Mobility and the Economic effect of COVID-19 In United Kingdom

Joseph P. Byrne, Edinburgh Business School, Heriot-Watt University

Mario Cerrato, Adam Smith Business School, University of Glasgow

Xuan Zhang, Institute of Economics and Finance, Nanjing Audit University

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Introduction

- The Global Pandemic of 2020 impacted the large majority of advanced and developing countries (SARS-CoV-2).

- Countries with relatively high infection rates experienced excess mortality and extreme pressure on health provision related to COVID-19.

- The economic consequences have included increased unemployment, firm closure, stock market volatility and strain on government public finances.

- Countries have reacted with both pharmaceutical and nonpharmaceutical interventions. By the middle of 2020, global COVID-19 cases exceeded 10 million and global COVID-19 deaths were greater than 500,000.

- The UK was also badly impacted, in terms of the daily death population ratio rates and in cumulative absolute deaths.

- In addition to the sizable public health impact, the UK has also had sizable economic impact. The annualised contraction in gross domestic product exceeded 20% in April.

Introduction

- A whole range of unprecedented non-pharmaceutical interventions (NPI) have been implemented.

- NPIs included social distancing, school closures, domestic and international travel restrictions, shelter at home orders, etc…

- Key questions have arisen: How (why) does the virus spread across UK regions?

- how fast does it spread? Do a full (local) national lockdown work in reducing the spread of the virus?

- We attempt to answer these questions in the first part of this project.

- In the second part of the project, we consider the (full) economic cost of implementing short-lived lock-downs at regional/national level and their economic impact.

- We also extend the research questions cited above to include other EU (non-EU) countries.

The Dynamics of the virus across the UK regions

- We begin by investigating the virus spread across different English regions, at an aggregate and disaggregate level. The source of English regions is from Public Health England. The English regions are as follows:

- East Midlands (EM); East of England (EE); London (LON); North East (NE); North West (NW); South East (SE); South West (SW);West Midlands (WM); and Yorkshire and The Humber (YTH).

- Figure on the next pp shows that London infection rate rose exponentially in

- March and then fell equally rapidly during April (i.e. peak infection rate date 2nd April, with1072 new cases; the North East and North West both followed London rapidly (with localised peaks on the 6th April, but delayed maximum infection dates in the 30th and 22nd of April respectively)

