Reproduction Number (R) and Forecasts of New Cases:
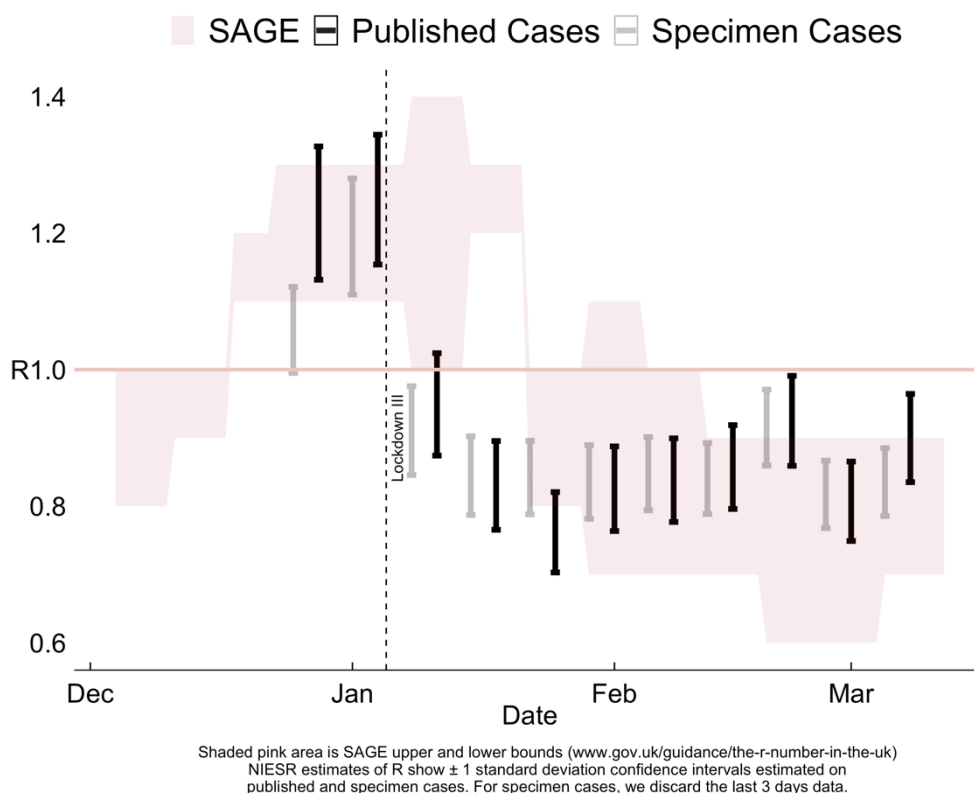## The effect of school openings yet to be seen

Figure 1 - UK R – NIESR and SAGE

Shaded pink area is SAGE upper and lower bounds (www.gov.uk/guidance/the-r-number-in-the-uk)
NIESR estimates of R show ± 1 standard deviation confidence intervals estimated on
published and specimen cases. For specimen cases, we discard the last 3 days data.

Main points

- The NIESR estimates use a new time series model to project new cases of Covid-19 and produce timely estimates of the R number. In addition, we also produce forecasts of hospital admissions and deaths due to Covid-19. The forecasts reported here were made using publicly available data on 9th March 2021.

- Figure 1 shows that the Reproduction number, R, which is the average number of secondary infections currently generated by an infected individual, **moved up to 0.85 – 0.95 by 8th March** from a range of 0.75 – 0.85 where it had been the week before.

- Based on our model, by 12th April when non-essential retail is scheduled to reopen, we expect trend daily cases to be around 900, admissions around 100 and deaths below 50 (Figures 2-4). Relative to last week, this represents a marginal

upward revision for cases of 200 and downward of 100 for admissions with deaths still below 50.

- To the extent that the re-opening increases transmission these numbers are likely to increase. On the other hand, these numbers could decrease to the extent that the vaccination programme reduces transmission. It will be interesting to see which of these effects dominate in the subsequent data.

- Figure 5 shows that all regional R number estimates below one. Currently, the South East has the lowest R number while Northern Ireland and Yorkshire and the Humber again have the highest.

"According to the latest data on new cases, our work shows an R number for the UK in the range 0.85 – 0.95, taking it slightly above the range it has been from mid-January. This is based on data up to 9th March 2021, the day after the schools were reopened. In the period ahead, contacts and hence transmission can be expected to increase and our forecasts for daily cases is likely to pick up the effects of school reopening in about one to two weeks. Looking back, in combination with the prevailing lock down our forecasts for admissions and deaths have adapted to factor in the efficacy of the vaccine in limiting admissions and deaths. Looking forward, the key will be the trade-off between increases in transmission due to schools reopening and the continued reduction in admissions and deaths to be expected as the vaccination roll out proceeds at pace."

