How COVID-19 Impacts Economics Indicators in the UK

0.1 Research Questions

This report is aimed to research on the associations between the severity of COVID-19 and some important economics indicators in the UK. More specifically, this report will answer the following questions: 1) Which COVID-19 severity indicator(s) and which economics indicator(s) have high and significant correlations? 2) And how the severity indicator(s) impact the economics indicator(s) exactly?

0.2 Datasets

0.2.1 COVID-19 Datasets (updated on 05-02-2021)

The following three COVID-19 datasets contain the number of positive cases, deaths, and patients admitted to hospitals, respectively. Each dataset includes the newly-added number and cumulative number.

1) Positive cases by spicemen date; [1];
2) Deaths with COVID-19 within 28 days of positive test by date of death [2];
3) Patients admitted to hospital [3]

(a) COVID19 Cases   (b) COVID19 Deaths   (c) COVID19 Patients
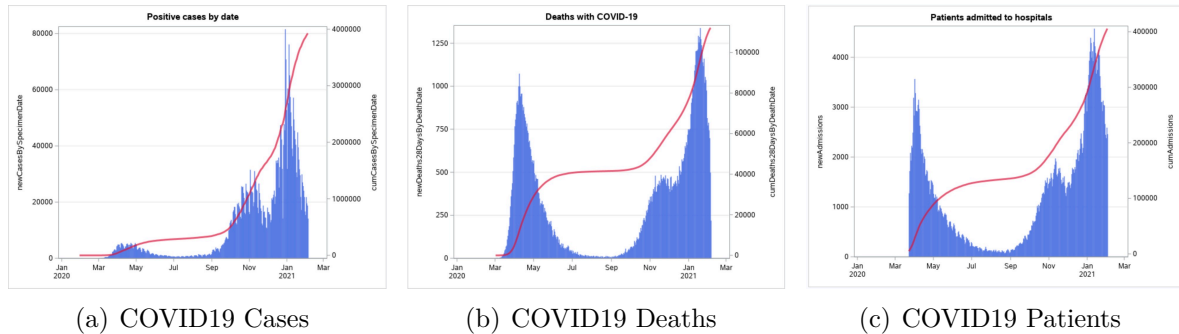
Figure 1: COVID19 Indicators

0.2.2 Economic indicators (updated in November 2020)

The following two datasets contain the data of five economics indicators: monthly GDP, services index, production index, construction index, and unemployment rate.
1) Monthly GDP and components index (seasonally adjusted) [4];

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[1]https://coronavirus.data.gov.uk/details/cases/

[2]https://coronavirus.data.gov.uk/details/deaths/

[3]https://coronavirus.data.gov.uk/details/healthcare/

[4]https://www.ons.gov.uk/economy/grossdomesticproductgdp/

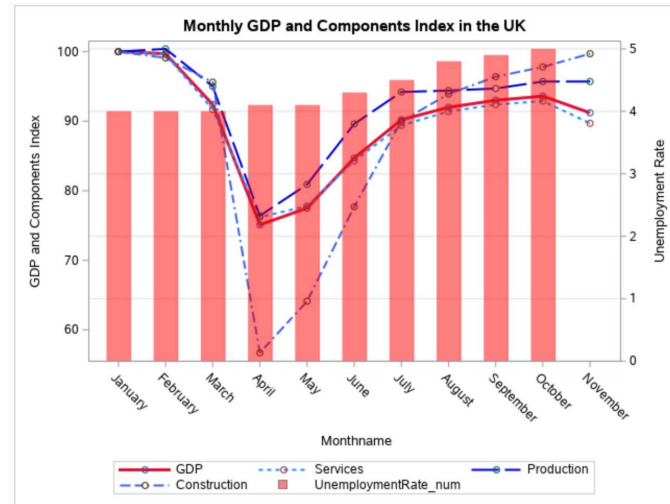2) Unemployment rate (aged 16 and over, seasonally adjusted) [5]