Infection Rates by UK Regions

Infection Rates - Daily Growth by Region
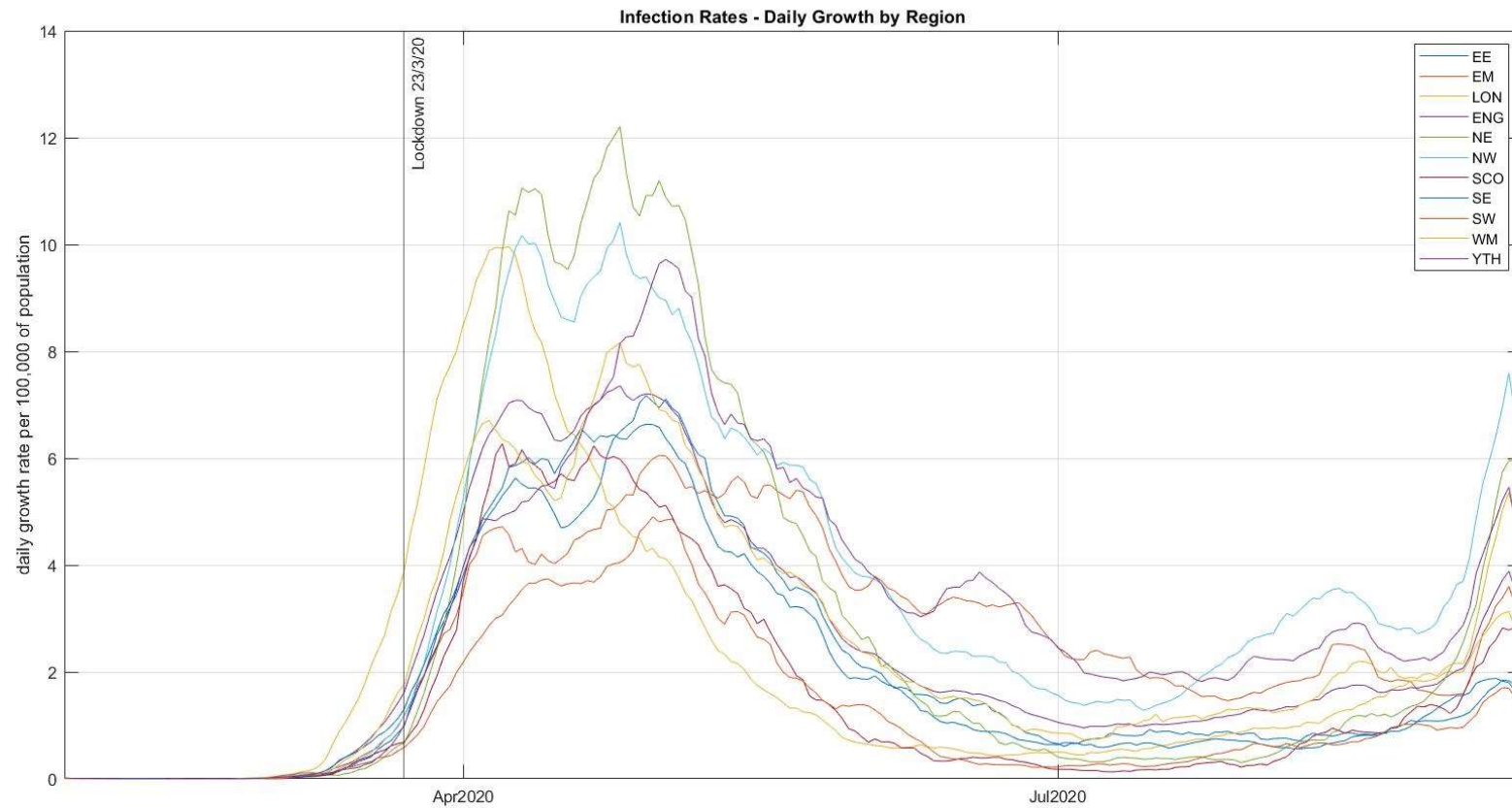
Average Regional Correlation of Infection
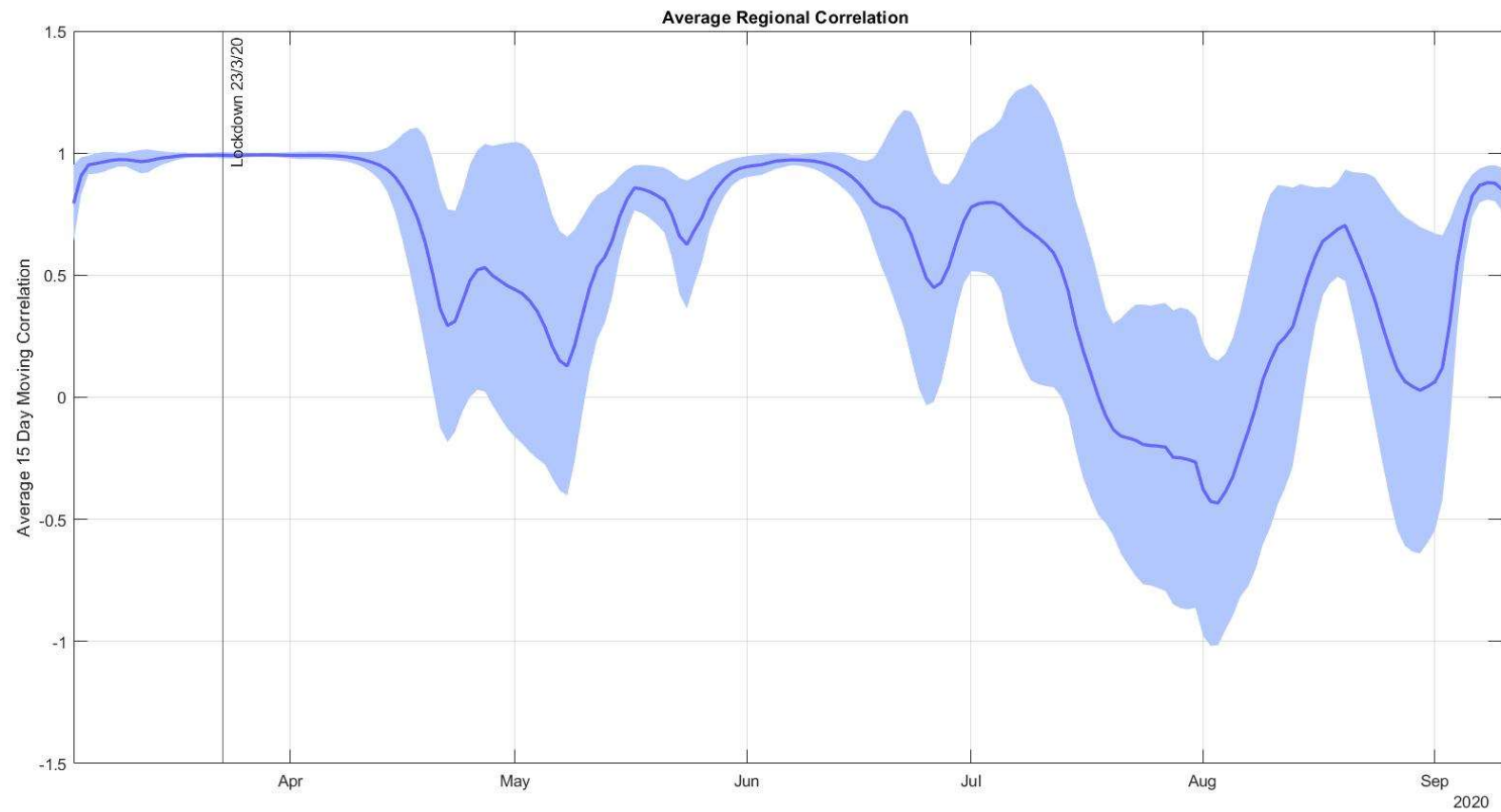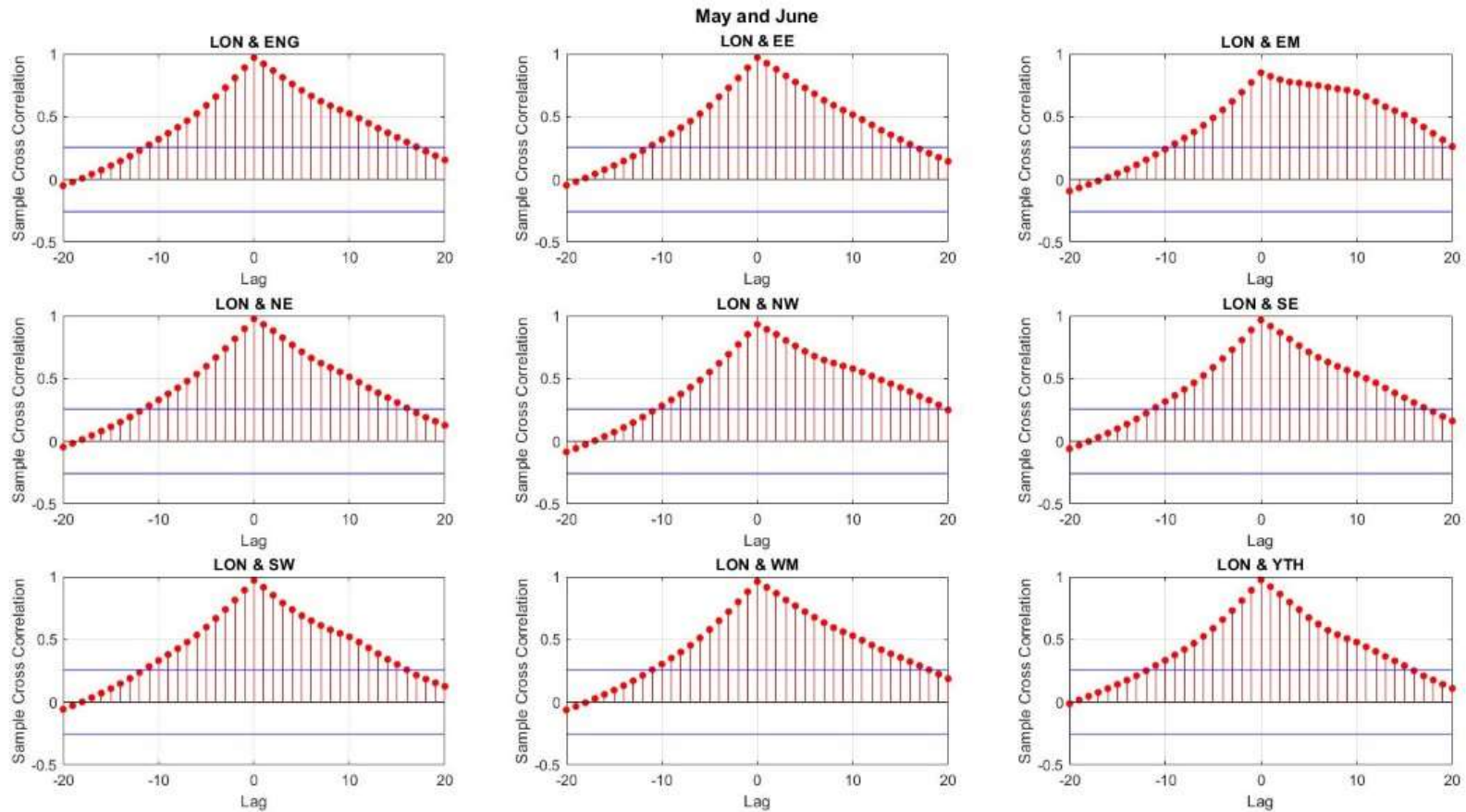
Temporal Shift in Correlations

