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## Case Study

# Country Risk to Face Global Emergencies: Negative Effects of High Public Debt on Health Expenditures and Fatality Rate in COVID-19 Pandemic Crisis

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## Abstract

Risk is a variation of performance in the presence of events and it can negatively impact socioeconomic system of countries. Statistical evidence here shows that high public debt reduces health expenditures over time and increases the vulnerability and risk of European countries to face health emergencies, such as COVID-19 pandemic crisis. Overall, then, findings suggest that high public debt weakens healthcare and socioeconomic system of countries to cope with crises, such as COVID-19 pandemic, conflicts, natural disasters, etc.

JEL Codes: I18; H12; H51; H60; H63

## Introduction

In contemporary economies, more and more countries have high levels of public debt that force to budget constraints with policies of public finance based on austerity measures (including spending cuts and/or tax increases), which impact funding for health, education and other public sectors [1-5]. Studies suggest that high levels of public debt may restrict government expenditure, especially in critical sectors like healthcare and education [6,7]. Moreover, high level of public debt has significative effects on socio-economic system and it can decrease a government's ability to respond to complex emergencies and social problems [8-10]. Research paper here explores the relationship between the public debt and healthcare expenditures for assessing country risk, measured with fatality rates, in the presence of pandemic crises, such as COVID-19. Findings can suggest effective long-run policies to face next global emergencies, such as pandemics similar to COVID-19, conflicts, natural disasters, etc., in various countries.

## Case study of European countries to face COVID-19 and study design

The literature about COVID-19 has a lot of studies on

manifold topics [11-67]. However, how the relationship between the public debt and healthcare expenditures affects fatality rates in the presence of pandemic crises, such as COVID-19, it is hardly known. This study focuses on a group of 27 European nations having comparable socioeconomic systems: 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 [68].

The study examines variables of the economic and health system in European countries in 2009 and 2019 to assess the level and change before the COVID-19 pandemic crisis and their relationship with case fatality rates of the COVID-19 in 2020 and 2022. Variables under study are:

- Health expenditures per capita in 2009 and 2019 [69]
- Government consolidated gross debt, as a share of GDP, in 2009 and 2019 [70]
- Case fatality rate (CFR) on 30 December 2020 and 2022 [68]

The average COVID-19 fatality rate in the year 2020, the starting year of the COVID-19 pandemic crisis, is used to categorize the sample of European countries under study into 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.

The arithmetic mean and the change from 2009 to 2019 (ten years) of general government gross debt and of health expenditures in countries of group 1 and 2, with a comparative analysis, assess the evolution of public debt and health expenditures between these categories before the emergence of COVID-19 pandemic crisis. The rate of change  $\Delta$  for variable  $x$  is given by:  $x$  in 2019 minus  $x$  in 2009 divided by  $x$  in 2009. Statistical analyses are based on descriptive statistics, independent sample T-test to assess the significance of the difference of means between group 1 and 2, correlation analyses of basic relation between health expenditure and COVID-19 fatality rate and a simple regression analysis with *log-log* model given by the following equation [1]:

COVID-19 fatality rates 2022

$$(y_i) = \alpha + \beta \text{ healthcare expenditures per capita 2019 } (x_i) + u_i \quad [1]$$

$\alpha$  = constant

$\beta$  = coefficient of regression

$u_i$  = error term

$i$  (subscript) = countries

Estimated relationship is calculated with Ordinary Last Squares (OLS) method that determines the unknown parameters. Statistical analyses are performed with the IBM SPSS Statistics 26®.

## Results

Table 1 reveals that Group 1 with a lower COVID-19 fatality rate in 2020 and 2022 than group 2 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, levels 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, Table 1 reveals that in group 1 is lower both in 2009 (46.8%) and 2019 (50.9%) than group 2, which had 67.2% in 2009 and 81.49% 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 that has experienced a high growth of government gross debt (% of GDP) of 0.29, generating a high burden for socioeconomic system, such that public finance had to reduce health expenditures with negatively effects on overall health system. Statistical significance of differences in arithmetic means (Table 1) is verified with independent sample T-test and results are in Table 2: the independent samples T-test compares the means of groups 1 and 2 to determine whether the associated population means are significantly different. Since the  $p$ -value is higher than significance level  $\alpha = 0.05$ , we can reject the null hypothesis of similarity of arithmetic means between groups 1 and 2, except for the COVID-19 fatality rate in 2020 and 2022.

Pearson’s coefficient of correlation is  $-0.67$ , which indicates a strong negative correlation. The more resources that European nations spend in health sector, the better they are likely to reduce the case fatality rates of COVID-19. The one-tailed significance value – which in this case has  $p$  - value < 0.001, considering that the standard alpha value is 0.05, means that correlation analysis here is highly significant (Table 3).

