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COVID19 Deaths Linked to Restrictions Stringency Lag: A G7 and Global Analysis, Implications for Public Policy

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Abstract: This study focuses on the results of the G7 countries from the analysis of daily data from 184 countries of the world during the COVID19 epidemic. After an increase in restrictions, there is an increase in new COVID19 deaths. To understand the influences on number of deaths by country, the analysis reveals that per capita income is significantly positively correlated with mortality from COVID19. This suggests that the epidemic first hit rich countries the hardest through the correlation to the human development index. This finding was contrary to what was predicted by the Global Health Security Index on pre-pandemic preparedness. Within affluent countries, deaths and cases were higher among socio-economic challenged populations. This was supported by the number of deaths that are positively influenced by the GINI index that is an indicator of disparity of income and wealth. The research indicates that after an increase in restrictions, there is an increase in new COVID19 deaths and cases. This along with the finding on the stringency index, correlated with the stringency lag, point to the effectiveness of policies being negatively correlated due to a lag in implementation and partial application. Moreover, the uncertainty or the variability of the stringency index has a negative impact on mortality. The "Power Distance" by was used to understand individual's reaction to restrictions indicated by the stringency index and the stringency lag, COVID19 death numbers were also found to be positively influenced by a countries "Power Distance". These findings are key to the improve policy management of the virus. The Delta plus and Lambda variant's increased transmissibility and potential vaccine resistance increases the urgency for policy makers to understand and immediately enforce the stringency of regulations in consideration of their countries Power Balance index, and to reduce the stringency lag of their policies to increase the effectiveness in reducing the transmission of COVID19.

Keywords: COVID19, Variant, Nonfinancial Risk Management, Public Policy, Mathematics, Spread of Viral Disease, GRAFT, Finance

1. Introduction

The whole world is facing a growing number of complex and interconnected challenges. Recently, many risks of different nature are intertwining and strengthening with each other, generating a dangerous accumulation in some points of the world system. Epidemic risks are inevitably linked to economic, financial, political stability risks and many other possible risks committed as evidenced by the various reports of the World Economic Forum (WEF). The WEF 2020 report identified the potential severity of a pandemic, however, did not give much evidence to the likelihood risk of pandemics. The WEF 2021 increased the spread of viral disease to the most severe and 2nd most likely, with the greatest inter-relationships with increasing Social Cohesion Erosion, and Debt Crisis.

Social and financial-economic systems are embedded in a complicated (complex) and connected world. Helbing D. [9] links the five global risks though networks, Tullo [19] links the correlations of five global clusters through the Global Risk and Trends Framework (GRAFT) and Tullo [20] focuses on the interrelationship of theses risk clusters and COVID19.

In short, we can say with certainty that no phenomenon can, now more than ever, be studied alone, or without taking into account the consequences on all other variables. Political, economic, and social tensions are growing. In the areas affected by the COVID19 pandemic, fear, crime and uncertainty increases, and the economic-financial system collapses: which is only the latest result. At the root there are fears and risks, especially this one, as serious as survival, living with a contagious disease, or lingering LongCovid.

Importantly, Szymanski et al [18] documents the failure of global risk networks approach: without identification the network is unable to precisely estimate the risks. An example of this failure was the underestimation of the pandemic risk that some philosophers had already thought of, highlighting the great potential of biological research in the hands of nations with few safety protocols such as China, Turchin [21]. The difficulties in modeling all these (interconnected) risks together are due to the fact that there is uncertainty in the communications, Leduc and Liu [13] and in the procedures themselves to be used. This is natural, given the novelty of the epidemiological risks that our societies are undergoing. There is a need to broaden the data used and apply new modeling techniques.

In responding to the COVID19 epidemic, modelling is an essential tool for researchers and policy advisors to simulate the impact of various interventions or public health strategies, and to provide quantitative predictions of how interventions might affect population health in the future. In this analysis, we cannot leave out other factors such as geographical areas and different responses by region and between and within countries.

The last four years have seen the continued decline of global governance as illustrated in the loss of funding and influence of global organizations such as the World Health Organization (WHO), the United Nations (UN), and the International Monetary Fund (IMF). The spread of viral disease such as coronavirus that resulted in the COVID19 pandemic can only be addressed through global cooperation of countries by strong multilateral organizations.

The recent research is still in its infancy and several elements are missing. The present work intends to map: what are the key connections? Until recently, much weight was attached to the economic and financial system. Today, other risks are more serious and manifest: epidemics, societal, technological, and geopolitical risks. Asking the question: What are the reasons for the differences between different geographical areas?

2. Methods

2.1. Stylized Facts

Even taking into account possible difficulties in obtaining data, it is evident that rich countries were most affected by the pandemic. Schellekens and Sourrouille [28] document that despite the extensive spread of the virus, the mortality toll in 2020 were highly concentrated in high-income countries. Developed countries represent, numerically, the most of world inhabitants: 15 percent of the global population, but 79 percent of the pandemic's death toll. We find that the countries with the highest per capita incomes are the most demanding. While, within the G7, the population with the highest GDP per capita has a significant and negative coefficient with respect to deaths. Therefore: in the world, the pandemic affects rich countries more but, within them, the wealthy population is less affected.

Table 1 shows a positive and significant coefficient between new deaths per million and the log of per capita GDP of .6016365, and Table 2 shows a positive and significant coefficient between total deaths per million and the log of per capita GDP of 79.494 (data description is in the appendix). Regressions are run until the 31 January 2021, in order to avoid the vaccination effects.

Table 1. *New deaths per million and per capita GDP (all countries).*

Random-effects GLS regression	**Number of obs = 57,546**					
Group variable: country	**Number of groups = 173**					
R-sq:	**Obs per group:**					
within = 0.0000	**min = 53**					
between = 0.2284	**avg = 332.6**					
overall = 0.0403	**max = 412**					
	Wald chi2(1) = 50.69					
corr(u_i, X) = 0 (assumed)	**Prob > chi2 = 0.0000**					
new_deaths_p~n	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
log_gdp_per_ca	.6016365	.0845047	7.12	0.000	.4360103	.7672626
_cons	-4.271105	.7885259	-5.42	0.000	-5.816587	-2.725622
sigma_u	1.328582					
sigma_e	3.291859					
rho	.1400734 (fraction of variance due to u_i)					

Table 2. *Total deaths per million and per capita GDP (all countries).*

Random-effects GLS regression	**Number of obs = 57,547**
Group variable: country	**Number of groups = 173**

R-sq:	**Obs per group:**					
within = 0.0000	**min = 53**					
between = 0.2000	**avg = 332.6**					
overall = 0.1008	**max = 412**					
	Wald chi2(1) = 42.79					
corr(u_i, X) = 0 (assumed)	**Prob > chi2 = 0.0000**					
total_deaths~n	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
log_gdp_per_ca	79.4941	12.15299	6.54	0.000	55.67468	103.3135
_cons	-574.8456	113.3938	-5.07	0.000	-797.0935	-352.5977
sigma_u	192.53477					
sigma_e	219.92155					
rho	.43389225 (fraction of variance due to u_i)					

2.2. Thesis

The question that this research seeks to understand is: Why, after an increase in restrictions, was there an increase in new COVID19 cases? Board, G. P. M. reports [1], [2] Mukherjee [27] suggest that perhaps this is due to the inadequacy or uncertainty of new norms.

The research focuses on the G7 countries to understand how the restrictive regulations, summarized by the stringency index, have impacted the epidemic. The report analyses data for 184 countries in order to compare the findings.

To avoid confusing causality impacts, we have selected the end date of January 2021 for our data sample, i.e. to avoid the influence of the start of the vaccine injection schedule. We have also provided the data on excess mortality over historical averages to inform interpretation of variances between country reporting in Table 8 of the Appendix.

The analysis included several GLS regressions for panel data. As a result, stringent and time-varying policies have worsened the situation worldwide.

The following tables analyze the G7: new deaths and total deaths per million of inhabitants. The variables that exhibited multicollinearities have been dropped from the data set.

2.3. Data Description

The data are downloaded from the Oxford Martin School and Worldometers database. The frequency is daily and covers 184 countries starting from the first day of the epidemic until February 1, 2021.

In this way we get an unbalanced panel for different countries. The analyzes was performed with data that is certain for all countries: the total number of deaths and the number of new deaths per million inhabitants. In fact, the number of tests is a very variable and unreliable figure. There are countries that have conducted many tests and others that have many positive individuals but do not have many deaths.

3. Results

3.1. Disparity of Income and Wealth

Intuitively, the COVID19 pandemic numbers by country are not as predicted or expected. To further understand why this has happened we dig deeper into the segment of society that was most effected by the COVID19 virus in 2020. Within affluent countries, reported cases and deaths were higher among socio-economic challenged populations Finch, W. H., and Hernandez Finch, M. E [6]. This was supported by the number of deaths that are significantly positively influenced by the Gini index. The Gini index OECD [14] measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. A Gini index of zero represents perfect equality and 100, perfect inequality.

According to World Bank's Poverty and Shared Prosperity 2020 report [26], the Gini coefficient increases about 1.5 points in the five years following major epidemics, such as H1N1 (2009), Ebola (2014), and Zika (2016). The International Monetary Fund has estimated that the GINI index has increased about 3 points at the end of Q3, 2020 as a result of the COVID19 pandemic, Cugat & Narita [4]. The Word Bank’s reported that COVID19 was likely to push between 88 and 115 million people into extreme poverty. Figure 1 shows Pre-industrial inequalities: Gini coefficients, and the Inequality Possibility Frontier. The estimates are prudent because they were made before COVID19 but still capture the effects of previous epidemics as highlighted by the World Bank.

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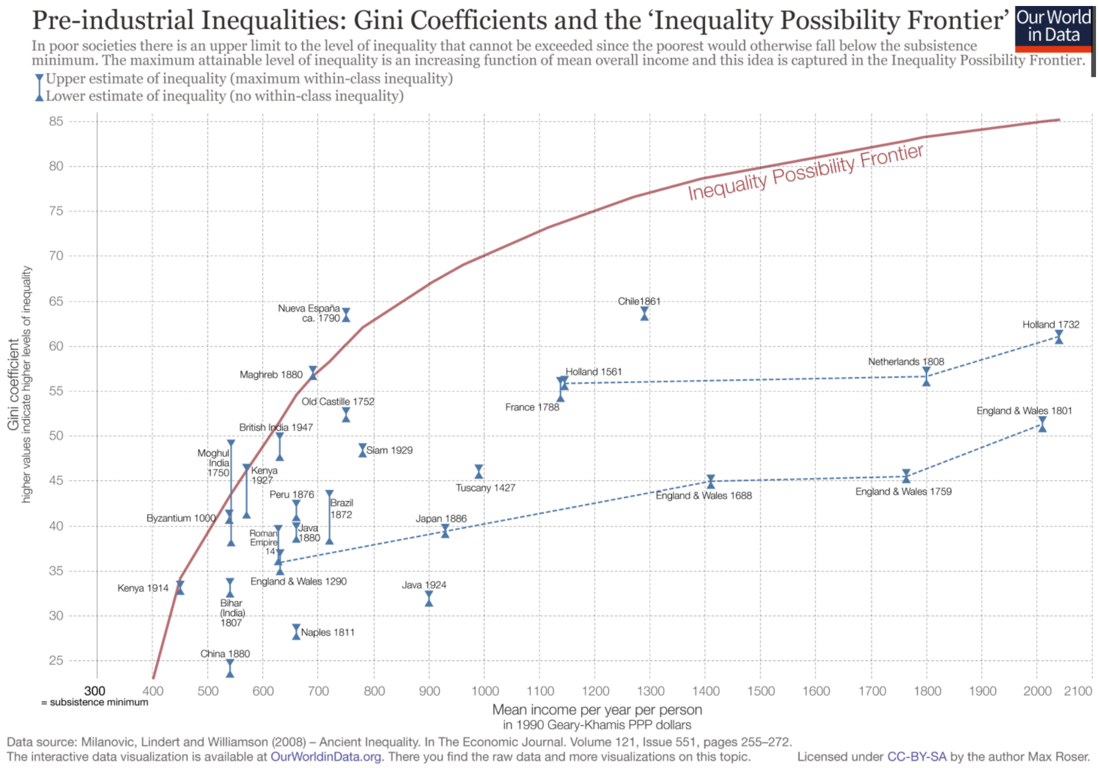

Figure 1. *Estimates of Gini's impact by country.*

In Figure 2 the country GINI index for 2018, World Bank [25] compares to Figure 3, John Hopkins [12] the daily COVID19 deaths 100,000 people in 2020. The data illustrates that in many countries Gini score are an indicator of increased risk for COVID19 exposure and potential severity.