- We now consider whether there is a temporal shift in the extent to which individual regions are correlated. There is a distinct asymmetry in the correlation between individual regions and London, and this is a lagging relationship and the most pronounced is between London and YTH.

- In contrast, for the later sample May-June the results are much more symmetrical. This indicates that while there were temporal gaps between regions when the epidemic was rapidly expanding, when it was contracting in May the regions behaved in a more similar fashion.

- There are regions for which the diffusion of the virus seems to happen very fast. Measured lock-downs in these regions should be imposed sooner rather than later; English regions could come out of Lock-down at the same speed. These results may reinforce the case for lock-downs to be co-ordinated at national level and therefore suggests that, there may need of central government intervention, while the unwound of lock-downs could be decided at regional level

Temporal Shift in Correlations
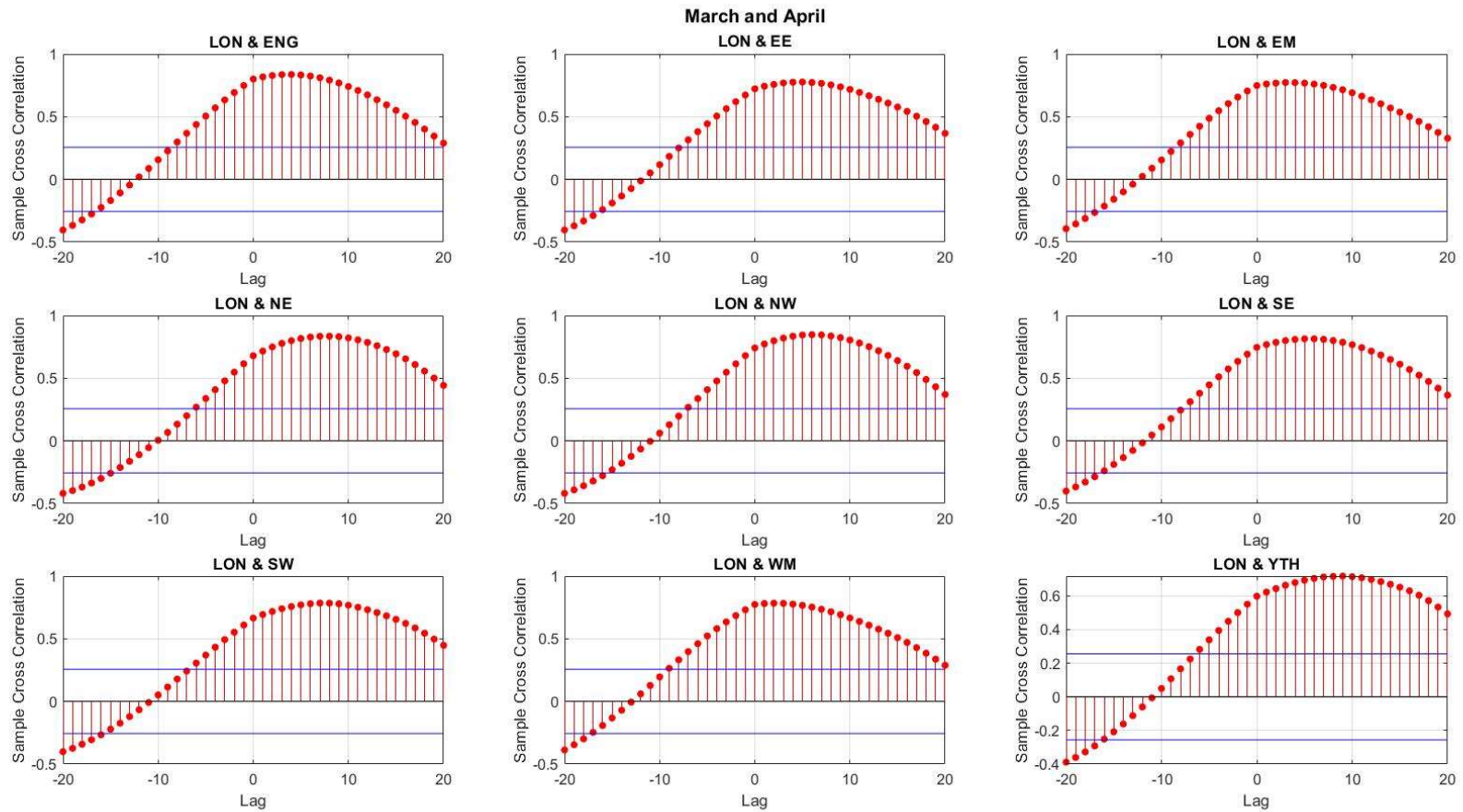
Temporal Shift in Correlations

Temporal Shift in Correlations

- These results suggest that the virus spreads quite fast across some regions and less across others. We now consider the association between mobility patters and the spread of the virus across regions.

