The Economic Impact of the 2020 Pandemic in the European Union

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This paper uses the recent (6 May 2020) GDP estimates of the European Commission (AMECO) which incorporates the impact of COVID-19 on the economies of the 27 European Union countries. These estimates range from 4% to 10% of output loss in 2020. In this paper, these prognoses of GDP losses are used in a simple regression model to test their associations with (a) the severity of COVID-19 measured by the number of deaths per million, (b) a convergence factor measured by GDP per capita and (c) the tourism share of GDP. The most important finding is revealed by an analysis of the residuals of this regression. Countries such as Greece and Italy are outliers relative to the fitted line and their growth rate is underestimated by the European Commission. On the other hand, Poland's growth rate is overestimated. However, economies which rely on tourism are expected to suffer large GDP losses.

Keywords: COVID-19, European Union, Population, GDP, Per Capita GDP.

Introduction

Pandemics are not new and recur quite often. However, their regularity is unpredictable. Most importantly from a social and economic point of view, the extent of pandemics' impacts on the number of deaths and economic declines is uncertain. Any preventive measure runs the risk to incur either needless economic costs or avoidable loss of lives. Thucydides provided the first written source of a plague that struck Athens from 430 to 427 BCE (see Papanikos, 2020a). Since then plagues have been examined by historians and have been narrated by many novelists throughout the centuries. The current pandemic will not be an exemption.

There is no doubt that economic impacts are massive but lack of data prohibit their reliable estimation. The first step is to predict the timing of a pandemic which is impossible. World Bank (2018) has warned that pandemics are unavoidable but the mechanism of predicting them has not been established. Economists or any other scientist cannot predict the next pandemic despite the warnings of international organizations and many individual scholars. To say that the next pandemic has a nonzero probability of occurrence in the near future is tantamount of saying that every individual faces a nonzero probability of dying one day. Such predictions are true but useless. The literature on pandemics puts an emphasis on preventions but these command huge resources and require cost-benefit analyses of measures taken prior to a pandemic outbreak. Such an analysis is almost impossible with the uncertainty and the risks that surround any pandemic.

Nevertheless, from an economic point of view, predicting the pandemic itself is not the most important issue. Uncertainties and risks are more important. However, these are non-economic problems which, still, exert tremendous economic impacts. These economic costs do not relate to the timing of a pandemic because we know with certainty that a pandemic will strike some time in the future. The uncertainty and risks relate to its spread and fatality. This is the problem and not the pandemic itself. How do governments decide how much money to spend on prevention if the extent of the impact is not known? This question is not answered. For example, on the issue of hospital infrastructure and in particular the intensive care units, what is the optimal number of intensive units per capita? The health economics literature is vast and researchers have examined

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the impact of uncertainty of demand in building hospital infrastructure. The conclusion of this literature is that in emergency situations there is a nonzero probability that some patients may not be served. This will always be the case with the current pandemic. The harsher the pandemic, the higher the number of people who could not be served.

The economic literature on pandemics is significant. Both the theory (including simulation studies) and specific cases of the past have been put forward to examine the economic impacts of pandemics. Many studies have reported aggregate economic impact estimates of a pandemic or many other related contagious diseases. Data form past pestilences such as the 1918 pandemic and some epidemics such as the Ebola, HIVS, and SARS (see Almond, 2006; Bandiera et al., 2018; Barro et al., 2020; Burns et al. 2018; Fan et al. 2018; Jonas, 2018) have been used to estimate economic impacts. Some studies have provided simulation results as well (see Eichenbaum, et al., 2020). These studies are considered as giving the benchmarks for this study and are further mentioned below.

Economic impacts differ according to the severity and the spread of diseases. Not all pandemics have significant economic impacts. For example, every year many people die from a common flu and aggregate economic impacts are negligence when are compared with the current coronavirus pandemic which forced almost all countries to lockdown social activities and as a consequence severely restricting many economic activities especially leisure and recreation activities.

Reviewing the relevant literature on pandemic economics one conclusion that naturally emerges is that the economic impact of a pandemic depends on its severity. If severity is measured by the numbers of deaths, then how do these death rates associate with economic impacts? One would expect that the higher the death rate, the higher the economic impact. However, the causality may run the other way around. The higher the economic activity in the midst of a pandemic, the higher the severity of the disease.