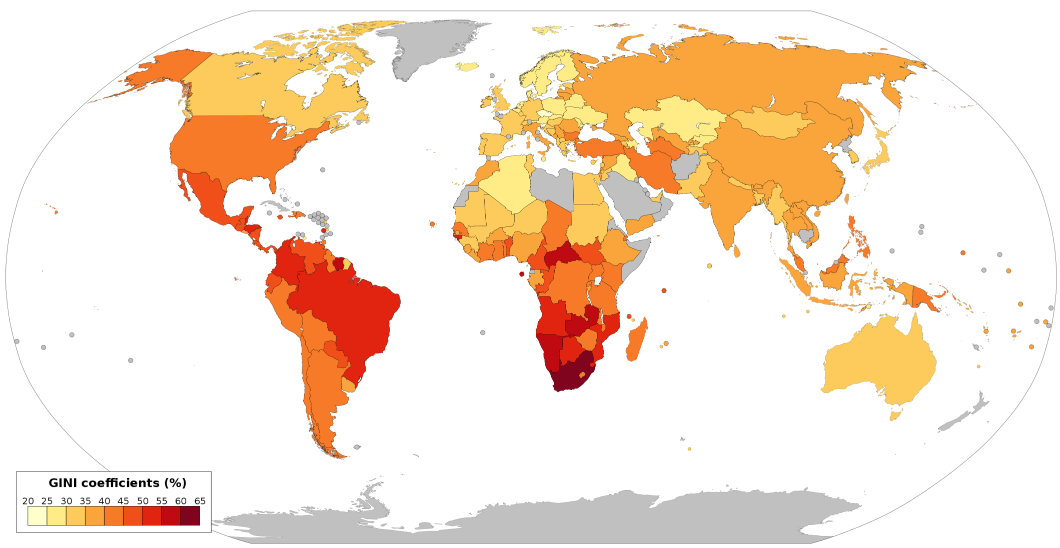

Figure 2. *World map of the GINI coefficients by country (World Bank 2018).*

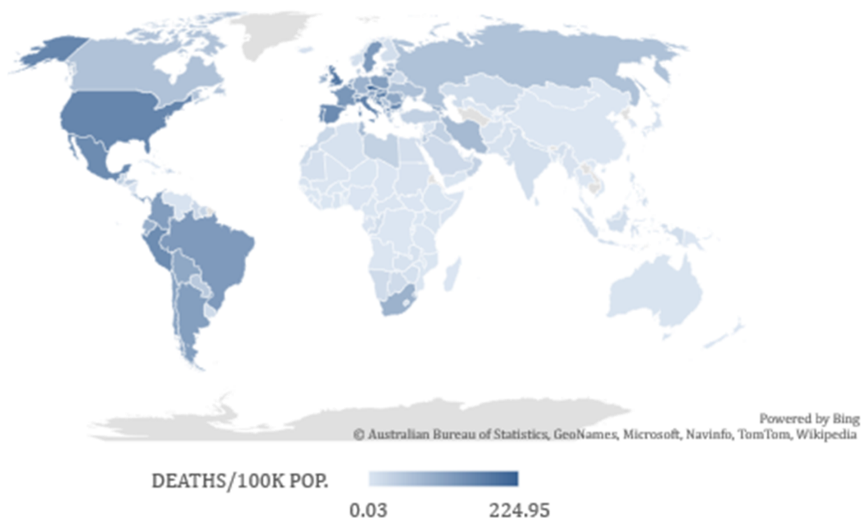

Figure 3. *COVID19 Deaths per 100,000 people.*

3.2. New COVID19 Deaths Rise After Restrictions Announced

The country Gini score sets the foundation for further investigation into the question of: Why? after an increase in restrictions, was there an increase in new COVID19 deaths? The results in Tables 3 and 4 illustrate the Generalized Least Squares (GLS) regression to identify the explain ability of the COVID19 deaths based upon stringency lag of 20 days.

Table 3. *New deaths per million Stringency Index 0 rules – 100 total lock down Stringency Lag number of 20 days All countries.*

Random-effects GLS regression	**Number of obs = 52,090**					
Group variable: country	**Number of groups = 167**					
R-sq:	**Obs per group:**					
within = 0.0094	**min = 42**					
between = 0.5232	**avg = 311.9**					
overall = 0.0918	**max = 378**					
	Wald chi2(15) = 677.65					
corr(u_i, X)= 0 (assumed)	**Prob > chi2 = 0.0000**					
new_deaths_pe~n	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
reproduction_~e	-.4283151	.0365402	-11.72	0.000	-.4999326	-.3566977
stringency_20~g	**.0145087**	**.0007886**	**18.40**	**0.000**	**.012963**	**.0160543**
population	-6.86e-11	4.91e-10	-0.14	0.889	-1.03e-09	8.93e-10
median_age	.0185347	.0276352	0.67	0.502	-.0356294	.0726988
aged_65_older	-.0922993	.0707718	-1.30	0.192	-.2310094	.0464109
aged_70_older	.1997357	.0824042	2.42	0.015	.0382266	.3612449
log_gdp_per_ca	.5189546	.1326864	3.91	0.000	.258894	.7790152
cardiovasc_de~e	-.0000826	.0008718	-0.09	0.925	-.0017912	.001626
diabetes_prev~e	-.0151876	.0246423	-0.62	0.538	-.0634855	.0331104
female_smokers	.0808222	.0145485	5.56	0.000	.0523076	.1093368
male_smokers	-.0138554	.0056565	-2.45	0.014	-.0249419	-.002769
handwashing_f~s	.0042947	.00254	1.69	0.091	-.0006836	.009273
hospital_beds~d	-.0065051	.0465413	-0.14	0.889	-.0977244	.0847142
life_expectancy	.0242283	.0141512	1.71	0.087	-.0035075	.0519642
human_develop~x	-4.82414	1.224384	-3.94	0.000	-7.223889	-2.424391
_cons	-3.590446	1.208734	-2.97	0.003	-5.959522	-1.22137
sigma_u	.95980656					
sigma_e	3.2377239					
rho	.08078059 (fraction of variance due to u_i)					

Table 4. *Total deaths per million.*

Random-effects GLS regression	**Number of obs = 52,090**
Group variable: country	**Number of groups = 167**
R-sq:	**Obs per group:**
within = 0.0524	**min = 42**

between = 0.4551	**avg = 311.9**					
overall = 0.2759	**max = 378**					
	Wald chi2(15) = 3016.00					
corr(u_i, X) = 0 (assumed)	**Prob > chi2 = 0.0000**					
total_deaths_~n	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
reproduction_~e	-90.79504	1.883012	-48.22	0.000	-94.48568	-87.10441
stringency_20~g	**.8351974**	**.0406861**	**20.53**	**0.000**	**.7554542**	**.9149407**
population	4.77e-08	6.68e-08	0.71	0.475	-8.32e-08	1.79e-07
median_age	-.319654	3.754007	-0.09	0.932	-7.677373	7.038065
aged_65_older	-10.66894	9.613712	-1.11	0.267	-29.51147	8.173585
aged_70_older	20.34791	11.20206	1.82	0.069	-1.607737	42.30355
log_gdp_per_ca	111.2287	18.03609	6.17	0.000	75.87857	146.5787
cardiovasc_de~e	-.0551732	.1183989	-0.47	0.641	-.2872308	.1768843
diabetes_prev~e	-6.489726	3.341425	-1.94	0.052	-13.0388	.0593462
female_smokers	8.36857	1.971421	4.24	0.000	4.504656	12.23248
male_smokers	-1.966119	.7684485	-2.56	0.011	-3.472251	-.4599879
handwashing_f~s	.5800273	.3451555	1.68	0.093	-.096465	1.25652
hospital_beds~d	-3.720021	6.311851	-0.59	0.556	-16.09102	8.650979
life_expectancy	8.861599	1.923916	4.61	0.000	5.090793	12.6324
human_develop~x	-961.9481	166.5152	-5.78	0.000	-1288.312	-635.5843
_cons	-806.1726	164.236	-4.91	0.000	-1128.069	-484.2759
sigma_u	132.55746					
sigma_e	165.78427					
rho	.38999285 (fraction of variance due to u_i)					

3.3. Stringency Index

The next element of the research compared the implications of the stringency of restrictions implemented to the number of deaths. Which produced the finding that there is an increase in deaths after there is an increase in restrictions for all countries. Table 3 shows that *new deaths* increased with respect to the stringency index which demonstrates the significant positive correlation of 0.0145 with a standard error of 0.0007.

Table 4 compares the daily country COVID19 *Total deaths* per million people to the stringency index which demonstrates the significant positive correlation of 0.83 with a standard error of 0.04. This positive correlation is counter-intuitive, as expectations of implementing stricter restrictions would cause the number of new deaths to decline. The significant positive correlation score is a conservative estimate due to the fact that the data set does not include excess mortality deaths which would increase correlations of the COVID19 to new and total deaths to stringency index. Data and graphical illustration of excess mortality shown in Appendix Table 8: Excess mortality P-scores, all ages percent.

3.4. Stringency Lag

With this counter-intuitive result on the Stringency Index the research turned to examine the effectiveness of stringency measures. The leading indicator was found to be the stringency lag index. The stringency index correlated with the stringency lag point to the effectiveness of policies being positively correlated due to a lag in implementation and partial application. Moreover, the uncertainty or the variability of the stringency index has a negative impact on mortality. (The longer the stringency lag, the higher the number of deaths.)

Tables 5 compares the daily country COVID19 deaths per million people by stringency index to the stringency lag index which demonstrates the significant positive correlation of new and total deaths for all countries. This positive correlation is surprising, as expectations of a lag in implementing stricter restrictions have seem to have caused or encouraged behavior that has increased the probability of exposure and resulted in an increase in the number of new deaths. The two stringency index comparisons, reported in Table 7, are:

a. G7 countries have a significant coefficient of 3.27 between stringency lags of 20 days, correlation to COVID19 total deaths by millions of people.
b. The average world country has a coefficient of 0.369 between stringency lags of 5 days, correlation to COVID19 total deaths by millions of people.