- Google Mobility Reports data from the middle of February 2020, for nine English regions, for six transportation categories: RET retail and recreation; GROC grocery and pharma; PARK parks; STAT transit stations; WORK workplaces; RESD residential.

Google Mobility in Different UK regions

Google Mobility in Different UK regions
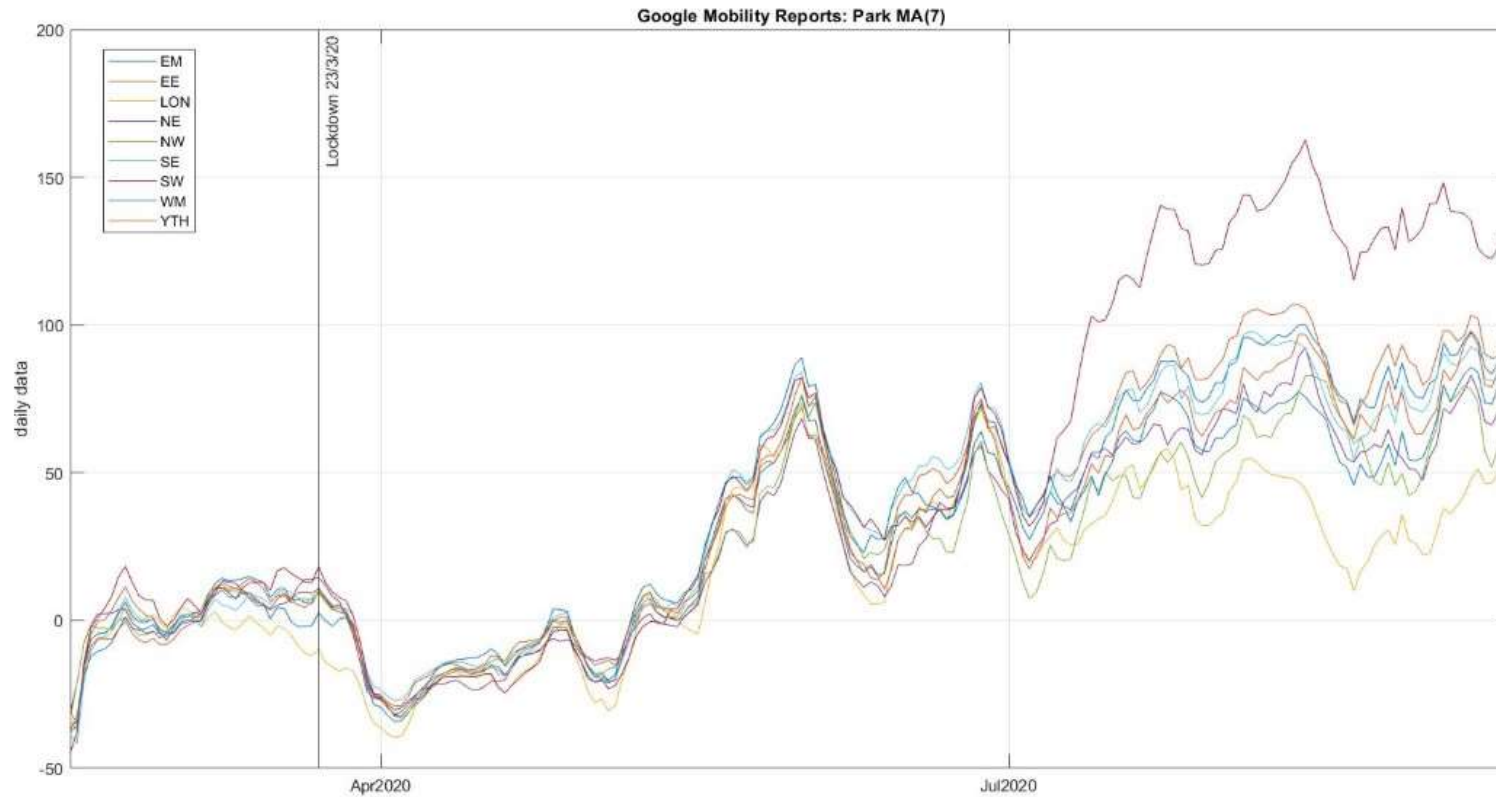
Google Mobility Reports: Park MA(7)

Google Mobility in Different UK regions

Google Mobility Reports: Residential MA(7)