In a recent paper, which used an interaction epidemiological model, Eichenbaum et al (2020, p. 1) stated that "Our model makes clear that people's decisions to cut back on consumption and work reduce the severity of the epidemic as measured by total deaths. These same decisions exacerbate the size of the recession caused by the epidemic". Therefore, there exist a tradeoff between the severity of a pandemic (measured by deaths) and economic impacts (measured by GDP declines).

This study addresses this issue using data from the 27 European Union (EU). Recently (6 May 2020), the European Commission has revised their 2020 Gross Domestic Product (GDP) estimates taken into consideration the economic impact of COVID-19. In addition, in a series of reports, the European Commission (2020a, 2020b, 2020c, 2020d) has attempted to tackle the challenge of COVID-19 impact on their economies.

Including this introduction, this paper counting is organized into five sections. The next section looks at European Commission's new GDP estimates for 2020 which take into consideration the effect of COVID-19. The third section examines the COVID-19 severity performance in terms of deaths per million as of 30 of June 2020. What is important here is not so much the absolute numbers but the variations between the 27 EU countries. In the fourth section, the association between the severity of COVID-19 and GDP growth is analyzed. The last section of the paper concludes.

Estimates of 2020 GDP Growth Rates

The European Commission reported, on 6 May 2020, GDP estimates for 2020 which included the COVID-19 economic impact. This section provides a brief overview of these estimates. The variable of interest is GDP growth. Table 1 shows the growth rate of real GDP in the 27 EU countries. According to these estimates, GDP in 2020 is expected to decrease by an average of 7.03%. The worst economic impact is reported for Greece. Its GDP is estimated to decrease by 9.74%. Poland is estimated with the smallest effect of 4.26%.

Table 1. GDP Growth in the EU Countries

	Country	GDPGR20/19 (1)	GDPGR19/18 (2)	GDPDIF (3)
1	Belgium	-0.0716	0.0137	-0.0852
2	Bulgaria	-0.0719	0.0337	-0.1056
3	Czechia	-0.0622	0.0257	-0.0878
4	Denmark	-0.0586	0.0237	-0.0822
5	Germany	-0.0647	0.0056	-0.0703
6	Estonia	-0.0695	0.0433	-0.1128
7	Ireland	-0.0795	0.0555	-0.1350
8	Greece	-0.0974	0.0187	-0.1161
9	Spain	-0.0938	0.0198	-0.1136
10	France	-0.0825	0.0132	-0.0956
11	Croatia	-0.0913	0.0294	-0.1207
12	Italy	-0.0952	0.0030	-0.0982
13	Cyprus	-0.0740	0.0323	-0.1063
14	Latvia	-0.0696	0.0220	-0.0915
15	Lithuania	-0.0790	0.0391	-0.1181
16	Luxembourg	-0.0538	0.0230	-0.0768
17	Hungary	-0.0705	0.0493	-0.1198
18	Malta	-0.0581	0.0438	-0.1020
19	Netherlands	-0.0685	0.0181	-0.0866
20	Austria	-0.0551	0.0158	-0.0710
21	Poland	-0.0426	0.0415	-0.0841
22	Portugal	-0.0677	0.0216	-0.0892
23	Romania	-0.0596	0.0408	-0.1004
24	Slovenia	-0.0698	0.0244	-0.0942
25	Slovakia	-0.0670	0.0228	-0.0898
26	Finland	-0.0633	0.0098	-0.0731
27	Sweden	-0.0606	0.0123	-0.0729
	Average	-0.0703	0.0260	-0.0963
	Maximum	-0.0426	0.0555	-0.0703
	Minimum	-0.0974	0.0030	-0.1350
	St. Dev.	0.0133	0.0136	0.0174

Data Source: https://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm.

This picture is in sharp contrast with GDP growth rates in 2019 when the average growth rate was 2.6% with Ireland leading the rates of growth with 5.55% and Italy fairing worst of all with an almost zero percent growth rate. A zero rate would have been considered as a great economic success in 2020.

What is important is this difference between the positive record of 2019 and the economic catastrophe expected in 2020. Column (3) of Table 1 shows this difference between the estimated 2020 and the 2019 growth rates. Ireland from an impressive 5.55% in 2019 will drop to a 7.95%, a difference of 13.5% output loss. Many countries will experience more that 10% growth rate differences in 2020 relative to 2019. The average difference is close to 10% with Germany leading the countries with the least change in growth rates from 2019 to 2020 of 7.03%. The range is close to 6.5%, from the lowest of Germany's rate to the highest economic impact of Ireland of 13.5%.