The analysis was performed on GLS regressions for four different stringency lags: 5, 10, 15 and 20 days. Results are significant and they confirm the failure of stringency policies in decreasing the new deaths per million of inhabitants. The Stringency Policy of the G7 countries was negatively affected by the increase of the stringency lag. The results in Figure 4 of correlation coefficient lag for the G7 countries overall in days: 5, 10, 15, 20 demonstrate a decrease in effectiveness as the influence of the stringency upon total number of deaths as the number of days of lag increase. All countries showed a decrease in effectiveness of Restrictive Stringency Measures as the Stringency Lag Increased.

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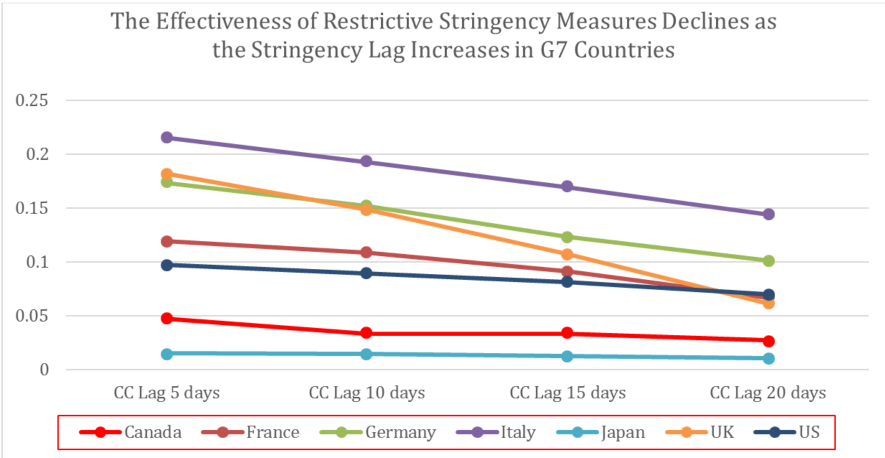

Figure 4. *G7 Country Correlation Coefficient for Stringency Lag and Number of COVID-19 Deaths.*

Canada had the greatest decline in effectiveness of restrictions between 5-to-10 days, and 15-to-20-day stringency lag. While the UK and Italy had a consistent decline in effectiveness of restrictions between 5-to-20-day stringency lag. Many countries including Canada, the UK, and Italy have entered the third wave with the variants spreading at a faster rate, and in some cases more serious outcomes. These findings support the epidemiologist recommendation of enforcing stringency restrictions with a minimum stringency lag.

Data in Table 5 summarized from regression analysis found in the Appendix: New deaths per million for the G7, Stringency Index 0 rules – 100 total lock-downs, Stringency.

Table 5. *Correlation Coefficient for Stringency Lag and Number of COVID-19 Deaths.*

Country	CC Lag 5 days	CC Lag 10 days	CC Lag 15 days	CC Lag 20 days
Canada	0.0469587	0.0330230	0.0330231	0.0268953
France	0.1191952	0.1086463	0.0912500	0.0667217
Germany	0.1735164	0.1519831	0.1234327	0.1011956
Italy	0.2153415	0.1929895	0.1695471	0.1436887
Japan	0.0149777	0.0142467	0.0122697	0.0106237
UK	0.1822433	0.1485170	0.1075094	0.0608768
US	0.0975260	0.0892139	0.0813467	0.0695305

3.5. Power Distance Index

To further understand or interpret the resultant reaction or behavior to the restrictions (stringency) and the implications in the speed of enforcement (stringency lag) in the G7 and globally, the research compared countries with similar stringency and stringency lags that have diverging COVID19 results. Countries heterogeneity is a key factor in COVID19 policy governance design as remarked Haug et al [8]. They assess how the effectiveness of Nonpharmaceutical Interventions (NPIs) depend on the local context such as timing of their adoption. This opens the way for forecasting the effectiveness of future interventions using hypothetical scenarios. In contrast to Haug et al [8], we actually tested what happened differently in relation to the various geographic areas. Our work is not "what if" but demonstrates the differences between countries with their cultures and consequential differences in legislation, habits, and mentality of the people.

This difference among individuals within a country is studied by the "Power Distance" by Hofstede, G. [10]. Hofstede's Power distance Index (PDI) measures the extent to which the less powerful members of organizations and institutions (like the family) accept and expect that power is distributed unequally. This represents inequality (more versus less), but defined from below, not from above. It suggests that a society's level of inequality is endorsed by the followers as much as by the leaders. A higher PDI score may indicate a higher acceptance and following of restrictions due to COVID19. Figure 5 compares the daily country COVID19 deaths per million people to the PDI. In isolation, a positive influence is not totally surprising, as stricter restrictions do not seem to have been enough to encouraged behavior that would decreased the probability of exposure and in-turn have resulted in an increase in the number of new cases in countries where a government's power to impose restrictions is not accepted.

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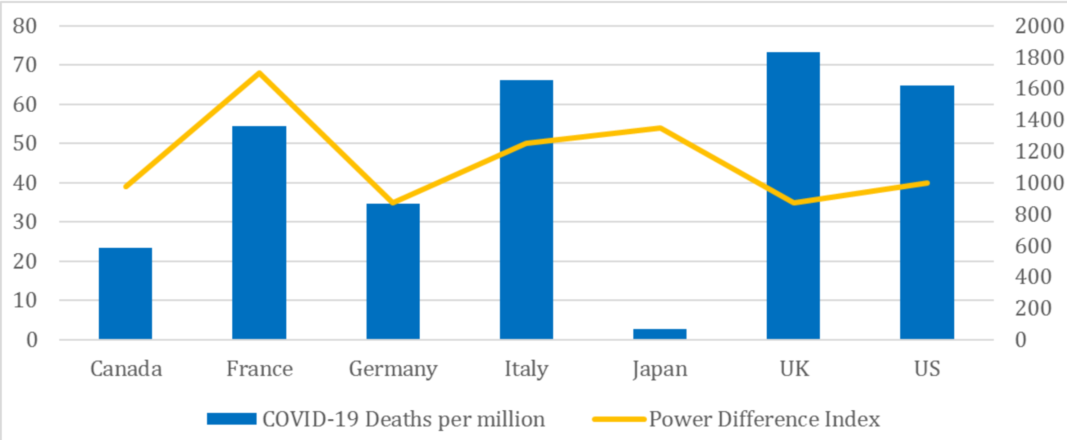

Figure 5. *Power Difference Index compared to COVID-19 Deaths per Million.*

4. Discussion

4.1. Improve Policy Management

On March 13, 2020, Dr. Ryan, WHO, stated "Be fast, have no regrets. You must be the first mover. The virus will always get you if you don't move quickly." Global results have unfortunately proven Dr. Ryan correct.

These important findings seek the key to improve policy management of the virus worldwide. These findings support the urgency for policy makers to understand and enforce the stringency of regulations, weighted heavily by impact that the stringency lag will make on the effectiveness of the restriction, in relation to the willingness of inhabitants of their countries to follow the restrictions as indicative of the countries Power Distance index. Limiting the stringency lag of their policies to increase the effectiveness in reducing the transmission of COVID19 and the resulting number and severity of new cases is supported by the positive correlation of the stringency lag to the number of COVID19 deaths per million.

4.2. Example and Implications of Stringency Lag

The Stringency Lag was observed in the early days, pre-declaration of the pandemic, there was a lag between symptoms of the virus, spread, declaration, and implementation of border closures, lockdowns, and travel restrictions. With the identification of the COVID19 variants the implications of a stringency lags are continuing to be identified.

4.2.1. Wuhan, Dec 2019

The initial stringency lag was witnessed even before the world realized that a pandemic was on their doorstep. In Wuhan, Dec 30, 2019, Chinese doctors warn of contagious infection, information is shared January 11, 2020 on WeChat, Dr. Zhangs uploaded the viruses sequencing to Global online library of genetic data. Not until Jan 23, 2020 did Xi Jennings seal off Wuhan. One early study projected that China could have reduced the total number of cases by 66% had officials acted a week earlier, and 95% if actions were taken 3 week earlier, Lai, S. [29].

As we examine the trends that are related to the spread of viral disease. COVID19 was potentially made worse by the interstate conflict between the US and China, as the US pulled the last US doctors from inside the Chinese CDC in July 2019, Buckley et al [3].

4.2.2. UK, September 2020

Another example of the effect of the Stringency Lag is the COVID-19 variant B117 first identified in the UK. It was identified September 20, 2020 and by the week ending December 9, 2020, B117 accounted for 62% of the infections in London. It took until December 20th for travel restrictions to be announced. Travel restrictions were first enforced by other countries banning flights from the UK as early as December 21. However, there was a lag of flight restrictions by the UK for air travel out of the UK. By January 29, 2021, 70 countries have shown both imported and local transmission cases of the new strains of coronavirus, O'Tolle and Hill [15].

4.2.3. Canada, January 2021

The spread of the COVID19 variants makes the stringency lag finding and the call to immediate action even greater. The UK variant entered a Barrie, Ontario Long-term care home identified on January 8th, by January 20th the variant had spread to most of the 130 residents, 69 staff, and two visitors. Nineteen people had already died and six were in hospital.

Newfoundland, which had all but isolated the province, previously had almost no COVID19 cases. Previous to February 5, 2021 when the COVID19 UK variant was identified the province had only a total of 412 cases. In the next 15 days, 256 new cases have been reported, over half of the entire case load to date. The increase transmission of the new variants increases the urgency in immediately reducing the stringency lag.

4.3. Impact of Stringency and Stringency Lag

The impact of the inter-relationship between the Stringency Index, Stringency Lag, and the Power Difference index across countries can be seen not only in the number of COVID19 deaths but also on many other indicators. The stringency lag affected the increase in unemployment between 10 – 90% dependent upon industry and geography Falk et al. [5]; the overall decline by country of GDP between 2 – 10%, Jackson et al [11]; the increase in mental health cases reported by the CDC, averaging an increase of adults showing symptoms of anxiety or depression disorder from 11% to 42%, Richter [16]; and increase of disparity of income and wealth demonstrated by the share of income going to the top 1% in the past year doubling, Goldin & Maggah [24]. The International Labor Organization estimated that the restrictions on businesses and public life destroyed 8.8% of all work hours around the world last year. That is equivalent to 255 million full-time jobs – quadruple the impact of the financial crisis over a decade ago. The drop in work translates to a loss of $3.7 trillion USD in income globally – what Ryder called an "extraordinary figure" – with women and young people taking the biggest hits by Jan 26, 2021.

These economic and societal implications are also the result of an increased stringency lag which policy makers must take into consideration by reducing the stringency lag to reduce the new deaths from COVID19 and which will in the short-term reduce the strain on hospitals, in the medium-term lead to a shorter complete lockdown periods, and a faster return to full employment and reduced mental health effects. The takeaway is, that where pandemic restrictions are concerned, it is better to rip-off the Band-Aid quickly, that is to implement quickly and completely restrictions without lag or delay.