Dr Craig Thamotheram
Senior Economist - Macroeconomic Modelling and Forecasting

Results

Figure 2 provides forecasts of daily cases of Covid-19 for the period until mid-April and highlights the underlying number of new cases to be expected on the key dates in the Government's roadmap: outdoor association on the 29th March and non-essential retail reopening on the 12th April.

- Trend daily cases are forecast to be around 1700 by the 29th of March and 900 by 12th of April.
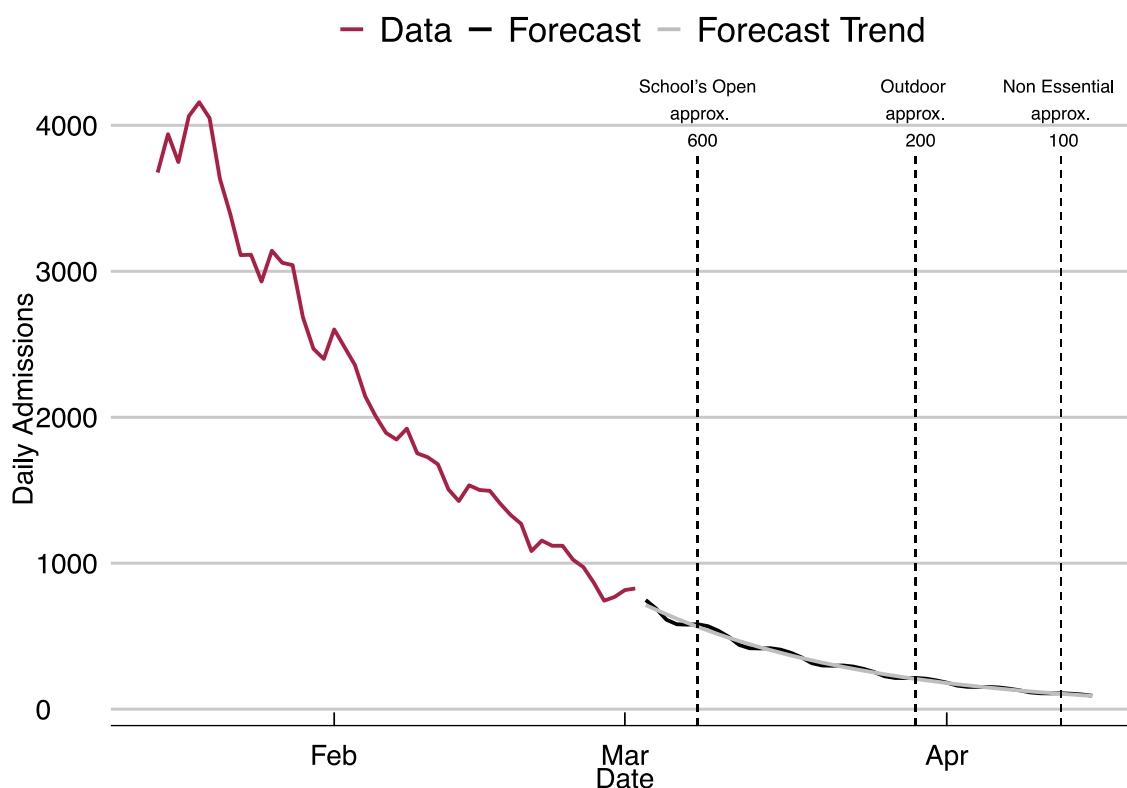
Figure 2 - UK forecast of new COVID-19 cases
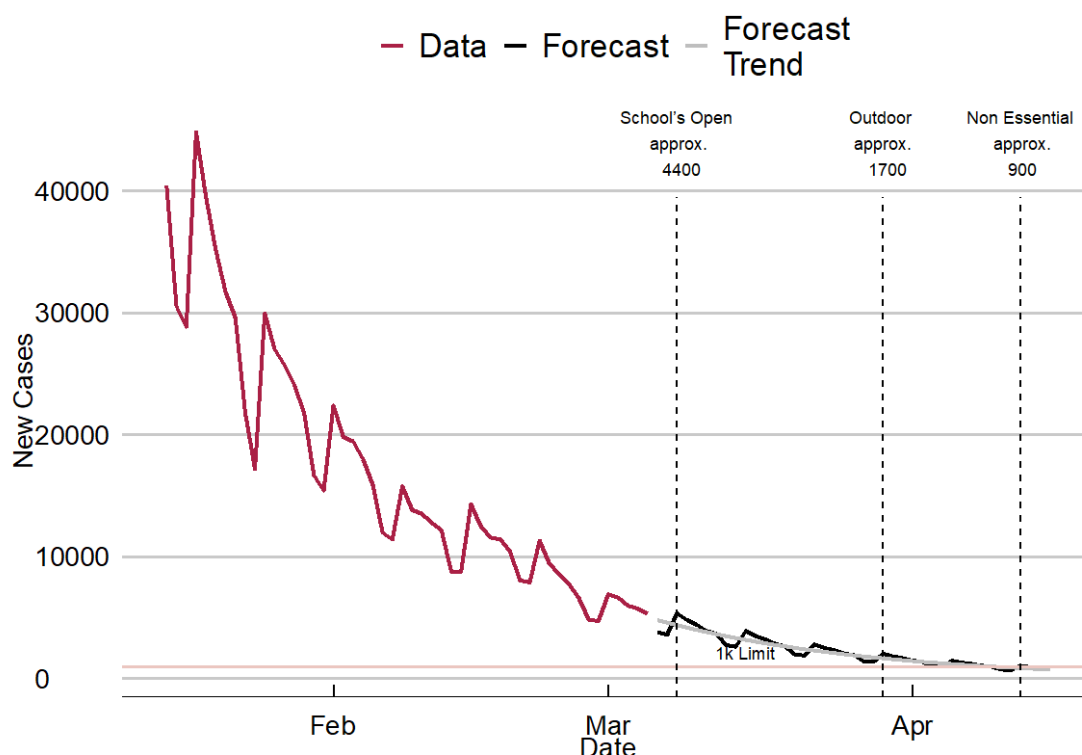
Vertical dashed lines show trend new cases on 8th March, 29th March and 12th April rounded to nearest 100.
Specimen case data avaiable on 09 March 2021, we discard the last 3 days data such that the estimation sample ends on 05 March 2021.