Another way of looking at this is by grouping the effects into three categories according to the magnitude of the economic impact. Table 2 groups the 27 EU countries into three categories of severe, moderate and relatively low economic growth impacts.

In 16 countries, the reduction of GDP growth will range from 6 to 8 percent. Higher declines will be experienced by five countries and six countries will have falls between 4 and 6 percent. According to McKibbin & Sidorenko (2006) and Burns et al. (2008) simulation estimates based on the Hong Kong Flu of 1968-69, the Asian Flu of 1957 and the 1918 so called Spanish Flu, a growth rate of less than -4% is considered severe. A loss over 8% was termed "ultra" severe. Table 2 shows that the decline of GDP is expected to be severe for 22 countries of EU and "ultra" severe for 5 countries.

Table 2. Cumulative Statistics of Growth Rates

Growth rates	Count	Percent	Cumulative Count	Cumulative Percent
-10% to -8%	5	18.52	5	18.52
8% to 6%	16	59.26	21	77.78
6% to 4%	6	22.22	27	100.00
Total	27	100.00	27	100.00

However, if the losses are measured as a difference between the 2020 and 2019 growth rate (see the last column of Table 1), then the economic impact is "ultra" severe for 23 countries with an output loss relative to 2019 growth rate of more than 8%. Four countries will have a growth rate difference between 7 and 8 percent.

The above severe impacts that previous studies have simulated are related with a huge mortality rate ranging from 0.3% to 2% of the population depending on the level of development of the country/area. For the EU countries, this was 0.3%. These mortality rates are examined in the next section of this paper.

The Severity of COVID-19 in the EU Countries

The usual measurement of the severity of COVID-19 is the number of deaths per million of population (see Table 3). Global Health 2035 (http://globalhealth2035.org/) has introduced a

similar measurement per 10,000 of population (10^{-4}) called *Standardized Mortality Unit* (SMU). However, the measurement per million is better because it facilitates interpretation. In addition, as mentioned in the previous section, the severity of a pandemic is measured in terms of the percentage of population who died from the disease. The threshold number was 0.3% for Europe. Below this number, the effect is considered relatively mild. This number was the outcome of simulation-based on the economic impact of the 1918 pandemic.

Table 3. The Severity of COVID-19 Measurements

	Country	Population (000s) (1)	Total Deaths (2)	Deaths per Population (3)	Deaths per Million of Population (4)
1	Belgium	11542	9747	0.0844%	844
2	Bulgaria	6939	230	0.0033%	33
3	Czechia	10710	349	0.0033%	33
4	Denmark	5843	605	0.0104%	104
5	Germany	83270	8990	0.0108%	108
6	Estonia	1331	69	0.0052%	52
7	Ireland	4962	1736	0.0350%	350
8	Greece	10652	192	0.0018%	18
9	Spain	47217	28355	0.0601%	601
10	France	66945	29846	0.0446%	446
11	Croatia	4054	107	0.0026%	26
12	Italy	60314	34767	0.0576%	576
13	Cyprus	890	19	0.0021%	21
14	Latvia	1908	30	0.0016%	16
15	Lithuania	2790	78	0.0028%	28
16	Luxembourg	632	110	0.0174%	174
17	Hungary	9752	585	0.0060%	60
18	Malta	516	9	0.0017%	17
19	Netherlands	17482	6132	0.0351%	351
20	Austria	8921	705	0.0079%	79
21	Poland	37922	1463	0.0039%	39
22	Portugal	10274	1576	0.0153%	153
23	Romania	19294	1651	0.0086%	86
24	Slovenia	2097	111	0.0053%	53
25	Slovakia	5461	28	0.0005%	5
26	Finland	5530	328	0.0059%	59
27	Sweden	10373	5333	0.0514%	514
	Average	16604	4932	0.0179%	179
	Maximum	83415	34767	0.0844%	844
	Minimum	531	9	0.0005%	5
	St. Dev.	22339	9807	0.0228%	228

These measurements for the 27 EU countries are reported in Table 3. It includes data of COVID-19 deaths as of 30 June 2020. The severity of COVID-19 in the 27 EU countries shows great variations measured either as the percentage of deaths to total population or the number of

deaths per million. The average total deaths were 4932 people which corresponds to an average of 179 per million of population. These are average over countries. In terms of total deaths, three countries Italy (34,767), France (29,846) and Spain (28,355) were hit really hard which a future study should explain especially when this is compared with Germany. Demographics and health spending cannot account for these differences as I have explained in Papanikos (2020c & 2020d). However, even in these three countries the threshold level of 0.3% was not reached. The highest percentage was recorded by Belgium of less than 0.1%.