Google Mobility in Different UK regions
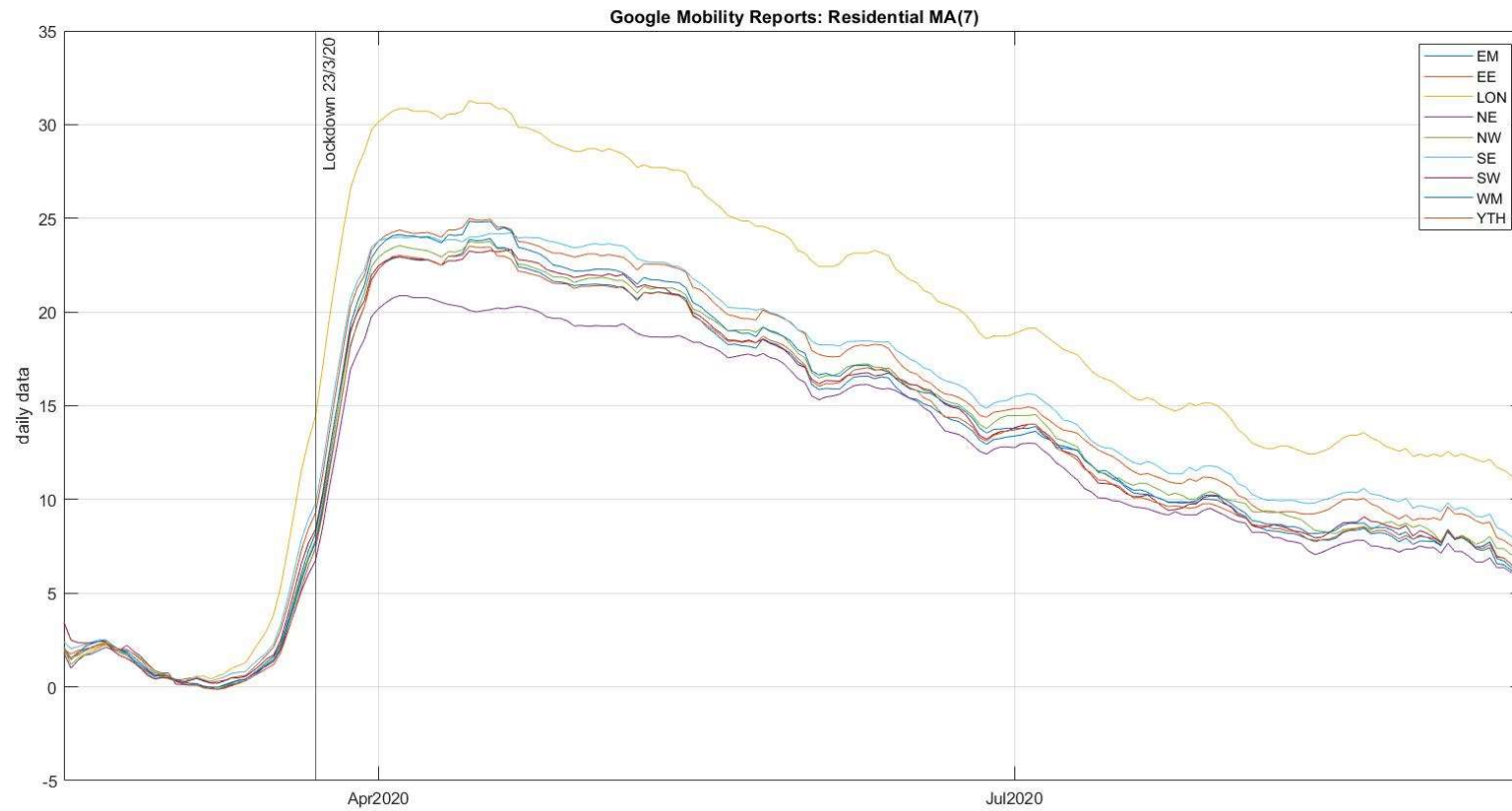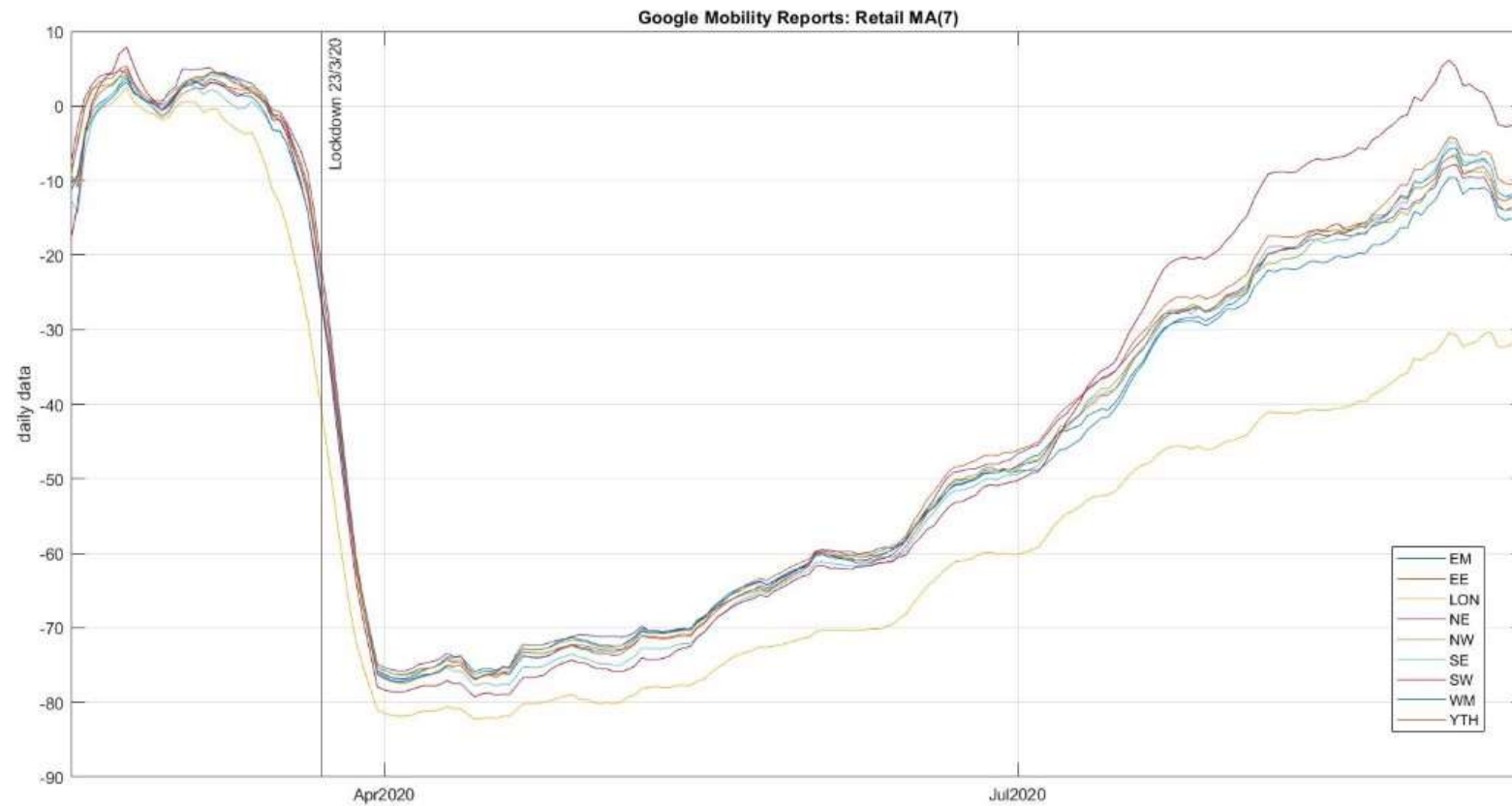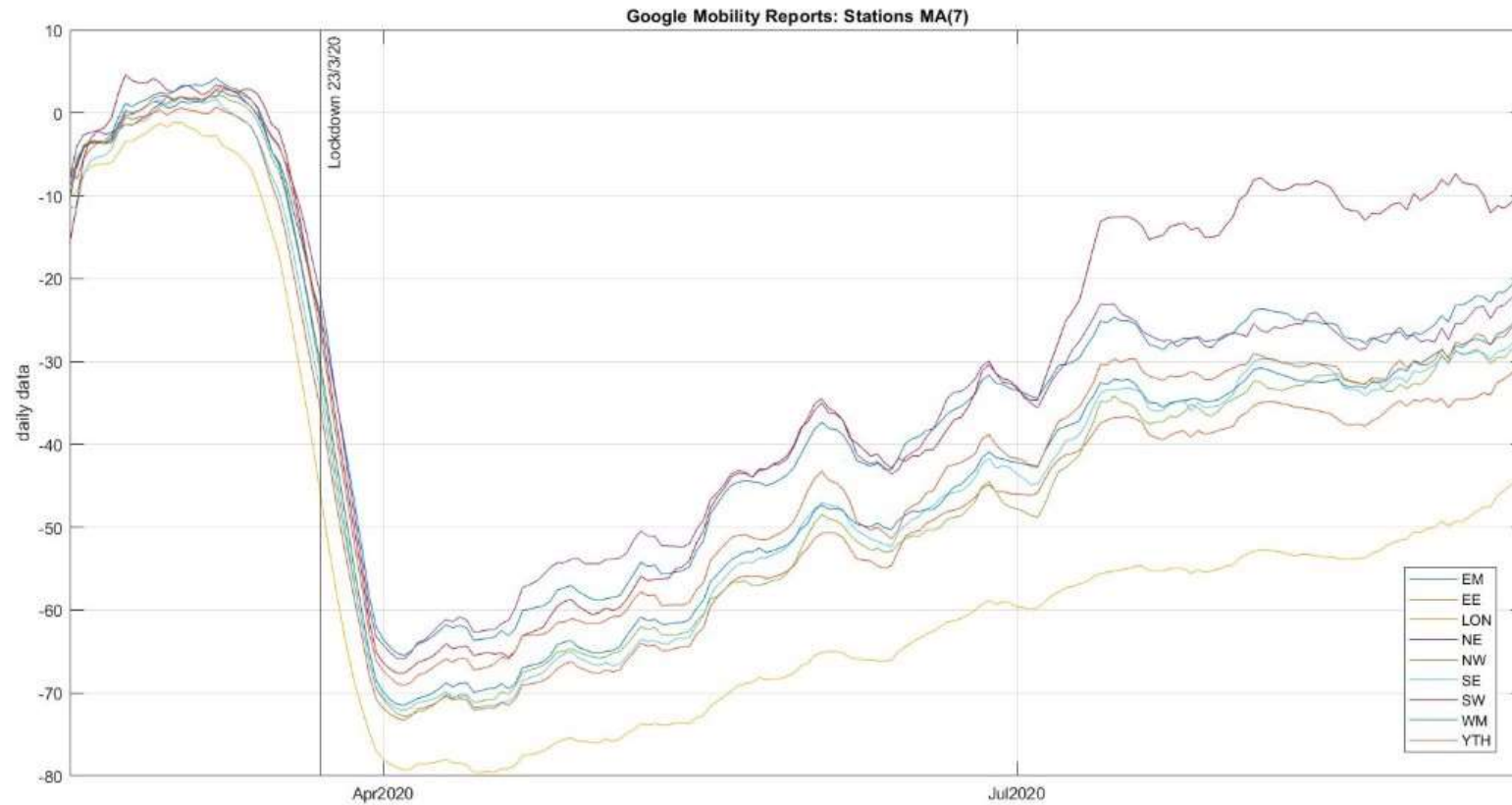