4.4. The Heterogeneity Among Areas

This section shows the supporting results. Several GLS regressions were run for panel data, in order to capture the most important and common results for all countries. In fact, as highlighted by international reports, Board, G. P. M. [1], [2], the management of COVID19 has lacked common and uniform policies with agreements between countries to stem the epidemic. As a result, stringent and time-varying policies have worsened the situation worldwide. The graph in Figure 6 and the supporting data in the appendix: Tab 15 shows how each macro area has significantly different results.

5. Conclusions

The primary conclusions are a) the ineffectiveness or inappropriateness of the virus containment stringency and stringency lag measures, b) The confirmation that COVID19 affected the countries with the highest per capita income was increased by the ineffectiveness of restrictions due to stringency lags.

It is important to highlight how the results are made even more robust by the problem that the data used in the estimates are the minimum number of cases, due to the underestimation of deaths due to the excess mortality reported in 2020. In the appendix, we have illustrated: Excess mortality during the COVID19 pandemic.

These findings are key to improve the future policy management of the virus and variants. The Delta plus and Lambda variant's increased transmissibility and potential vaccine resistance increases the urgency for policy makers to understand and immediately enforce the stringency of regulations in consideration of their countries Power Balance index, and to reduce the stringency lag of their policies to increase the effectiveness in reducing the transmission of COVID19. Follow-up research will further examine and compare the effects of the COVID19 variants, vaccine distribution, COVID19 deaths and public policy measures.

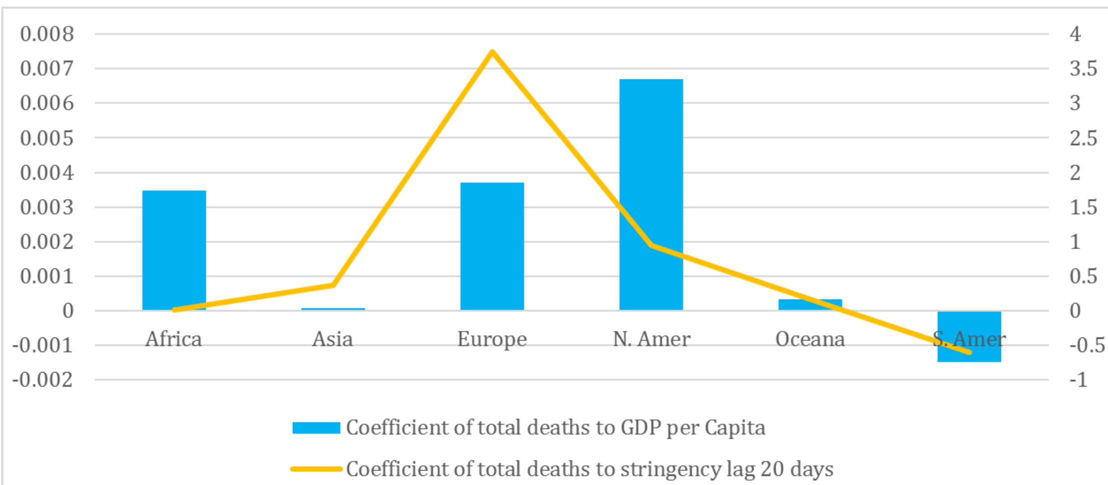

Figure 6. *Coefficient of Total COVID19 deaths to 20-day stringency lag and GDP per Capita.*

Appendix

Table 6. *Description of Variables.*

Variables description	
new_deaths_per_million	Daily new deaths per million of inhabitants
stringency_20lag	Stringency index: from 0 rules to 100 lockdown with 20 days of lag
total_deaths_per_million	Total deaths per million of inhabitants
reproduction_rate	The indicator that measures in which conditions generations are replaced. It is computed by establishing a ratio between the number of daughters and that of their mothers, independently from effects due to population structure. This calculation can be made by taking into account the mortality (net reproduction rate) or in the absence of mortality (crude reproduction rate). In practice this rate is usually computed for a given year or period, in that case it measures the conditions of the moment in terms of reproduction
population_density	Measured by the number of human inhabitants per square kilometer
median_age	Age that divides the population in two parts of equal size, that is, there are as many persons with ages above the median as there are with ages below the median
aged_65_older	People older than 65 and less than 70
aged_70_older	People older than 70
log_gdp_per_ca	Log of gdp per capital
cardiovasc_death_rate	The annual number of deaths from cardiovascular diseases per 100000 people
diabetes_prevalence	The percentage of people ages 20-79 who have type 1 or type 2 diabetes
female_smokers	The share of women aged 15 years and older who smoke any form of tobacco, including cigarettes, cigars, pipes or any other smoked tobacco products. Data include daily and non-daily or occasional smoking.
male_smokers	The share of male aged 15 years and older who smoke any form of tobacco, including cigarettes, cigars, pipes or any other smoked tobacco products. Data include daily and non-daily or occasional smoking.
handwashing_facilities	Population with basic handwashing facilities at home (%)
hospital_beds_per_thousand	Hospital beds (per 1000 people) from The World Bank
life_expectancy	Estimate of the average number of additional years that a person of a given age can expect to live
human_development_index	The Human Development Index (HDI) is a summary measure of key dimensions of human development: a long and healthy life, a good education, and having a decent standard of living

We perform GLS regressions for different lags: 5, 10, 15 and 20 days. Results are significant and they confirm the failure of stringency policies in decreasing the new deaths per million of inhabitants.

Table 7. *New deaths per million for the G7.*

Stringency Index 0 rules – 100 total lock down Stringency Lag number of 5 days.

Canada

Source	**SS**	**df**	**MS**	**Number of obs = 329**		
				F(1, 327) = 44.32		
Model	**98.6815349**	**1**	**98.6815349**	**Prob > F = 0.0000**		
Residual	**728.161958**	**327**	**2.22679498**	**R-squared = 0.1193**		
				Adj R-squared = 0.1167		
Total	**826.843493**	**328**	**2.52086431**	**Root MSE = 1.4922**		
new_deaths_pe~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_5lag	.0469587	.007054	6.66	0.000	.0330817	.0608357
_cons	-1.483953	.4725702	-3.14	0.002	-2.413614	-.5542915

France

Source	**SS**	**df**	**MS**	**Number of obs = 352**		
				F(1, 350) = 127.51		
Model	**1901.79139**	**1**	**1901.79139**	**Prob > F = 0.0000**		
Residual	**5220.25352**	**350**	**14.9150101**	**R-squared = 0.2670**		
				Adj R-squared = 0.2649		
Total	**7122.04491**	**351**	**20.2907262**	**Root MSE = 3.862**		
new_deaths_pe~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_5lag	.1191952	.0105558	11.29	0.000	.0984345	.1399559
_cons	-3.984215	.6785171	-5.87	0.000	-5.318699	-2.649731

Germany

Source	**SS**	**df**	**MS**	**Number of obs = 329**		
				F(1, 327) = 218.13		
Model	**1539.28506**	**1**	**1539.28506**	**Prob > F = 0.0000**		
Residual	**2307.55672**	**327**	**7.05674836**	**R-squared = 0.4001**		
				Adj R-squared = 0.3983		
Total	**3846.84177**	**328**	**11.7281761**	**Root MSE = 2.6565**		
new_deaths_pe~n	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
stringency_5lag	.1735164	.0117485	14.77	0.000	.1504041	.1966286

_cons	-8.880281	.7560035	-11.75	0.000	-10.36753	-7.393037

Italy

Source	**SS**	**df**	**MS**	**Number of obs = 346**		
				F(1, 344) = 610.93		
Model	**4362.39426**	**1**	**4362.39426**	**Prob > F = 0.0000**		
Residual	**2456.36392**	**344**	**7.1405928**	**R-squared = 0.6398**		
				Adj R-squared = 0.6387		
Total	**6818.75819**	**345**	**19.7645165**	**Root MSE = 2.6722**		
new_deaths_pe~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_5lag	.2153415	.0087123	24.72	0.000	.1982054	.2324776
_cons	-10.17694	.6003652	-16.95	0.000	-11.35779	-8.996093

Japan

Source	**SS**	**df**	**MS**	**Number of obs= 354**		
				F(1, 352) =177.83		
Model	**5.29906023**	**1**	**5.29906023**	**Prob > F =0.0000**		
Residual	**10.4888523**	**352**	**.029797876**	**R-squared = 0.3356**		
				Adj R-squared = 0.3338		
Total	**15.7879125**	**353**	**.044724965**	**Root MSE =.17262**		
new_deaths_pe~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_5lag	.0149777	.0011232	13.34	0.000	.0127688	.0171866
_cons	-.4233705	.0423899	-9.99	0.000	-.5067398	-.3400013

United Kingdom

Source	**SS**	**df**	**MS**	**Number of obs = 332**		
				F(1, 330) = 102.15		
Model	**2469.57534**	**1**	**2469.57534**	**Prob > F = 0.0000**		
Residual	**7978.24853**	**330**	**24.1765107**	**R-squared = 0.2364**		
				Adj R-squared = 0.2341		
Total	**10447.8239**	**331**	**31.5644225**	**Root MSE = 4.917**		
new_deaths_pe~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_5lag	.1822433	.0180317	10.11	0.000	.1467716	.2177149
_cons	-7.713728	1.259423	-6.12	0.000	-10.19124	-5.236218

United States

Source	**SS**	**df**	**MS**	**Number of obs = 338**		
				F(1, 336) = 83.49		
Model	**583.512663**	**1**	**583.512663**	**Prob > F = 0.0000**		
Residual	**2348.27748**	**336**	**6.98892109**	**R-squared = 0.1990**		
				Adj R-squared=0.1966		
Total	**2931.79015**	**337**	**8.69967403**	**Root MSE = 2.6437**		
new_deaths_pe~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_5lag	.097526	.0106733	9.14	0.000	.076531	.1185209
_cons	-2.47667	.7187014	-3.45	0.001	-3.890391	-1.062949

New deaths per million for the G7, Stringency Lag number of 10 days

Canada

Source	**SS**	**df**	**MS**	**Number of obs = 329**		
				F(1, 327) = 42.48		
Model	**95.0724331**	**1**	**95.0724331**	**Prob > F = 0.0000**		
Residual	**731.77106**	**327**	**2.23783199**	**R-squared = 0.1150**		
				Adj R-squared = 0.1123		
Total	**826.843493**	**328**	**2.52086431**	**Root MSE = 1.4959**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_10lag	.0385832	.0059195	6.52	0.000	.0269381	.0502283
_cons	-.8888085	.3927274	-2.26	0.024	-1.6614	-.1162175

France

Source	**SS**	**df**	**MS**	**Number of obs = 352**		
				F(1, 350) = 111.93		
Model	**1725.69751**	**1**	**1725.69751**	**Prob > F = 0.0000**		
Residual	**5396.3474**	**350**	**15.4181354**	**R-squared = 0.2423**		
				Adj R-squared = 0.2401		
Total	**7122.04491**	**351**	**20.2907262**	**Root MSE = 3.9266**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_10lag	.1086463	.0102695	10.58	0.000	.0884487	.128844

