDP) that affects the structure and function of health system.

Firstly, the variables of Table 1 are analyzed with descriptive statistics given by arithmetic mean, standard deviation, skewness and kurtosis to assess the normality of distributions for appropriate statistical analyses.

Secondly, average value of COVID-19 fatality rate in 2020, the year when COVID-19 pandemic crisis started, is used to categorize the sample of European countries in two groups:

Group 1: Countries with lower COVID-19 fatality rates in 2020 than the sample arithmetic mean
Group 2: Countries with higher COVID-19 fatality rates in 2020 than the sample arithmetic mean

Using the categorization in group 1 and 2, it is calculated for variables of general government gross debt and health system in countries, both arithmetic mean and the change from 2009 to 2019 to assess the evolution of economic system before the emergence of COVID-19 pandemic crisis. The year 2009 is the starting point considering global financial and economic crisis occurred in 2009 that has generated consequential interventions of political economy and public finance to control debt in countries where the burden was high, such as Italy. The rate of change for variable $x$ is given by:

$$\text{change of variable } x = \frac{(x \text{ in } 2019 - x \text{ in } 2009)}{x \text{ in } 2009}$$

After that, arithmetic mean of this change ($\Delta$) and standard deviation of values in groups 1 and 2 are calculated to assess differences. The significance of these arithmetic mean between groups 1 and 2 is analyzed by using the Independent Samples $t$-Test: i.e., comparing the means to determine whether there is statistical evidence that associated population means are also significantly different. Levene’s test was used to check the underlying assumption of homogeneity of variance (i.e., that both groups have the same variance). After that, hypotheses used for the Independent Samples $t$-Test are:

$H'_{0}$: $\mu_1 = \mu_2$, the two-population means of group 1 and 2 are equal

$H'_{1}$: $\mu_1 \neq \mu_2$, the two-population means of group 1 and 2 are not equal

Thirdly, the relationships between general government gross debt (as % GDP), healthcare expenditures, and COVID-19 case fatality in European countries are analyzed with Two-Stage Least-Squares Regression. Two-stage least-squares regression uses instrumental variables that are uncorrelated with the error terms to compute estimated values of the problematic predictor (the first stage) and then uses those computed values to estimate a linear regression model of the dependent variable (the second stage). Since the computed values are based on variables that are uncorrelated with the errors, the results of the Two-Stage Least-Squares model are optimal (cf., Angrist and Krueger, 2001).

Two-stage Least Squares Analysis here is based on following variables and equation.

- Dependent variable: Case fatality rate in 2020
- Explanatory variable (predictor): change of health care expenditures per capita US$ from 2009 to 2019
- Instrumental variable: General government gross debt, percentage of GDP in 2009

The two stages of model are given by following equations.

**Stage 1.**

$$y_i = \alpha + \beta_1 x_i + u_i \ [1]$$

$y_i =$ change of health care expenditures per capita from 2009 to 2019

$x_i =$ General government gross debt, percentage of GDP in 2009

$u_i =$ error term, $i =$countries
Stage 2.

\[ f_i = x + \beta_2 \text{ fit } y_i + \epsilon_i \]  \[ [2] \]

\[ f_i = \text{COVID-19 case fatality rate in 2020} \]

\[ \text{fit } y_i = \text{fit for change of health care expenditures per capita from 2009 to 2019 with model [1]} \]

\[ \epsilon_i = \text{error term} \]

\( a, x = \text{constant: the value of response or dependent variable when the associated predictor or independent variable is equal to zero} \)

\( \beta_1 \text{ and } \beta_2 = \text{coefficients of regression: it estimates the unknown parameter to describe the relationship between a predictor variable and response variable} \)

Results of statistical analyses

First of all, arithmetic mean (M) of Case fatality rate on 30 December 2020, in the first year of COVID-19 pandemic crisis is M= 1.98% (Standard Deviation, SD=0.86%). This average mean is used to categorize European countries in two groups:

Countries with a lower COVID-19 fatality rate in 2020 than the sample arithmetic mean, average value is \( M_{\text{group1}} = 1.40\% \)