Figure 2: Economics Indicators

0.2.3 Stock Index (updated on 05-02-2021)

The following are two FTSE stock index datasets: 1) FTSE 100 Index;
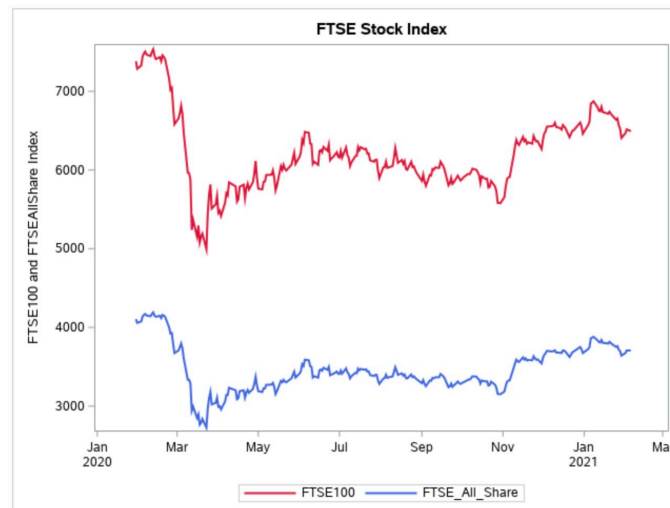2) FTSE All-Share Index [6]

Figure 3: FTSE Stock Indicators

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[5]https://www.ons.gov.uk/employmentandlabourmarket/peoplenotinwork/unemployment/
[6]Source: Capital IQ

0.3 Methodology and Results

1. To answer the first research question, correlations between COVID-19 severity indicators and economics indicators(including stock index) are examined:

Table 1: Correlation Matrix Economics Indicators (new)

Pearson Correlation Coefficients
Prob > |r| under H0: Rho=0
Number of Observations

	cases	deaths	patients	MonthlyGDP_num	Services_num	Production_num	Construction_num	UnemploymentRate_num
cases	1.00000 11	0.32482 0.3598 10	0.51616 0.1549 9	0.01622 0.9622 11	-0.02370 0.9448 11	0.06801 0.8425 11	0.22120 0.5133 11	0.61669 0.0576 10
deaths	0.32482 0.3598 10	1.00000 10	0.95908 <.0001 9	-0.72783 0.0170 10	-0.72210 0.0184 10	-0.75782 0.0111 10	-0.66762 0.0349 10	-0.36392 0.3357 9
patients	0.51616 0.1549 9	0.95908 <.0001 9	1.00000 9	-0.52790 0.1441 9	-0.53257 0.1399 9	-0.55376 0.1219 9	-0.44660 0.2282 9	-0.40141 0.3243 8
MonthlyGDP_num	0.01622 0.9622 11	-0.72783 0.0170 10	-0.52790 0.1441 9	1.00000 11	0.99713 <.0001 11	0.98133 <.0001 11	0.94987 <.0001 11	0.14369 0.6921 10
Services_num	-0.02370 0.9448 11	-0.72210 0.0184 10	-0.53257 0.1399 9	0.99713 <.0001 11	1.00000 11	0.96541 <.0001 11	0.92494 <.0001 11	0.10920 0.7639 10
Production_num	0.06801 0.8425 11	-0.75782 0.0111 10	-0.55376 0.1219 9	0.98133 <.0001 11	0.96541 <.0001 11	1.00000 11	0.97387 <.0001 11	0.18798 0.6030 10
Construction_num	0.22120 0.5133 11	-0.66762 0.0349 10	-0.44660 0.2282 9	0.94987 <.0001 11	0.92494 <.0001 11	0.97387 <.0001 11	1.00000 11	0.31562 0.3743 10
UnemploymentRate_num	0.61669 0.0576 10	-0.36392 0.3357 9	-0.40141 0.3243 8	0.14369 0.6921 10	0.10920 0.7639 10	0.18798 0.6030 10	0.31562 0.3743 10	1.00000 10

Table 2: Corrlation Matrix Economics Indicators (cum)

Pearson Correlation Coefficients
Prob > |r| under H0: Rho=0
Number of Observations