_cons	-3.256643	.6556091	-4.97	0.000	-4.546072	-1.967214

Germany

Source	SS	df	MS	Number of obs = 329		
				F(1, 327) = 168.09		
Model	**1306.0365**	**1**	**1306.0365**	**Prob > F = 0.0000**		
Residual	**2540.80527**	**327**	**7.77004671**	**R-squared = 0.3395**		
				Adj R-squared = 0.3375		
Total	**3846.84177**	**328**	**11.7281761**	**Root MSE = 2.7875**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_10lag	.1519831	.0117227	12.96	0.000	.1289216	.1750446
_cons	-7.383592	.7454771	-9.90	0.000	-8.850128	-5.917055

Italy

Source	SS	df	MS	Number of obs = 346		
				F(1, 344) = 456.37		
Model	**3888.04338**	**1**	**3888.04338**	**Prob > F = 0.0000**		
Residual	**2930.7148**	**344**	**8.51951977**	**R-squared = 0.5702**		
				Adj R-squared = 0.5689		
Total	**6818.75819**	**345**	**19.7645165**	**Root MSE = 2.9188**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_10lag	.1929895	.0090339	21.36	0.000	.1752208	.2107581
_cons	-8.516139	.6169943	-13.80	0.000	-9.729695	-7.302583

Japan

Source	SS	df	MS	Number of obs = 354		
				F(1, 352) = 164.44		
Model	**5.02705714**	**1**	**5.02705714**	**Prob > F = 0.0000**		
Residual	**10.7608554**	**352**	**.030570612**	**R-squared = 0.3184**		
				Adj R-squared = 0.3165		
Total	**15.7879125**	**353**	**.044724965**	**Root MSE =.17484**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_10lag	.0142467	.001111	12.82	0.000	.0120617	.0164318
_cons -.3899326	.0414841	-9.40	0.000	-.4715204	-.3083448	

United Kingdom

Source	SS	df	MS	Number of obs = 332		
				F(1, 330) = 75.97		
Model	**1955.21382**	**1**	**1955.21382**	**Prob > F = 0.0000**		
Residual	**8492.61004**	**330**	**25.7351819**	**R-squared = 0.1871**		
				Adj R-squared = 0.1847		
Total	**10447.8239**	**331**	**31.5644225**	**Root MSE = 5.073**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_10lag	.148517	.0170389	8.72	0.000	.1149983	.1820356
_cons	-5.245076	1.176611	-4.46	0.000	-7.559681	-2.930471

United States

Source	SS	df	MS	Number of obs= 338		
				F(1, 336) = 91.89		
Model	**629.626347**	**1**	**629.626347**	**Prob > F = 0.0000**		
Residual	**2302.1638**	**336**	**6.85167798**	**R-squared = 0.2148**		
				Adj R-squared = 0.2124		
Total	**2931.79015**	**337**	**8.69967403**	**Root MSE = 2.6176**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_10lag	.0892139	.0093066	9.59	0.000	.0709075	.1075204
_cons	-1.840922	.6214142	-2.96	0.003	-3.063274	-.6185692

New deaths per million for the G7, Stringency Lag number of 15 days
Canada

Source	SS	df	MS	Number of obs = 329	
				F(1, 327) = 39.75	
Model	**89.6132458**	**1**	**89.6132458**	**Prob > F = 0.0000**	
Residual	**737.230247**	**327**	**2.25452675**	**R-squared = 0.1084**	
				Adj R-squared = 0.1057	
Total	**826.843493**	**328**	**2.52086431**	**Root MSE = 1.5015**	
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**

stringency_15lag	.0330231	.0052379	6.30	0.000	.0227188	.0433274
_cons	-.4916726	.3440802	-1.43	0.154	-1.168563	.1852174

France

Source	**SS**	**df**	**MS**	**Number of obs = 352**		
				F(1, 350) = 79.39		
Model	**1316.74159**	**1**	**1316.74159**	**Prob > F = 0.0000**		
Residual	**5805.30333**	**350**	**16.5865809**	**R-squared = 0.1849**		
				Adj R-squared = 0.1826		
Total	**7122.04491**	**351**	**20.2907262**	**Root MSE = 4.0727**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_15lag	.09125	.0102414	8.91	0.000	.0711075	.1113926
_cons	-2.13575	.6492931	-3.29	0.001	-3.412757	-.8587434

Germany

Source	**SS**	**df**	**MS**	**Number of obs= 329**		
				F(1, 327) = 115.56		
Model	**1004.50784**	**1**	**1004.50784**	**Prob > F = 0.0000**		
Residual	**2842.33393**	**327**	**8.69215269**	**R-squared = 0.2611**		
				Adj R-squared = 0.2589		
Total	**3846.84177**	**328**	**11.7281761**	**Root MSE = 2.9482**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_15lag	.1234327	.011482	10.75	0.000	.1008448	.1460205
_cons	-5.475697	.7208341	-7.60	0.000	-6.893754	-4.057639

Italy

Source	**SS**	**df**	**MS**	**Number of obs = 346**		
				F(1, 344) = 319.38		
Model	**3282.84626**	**1**	**3282.84626**	**Prob > F = 0.0000**		
Residual	**3535.91192**	**344**	**10.2788137**	**R-squared = 0.4814**		
				Adj R-squared = 0.4799		
Total	**6818.75819**	**345**	**19.7645165**	**Root MSE = 3.2061**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_15lag	.1695471	.0094872	17.87	0.000	.150887	.1882073
_cons	-6.822534	.6420873	-10.63	0.000	-8.085446	-5.559623

Japan

Source	**SS**	**df**	**MS**	**Number of obs = 354**		
				F(1, 352) = 132.80		
Model	**4.32471681**	**1**	**4.32471681**	**Prob > F = 0.0000**		
Residual	**11.4631957**	**352**	**.032565897**	**R-squared = 0.2739**		
				Adj R-squared = 0.2719		
Total	**15.7879125**	**353**	**.044724965**	**Root MSE =.18046**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_15lag	.0122697	.0010647	11.52	0.000	.0101757	.0143638
_cons	-.3102693	.0392658	-7.90	0.000	-.3874944	-.2330441

United Kingdom

Source	**SS**	**df**	**MS**	**Number of obs = 332**		
				F(1, 330) = 42.01		
Model	**1179.885**	**1**	**1179.885**	**Prob > F = 0.0000**		
Residual	**9267.93886**	**330**	**28.0846632**	**R-squared = 0.1129**		
				Adj R-squared = 0.1102		
Total	**10447.8239**	**331**	**31.5644225**	**Root MSE = 5.2995**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_15lag	.1075094	.0165868	6.48	0.000	.0748803	.1401386
_cons	-2.372317	1.132121	-2.10	0.037	-4.599401	-.145233

United States

Source	**SS**	**df**	**MS**	**Number of obs = 338**		
				F(1, 336) = 93.21		
Model	**636.696992**	**1**	**636.696992**	**Prob > F = 0.0000**		
Residual	**2295.09316**	**336**	**6.83063439**	**R-squared = 0.2172**		
				Adj R-squared = 0.2148		
Total	**2931.79015**	**337**	**8.69967403**	**Root MSE = 2.6135**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	

stringency_15lag	.0813467	.0084257	9.65	0.000	.064773	.0979204
_cons	-1.249924	.5577965	-2.24	0.026	-2.347137	-.1527108

New deaths per million for the G7, Stringency Lag number of 20 days

Canada

Source	**SS**	**df**	**MS**	**Number of obs = 329**		
				F(1, 327) = 31.24		
Model	**72.1057043**	**1**	**72.1057043**	**Prob > F = 0.0000**		
Residual	**754.737789**	**327**	**2.30806663**	**R-squared = 0.0872**		
				Adj R-squared = 0.0844		
Total	**826.843493**	**328**	**2.52086431**	**Root MSE = 1.5192**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_20lag	.0268953	.0048119	5.59	0.000	.0174291	.0363615
_cons	-.0712539	.3129128	-0.23	0.820	-.6868301	.5443223

France

Source	**SS**	**df**	**MS**	**Number of obs = 352**		
				F(1, 350) = 41.53		
Model	**755.394241**	**1**	**755.394241**	**Prob > F = 0.0000**		
Residual	**6366.65067**	**350**	**18.1904305**	**R-squared = 0.1061**		
				Adj R-squared = 0.1035		
Total	**7122.04491**	**351**	**20.2907262**	**Root MSE = 4.265**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_20lag	.0667217	.0103539	6.44	0.000	.0463581	.0870853
_cons	-.6201479	.6518119	-0.95	0.342	-1.902109	.6618129

Germany

Source	**SS**	**df**	**MS**	**Number of obs = 329**		
				F(1, 327) = 82.40		
Model	**774.231996**	**1**	**774.231996**	**Prob > F = 0.0000**		
Residual	**3072.60978**	**327**	**9.39636017**	**R-squared = 0.2013**		
				Adj R-squared = 0.1988		
Total	**3846.84177**	**328**	**11.7281761**	**Root MSE = 3.0653**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_20lag	.1011956	.0111482	9.08	0.000	.0792643	.1231269
_cons	-4.004547	.690616	-5.80	0.000	-5.363158	-2.645936

Italy

Source	**SS**	**df**	**MS**	**Number of obs = 346**		
				F(1, 344) = 205.48		
Model	**2549.90063**	**1**	**2549.90063**	**Prob > F = 0.0000**		
Residual	**4268.85755**	**344**	**12.4094696**	**R-squared = 0.3740**		
				Adj R-squared = 0.3721		
Total	**6818.75819**	**345**	**19.7645165**	**Root MSE = 3.5227**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_20lag	.1436887	.0100239	14.33	0.000	.1239728	.1634046
_cons	-5.013629	.6721617	-7.46	0.000	-6.335693	-3.691565

Japan

Source	**SS**	**df**	**MS**	**Number of obs = 354**		
				F(1, 352) = 108.95		
Model	**3.73150535**	**1**	**3.73150535**	**Prob > F = 0.0000**		
Residual	**12.0564071**	**352**	**.034251157**	**R-squared = 0.2364**		
				Adj R-squared = 0.2342		
Total	**15.7879125**	**353**	**.044724965**	**Root MSE =.18507**		
new_deaths_per~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_20lag	.0106237	.0010178	10.44	0.000	.0086219	.0126255
_cons	-.2443886	.0370562	-6.60	0.000	-.317268	-.1715092

United Kingdom

Source	**SS**	**df**	**MS**	**Number of obs = 332**
				F(1, 330) = 13.99
Model	**424.977001**	**1**	**424.977001**	**Prob > F = 0.0002**
Residual	**10022.8469**	**330**	**30.3722632**	**R-squared = 0.0407**
				Adj R-squared = 0.0378
Total	**10447.8239**	**331**	**31.5644225**	**Root MSE = 5.5111**

new_deaths_per~n	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
stringency_20lag	.0608768	.0162745	3.74	0.000	.028862	.0928917
_cons	.7725027	1.097639	0.70	0.482	-1.38675	2.931755

United States

Source	SS	df	MS	Number of obs = 338		
				F(1, 336) = 76.68		
Model	544.744737	1	544.744737	Prob > F = 0.0000		
Residual	2387.04541	336	7.10430182	R-squared = 0.1858		
				Adj R-squared = 0.1834		
Total	2931.79015	337	8.69967403	Root MSE = 2.6654		
new_deaths_per~n |	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
stringency_20lag |	.0695305	.0079403	8.76	0.000	.0539114	.0851496
_cons |	-.4254083	.5211071	-0.82	0.415	-1.450452	.5996351

Excess Mortality During COVID-19: Deaths from All Causes Compared to Previous Years, All Ages

Shown in Figure 7 and Table 8 is how the number of weekly or monthly deaths in 2020–2021 differs as a percentage from the average number of deaths in the same period over the years 2015–2019. This metric is called the P-score. The reported number of deaths might not count all deaths that occurred due to incomplete coverage and delays in death reporting.