Countries with a higher COVID-19 fatality rate in 2020 than the sample arithmetic mean, average value within the group is \( M_{\text{group2}} = 2.83\% \)

Table 2 shows arithmetic mean of variables and rate of change in the two groups just mentioned. Statistical significance of the differences of arithmetic mean between groups 1 and 2 in table 2 is analyzed by using the Independent Samples -Test (and Levene’s test) and results are table 3. Results of table 2 reveal that COVID-19 fatality in group 1 is lower in 2020 (1.40%) than group 2 (2.83%). Group 1 with a lower COVID-19 fatality rate has in the year 2009 and 2019 higher levels of health expenditure per capita (> $3,100 per capita). From 2009 to 2019 this group 1 has a rate of growth of health expenditure per capita of 0.19. Instead, countries with a higher COVID-19 fatality rate in 2020 had in 2009 and 2019 values of health expenditure per capita lower than previous group 1 (about $2,530 in 2009 and $2,600 in 2019). Moreover, this group 2 has a lower rate of growth of health expenditure per capita from 2009 to 2019 and equal to 0.09. If we consider government gross debt as % of GDP, results of table 2 reveal that in group 1 is lower both in 2009 (50.79%) and 2019 (46.80%) than group 2, which had 81.49% in 2009 and 67.22% in 2019. In addition, group 1 has had from 2009 to 2019 a lower growth of government gross debt (% of GDP) given by 0.12 compared to group 2 that has experienced a high growth of government gross debt (% of GDP) of 0.29, generating a high burden for socioeconomic system and public finance that affects health expenditures and health system.

Table 2. Descriptive statistics categorized per groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Countries with LOWER COVID-19 Fatality in 2020</th>
<th>Countries with LOWER COVID-19 Fatality in 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>COVID-19 Fatality 2020 (%)</td>
<td>Mean</td>
<td>Std. Deviation</td>
</tr>
<tr>
<td></td>
<td>1.40</td>
<td>0.44</td>
</tr>
<tr>
<td>Healthcare Exp Per Capita $ 2009</td>
<td>$3,119.79</td>
<td>$2,192.71</td>
</tr>
<tr>
<td>Healthcare Exp Per Capita $ 2019</td>
<td>$3,376.29</td>
<td>$2,014.03</td>
</tr>
<tr>
<td>Δ Healthcare Exp Per Capita $ 2009-2019</td>
<td>0.19</td>
<td>0.30</td>
</tr>
<tr>
<td>Government gross debt, % of GDP 2009</td>
<td>50.79</td>
<td>27.22</td>
</tr>
<tr>
<td>Government gross debt, % of GDP 2019</td>
<td>46.80</td>
<td>22.21</td>
</tr>
<tr>
<td>ΔGovernment gross debt, % of GDP 2009-2019</td>
<td>0.12</td>
<td>0.31</td>
</tr>
</tbody>
</table>
Note: \( \Delta \) = the rate of change from 2009 to 2019 to assess the dynamics of the Government gross debt and health expenditures per capita before the emergence of COVID-19 pandemic crisis.

Table 3 presents the results of the Independent Samples t-Test, which compares the means of groups 1 and 2 to determine whether the associated population means are significantly different. Since \( p \) -value is higher than significance level \( \alpha = 0.05 \), we can reject null hypothesis of similarity of arithmetic means between group 1 and 2, except for COVID-19 fatality rate 2020.

Table 4 shows regression analysis with 2SLS: the model considers, at stage 2, the COVID-19 fatality rate in 2020 between European countries as dependent variable and fit for change of healthcare expenditure per capita 2009-2019 from stage 1 as explanatory variable. Results clearly show that countries with a 1% increase of the change in health expenditure per capita over 2009-2019 (predicted values considering in the stage 1, the government gross debt as % of GDP in 2009 as explanatory variable), it reduces the level of COVID-19 fatality rate by 2.63%. The coefficient R\(^2\) explains about 25% variance in the data. Although R\(^2\) is not high in the model, the F value is significant (\( p \) -value<0.01), then independent variable reliably predicts dependent variable (i.e., COVID-19 Fatality rate reduction %). Figure 1 shows the estimated relation and average line on y-axis that can suggest how countries above this horizontal line, they have experienced a higher vulnerability to face COVID-19 pandemic crisis, such as Belgium, Hungary, Spain, Poland, Slovenia, Romania, and in particular countries that are in the upper left section having a higher vulnerability and fatality rate to face COVID-19 crisis: i.e., Greece and Italy. Instead, below the line, results suggest countries having a lower public debt have also better health system resilience: the capacity to recover quickly from socioeconomic shocks and crises, in this case a health emergency (Sagan et al., 2020, 2021).