Table 4 presents the results of the regression analysis using the OLS method. The findings clearly indicate that when countries experience a 1% increase in healthcare expenditure per capita in 2019, it leads to a 1.2% reduction in the COVID-19 fatality rate. The  $R^2$  coefficient of determination explains approximately 45% of the variance in the data, whereas the

**Table 1:** Descriptive statistics categorized per groups.

Variables	Countries with LOWER COVID-19 Fatality in 2020, group 1		Countries with HIGHER COVID-19 Fatality in 2020, group 2	
	Mean	Std. Deviation	Mean	Std. Deviation
COVID-19 Fatality 2020 (%)	1.40	0.44	2.83	0.54
COVID-19 Fatality 2022 (%)	0.57	0.32	1.21	0.89
Healthcare Exp Per Capita \$ 2009	\$3,119.79	\$2,192.71	\$2,609.13	\$1,828.01
Healthcare Exp Per Capita \$ 2019	\$3,376.29	\$2,014.03	\$2,530.77	\$1,749.05
$\Delta$ Healthcare Exp Per Capita \$ 2009-2019	0.19	0.30	0.09	0.31
Government gross debt, % of GDP 2009	46.79	22.21	67.22	37.35
Government gross debt, % of GDP 2019	50.93	27.43	81.51	46.61
$\Delta$ Government gross debt, % of GDP 2009-2019	0.12	0.31	0.29	0.38

Note:  $\Delta$ = the rate of change from 2009 to 2019 to assess the dynamics of health expenditures per capita, Government gross debt before the emergence of COVID-19 pandemic crisis

**Table 2:** Independent Samples T-Test based on average mean and change of variables from 2009 to 2019 in European countries of group 1 (Countries with LOWER COVID-19 Fatality in 2020) and group 2 (Countries with HIGHER COVID-19 Fatality in 2020).

	Equal Variances	Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t-test	Degrees of freedom	Sig. (2-tailed)
Healthcare Exp per Capita \$ 2009	assumed	1.358	0.255	0.635	25	0.531
	not assumed			0.657	23.947	0.517
Healthcare Exp per Capita \$ 2019	assumed	2.095	0.16	1.129	25	0.270
	not assumed			1.16	23.515	0.258
Δ Healthcare Exp per Capita \$, 2009-2019	assumed	0.214	0.648	0.828	25	0.416
	not assumed			0.826	21.541	0.418
Government gross debt, % GDP 2009	assumed	4.609	0.042	-1.784	25	0.087
	not assumed			-1.626	14.865	0.125
Government gross debt, % GDP 2019	assumed	3.460	0.075	-2.163	25	0.040
	not assumed			-1.966	14.702	0.068
Δ Government gross debt, % GDP, 2009-2019	assumed	0.64	0.431	-1.275	25	0.214
	not assumed			-1.23	18.852	0.234
COVID-19 fatality rate in 2020	assumed	0.698	0.411	-7.518	25	0.001
	not assumed			-7.245	18.775	0.001
COVID-19 fatality rate in 2022	assumed	23.11	0.001	-2.663	25	0.013
	not assumed			-2.292	11.82	0.041

**Table 3:** Bivariate correlation between health expenditure and COVID-19 fatality rates.

	Log Healthcare Expenditure per Capita \$ in 2019
Log COVID-19 fatality rate in 2022	-0.67**

Note: \*\*Correlation is significant at the 0.01 level (1-tailed).

**Table 4:** Estimated relationship of COVID-19 fatality rate in 2022 on Healthcare Expenditure per Capita \$ 2019, log-log model.

	Constant	Coefficient of regression β	Standardized coefficient of regression β	R <sup>2</sup>	F
COVID-19 case fatality rate 2022	9.04***	-1.17***	-0.67	0.45	20.79***

Note: \*\*\*  $p < 0.001$ ; Explanatory variable: Healthcare Expenditure per Capita \$ 2019. R<sup>2</sup> is the coefficient of determination. F is the ratio of the variance explained by the model to the unexplained variance.