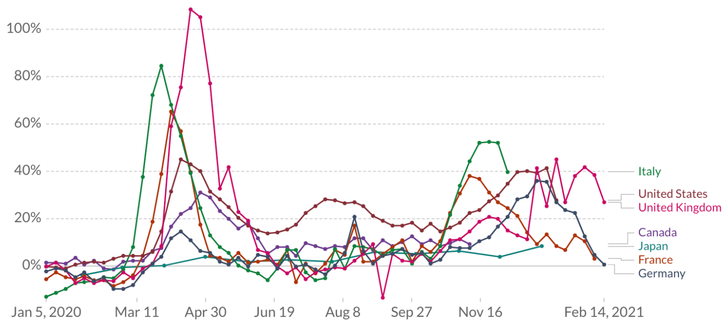

Figure 7 *Excess Mortality G7*

Excess mortality is a term used in epidemiology and public health that refers to the number of deaths from all causes during a crisis above and beyond what we would have expected to see under "normal" conditions. In this case, we're interested in how deaths during the COVID19 pandemic compare to the average number of deaths over the same period in previous years.

Excess mortality is a more comprehensive measure of the total impact of the pandemic on deaths than the COVID19 confirmed death count alone. In addition to confirmed deaths, excess mortality captures COVID19 deaths that have not been diagnosed and reported correctly, as well as deaths from other causes attributable to general crisis conditions. In future works, we intend to develop these points and the impact of vaccines.

Table 8. *Excess mortality P-scores, all ages percent.*

Start	End	Absolute Change	Relative Change	
Armenia	-6% in Jan 31	79% in Dec 31	+85 pp	+1,437%
Australia	1% in Jan 5	-5% in Nov 22	-6 pp	-456%
Austria	-11% in Jan 5	-5% in Feb 14	+6 pp	+57%
Azerbaijan	-5% in Jan 31	196% in Dec 31	+201 pp	+4,213%
Belarus	-6% in Jan 31	40% in Jun 30	+46 pp	+728%
Belgium	-6% in Jan 5	-11% in Feb 7	-5 pp	-75%
Brazil	6% in Jan 31	26% in Jan 31	+20 pp	+337%
Bulgaria	-18% in Jan 5	-2% in Feb 14	+17 pp	+92%
Canada	2% in Jan 5	9% in Nov 8	+8 pp	+480%
Chile	8% in Jan 5	28% in Feb 14	+21 pp	+275%
Costa Rica	10% in Jan 31	-5% in Jun 30	-15 pp	-148%
Croatia	-16% in Jan 5	21% in Jan 3	+38 pp	+232%
Cyprus	12% in Jan 5	-13% in Jan 10	-25 pp	-208%
Czechia	-3% in Jan 5	54% in Jan 17	+57 pp	+2,225%
Denmark	>-1% in Jan 5	-10% in Feb 21	-10 pp	-2,479%
Egypt	-3% in Jan 31	13% in Aug 31	+15 pp	+574%
England & Wales	<1% in Jan 5	29% in Feb 14	+28 pp	+6,445%
Estonia	-14% in Jan 5	1% in Jan 31	+15 pp	+109%

Start	End	Absolute Change	Relative Change	
Finland	-10% in Jan 5	-12% in Feb 7	-2 pp	-21%
France	-5% in Jan 5	3% in Feb 7	+9 pp	+161%
Georgia	-9% in Jan 5	-5% in Jun 21	+3 pp	+39%
Germany	-2% in Jan 5	<1% in Feb 14	+3 pp	+127%
Greece	-3% in Jan 5	37% in Dec 6	+40 pp	+1,460%
Hong Kong	-3% in Jan 31	8% in Dec 31	+11 pp	+371%
Hungary	-10% in Jan 5	-7% in Jan 24	+2 pp	+23%
Iceland	24% in Jan 5	-29% in Jan 3	-53 pp	-217%
Israel	8% in Jan 5	6% in Feb 7	-1 pp	-18%
Italy	-13% in Jan 5	40% in Dec 6	+53 pp	+413%
Japan	-4% in Jan 31	8% in Dec 31	+12 pp	+313%
Kyrgyzstan	1% in Jan 31	37% in Dec 31	+36 pp	+3,480%
Latvia	-6% in Jan 5	25% in Feb 7	+31 pp	+487%
Liechtenstein	-62% in Jan 5	-29% in Feb 7	+33 pp	+54%
Lithuania	-6% in Jan 5	9% in Feb 14	+16 pp	+246%
Luxembourg	-27% in Jan 5	18% in Jan 3	+45 pp	+164%
Macao	-4% in Jan 31	-4% in Dec 31	>-1 pp	-19%
Malta	-3% in Jan 5	-8% in Jan 3	-5 pp	-151%
Mauritius	7% in Jan 31	6% in Dec 31	>-1 pp	-8%
Mexico	-11% in Jan 5	68% in Jan 3	+79 pp	+696%
Moldova	-14% in Jan 31	17% in Nov 30	+31 pp	+218%
Mongolia	-3% in Jan 31	-3% in Nov 30	<1 pp	+24%
Montenegro	-43% in Jan 5	34% in Sep 27	+77 pp	+178%
Netherlands	-5% in Jan 5	8% in Feb 21	+14 pp	+251%
New Zealand	4% in Jan 5	6% in Feb 7	+2 pp	+63%
North Macedonia	-14% in Jan 31	142% in Dec 31	+156 pp	+1,114%
Northern Ireland	-14% in Jan 5	11% in Feb 21	+25 pp	+179%
Norway	-7% in Jan 5	-7% in Jan 31	>-1 pp	>-1%
Oman	2% in Jan 31	5% in Jan 31	+2 pp	+98%
Philippines	3% in Jan 31	3% in Sep 30	<1 pp	+26%
Poland	>-1% in Jan 5	2% in Feb 14	+3 pp	+440%
Portugal	-10% in Jan 5	42% in Feb 7	+53 pp	+516%
Qatar	-3% in Jan 31	5% in Dec 31	+8 pp	+289%
Romania	-11% in Jan 5	33% in Dec 27	+43 pp	+409%
Russia	-5% in Jan 31	58% in Dec 31	+63 pp	+1,299%
San Marino	-3% in Jan 31	110% in Dec 31	+114 pp	+3,382%
Scotland	-9% in Jan 5	12% in Feb 21	+21 pp	+238%
Serbia	-11% in Jan 31	6% in Jan 31	+17 pp	+152%
Singapore	17% in Jan 31	8% in Sep 30	-9 pp	-54%
Slovakia	>-1% in Jan 5	62% in Dec 27	+63 pp	+8,278%
Slovenia	-5% in Jan 5	32% in Jan 17	+37 pp	+720%
South Korea	6% in Jan 5	<1% in Jan 3	-5 pp	-88%
Spain	-12% in Jan 5	2% in Feb 14	+14 pp	+116%
Sweden	-8% in Jan 5	-5% in Feb 7	+3 pp	+35%
Switzerland	-10% in Jan 5	-10% in Feb 7	<1 pp	+8%
Taiwan	4% in Jan 5	3% in Dec 27	-1 pp	-26%
Thailand	10% in Jan 31	12% in Dec 31	+2 pp	+16%
Tunisia	3% in Jan 31	2% in Sep 30	>-1 pp	-34%
Ukraine	-6% in Jan 31	34% in Dec 31	+40 pp	+647%
United Kingdom	>-1% in Jan 5	27% in Feb 14	+27 pp	+10,089%
United States	<1% in Jan 5	28% in Jan 10	+28 pp	+277,900%
Uzbekistan	9% in Jan 31	6% in Dec 31	-3 pp	-32%

Table 9*. Power Distance Index and COVID19 response to Stringency Index by Macro Area.*

Country	PDI	IDV	MAS	UAI	LTO
Malaysia	104	26	50	36	
Guatemala	95	6	37	101	
Panama	95	11	44	86	
Philippines	94	32	64	44	19

Country	PDI	IDV	MAS	UAI	LTO
Mexico	81	30	69	82	
Venezuela	81	12	73	76	
China	80	20	66	40	118
Egypt	80	38	52	68	
Iraq	80	38	52	68	
Kuwait	80	38	52	68	
Lebanon	80	38	52	68	
Libya	80	38	52	68	
Saudi Arabia	80	38	52	68	
United Arab Emirates	80	38	52	68	
Ecuador	78	8	63	67	
Indonesia	78	14	46	48	
Ghana	77	20	46	54	16
India	77	48	56	40	61
Nigeria	77	20	46	54	16
Sierra Leone	77	20	46	54	16
Singapore	74	20	48	8	48
Brazil	69	38	49	76	65
France	68	71	43	86	
Hong Kong	68	25	57	29	96
Poland	68	60	64	93	
Colombia	67	13	64	80	
El Salvador	66	19	40	94	
Turkey	66	37	45	85	
Belgium	65	75	54	94	
Ethiopia	64	27	41	52	25
Kenya	64	27	41	52	25
Peru	64	16	42	87	
Tanzania	64	27	41	52	25
Thailand	64	20	34	64	56
Zambia	64	27	41	52	25
Chile	63	23	28	86	
Portugal	63	27	31	104	
Uruguay	61	36	38	100	
Greece	60	35	57	112	
South Korea	60	18	39	85	75
Iran	58	41	43	59	
Taiwan	58	17	45	69	87
Czech Republic	57	58	57	74	
Spain	57	51	42	86	
Pakistan	55	14	50	70	
Japan	54	46	95	92	80
Italy	50	76	70	75	
Argentina	49	46	56	86	
South Africa	49	65	63	49	
Hungary	46	55	88	82	
Jamaica	45	39	68	13	
United States	40	91	62	46	29
Netherlands	38	80	14	53	44
Australia	36	90	61	51	31
Costa Rica	35	15	21	86	
Germany	35	67	66	65	31
United Kingdom	35	89	66	35	25
Switzerland	34	68	70	58	
Finland	33	63	26	59	
Norway	31	69	8	50	20
Sweden	31	71	5	29	33
Ireland	28	70	68	35	
New Zealand	22	79	58	49	30
Denmark	18	74	16	23	
Israel	13	54	47	81	
Austria	11	55	79	70	

Table 10. *Total deaths per million. Sensitivity: Different Stringency Lag Number of 20, 30 and 40 Days.*