Table 4 groups these effects into nine categories each one with a range of 50 deaths per one million of people. Ten countries had less than 50 deaths per million of population of the 37% of the EU countries. Six countries had between 50 and 100 deaths per million which represents 22% of the EU countries.

Table 4. Cumulative Severity Impacts (Deaths per Million)

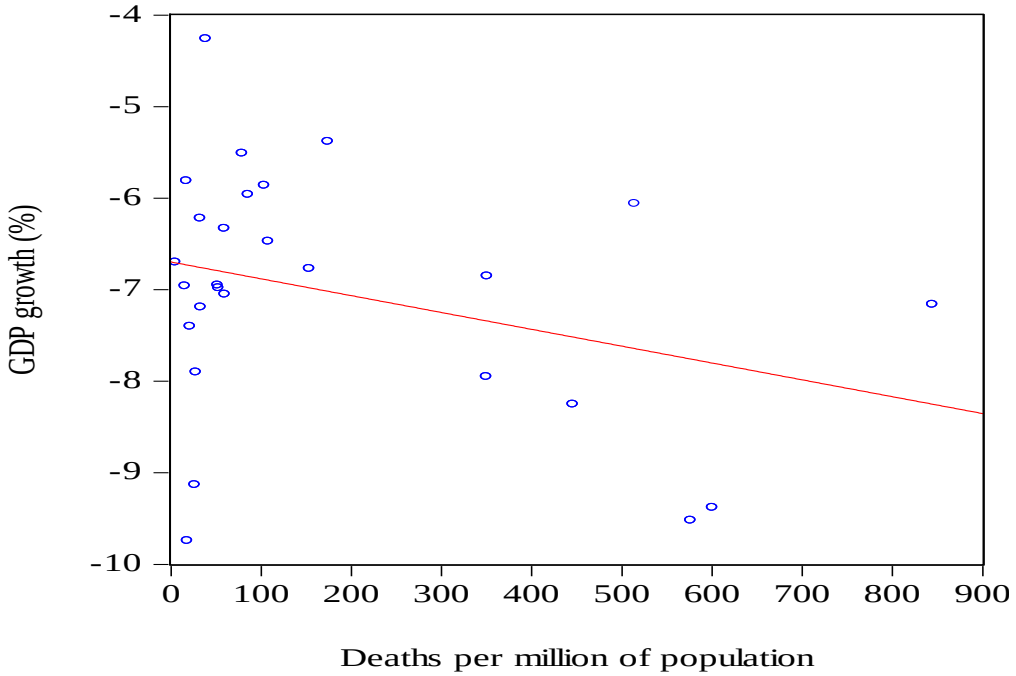
Deaths per Million	Count	Percent	Cumulative Count	Cumulative Percent
[0, 50)	10	37.04	10	37.04
[50, 100)	6	22.22	16	59.26
[100, 150)	2	7.41	18	66.67
[150, 200)	2	7.41	20	74.07
[300, 350)	1	3.70	21	77.78
[350, 400)	1	3.70	22	81.48
[400, 450)	1	3.70	23	85.19
[500, 550)	1	3.70	24	88.89
[550, 600)	1	3.70	25	92.59
[600, 650)	1	3.70	26	96.30
[800, 850)	1	3.70	27	100.00
Total	27	100.00	27	100.00

The impact of variations of COVID-19 death rates on the economies of the EU countries is analysed in the next section. As mentioned in the introduction, the causality of this effect may run the other way as well. This is the reason that the results should be interpreted as associations rather than as causal relationships.

The Tradeoff between GDP Growth and the Severity of COVID-19

Figure 1 displays the scatter diagram of the 2020 GDP growth rates estimated by the European Commission and the severity of COVID-19 in the 27 EU countries. For each country, severity is measured as the number of deaths per million of population. The regression line has a negative slope. A rise in the severity of the pandemic, decreases the rate of growth of GDP. However, the graph also reveals that within the EU area there exist huge variations as these described in the previous sections of this paper and summarized below.