Google Mobility Reports: Retail MA(7)

Google Mobility in Different UK regions

Google Mobility Reports: Stations MA(7)

Google Mobility in Different UK regions

Google Mobility Reports: Work MA(7)
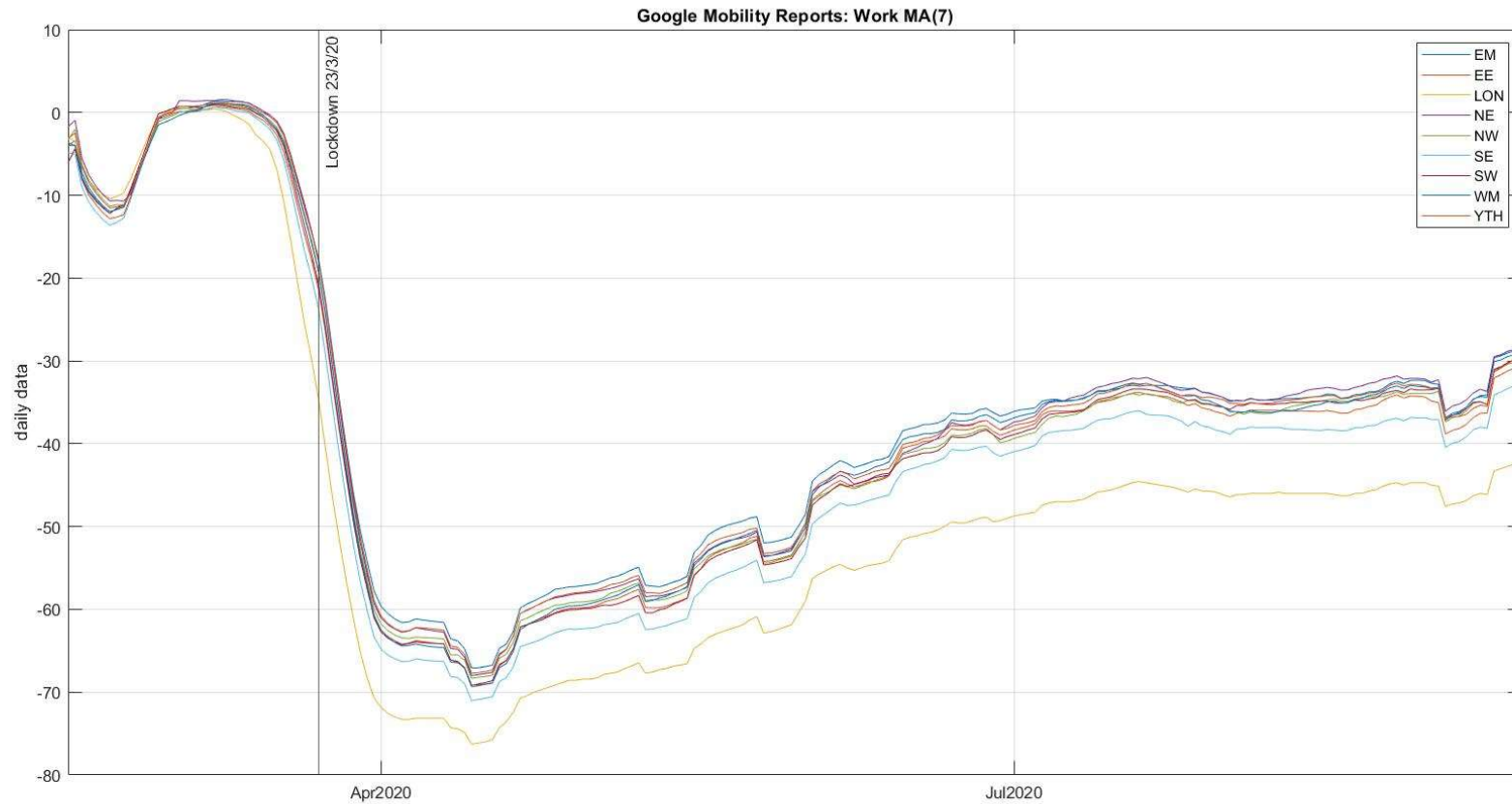
The Oxford Stringency Index