Lag number of 20

Random-effects GLS regression	**Number of obs = 49,538**					
Group variable: country	**Number of groups = 166**					
R-sq:	**Obs per group:**					
within = 0.0028	**min = 25**					
between = 0.0170	**avg = 298.4**					
overall = 0.0087	**max = 357**					
Wald chi2(1) = 140.57						
corr(u_i, X) = 0 (assumed)	**Prob > chi2 = 0.0000**					
total_deaths_~n	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
stringency_20~g	.5593817	.0471806	11.86	0.000	.4669095	.651854
_cons	101.5556	15.31085	6.63	0.000	71.54692	131.5643
sigma_u	193.51413					
sigma_e	171.991					
rho	.55868249 (fraction of variance due to u_i)					

Lag number of 30

Random-effects GLS regression	**Number of obs = 48,525**					
Group variable: country	**Number of groups = 166**					
R-sq:	**Obs per group:**					
within = 0.0052	**min = 25**					
between = 0.0129	**avg = 292.3**					
overall = 0.0088	**max = 352**					
Wald chi2(1) 256.02						
corr(u_i, X) = 0 (assumed)	**Prob > chi2 = 0.0000**					
total_deaths_~n	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
stringency_30~g	.7286156	.0455368	16.00	0.000	.6393651	.8178661
_cons	94.18775	15.5779	6.05	0.000	63.65562	124.7199
sigma_u	197.2944					
sigma_e	170.6772					
rho	.57195843 (fraction of variance due to u_i)					

Lag number of 40

Random-effects GLS regression	**Number of obs = 47,283**					
Group variable: country	**Number of groups=166**					
R-sq:	**Obs per group:**					
within = 0.0054	**min =25**					
between = 0.0096	**avg =284.8**					
overall = 0.0073	**max =343**					
Wald chi2(1) = 255.26						
corr(u_i, X) = 0 (assumed)	**Prob > chi2 =0.0000**					
total_deaths_p~n	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
stringency_40lag	.7146716	.0447313	15.98	0.000	.627	.8023433
_cons	98.4569	15.91409	6.19	0.000	67.26585	129.648
sigma_u	201.81732					
sigma_e	169.33417					
rho	.58685466 (fraction of variance due to u_i)					

Table 11. *Total deaths per million. By selected countries.*

-> country = United States

Source	**SS**	**df**	**MS**	**Number of obs = 339**		
				F(1, 337) = 160.87		
Model	**12747585.5**	**1**	**12747585.5**	**Prob > F = 0.0000**		
Residual	**26704365.4**	**337**	**79241.4403**	**R-squared = 0.3231**		
				Adj R-squared = 0.3211		
Total	**39451950.8**	**338**	**116721.748**	**Root MSE = 281.5**		
total_deaths_p~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_30lag	9.353206	.7374333	12.68	0.000	7.902654	10.80376
_cons	-41.47281	47.55285	-0.87	0.384	-135.0106	52.06499

-> country = Canada

Source	**SS**	**df**	**MS**	**Number of obs = 330**
				F(1, 328) = 195.38

Model	**1920894.58**	**1**	**1920894.58**	**Prob > F = 0.0000**		
Residual	**3224717.42**	**328**	**9831.45555**	**R-squared = 0.3733**		
				Adj R-squared = 0.3714		
Total	**5145612**	**329**	**15640.1581**	**Root MSE = 99.154**		
total_deaths_p~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_30lag	3.791176	.2712258	13.98	0.000	3.257614	4.324737
_cons	10.4784	17.32947	0.60	0.546	-23.61253	44.56933

Table 12. *New deaths per million All Countries.*

Random-effects GLS regression	**Number of obs = 50651**					
Group variable: country	**Number of groups = 182**					
R-sq: within = 0.0129	**Obs per group: min = 24**					
between = 0.3868	**avg = 278.3**					
overall = 0.0631	**max = 346**					
	Wald chi2(15) = 780.92					
corr(u_i, X) = 0 (assumed)	**Prob > chi2 = 0.0000**					
new_deaths_per_million	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
reproduction_rate	-.3449307	.0297394	-11.60	0.000	-.4032189	-.2866424
stringency_5lag	.0177845	.0007274	24.45	0.000	.0163589	.0192101
population_density	-.0001706	.0000892	-1.91	0.056	-.0003455	4.24e-06
median_age	.0100886	.0188078	0.54	0.592	-.0267741	.0469513
aged_65_older	-.0386095	.0610652	-0.63	0.527	-.1582951	.081076
aged_70_older	.1277235	.0726755	1.76	0.079	-.0147178	.2701648
log_gdp_per_ca	.4431614	.1137241	3.90	0.000	.2202662	.6660565
cardiovasc_death_rate	-.000236	.0007485	-0.32	0.753	-.001703	.001231
diabetes_prevalence	.0060938	.0193497	0.31	0.753	-.0318309	.0440185
female_smokers	.0502692	.0119729	4.20	0.000	.0268027	.0737357
male_smokers	-.0118881	.004623	-2.57	0.010	-.020949	-.0028272
handwashing_facilities	.0034953	.0021489	1.63	0.104	-.0007165	.0077071
hospital_beds_per_thousand	.0085024	.0404034	0.21	0.833	-.0706868	.0876916
life_expectancy	.0311515	.0123913	2.51	0.012	.006865	.055438
human_development_index	-4.590632	.9956138	-4.61	0.000	-6.541999	-2.639265
_cons	-3.745812	1.046093	-3.58	0.000	-5.796116	-1.695507
sigma_u	.84767062					
sigma_e	2.9428698					
rho	.07661193 (fraction of variance due to u_i)					

Table 13. *Total deaths per million All countries.*

Random-effects GLS regression	**Number of obs = 50651**					
Group variable: country	**Number of groups = 182**					
R-sq: within = 0.0197	**Obs per group: min = 24**					
between = 0.4518	**avg = 278.3**					
overall = 0.2823	**max = 346**					
	Wald chi2(15) = 1161.93					
corr(u_i, X) = 0 (assumed)	**Prob > chi2 = 0.0000**					
total_deaths_per_million	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
reproduction_rate	-38.48277	1.232555	-31.22	0.000	-40.89853	-36.06701
stringency_5lag	.3693264	.030636	12.06	0.000	.3092809	.429372
population_density	-.0252863	.0111139	-2.28	0.023	-.0470692	-.0035034
median_age	-.5218229	2.348235	-0.22	0.824	-5.124278	4.080632
aged_65_older	-3.254617	7.74269	-0.42	0.674	-18.43001	11.92078
aged_70_older	12.33805	9.215409	1.34	0.181	-5.723816	30.39992
log_gdp_per_ca	93.45486	14.40793	6.49	0.000	65.21583	121.6939
cardiovasc_death_rate	-.0543218	.0945109	-0.57	0.565	-.2395597	.1309161
diabetes_prevalence	-4.148232	2.421776	-1.71	0.087	-8.894825	.5983611
female_smokers	4.130391	1.516664	2.72	0.006	1.157784	7.102999
male_smokers	-1.191603	.5851307	-2.04	0.042	-2.338438	-.044768
handwashing_facilities	.3463704	.2718617	1.27	0.203	-.1864688	.8792096
hospital_beds_per_thousand	-6.208756	5.105651	-1.22	0.224	-16.21565	3.798136
life_expectancy	8.881065	1.5698	5.66	0.000	5.804314	11.95782
human_development_index	-881.6999	125.8153	-7.01	0.000	-1128.293	-635.1065
_cons	-752.706	132.5091	-5.68	0.000	-1012.419	-492.993
sigma_u	109.55672					
sigma_e	121.34479					
rho	.44908036 (fraction of variance due to u_i)					

Table 14. *Regressions for G7 changing lags.*

G7: 5 days lag of Stringency index.

Random-effects GLS regression	Number of obs = 2,282					
Group variable: country	Number of groups = 7					
R-sq:	Obs per group:					
within = 0.3130	min = 317					
between = 1.0000	avg = 326.0					
overall = 0.4159	max = 336					
	Wald chi2(8) =1618.41					
corr(u_i, X) = 0 (assumed)	Prob > chi2 = 0.0000					
new_deaths_per_mill~n	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
reproduction_rate	.9820385	.1682688	5.84	0.000	.6522378	1.311839
stringency_5lag	.1684631	.0057608	29.24	0.000	.1571722	.179754
population	9.10e-09	1.84e-09	4.95	0.000	5.50e-09	1.27e-08
median_age	-.459043	.0719255	-6.38	0.000	-.6000144	-.3180715
aged_65_older	.463677	.3617146	1.28	0.200	-.2452705	1.172624
aged_70_older	.0626447	.410799	0.15	0.879	-.7425066	.867796
log_gdp_per_ca	-9.01679	1.156705	-7.80	0.000	-11.28389	-6.749689
cardiovasc_death_rate	.0161058	.0113453	1.42	0.156	-.0061307	.0383422
_cons	94.0879	12.30975	7.64	0.000	69.96123	118.2146
sigma_u	0					
sigma_e	2.9544667					
rho	0(fraction of variance due to u_i)					
Random-effects GLS regression	Number of obs = 2,282					
Group variable: country	Number of groups = 7					
R-sq:	Obs per group:					
within = 0.1991	min = 317					
between = 1.0000	avg = 326.0					
overall = 0.5814	max = 336					
	Wald chi2(8) = 3157.41					
corr(u_i, X) = 0 (assumed)	Prob > chi2 = 0.0000					
total_deaths_per_mi~n	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
reproduction_rate	-238.4194	12.03247	-19.81	0.000	-262.0026	-214.8362
stringency_5lag	-.2714073	.4119373	-0.66	0.510	-1.07879	.535975
population	2.63e-06	1.31e-07	19.97	0.000	2.37e-06	2.88e-06
median_age	-5.607394	5.143212	-1.09	0.276	-15.6879	4.473116
aged_65_older	-165.6524	25.86528	-6.40	0.000	-216.3474	-114.9573
aged_70_older	113.1174	29.37519	3.85	0.000	55.54307	170.6917
log_gdp_per_ca	-3268.702	82.71305	-39.52	0.000	-3430.817	-3106.588
cardiovasc_death_rate	1.171426	.811275	1.44	0.149	-.4186439	2.761496
_cons	37080.47	880.239	42.13	0.000	35355.23	38805.71
sigma_u	0					
sigma_e	211.26637					
rho	0(fraction of variance due to u_i)					