**Table 3.** Independent Samples Test based on average mean of change of variables from 2009 to 2019 in European countries of group 1 and group 2

<table>
<thead>
<tr>
<th>( \Delta ) = the rate of change from 2009 to 2019</th>
<th>Levene’s Test for Equality of Variances</th>
<th>Levene’s Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
<th>t-test for Equality of Means</th>
<th>t-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>from 2009 to 2019</td>
<td>Equal variances assumed</td>
<td>( F )</td>
<td>Sig.</td>
<td>t</td>
<td>df</td>
</tr>
<tr>
<td>Healthcare Exp Per Capita $2009</td>
<td></td>
<td>1.358</td>
<td>0.255</td>
<td>0.635</td>
<td>25</td>
</tr>
<tr>
<td>Healthcare Exp Per Capita $2009</td>
<td>not assumed assumed</td>
<td>2.095</td>
<td>0.16</td>
<td>1.129</td>
<td>25</td>
</tr>
<tr>
<td>Healthcare Exp Per Capita $2019</td>
<td>not assumed assumed</td>
<td>0.214</td>
<td>0.648</td>
<td>1.16</td>
<td>23.515</td>
</tr>
<tr>
<td>Healthcare Exp Per Capita $2009-2019</td>
<td>not assumed assumed</td>
<td>4.609</td>
<td>0.042</td>
<td>-1.784</td>
<td>25</td>
</tr>
<tr>
<td>Government gross debt, % of GDP 2009</td>
<td>not assumed assumed</td>
<td>-1.626</td>
<td>14.865</td>
<td>0.125</td>
<td></td>
</tr>
</tbody>
</table>
Δ = the rate of change from 2009 to 2019

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government gross debt, % of GDP 2019</td>
<td>assumed: 3.460, 0.075, -2.163, 25, 0.040</td>
<td>not assumed: 1.966, 14.702, 0.068</td>
</tr>
<tr>
<td>ΔGovernment gross debt, % of GDP 2009-2019</td>
<td>assumed: 0.64, 0.431, -1.275, 25, 0.214</td>
<td>not assumed: -1.23, 18.852, 0.234</td>
</tr>
<tr>
<td>COVID-19 Fatality rate in 2020</td>
<td>assumed: 0.698, 0.411, -7.518, 25, 0.001</td>
<td>not assumed: -7.245, 18.775, 0.001</td>
</tr>
</tbody>
</table>

*Note*: Group 1 is Countries with LOWER COVID-19 Fatality in 2020; Group 2 is Countries with HIGHER COVID-19 Fatality in 2020; Exp=Expenditure

**Table 4.** Parametric estimates of the 2SLS model

<table>
<thead>
<tr>
<th>Stage</th>
<th>Parameter</th>
<th>Coefficient</th>
<th>Standardized Coefficient</th>
<th>R²</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Change of health care expenditures per capita US$ in 2009 – 2019</td>
<td>0.449***</td>
<td>-0.005**</td>
<td>-0.540</td>
<td>0.29</td>
</tr>
<tr>
<td>2</td>
<td>COVID-19 Case fatality rate 2020</td>
<td>2.383***</td>
<td>-2.626**</td>
<td>-0.502</td>
<td>0.25</td>
</tr>
</tbody>
</table>

*Note*: *** p<0.001
** p<0.01

(1) Explanatory variable: General government gross debt, percentage of GDP in 2009
(2) Explanatory variable: Fit for change of health care expenditures per capita from 2009 to 2019 with model of stage 1
Scientific explanation of results