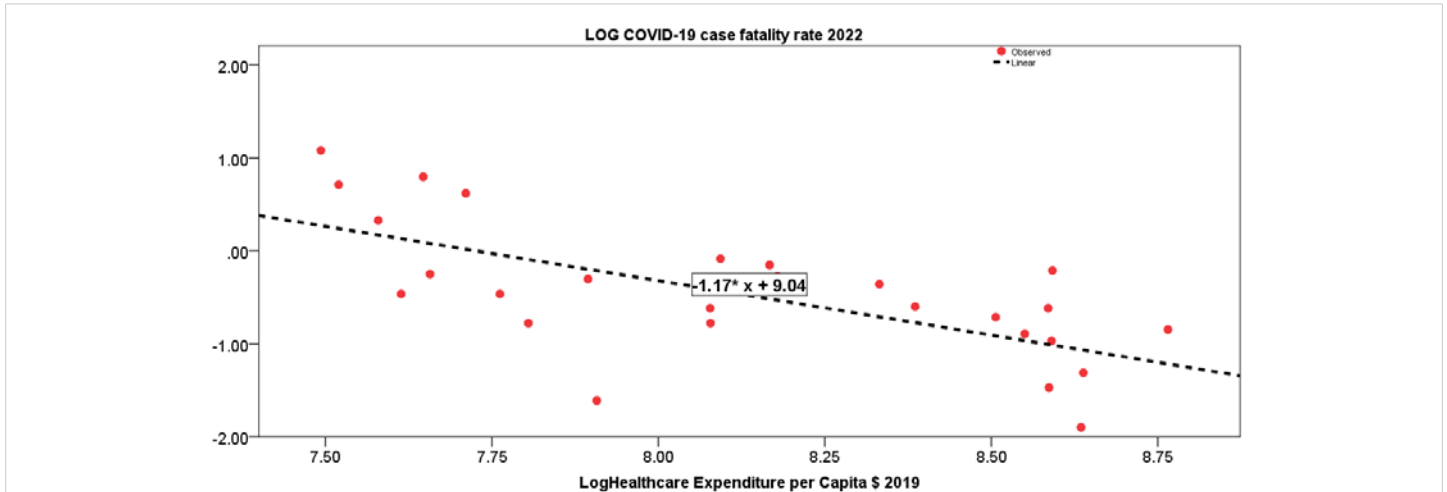
F - value is statistically significant ( $p$  - value < 0.001), indicating that the independent variable reliably predicts the dependent variable, namely the reduction in the COVID-19 fatality rate.

Figure 1 illustrates the estimated relationship between COVID-19 fatality rate in 2022 and healthcare expenditures per capita, whereas bar graphs in Figure 2 confirm empirical analyses with a comparison of COVID-19 fatality rate in 2022, health expenditure per capita in 2019 and level of public debt in European countries of group 1 (Countries with LOWER COVID-19 Fatality in 2020) and group 2 (Countries with HIGHER COVID-19 Fatality in 2020).

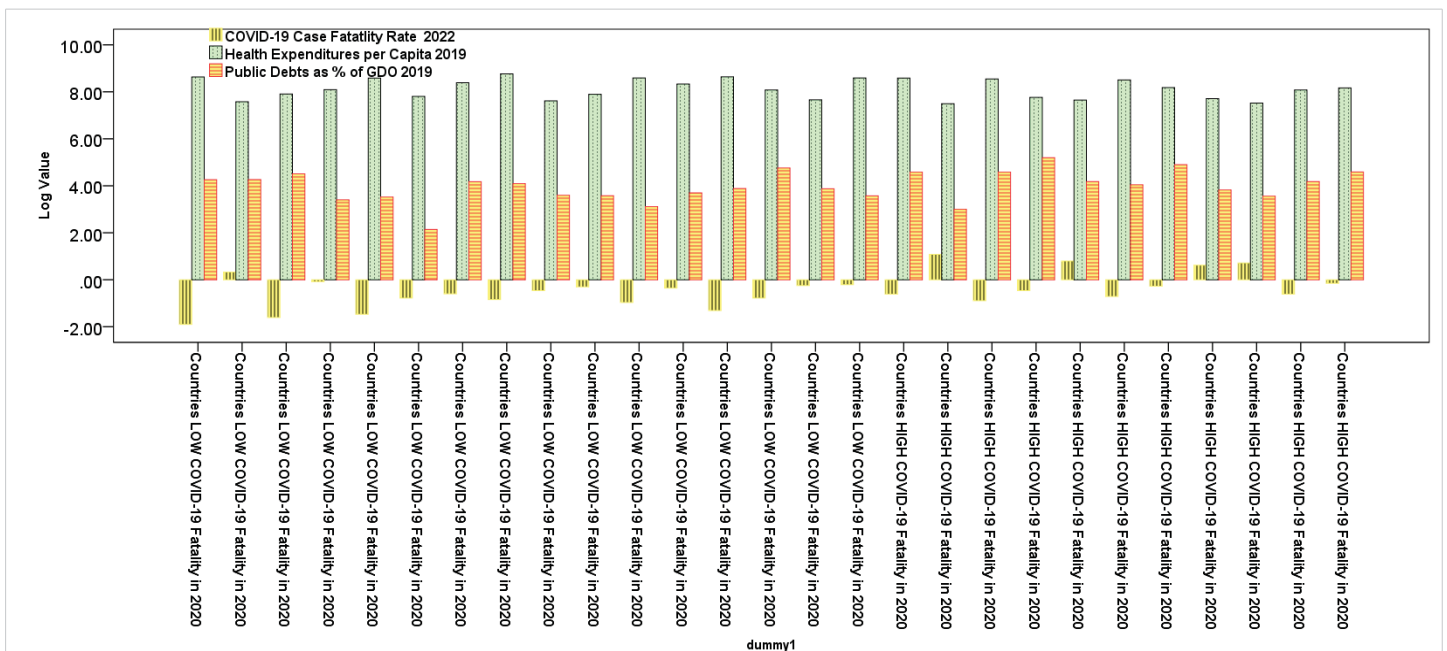
### Discussion and public policy implications to face next emergencies