	cumcases	cumdeaths	cumpatients	MonthlyGDP_num	Services_num	Production_num	Construction_num	UnemploymentRate_num
cumcases	1.00000 11	0.75790 0.0180 9	0.87215 0.0022 9	0.02525 0.9413 11	-0.02961 0.9311 11	0.12148 0.7220 11	0.27129 0.4197 11	0.85307 0.0017 10
cumdeaths	0.75790 0.0180 9	1.00000 9	0.97736 <.0001 9	0.15564 0.6893 9	0.12697 0.7448 9	0.21518 0.5782 9	0.22532 0.5600 9	0.70706 0.0498 8
cumpatients	0.87215 0.0022 9	0.97736 <.0001 9	1.00000 9	0.28856 0.4514 9	0.25908 0.5009 9	0.33980 0.3710 9	0.36895 0.3285 9	0.81811 0.0131 8
MonthlyGDP_num	0.02525 0.9413 11	0.15564 0.6893 9	0.28856 0.4514 9	1.00000 11	0.99713 <.0001 11	0.98133 <.0001 11	0.94987 <.0001 11	0.14369 0.6921 10
Services_num	-0.02961 0.9311 11	0.12697 0.7448 9	0.25908 0.5009 9	0.99713 <.0001 11	1.00000 11	0.96541 <.0001 11	0.92494 <.0001 11	0.10920 0.7639 10
Production_num	0.12148 0.7220 11	0.21518 0.5782 9	0.33980 0.3710 9	0.98133 <.0001 11	0.96541 <.0001 11	1.00000 11	0.97387 <.0001 11	0.18798 0.6030 10
Construction_num	0.27129 0.4197 11	0.22532 0.5600 9	0.36895 0.3285 9	0.94987 <.0001 11	0.92494 <.0001 11	0.97387 <.0001 11	1.00000 11	0.31562 0.3743 10
UnemploymentRate_num	0.85307 0.0017 10	0.70706 0.0498 8	0.81811 0.0131 8	0.14369 0.6921 10	0.10920 0.7639 10	0.18798 0.6030 10	0.31562 0.3743 10	1.00000 10

Table 3: Correlation Matrix FTSE

Pearson Correlation Coefficients, N = 219								
Prob > |r| under H0: Rho=0								
	cases	deaths	patients	cumcases	cumdeaths	cumpatients	FTSE100_num	FTSE_AS_num
cases	1.00000	0.61481	0.75789	0.82023	0.70012	0.76110	0.54659	0.62152
		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
deaths	0.61481	1.00000	0.94280	0.69671	0.45259	0.52817	0.33781	0.35844
	<.0001		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
patients	0.75789	0.94280	1.00000	0.73770	0.46879	0.55868	0.35904	0.39259
	<.0001	<.0001		<.0001	<.0001	<.0001	<.0001	<.0001
cumcases	0.82023	0.69671	0.73770	1.00000	0.93223	0.96675	0.73760	0.79786
	<.0001	<.0001	<.0001		<.0001	<.0001	<.0001	<.0001
cumdeaths	0.70012	0.45259	0.46879	0.93223	1.00000	0.99170	0.81782	0.87243
	<.0001	<.0001	<.0001	<.0001		<.0001	<.0001	<.0001
cumpatients	0.76110	0.52817	0.55868	0.96675	0.99170	1.00000	0.79776	0.86003
	<.0001	<.0001	<.0001	<.0001	<.0001		<.0001	<.0001
FTSE100_num	0.54659	0.33781	0.35904	0.73760	0.81782	0.79776	1.00000	0.98943
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001		<.0001
FTSE_AS_num	0.62152	0.35844	0.39259	0.79786	0.87243	0.86003	0.98943	1.00000
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	

2. As for the second question, regression analysis is implemented to further explore how the COVID-19 indicators impact the economics indicators. Only highly and significantly correlated variables are chosen to perform the regression analysis. Table 4 and Table 5 is the summary of the regression analysis (with only one parameter) on COVID-19 indicators and economics indicators /stock indexes, respectively;

Table 4: Regression Analysis on Economics Indicators

Y	X	Coef	Intercept	p	R-square
Monthly GDP	Deaths	-0.00073	93.31	0.017	0.53
Service Index	Deaths	-0.00068	92.62	0.018	0.52
Production Index	Deaths	-0.00074	96.14	0.011	0.57
Condtruction Index	Deaths	-0.0014	95.28	0.035	0.45
Unemployment Rate	CumCases	1.09e-6	4.05	0.0017	0.73
Unemployment Rate	CumDeaths	2.04e-5	3.73	0.050	0.50
Unemployment Rate	CumCases	7.14e-6	3.62	0.013	0.67

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Table 5: Regression Analysis on FTSE Indexes