Expenditures and investments in health system have a vital role to support wellbeing of people and the preparedness to face pandemic crises and in general emergencies (Coccia, 2021, 2021b, 2022). Countries with higher health expenditures generally have better-equipped healthcare systems, which allow for earlier and more accurate diagnoses, more effective treatments, and better crisis management of health emergencies (Coccia, 2021a). Results show that countries with a lower COVID-19 fatality rate have higher levels of healthcare expenditure per capita (including physicians, nurses, hospital beds, preventive care and curative acute care). Instead, European countries with higher COVID-19 fatality rate have health expenditure per capita lower and equal to about $2,600 in 2019. Regression analysis shows that countries with 1% increase of the change of health expenditure per capita over 2009-2019 (predicted values considering in the stage 1 the government gross debt - % of GDP in 2009 as explanatory variable), it reduces the level of COVID-19 fatality rate by 2.63%. This finding suggests the critical role of the level of public debt for the effective functioning of economic system. Countries with a higher vulnerability to face COVID-19 pandemic crisis, such as Greece and Italy, have high levels of government debt as % of GDP that deteriorate health system resilience and consequential capacity to recover quickly from socioeconomic shocks, crises and health emergencies (cf., Sagan et al., 2020, 2021). The source of systemic vulnerability associated with high public debt in some countries is also due to measures of political economy to reduce the burden of high government debt. In fact, studies show that countries with high public debt, in particular in Europe, have the goal to reduce them based on austerity measures that can generate problems for wages, social services (e.g., in health sector) and public ownership (Bush et al., 2013). Nickel et al. (2010) find that financial crisis of 2008/2009 has left European economies with a sizeable public debt stock. They suggest that major debt reductions are mainly driven by decisive and lasting fiscal consolidation efforts focused on reducing government expenditure, in particular, cuts in social benefits, health services and public wages. Kühler-Töghofer and Zagler (2004) point out that a high debt burden after a fiscal expansion will constrain policy in the future and a high level of public debt will be a drag on financial markets in the entire union. Reductions in government expenditures will lead to a dampening of debt dynamics across all fiscal policy regimes, such that expenditure cuts are more important for debt reductions than revenue increases. Iwata and Iiboshi (2023) argue that the increased magnitude of fiscal adjustments appears to be the major driving force behind the decline in government spending multipliers rather than debt accumulation itself. Of course, these public policies do not consider the effects on systemic resilience of nation to face crises. Burriel et al. (2020) analyze economic risks associated with regimes of high public debt associated with the 2009 global financial and economic crisis and more severe
COVID-19 pandemic crisis and suggest that high-debt economies can have more reduction of output in a crisis and have less scope for counter-cyclical fiscal policy leading to high debt economies to higher socioeconomic vulnerabilities. ECB (2016) shows that high government debt generates the economy less resilient to shocks. It can exert adverse pressure on the economy through multiple channels, such as lower real growth or inflation shocks increase the real burden of debt, with larger fiscal costs if the initial level of debt is high. (De Soyres et al., 2022) show that the impact of an unanticipated increase in public debt on the real GDP level is generally negative in particular for countries that have a high initial debt level or a rising debt trajectory over the five preceding years. Heimberger (2022) suggests that a 10 percentage points increase in public debt-to-GDP is associated with a decline in annual growth rates by 0.14 percentage points but lack the evidence of a negative growth effect because of higher public debt-to-GDP. Panizza and Presbitero (2014) also show that there is no evidence that public debt has a causal effect on economic growth and this is important because the negative correlation between debt and growth is used to justify policies that assume that debt has a negative causal effect on economic growth. According to Fan et al. (2023), public debt in economies rose at a fast clip during 2020–2021, also due to the global COVID-19 pandemic crisis. Fan et al. (2023) examine trends in debt because of the onset of three types of calamities, namely natural disasters, armed conflicts, and external debt distress in countries and show that debt and growth evolve quite differently depending on the type of calamity. Georgantas et al. (2023) maintain that fiscal and spending adjustments implemented in recessions, in periods with tight monetary conditions and when the debt ratio is above 80% are self-defeating, whereas fiscal consolidations that are initiated in expansions, in low debt countries, and with monetary conditions that are loose in open economies can lead to a more pronounced decline in the debt ratio.

