DO NATIONAL HEALTH EXPENDITURES MATTER FOR THE COVID-19? EVIDENCE FROM THE EUROPEAN UNION

GREGORY T. PAPANIKOS

In a series of previous papers, I have examined various aspects of COVID-19. In a history paper, I compared ancient Athenian Plague of 430-427 BCE (Papanikos, 2020a) with the current pandemic. I showed the social and political similarities as well as individual impacts. Similarities are striking. The only constraint researchers face is the lack of economic and statistical data.

In a second paper (Papanikos, 2020b), I looked at the impact of lockdown on the Greek economy with an emphasis on international tourism arrivals and the dramatic fall in this year's tourism receipts. Using a scenario analysis based on pre-bookings, the economic effect in terms of Gross Domestic Product (GDP), may reach a double-digit figure.
My last paper (Papanikos, 2020c) investigated the association between the size of population sizes (including densities and age structure) and COVID-19 effects in terms of total and per million deaths and cases. Total population, as one would expect, had a positive impact even though population density and the aging of population did not exert a statistically significant impact. Future studies, at a less aggregated level, may shed light on this puzzle.

The surprising result of this study was the positive association of total and per capita GDP to the effects of COVID-19. One may explain the association with the number of people infected as a result of a better measurement in richer countries. However, this could not be the case of number of deaths. One expects that death rates are more accurately measured than the total number of people infected. After all, the latter statistic does not include the number of people who either did not notice it or avoided to be tested.

This study is an extension of a demographic study I have conducted. I look at a particular component of GDP that of total health expenditures. One may expect a negative association between health expenditures (total, per capita and per GDP) with the number of people died due to COVID-19. On the other hand, the finding of my previous study of a positive association between deaths and GDP and given the positive relations of GDP with health expenditures, makes the effect of health expenditures on deaths an empirical issue.