Y	X	Coef	Intercept	p	R-square
FTSE100	CumDeaths	0.0124	5544.47	<0.0001	0.67
FTSE100	CumPatients	0.0031	5626.53	<0.0001	0.64
FTSE100	CumCases	0.00023	5912.69	<0.0001	0.54
FTSE100	cases	0.0112	5976.05	<0.0001	0.30
FTSE All Share	CumDeaths	0.0083	3029.41	<0.0001	0.76
FTSE All Share	CumPatients	0.0021	3080.99	<0.0001	0.74
FTSE All Share	CumCases	0.00016	3274.74	<0.0001	0.64
FTSE All Share	cases	0.0080	3312.77	<0.0001	0.39

0.4 Conclusion and Limitations

Conclusions:
1) Among three newly-added COVID-19 indicators, only the number of deaths has close relationship with economics indicators and it negatively affects the these indicators. One additional death case will lead to these indicators decrease 0.00073, 0.00068, 0.0074, and 0.0014.
2) As for cumulative COVID-19 indicators, the three indicators only have significant and highly positive correlations with the unemployment rate. One additional cumulative case, death, patient will lead the unemployment rate to increase 1.09e-6, 2.04e-5, and 7.14e-6, respectively.
3) All the COVID-19 indicators have significant correlations with two stock indexes. Among these indicators, all the cumulative indicators and 'cases' indicators have relatively high correlations with stock indexes. One additional cumulative case, death, patient, and newly-added case will lead the FTSE 100 index to increase 0.0124, 0.0031, 0.00023, and 0.0112, respectively; whereas they will make FTSE All Share index increase 0.0083, 0.0021, 0.00016, and 0.0080, respectively.

Limitations:
1) The number of instances of economics indicators (9 to 11) is relatively limited. More instances will allow us to perform more accurate analysis;
2) As we can see from the COVID-19 figures above, the COVID-19 crisis in the UK can be divided into three stages. It would be better to analyse the correlations between the COVID-19 indicators and stock indexes at different stages;
3) Although all the simple linear regression models above are significant and have relatively good R-square score, the linear regression itslef may be too simple to demonstrate how COVID-19 indicators impact the economics indicators and the stock market exactly.

.1 Appendix

Table 1: Summary of Steps and Procedures

Number	Step/process name	Macro name	Used for
1	proc import	importdata	Import all the raw datasets from seven csv and excel files
2	proc sort	sortdata	Sort datasets by common variables: e.g. sort 3 COVID-19 datasets by 'date'
3	proc merge	mergedata	Merg datasets by common variables: e.g. merge 3 COVID-19 datasets by 'date'
4	proc print	no	Print datasets: e.g. print COVID19-final
5	proc contents	no	Print the contents of datasets: e.g. print contents of COVID19-final
6	data step drop	no	Drop some variables: e.g. drop areaType in COVID19-final
7	data step delete/output	no	Delet/Select some rows: e.g. delete 1-6 rows in GDP-components
8	data step rename	no	Rename variable names: e.g. rename 'title' in GDP-component
9	data step input/format	no	Set the type/format of variables: e.g. convert 'month' to monname. format
10	data step data	no	Create a new dataset: e.g. create the 'test' and 'teste2' dataset
11	proc means	statistics	Get the statistics info of variables: e.g. the min p5 Q1... of variables
12	proc sgplot1	barlineplot	Make a plot with one line and bar: e.g. the figure 'Deaths with COVID19'
13	proc sgplot2	no	Make a plot with several lines and a bar: e.g. the figure for economics-final
14	proc sgplot3	no	Make a plot with two lines: e.g. the figure 'FTSE Stock Index'
15	proc sgplot4	scatter-single	Make a scatter plot for two variables: e.g. 'deaths' and 'monthlyGDP'
16	proc sgplot5	scatter	Make a scatter plot for predictions and obs: e.g. the 'pred vs obs' figure
17	proc corr	corr	Get the correlations of each two variables: e.g. the variables in covid19-stock

Table 1: Summary of Steps and Procedures (Continue)

Number	Step/process name	Macro name	Used for
18	proc reg	regression	Build a linear regression model: e.g. a model on 'deaths' and 'monthlyGDP'
19	proc score	predictions	Make predictions on the lr model: e.g. predict the stock indexes
20	proc summary	no	Sum up selected variables by a given class: e.g. convert daily data to monthly data
21	option validvarname	no	Set the format of the variable names: e.g. convert names with spaces to normal format