In short, in the presence of the potentially devastating effects of various types of crises that can happen anytime, such as COVID-19 pandemic crisis, it is important maintain country’s ability to respond quickly with a resilient system and this strategy cannot be done with high and rising public debt that deteriorates socioeconomic system with cuts (also to health sectors), generating a high fatality. In general, studies by CBO (2014) argue that main consequences of high public debts are lower national savings and income, higher interest payments, leading to large tax hikes and spending cuts as well as decreased resilience and consequential ability to respond to problems, risks and crises (Coccia, 2018). In fact, governments with a large and growing public debt, during a main crisis, are not able to respond by increasing spending and cutting taxes to stimulate the economy. As a result, future recessions and crises could have larger negative effects on socioeconomic systems and people’s well-being in countries with high public debt and general cuts to services and other factors of socioeconomic system.

To conclude, McKee et al. (2012) argue that many governments in Europe, either of their own volition or at the behest of the international financial institutions, have adopted stringent austerity policies in response to high levels of public debt. However, austerity in Europe has been not only an economic failure, but also a health failure, with cuts in health budgets being imposed, increasing numbers of people have been unable to access care, and in particular, higher numbers of COVID-19 related infected individuals and deaths. This ambiguous public has increased the vulnerability and reduced resilience of health systems of many European countries.

**Economic policy implications for health planning**

Higher preparedness and resilience of nations to face pandemic crisis, in addition to higher health expenditure per capita, have to be supported by good governance to create efficient public health infrastructures, effective disease surveillance systems and health policy responses, which help to prevent diffusion of outbreaks and improve treat patients (Benati and Coccia, 2022, 2022a; Kluge et al., 2020; Sagan et al., 2020). This approach should be done also with high public debts. Overall, the relationship between health expenditure and fatality rate of COVID-19 is affected by the level of health expenditures and related European policy perspective directed to reduce high public debt with general spending cuts (austerity, Alesina et al., 2019) to avoid financial crises but exposing countries to systemic risk in the presence of pandemic and other crisis. Lessons
learned of COVID-19 pandemic crisis highlight the importance of investing in healthcare systems and public health infrastructure, supported by a good governance, as a means for reducing vulnerability in crisis management and protecting populations from the impact of new infectious diseases similar to COVID-19 (Benati and Coccia, 2022a; Coccia, 2021a). Therefore, investing in healthcare infrastructure or increasing healthcare expenditures, rather than general cuts, may lead to a significant improvement in health performance and preparedness to environmental threats for national system in the presence of a crisis. Jacques et al. (2023) show that public health systems have been center stage during the COVID-19 pandemic, but governments invest relatively little in public health in many countries. Studies show that fiscal austerity reduces both public health and curative expenditures. Benach et al. (2022) argue that to ensure preparedness for future crises, it is also important investment in for reducing health inequalities and improving research capacities. Considering lesson learned from COVID-19 pandemic crisis, the group of Global Burden of Disease (2023) suggests that there is a unique opportunity to sustain funding for crucial health functions, including pandemic preparedness. In fact, historical patterns of underfunding in health sector, after financial crisis of 2009, suggest that deliberate effort must be made to support funding to improve preparedness for next pandemics. Sagan et al. (2020) maintain that enhancing health system resilience is based on reinforcing health expenditures for all functions of health sector, associated with effective governance, which is the adhesive factor for a systemic resilience of countries that should be pursued mitigating cuts in health sector, though a high public debt. In fact, higher health expenditures support the health systems resilience that nowadays has expanded the function to also consider aspects of how to minimize exposure to shocks (i.e. managing risks) and to identify timely and effective measures that address more predictable and enduring system strains or stresses, such as during a pandemic crisis and other emergencies, such as natural disasters, conflicts, socio-political crises and economic and financial crises (Bouchet et al., 2003). As said, regardless high public debt, health expenditures directed to support resilience have to be supported by the good governance that is the key to a resilient response based on: 1) appropriate and effective governance and 2) technical capacity to respond. In addition to reinforcing health expenditures and investments at national level, also overall European Union has to increase investment to reinforce common surveillance systems, joint procurement initiatives, and targeted funding for a comprehensive and stable system of preparedness for crises (Legido-Quigley et al., 2020). These strategies for improving the preparedness and resilience of nations to face new pandemic crisis and not only should be based on systemic approach, going beyond strengthening health systems and incorporating best practices of good governance in all institutions that should reduce COVID-19 fatality rates (and similar diseases) between European countries (Coccia, 2019; Penkler et al., 2020). This systemic approach is important as the countries and Europe have a collection of complex interconnected and inter-related systems, of which the health system is just one element. Hence, strategies to increase expenditures and investment in health sectors have not to be isolated public policy but they have to be part of broader and systemic multi-sectorial approaches to effectively enhance health system resilience of overall countries operating in the European area (Allen Douglas, 2022; Barro, 2020; McKee, 2020; Sagan et al., 2020).