Figure 1. GDP Growth and the Severity of COVID-19



The scatter diagram shows a relatively strong negative association. A simple regression model of GDP growth is developed to test this relation which here is interpreted as a possible causal relationship running from COVID-19 to GDP growth rates. The model specification is as follows:

$$GDPGR\ \beta_0 + \beta_1 * \ln(\text{deaths per million}) + \beta_2 * \ln(\text{per capita GDP of 2019}) + \beta_3 * \ln(\text{GDP Tourism Share})$$

Summary statistics of the variables used in the regression are reported in Table 5 and the estimation of coefficients in Table 6. One of the most important policy reactions to a contagious disease spread is to close down the country to international and national travel. This was also the case with the COVID-19 pandemic. This, as expected, has had a devastating impact on the tourism industry and therefore to the aggregate activity. Thus, the higher the tourism share of GDP the higher the impact.

In EU countries, tourism contributes 10.9% to GDP. There are, however, huge variations of as low as 4.5% and as big as 24.9%. This implies that variations in GDP impacts may be explained by variations in the tourism importance as a share of GDP. I have examined in another paper the impact of the current pandemic on Greek tourism industry (Papanikos, 2020b).

Even though the EU area consists of relatively high-income countries and in theory they have well integrated economies, there exist, nevertheless, large differences in terms of per capita income and GDP growth. According to the convergence hypothesis, initial per capita income and GDP growths are related. Countries with lower than average per capita income would tend to grow faster than countries with relatively higher per capita income. Thus, it is expected that the convergence coefficient (β_2) in the above equation is negative.

Table 5. Summary Statistics

	GDP Growth	Deaths per Million	GDP per Capita (€)	GDP Share of Tourism (%)
Mean	-0.070274	179	27615.56	10.92
Median	-0.069500	60	22040.00	8.7
Maximum	-0.042600	844	83640.00	24.9
Minimum	-0.097400	5	6800.000	4.5
Std. Dev.	0.013313	228	17551.78	5.55
Skewness	-0.420693	1.48	1.408039	0.99
Kurtosis	2.858607	4.1	5.033911	3.1

Table 6 shows that, as expected, the severity of COVID-19 has a negative impact on GDP growth. The higher the severity (deaths per million) the lower the estimated growth of GDP. The 2019 per capita GDP can be interpreted as the convergence term of GDP growths among the 27 EU countries. The positive sign shows non-convergence but the coefficient is not statistically significant. The tourism impact is negative. Countries with high tourism share of GDP are more vulnerable.

Table 6. Regression Results

Dependent Variable: GDP Growth

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.092419	0.044013	-2.099796	0.0469
Ln (Deaths per Million)	-0.004085	0.002069	-1.974401	0.0605
Ln (GDP per Capita)	0.006993	0.004259	1.641816	0.1142
Ln (GDP share of Tourism)	-0.013284	0.005916	-2.245228	0.0347
R-squared	0.325077	Mean dependent var		-0.070274
Adjusted R-squared	0.237044	S.D. dependent var		0.013313
F-statistic	3.692658	Prob (F-statistic)		0.043387

Note: White heteroskedasticity-consistent standard errors & covariance are reported

The 2020 GDP growth rates are European Commission's estimates. For some countries, the simple model here shows great variations between the estimate of the European Commission and the one predicted by the fitted line of the estimated model. Figure 2 graphs the residuals of the regression and Table 7 reports the actual (the ones reported by the European Commission) and fitted values of the model.