Figure 3 provides forecasts of daily hospital admissions for Covid-19 until mid-April and highlights the underlying number of new admissions to be expected on the key dates in the Government's roadmap: outdoor association on the 29th March and non-essential retail reopening on the 12th April.

- Hospital admissions are forecast to be around 200 by 29th of March and 100 by the 12th of April.

## Figure 3 – UK forecast of daily Covid-19 hospital admissions

Vertical dashed lines show trend Admissions on 8th March,
29th March and 12th April rounded to nearest 100.
Admissions data avaiable on 09 March 2021, there is a 5 – 7 days lag
in data collection. Hence, the estimation sample ends on 02 March 2021.

Figure 4 provides forecasts of daily deaths due to Covid-19 until mid-April and highlights the underlying number of daily deaths to be expected on the key dates in the Government's roadmap: outdoor association on the 29th March and non-essential retail reopening on the 12th April.

- By 29th March when outdoor association restarts, daily deaths are forecast to be below 50.

Figure 4 – UK forecast of daily Covid-19 deaths

Vertical dashed lines show trend Deaths on 8th March,
29th March and 12th April rounded to nearest 100.
Publish Deaths data avaiable on 09 March 2021
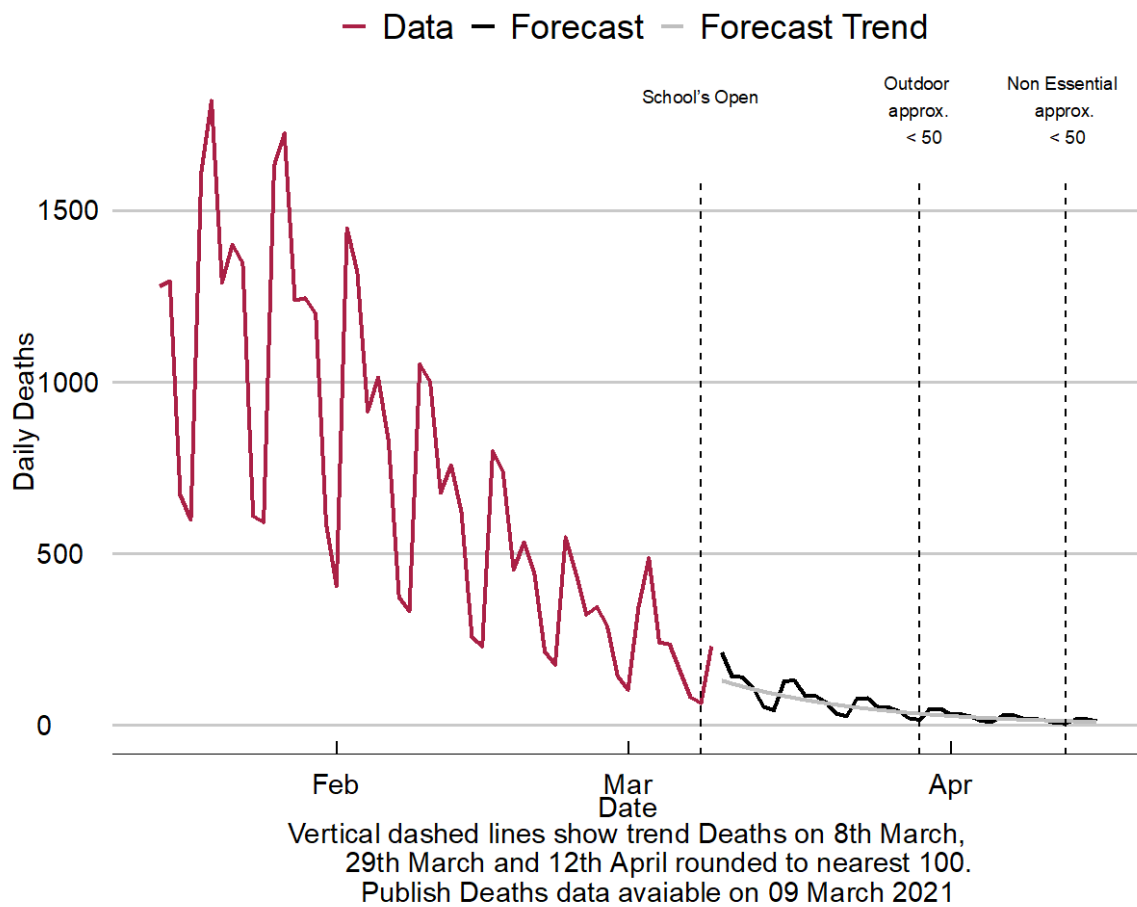
- Figure 5 provides regional R number estimates on specimen date data series released on 9th March 2021. We discard the last 3 days data due to data revisions in that time window. Thus, at the end of our estimation sample on the 5th March 2021, all regional R number estimates are below one.
- Among nations of the UK, Northern Ireland has the largest R number (0.87) and Wales has the lowest (0.80).
- Among regions of England, Yorkshire and Humber has the highest R number (0.90) and the South East has the lowest (0.79).

Figure 5 - UK Regional R
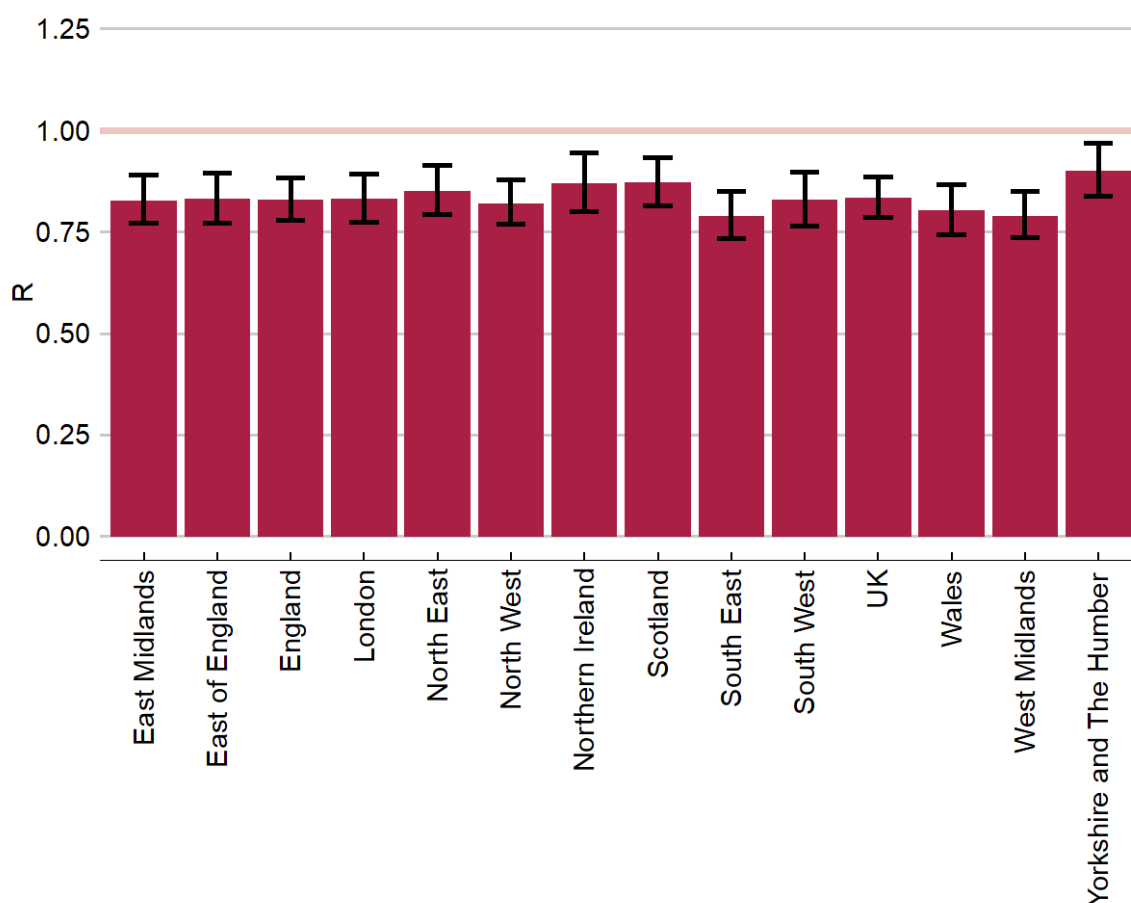
Bar chart shows point estimates of R and the ± 1 standard deviation confidence intervals