- To assess the impact of lock-down on the virus spread, We use the Oxford COVID-19 Government see Hale et al. (2020).

- The index is based upon 17 indicators including School closures and restriction on travel. In particular the indicators are: information on containment and closures (C1-C8); economic policies (E1-E4); and health policies (H1-H4). An increase in the index (STRING) indicates a more stringency lockdown. The index rises from 1 (least stringent) to 100 (most stringent). Following an increase in the stringency index, we would expect to observe a fall in infection and death rates (i.e. a negative relationship).

Oxford Stringency Index

UK and UK Nations NPI Response
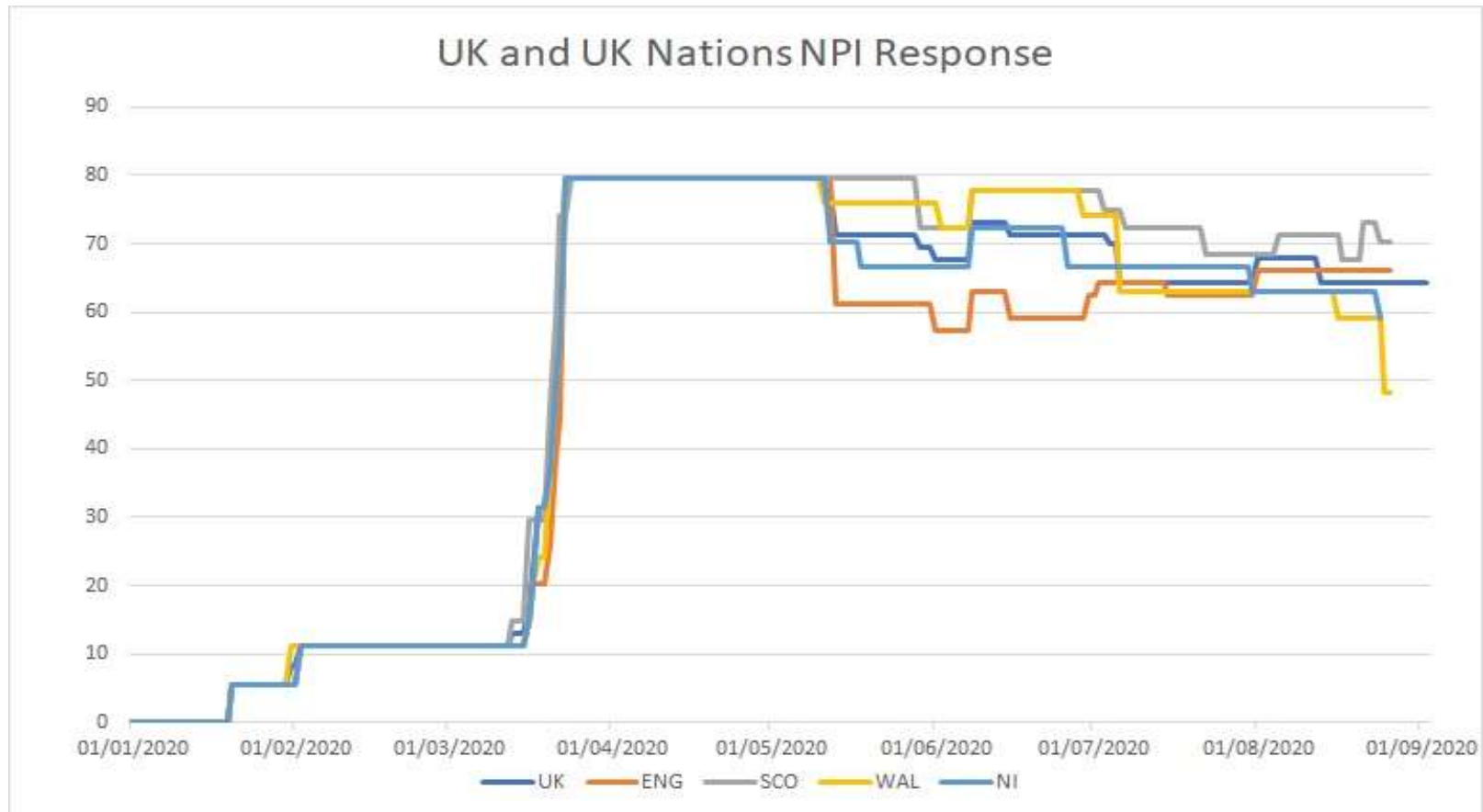
Oxford Stringency Index

- We see that the NPI response has been rather hard during the lockdown period and this is consistent across all UK Nations.