Figure 2. Residual Plots

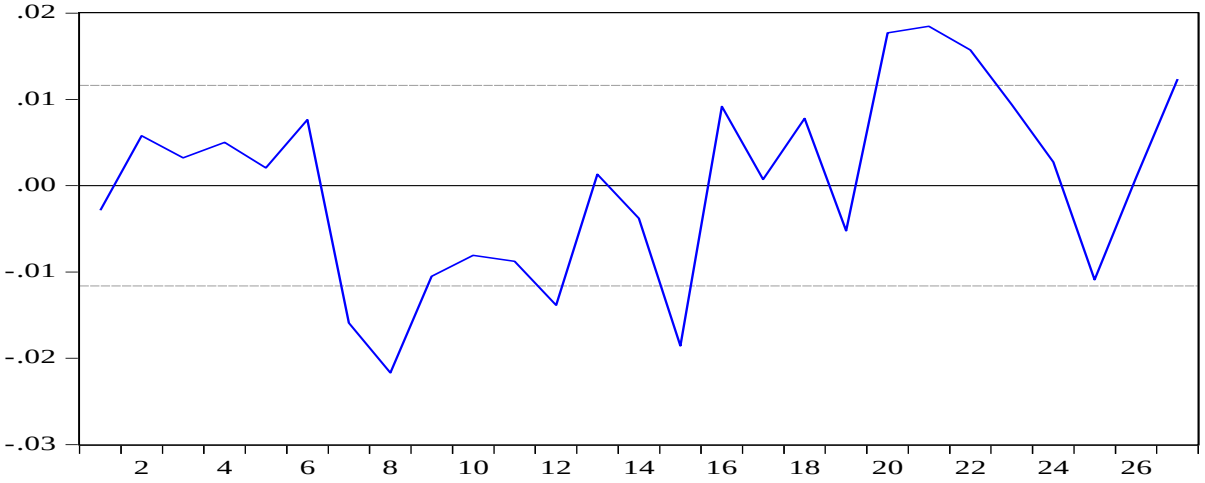


Table 7. Actual and Fitted Values

	Country	Actual	Fitted	Residual
1	Belgium	-0.0716	-0.06875	-0.00285
2	Bulgaria	-0.0719	-0.07768	0.00578
3	Czechia	-0.0622	-0.06542	0.00322
4	Denmark	-0.0586	-0.06361	0.00501
5	Germany	-0.0647	-0.06676	0.00206
6	Estonia	-0.0695	-0.07715	0.00765
7	Ireland	-0.0795	-0.0636	-0.0159
8	Greece	-0.0974	-0.07571	-0.02169
9	Spain	-0.0938	-0.0833	-0.0105
10	France	-0.0825	-0.07443	-0.00807
11	Croatia	-0.0913	-0.08254	-0.00876
12	Italy	-0.0952	-0.08134	-0.01386
13	Cyprus	-0.074	-0.07532	0.00132
14	Latvia	-0.0696	-0.06582	-0.00378
15	Lithuania	-0.079	-0.06043	-0.01857
16	Luxembourg	-0.0538	-0.06297	0.00917
17	Hungary	-0.0705	-0.07123	0.00073
18	Malta	-0.0581	-0.06589	0.00779
19	Netherlands	-0.0685	-0.06329	-0.00521
20	Austria	-0.0551	-0.0728	0.01770
21	Poland	-0.0426	-0.06109	0.01849
22	Portugal	-0.0677	-0.08343	0.01573
23	Romania	-0.0596	-0.06898	0.00938
24	Slovenia	-0.0698	-0.07254	0.00274
25	Slovakia	-0.067	-0.05611	-0.01089
26	Finland	-0.0633	-0.06424	0.00094
27	Sweden	-0.0606	-0.07294	0.01234

Greece's GDP impact is estimated by the European Commission to be the highest in the EU. It is estimated theta the Greek GDP will decrease by 9.7%. However, Greece is an outlier in the

simple model presented above. Given its per capita income and its tourism share of GDP, the fitted growth rate is 2.2% lower than the one estimated by the European Commission. According to the model the Greek GDP is predicted to decrease by 7.6%. Within the same context, the Italian GDP growth rate is underestimated from 8.1% decline to 9.5%, a residual of 1.4%. On the other hand, Poland's GDP fitted growth rate is much lower (by 1.8%) than the one reported by European Commission of -4.3%. These estimates need further discussion and future research.

Conclusions

The economic impact of COVID-19 is huge as this is estimated now by the European Commission and more recently by IMF. This, of course, was expected, when all countries lockdown all their social activities which include economic activities. The sharp declines in GDP classify the current pandemic as being one of the most severe ones given that these impacts vary from 4% to 10% of GDP losses. However, in terms of deaths per million of population the impact cannot be classified as severe or ultra-severe as these terms are defined in the relative literature.

There seems to be a shift in the tradeoff curve and now lower death rates are associated with much higher output losses. At least two interpretations can be given to explain this structural change of the tradeoff.

Firstly, in the modern world international and national travel for business, education and pleasure has been unprecedented. A pandemic has disproportionally larger impact on the tourism sector of the economy. People cannot do without eating but they can live without travelling. The second explanation is policy related.

Secondly, governments took different measures to cope with the COVID-19 which had different impacts on the economy. The question to be examined by future studies is whether there was an overreaction relative to the severity of the COVID-19. One then should examine how countries coped with the COVID-19 and how this is related to economic growth and the severity of the pandemic. One such case is Sweden which did not take as severe measures as other countries.

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