Studies about COVID-19 discuss manifold implications about health and other socioeconomic effects [71-84]. What this study adds is that countries with higher fatality rates had previous high levels of public debt (0.29% of GDP), resulting in a decline in overall health expenditures over time for healthcare system. Conversely, countries with lower fatality rates, despite a lesser increase in public debt (0.12% of GDP), had a notable escalation in health expenditures per capita, totaling 0.19% of GDP. Results suggest that countries with lower levels of public debt over time are associated with

greater resilience in healthcare system and consequential lower-case fatality rate of COVID-19 [35,85-88]. The susceptibility of the health system stems from the high level of public debt in certain countries, often resulting from political economy strategies based on austerity measures aimed at alleviating the burden of government debt, such as the Stability and Growth Pact (SGP) in Europe, that also reduces health expenditures over time; several studies indicate that European nations striving to reduce their public debt levels adhere to the rules outlined in the SGP, also reducing the spending in health and education [8,89]. However, findings here show that when European countries have a 1% increase in healthcare expenditure per capita, they experienced a 1.2% reduction in the COVID-19 fatality rate. The European Central Bank [90] affirms that excessive government debt leads economies to be less resilient to unforeseen shocks, crises, emergencies, etc. and the trimming of health and social expenditures is frequently a response to initiatives aimed at addressing high level of public debt. Iwata and Iiboshi [91] argue that fiscal adjustments seems to be the primary factor contributing to the diminishing government spending multipliers, rather than the accumulation of debt itself. Hence, financial strategies and public finance policies that impose limitations in various European countries with significant high level of public debt tend to heighten systemic fragility and diminish the ability of health systems to effectively respond



**Figure 1:** Regression line of the COVID-19 fatality rate in 2022 on healthcare expenditures per capita in 2019.



**Figure 2:** Comparison of COVID-19 fatality rate in 2022, health expenditure per capita in 2019 and level of public debt in European countries of group 1 (Countries with LOWER COVID-19 Fatality in 2020) and group 2 (Countries with HIGHER COVID-19 Fatality in 2020).

to crises and complex emergencies [92]. Undoubtedly, these governmental strategies fail to take into account the impact of elevated public debt on a nation’s systemic ability to withstand crises and socio-economic shock. The fundamental implications of economic policy of findings here are that countries must decrease public debt with good governance and institutions [93] and steer clear of austerity measures in order to allocate more resources to the healthcare sector and enhance readiness to address unforeseen emergencies like the COVID-19 pandemic, natural calamities, conflicts, and other environmental disruptions [94-135].

### Concluding remarks

One of the main problems for managing global crises

is to clarify the drivers of systemic weakness or strength in countries to face emergencies. This study here analyzes how the level of public debt can affect healthcare expenditures and fatality rates in the presence of pandemic crises, such as COVID-19.

Main findings of the empirical evidence are that:

- High public debt over time reduces health expenditures and increases the vulnerability of countries to face complex emergencies, such as COVID-19 pandemic crisis.
- High public debt weakens healthcare and socio-economic system of countries in the presence of crises.



- More economic resources the nations spend in health sector, the better they are likely to face emergencies and reduce the case fatality rates.
- When countries experience a 1% increase in healthcare expenditure per capita, in general they have a 1.2% reduction in the COVID-19 fatality rate.
- Countries must reduce public debt with good governance and institutions without reducing the allocation of economic resources to the healthcare sector in order to improve the preparedness to unforeseen complex emergencies and crises, such as pandemics, natural disasters, conflicts, and other environmental catastrophes.

These conclusions are of course tentative. There is need for much more detailed research with additional data and different methods into the relations of socioeconomic factors to reduce country risk and improve the resilience of nations in the presence of emergencies and global crises.

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