Conclusions and prospects

The group of Global Burden of Disease (2023) shows that the COVID-19 pandemic highlighted gaps in disease prevention and treatment between European countries and worldwide. Among the many factors that might have led to these gaps is the issue of the financing of national health systems that can be reduced in countries with high public debts when applying plans based on austerity measures. In the presence of pandemic crises, one of the goals of nations is to mitigate mortality and support the socioeconomic system (Coccia, 2021). The statistical evidence in sections above seems in general to support the working hypothesis stated in Section 2, that the case fatality rates of COVID-19 can be explained by the level of public debt that affects health expenditures between European countries. In particular, the findings here suggest that countries with average high level of government debt as % of GDO over 2009-2019, have also lower health spending per capita because of constraints of austerity policy (Alesina et al., 2019) and as a consequence high levels of COVID-19 case fatality rate. In short, austerity policy to keep debt ratios at prudent levels and avoid further sovereign debt
crises and financial shocks lead to general cuts of expenses, included health sector, which expose countries to vulnerabilities to face pandemic crises (and not only) reinforcing detrimental impact on national output and welfare in society. Findings here show that 1% increase in the change of healthcare expenditures per capita from 2009 to 2019, it reduces the level of COVID-19 Fatality rate by about 2.63%, improving the resilience of countries to face pandemic crises. In short, high levels of investments in healthcare sector and in new medical technology (e.g., mechanical ventilators, etc.) support the preparedness and resilience of countries to face unknown infectious respiratory (cf., Coccia, 2023). To put it differently, the preparedness of countries for next pandemic crises should be oriented to strengthening health system in a context of good governance of all institutions to cope with future health emergencies, especially when effective drugs to treat patients with acute respiratory illness are missing (Coccia, 2022, 2022a, 2022b; Kluge et al., 2020; Kapitsinis, 2020). Hence, considering results of the study here, a basic aspect to cope with pandemics is a systematic planning, which should consider continuous investments in health sectors to support IT infrastructure, staffing and training.

Overall, then, results of this analysis here seem to suggest that in the first pandemic wave of COVID-19, countries with lower public debt as % of GDP and high healthcare expenditure per capita experienced a lower fatality rate of COVID-19. These conclusions are of course tentative. There is a need for much more research on these topics because not all the confounding factors that affect the relationship between COVID-19 fatality rates, level of public debt and health expenditures are discussed. Hence, results here have to be reinforced with a follow-up investigation based on new factors of health system and structural indicators to clarify the factors determining lower level of health expenditures in some European countries. This finding can clarify the basic and structural factors of economic systems that have increased the vulnerability of some European countries to COVID-19 pandemic crisis leading to high fatality rates. To conclude, preparedness and resilience of nations to face and reduce negative effects of next potential pandemics (similar to COVID-19) and other crises should be based on systemic policies of public debt reduction without affecting critical sector of public health that plays a critical role in crisis management for effective policy responses and to maintain wellbeing of people in sustainable socioeconomic systems.

References


Magazzino C., Mele M., Coccia M. 2022. A machine learning algorithm to analyze the effects of vaccination on COVID-19 mortality. Epidemiology and infection, 1–24. Advance online publication. https://doi.org/10.1017/S0950268822001418