- Starting from the end of May, nations have reverted their policies.

- Scotland appear to retain a stringent policy after May 2020.

- Wales and Northern Ireland appear to be the Nations that relax their policies the most.

- It's instructive that these are the only two Nations experiencing a relatively more stringent second lockdown.

The Model

- The empirical model we consider is an infection rate (IR) model, new confirmed positive cases per 100,000 as function of stringency index (STRING) and some measure of social mobility, Work (WORK), transport (STAT), shopping (GROC) and recreational retail (RET). We investiaget a common factor (f), other explicators (X) and a lag of infection rate. e_{it} is an error term and Gammas (γ) are estimated elasticities

$$IR_{it} = \gamma_{0,i} + \gamma_1\ STRING_t + \gamma_{21}\ WORK_{it} + \gamma_{22}\ STAT_{it} + \gamma_{23}\ GROC_{it} + \gamma_{24}RET_{it} + \gamma_3 f_t + \gamma_4 X_{it} +$$

$$\gamma_5 IR_{i,t-1} + e_{it}$$

Basic Statistics

	EE	EM	LON	ENG	NE	NW	SCO	SE	SW	WM	YTH
1st Case(s)	3/2	5/2	11/2	30/1	2/3	28/2	28/2	3/2	3/2	12/2	12/3
Peak Case	22/4 (522)	29/4 (378)	2/4 (10,72)	22/4 (4,797)	30/4 (383)	22/4 (911)	20/4 (776)	7/4 (717)	29/4 (348)	22/4 (578)	29/4 (712)
TTP Case	79	84	51	83	59	54	52	64	86	70	48
Cum. Cases	23,162	20,484	33,575	242,081	15,020	42,022	18,213	33,476	12,672	25,076	28,451
1st Death	9/3	3/3	9/3	3/3	15/3	8/3	18/3	3/3	9/3	8/3	12/3
Peak Death	8/4 (116)	6/4 (67)	8/4 (231)	8/4 (975)	10/4 (56)	16/4 (166)	16/4 (84)	9/4 (130)	10/4 (62)	8/4 (135)	16/4 (82)
TTP Death	30	34	30	36	26	39	29	37	32	31	35
Cum. Deaths	4,335	3,103	6,677	39,234	2,317	6,470	2,482	5,272	2,030	4,923	3,771
Excess Deaths	5,546	4,199	9,154	52,298	2,596	8,306	4,349	7,698	3,071	6,792	4,936

Note: This table displays basic comparative and descriptive statistics from data released on 6/7/20. Cases are from PHE. Time To Peak (*TTP*) is number of days between first and peak cases or deaths. Numbers in parentheses (.) are cases/deaths at peak. Cumulative COVID-19 cases and deaths are on 26/6/20 from PHE and SG. Cumulative Excess deaths for 2020 (compared to a 5 year average) from ONS and NRS are 26/6/20. Regions/Nations are as follows. East of England (EE); East Midlands (EM); London (LON); England (ENG); North East (NE); North West (NW); Scotland (SCO); South East (SE); South West (SW); West Midlands (WM); Yorkshire and The Humber (YTH).

Table 2: **Google Mobility and Covid-19 in English Regions**

Regressor	[1]	[2]	[3]	[4]	[5]	[6]
WORK	0.015	-0.004	0.038*	0.003	0.040***	0.003**
STAT	-0.006	0.001	-0.004	0.000	-0.004	-0.000
GROC	0.026***	0.004	0.020	0.007**	0.024***	0.007***
RET	-0.035**	-0.005**	-0.047**	-0.011***	-0.051***	-0.012***
STRING	-0.105	-0.017	-0.120**	-0.023**	-0.094	-0.057
FR					0.000	-0.000
LAG(IR)	0.988***		0.974***		0.966***	
LAG(DR)		0.982***		0.964***		0.958***

Note: this table presents panel econometric estimates of the relationship between COVID-19 infection rates (IR) in nine English regions and Google Mobility indicators. The indicators we consider are mobility around places of work (*WORK*), transport hubs (*STAT*), grocery and pharmaceutical (*GROC*) and recreational retail in cinemas, theatres etc (*RET*). We also examine the importance of Bravatnik Stringency Indicators (*STRING*). We add in dynamic terms and account for time dummies. Results column [1] IRSDYD is for the infection rates with mobility indicators and stringency lagged one day and estimation by Fixed Effects; [2] DRSDYD is death rate with indicators lagged one day and estimation by Fixed Effects; [3] IRSDYD7 is infection rate with indicators lagged seven days and estimation by Fixed Effects; [4] IRSDYD7 is infection rate with indicators lagged seven days and estimation by Fixed Effects. [5] IRIV is infection rate with indicators lagged seven days and estimation by instrumental variables; [6] DRIV is death rate with indicators lagged seven days and estimation by instrumental variables. Statistical significance is denoted by: * $p<0.05$; ** $p<0.01$; *** $p<0.001$. Regions are as follows. East of England (EE); East Midlands (EM); London (LON); North East (NE); North West (NW); South East (SE); South West (SW); West Midlands (WM); Yorkshire and The Humber (YTH).

Conclusions

- We present first empirical evidence on how the virus spreads across English regions and how quickly it spreads.

- We also present first evidence for UK that 1. social distancing policies work; 2. mobility can explain the diffusion of the virus within the region and across the regions; 3. we also report evidence that stringent policy measures (lockdowns) are effective in reducing the spread of the virus.

- We conclude that lockdown needs to be co-ordinates at national level while exit from lockdowns can be decided regionally.

- These results are only indicative and further empirical research is being carried out.

- Further questions we aim to answer are: how long it takes for lockdowns to be effective to reduce the spread of the virus? Should Governments aim for timed and quick lockdowns? What is the economic costs of tis strategy? Should Government link lockdowns to the capacity of the NHS or rather to an "acceptable" growth of the virus within the country?