G7: 10 days lag of Stringency index

Random-effects GLS regression	Number of obs = 2,282					
Group variable: country	Number of groups = 7					
R-sq:	Obs per group:					
within = 0.2854	min = 317					
between = 1.0000	avg = 326.0					
overall = 0.3924	max = 336					
	Wald chi2(8) = 1468.01					
corr(u_i, X) = 0 (assumed)	Prob > chi2 = 0.0000					
new_deaths_per_mill~n	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
reproduction_rate	1.981977	.199233	9.95	0.000	1.591487	2.372466
stringency_10lag	.1682839	.0062104	27.10	0.000	.1561118	.180456
population	8.24e-09	1.88e-09	4.38	0.000	4.55e-09	1.19e-08
median_age	-.4605611	.0734848	-6.27	0.000	-.6045887	-.3165336
aged_65_older	.5737018	.3703565	1.55	0.121	-.1521837	1.299587
aged_70_older	-.0687287	.4197393	-0.16	0.870	-.8914027	.7539453
log_gdp_per_ca	-9.04728	1.187221	-7.62	0.000	-11.37419	-6.72037
cardiovasc_death_rate	.0203444	.0115755	1.76	0.079	-.0023431	.0430319
_cons	92.65438	12.69021	7.30	0.000	67.78203	117.5267
sigma_u	0					

sigma_e	3.0132724					
rho	0(fraction of variance due to u_i)					
Random-effects GLS regression	Number of obs = 2,282					
Group variable: country	Number of groups = 7					
R-sq:	Obs per group:					
within = 0.1991	min = 317					
between = 1.0000	avg = 326.0					
overall = 0.5814	max = 336					
	Wald chi2(8) = 3157.47					
corr(u_i, X) = 0 (assumed)	Prob > chi2 = 0.0000					
total_deaths_per_mi~n	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
reproduction_rate	-227.1187	13.96852	-16.26	0.000	-254.4965	-199.7409
stringency_10lag	.2959683	.4354185	0.68	0.497	-.5574362	1.149373
population	2.60e-06	1.32e-07	19.68	0.000	2.34e-06	2.86e-06
median_age	-6.772395	5.15213	-1.31	0.189	-16.87038	3.325594
aged_65_older	-159.2354	25.96626	-6.13	0.000	-210.1284	-108.3425
aged_70_older	108.9476	29.42856	3.70	0.000	51.26873	166.6266
log_gdp_per_ca	-3230.585	83.23784	-38.81	0.000	-3393.728	-3067.442
cardiovasc_death_rate	1.199408	.8115735	1.48	0.139	-.3912468	2.790063
_cons	36604.88	889.7294	41.14	0.000	34861.04	38348.72
sigma_u	0					
sigma_e	211.26507					
rho	0 (fraction of variance due to u_i)					

G7: 15 days lag of Stringency index

Random-effects GLS regression	Number of obs = 2,282					
Group variable: country	Number of groups = 7					
R-sq:	Obs per group:					
within = 0.2166	min = 317					
between = 1.0000	avg = 326.0					
overall = 0.3339	max = 336					
	Wald chi2(8) = 1139.35					
corr(u_i, X) = 0 (assumed)	Prob > chi2 = 0.0000					
new_deaths_per_mill~n	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
reproduction_rate	2.143525	.235622	9.10	0.000	1.681714	2.605335
stringency_15lag	.1471112	.0067853	21.68	0.000	.1338123	.1604101
population	8.73e-09	1.98e-09	4.41	0.000	4.85e-09	1.26e-08
median_age	-.4191535	.077064	-5.44	0.000	-.570196	-.2681109
aged_65_older	.3905103	.389037	1.00	0.315	-.3719882	1.153009
aged_70_older	.0212089	.4401611	0.05	0.962	-.841491	.8839087
log_gdp_per_ca	-10.46006	1.250014	-8.37	0.000	-12.91004	-8.010077
cardiovasc_death_rate	.0219914	.0121261	1.81	0.070	-.0017754	.0457581
_cons	109.3482	13.41002	8.15	0.000	83.06506	135.6314
sigma_u	0					
sigma_e	3.1550475					
rho	0 (fraction of variance due to u_i)					
Random-effects GLS regression	Number of obs = 2,282					
Group variable: country	Number of groups = 7					
R-sq:	Obs per group:					
within = 0.2033	min = 317					
between = 1.0000	avg = 326.0					
overall = 0.5836	max = 336					
	Wald chi2(8) = 3185.73					
corr(u_i, X) = 0 (assumed)	Prob > chi2 = 0.0000					
total_deaths_per_mi~n	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
reproduction_rate	-190.7303	15.73659	-12.12	0.000	-221.5734	-159.8871
stringency_15lag	1.588861	.4531705	3.51	0.000	.7006628	2.477059
population	2.52e-06	1.32e-07	19.08	0.000	2.26e-06	2.78e-06
median_age	-9.457585	5.146903	-1.84	0.066	-19.54533	.6301609
aged_65_older	-143.5209	25.98278	-5.52	0.000	-194.4462	-92.59563
aged_70_older	98.16315	29.39723	3.34	0.001	40.54565	155.7807
log_gdp_per_ca	-3143.701	83.48521	-37.66	0.000	-3307.329	-2980.073
cardiovasc_death_rate	1.310599	.8098718	1.62	0.106	-.276721	2.897918
_cons	35502.91	895.6206	39.64	0.000	33747.53	37258.29
sigma_u	0					

sigma_e	210.71751				
rho	0 (fraction of variance due to u_i)				

G7: 20 days lag of Stringency index

Random-effects GLS regression	Number of obs = 2,282				
Group variable: country	Number of groups = 7				
R-sq:	Obs per group:				
within = 0.1174	min = 317				
between = 1.0000	avg = 326.0				
overall = 0.2495	max = 336				
	Wald chi2(8) = 755.78				
corr(u_i, X) = 0 (assumed)	Prob > chi2 = 0.0000				
new_deaths_per_mill~n	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
reproduction_rate |	.8433022	.2630022	3.21	0.001	.3278274	1.358777
stringency_20lag |	.0900844	.0070836	12.72	0.000	.0762008	.1039681
population	1.17e-08	2.10e-09	5.57	0.000	7.60e-09	1.58e-08
median_age	-.3009672	.0817546	-3.68	0.000	-.4612032	-.1407312
aged_65_older	-.2753852	.4129944	-0.67	0.505	-1.084839	.5340689
aged_70_older	.4636635	.4673455	0.99	0.321	-.4523168	1.379644
log_gdp_per_ca	-14.31097	1.323376	-10.81	0.000	-16.90473	-11.7172
cardiovasc_death_rate	.0186673	.0128757	1.45	0.147	-.0065685	.0439032
_cons	157.6571	14.19727	11.10	0.000	129.831	185.4832
sigma_u	0					
sigma_e	3.3488722					
rho	0 (fraction of variance due to u_i)					
Random-effects GLS regression	Number of obs = 2,282					
Group variable: country	Number of groups = 7					
R-sq:	Obs per group:					
within = 0.2179	min = 317					
between = 1.0000	avg = 326.0					
overall = 0.5912	max = 336					
	Wald chi2(8) = 3287.58					
corr(u_i, X) = 0 (assumed)	Prob > chi2 = 0.0000					
total_deaths_per_mi~n	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
reproduction_rate	-136.0167	16.39635	-8.30	0.000	-168.153	-103.8805
stringency_20lag	3.273042	.4416141	7.41	0.000	2.407495	4.13859
population	2.42e-06	1.31e-07	18.45	0.000	2.16e-06	2.68e-06
median_age	-12.95185	5.096828	-2.54	0.011	-22.94145	-2.962249
aged_65_older	-122.4291	25.74732	-4.76	0.000	-172.893	-71.96531
aged_70_older	83.338	29.13573	2.86	0.004	26.23301	140.443
log_gdp_per_ca	-3031.249	82.50327	-36.74	0.000	-3192.952	-2869.545
cardiovasc_death_rate	1.495636	.8027093	1.86	0.062	-.0776448	3.068918
_cons	34063.37	885.1005	38.49	0.000	32328.6	35798.13
sigma_u	0					
sigma_e	208.77885					
rho	0 (fraction of variance due to u_i)					

Tab 15. *Macroarea Stringency Coef and Std.Err.*

-> macroarea = Africa

Source	**SS**	**df**	**MS**	**Number of obs = 13,804**		
				F(2, 13801) = 620.71		
Model	**4462397.3**	**2**	**2231198.65**	**Prob > F = 0.0000**		
Residual	**49609315.4**	**13,801**	**3594.61745**	**R-squared = 0.0825**		
				Adj R-squared = 0.0824		
Total	**54071712.7**	**13,803**	**3917.38845**	**Root MSE = 59.955**		
total_deaths_~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_20~g	.0087896	.0239606	0.37	0.714	-.0381766	.0557557
gdp_per_capita	.0034733	.0000999	34.76	0.000	.0032774	.0036692
_cons	7.319556	1.485048	4.93	0.000	4.40866	10.23045

-> macroarea = Asia

Source	**SS**	**df**	**MS**	**Number of obs = 11,500**
				F(2, 11497) = 28.73
Model	**635839.029**	**2**	**317919.514**	**Prob > F = 0.0000**
Residual	**127215936**	**11,497**	**11065.1419**	**R-squared = 0.0050**
				Adj R-squared = 0.0048
Total	**127851775**	**11,499**	**11118.5125**	**Root MSE = 105.19**

total_deaths_~n	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
stringency_20~g	.371414	.0496451	7.48	0.000	.2741012	.4687268
gdp_per_capita	.0000692	.0000371	1.86	0.062	-3.58e-06	.000142
_cons	37.146	3.514532	10.57	0.000	30.25691	44.03508

-> macroarea = Europe

Source	SS	df	MS	Number of obs = 12,598		
				F(2, 12595) = 476.53		
Model	116633365	2	58316682.5	Prob > F = 0.0000		
Residual	1.5414e+09	12,595	122378.092	R-squared = 0.0703		
				Adj R-squared = 0.0702		
Total	1.6580e+09	12,597	131617.483	Root MSE = 349.83		
total_deaths_~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_20~g	3.753256	.1583847	23.70	0.000	3.442798	4.063714
gdp_per_capita	.0037118	.0001747	21.24	0.000	.0033693	.0040543
_cons	-47.19201	11.4543	-4.12	0.000	-69.64419	-24.73983

-> macroarea = North America

Source	SS	df	MS	Number of obs = 4,974		
				F(2, 4971) = 496.41		
Model	50461663.3	2	25230831.6	Prob > F = 0.0000		
Residual	252658991	4,971	50826.5924	R-squared = 0.1665		
				Adj R-squared = 0.1661		
Total	303120654	4,973	60953.2785	Root MSE = 225.45		
total_deaths_~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_20~g	.9438481	.1417317	6.66	0.000	.6659914	1.221705
gdp_per_capita	.0066964	.0002193	30.54	0.000	.0062665	.0071262
_cons	.1988554	10.63833	0.02	0.985	-20.65697	21.05468

-> macroarea = Oceania

Source	SS	df	MS	Number of obs = 1,022		
				F(2, 1019) = 273.31		
Model	48641.4214	2	24320.7107	Prob > F = 0.0000		
Residual	90676.9976	1,019	88.9862587	R-squared = 0.3491		
				Adj R-squared = 0.3479		
Total	139318.419	1,021	136.452908	Root MSE = 9.4333		
total_deaths_~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_20~g	.1619389	.015238	10.63	0.000	.1320374	.1918404
gdp_per_capita	.0003324	.0000177	18.82	0.000	.0002977	.000367
_cons	-9.223279	.8833533	-10.44	0.000	-10.95668	-7.48988

-> macroarea = South America

Source	SS	df	MS	Number of obs = 3,757		
				F(2, 3754) = 2.34		
Model	559895.862	2	279947.931	Prob > F = 0.0961		
Residual	448347667	3,754	119431.984	R-squared = 0.0012		
				Adj R-squared = 0.0007		
Total	448907563	3,756	119517.455	Root MSE = 345.59		
total_deaths_~n	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
stringency_20~g	-.6106061	.3228851	-1.89	0.059	-1.243653	.0224413
gdp_per_capita	-.0014847	.0011617	-1.28	0.201	-.0037623	.0007929
_cons	370.0127	30.8378	12.00	0.000	309.5522	430.4731

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