Background

NIESR aims to set out projections of the future path of the Covid-19 epidemic in the United Kingdom, its constituent nations and the regions of England, based on current policies.

NIESR will be producing weekly updates on Thursdays, projecting new cases and estimating the R number using a class of time series models developed by Prof. Andrew Harvey and Dr. Paul Kattuman of Cambridge University; see Harvey and Kattuman (2020a). The models generate forecasts by extracting changing trends from historical data. They are relatively simple and transparent, and their specifications can be assessed by standard statistical test procedures. The advantage of the time series approach is that it can adapt very quickly to the most recent information and hence produce timely estimates. This flexibility enables the effects of changes in policy, virus mutations and human behaviour to be tracked. The models are data driven and so are different from the structural models used by epidemiologists which rely on assumptions about transmission and behaviour; see Avery et al (2020).

A description of the methods used to produce these estimates and an evaluation of their forecasting performance can be found in Harvey, Kattuman, and Thamotheram (2021).

Data

Data: COVID-19 confirmed cases and deaths data are sourced from
https://coronavirus.data.gov.uk

Caveat

The model relies on historical data and does not incorporate future outlined changes in the underlying environment. Thus, it is important to read the forecasts in this context. For example, the current forecasts make no assumptions about the effect of reopening the schools on increasing transmissions. On the other hand, the effect of the vaccine program will be in the opposite direction.

Authors

Professor Andrew Harvey is Emeritus Professor of Econometrics at the University of Cambridge and a Fellow of Corpus Christi College. He has published over 100 articles and is the author of four books: *The Econometric Analysis of Time Series* (1981), *Time Series Models* (1981), *Forecasting. Structural Time Series Models and the Kalman Filter* (1989) and *Dynamic models for Volatility and Heavy Tails* (2013). He is a Fellow of the British Academy and the Econometric Society.

Dr Paul Kattuman is a reader in Economics at Cambridge University. He has been a Senior Research Fellow at the University of Cambridge Department of Applied Economics, and a lecturer in economics at Durham. He has held Visiting Professorships at Université Paris 12 and Paris-Est Créteil and was appointed Grupo Santander Visiting Professor at Universidad Complutense de Madrid. He was visiting Faculty Scholar at the Kennedy School of Government, and at the Department of Statistics, both at Harvard University.

Dr Craig Thamotheram is a Senior Economist at NIESR. Prior to joining NIESR, he studied Engineering at Imperial and obtained a PhD in Economics at Warwick. He has work experience as a post-doc in macro and financial econometrics.

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Notes for editors

For further information and to arrange interviews please contact the NIESR Press Office: press@niesr.ac.uk or Luca Pieri on l.pieri@niesr.ac.uk / 07930 544 631

National Institute of Economic and Social Research

2 Dean Trench Street
Smith Square
London, SW1P 3HE
United Kingdom

Switchboard Telephone Number: 020 7222 7665

Website: http://www.niesr.ac.uk