Figure 1. *National Health Expenditures and GDP*

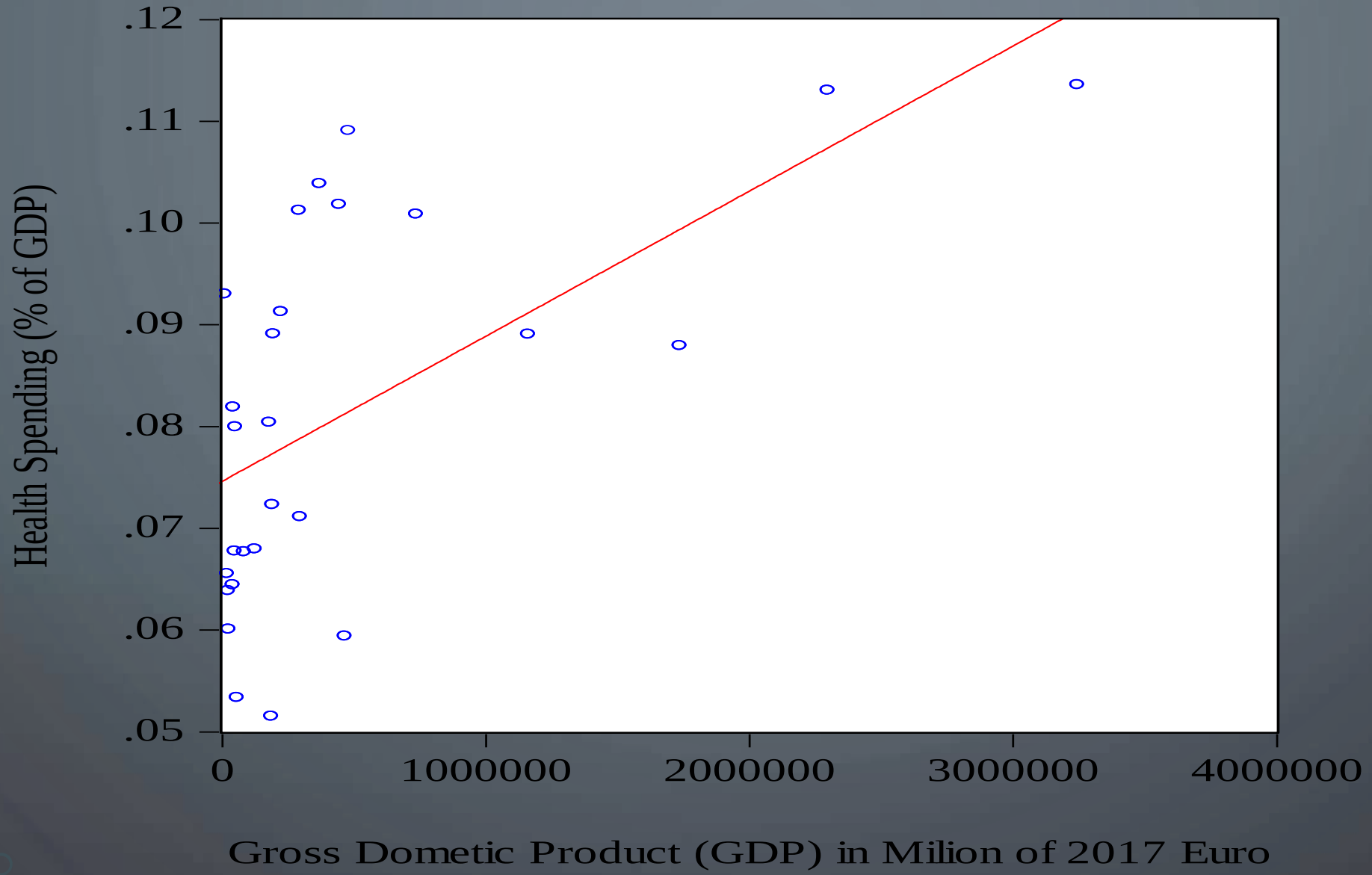

Table 1. *GDP Effects on Health Spending*

Dependent Variable: Total Health Expenditures as a % of GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.071663	0.003	21.17	0.0000
GDP	2.98E-08	9.20E-09	3.24	0.0035
$(GDP)^2$	-5.57E-15	2.93E-15	-1.90	0.0693
Adjusted R-squared	0.3380			
F-statistic	7.64			
Prob(F-statistic)	0.003			
Prob (Wald F-statistic)	0.000			

Note: HAC standard errors & covariance are reported.

Descriptive and Summary Statistics

Table 2 (in the Paper not reported here) reports raw data and summary statistics of the 27 EU countries. Data are reported for total health expenditures, population, total number of deaths and per million of population, total number people infected and per million of population. However, the most important variable for our purpose here is the percentage of total health expenditures to GDP reported in Column (4) of Table 2. This table reveals a number of important issues related to total health expenditures as a percentage of GDP.

1. The average total health expenditures as a percentage of GDP in EU countries is 8.2% and a median of 8% reveals a normal distribution with a standard deviation of 1.9% and a range of 6.2%. The minimum spending of 5.2% was reported by Romania and the maximum of 11.4% by Germany.

2. EU countries show large variations in almost all variables of concern here. Deaths from COVID-19 show large variations. The average value of deaths per million is 172 people but this varies from a maximum of 831 deaths per million reported by Belgium to only 5 deaths per million reported by Slovakia. The median is 57 which compared with the arithmetic mean of 172 deaths per million shows a large skewness something that is also indicated by the relatively large standard deviations of 224 deaths per million. These numbers need further research on a country by country case which goes beyond the purpose of this study.

3. A real puzzle is that the two most populated countries of the EU show exactly opposite results. Germany has a population of 82 million and France 67 million. The percentage of total health expenditures to GDP is almost the same, 11.4% and 11.3%, respectively. Yet the number of deaths reported by France is 3.4 times higher than that of Germany. How can such huge differences be explained? Effectiveness might be one explanation and requires further investigation, which goes beyond the limited scope of this paper.

4. The next two countries with the largest populations are Italy and Spain which happened to have about the same percentage of health spending of 8.8% and 8.9%, respectively. Their COVID-19 deaths are relatively comparable. Italy with a population of 61 million people had as of 31 of May 2020, 33 thousand deaths and in Spain, with a population of 47 million, the number of deaths reached 29 thousand.

5. The other countries show a mixture of performances which again need further explanation. Twenty countries of EU spend less than 10% of their GDP on health. Their performance shows great variations. On average, deaths per million in these 20 countries was 116 per million with a standard deviation of 180 people. The seven countries with health spending higher than 10% of GDP reported more than double deaths per million (332 people) and a standard deviation of 271 deaths per million.

Table 3. *Regression Results I (Logarithmic Specification)*

Dependent Variable: Total Deaths per Million (in logs)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-12.01176	2.427865	-4.947458	0.0001
LOG(H17/GDP17)	-0.117158	0.678974	-0.172552	0.8645
LOG(POP17)	0.498422	0.123289	4.042711	0.0005
LOG(GDP17/POP17)	1.465476	0.177574	8.252739	0.0000
Adjusted R-squared	0.592475			
F-statistic	13.59993			
Prob(F-statistic)	0.000026			

White heteroskedasticity-consistent standard errors & covariance estimates are reported

Table 4. *Regression Results II (Non-Linear)*

Dependent Variable: Total Deaths per Million

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.346957	0.173509	-1.999649	0.0586
H17/GDP17	1.523879	2.424456	0.628545	0.5364
POP17	1.93E-05	6.15E-06	3.133617	0.0050
POP17^2	-2.27E-10	8.02E-11	-2.835119	0.0099
GDP17/POP17	0.011622	0.004861	2.390903	0.0263
(GDP17/POP17)^2	-7.59E-05	4.59E-05	-1.653550	0.1131
Adjusted R-squared	0.444559			
F-statistic	5.161926			
Prob(F-statistic)	0.003043			

White heteroskedasticity-consistent standard errors & covariance estimates are reported

SOME TENTATIVE CONCLUSIONS

- Data show a number of puzzles that future studies should explain. For example, how can one explain the dramatic difference between France and Germany? In general, how can one explain the disappointing performance of countries which spend a high percentage of their GDP on health, e.g., more than 10% of their GDP.
- The surprising performance of some countries such as Greece.
- These puzzles cannot be solved using aggregate data. A future study should look at each country's policy reaction to COVID-19.