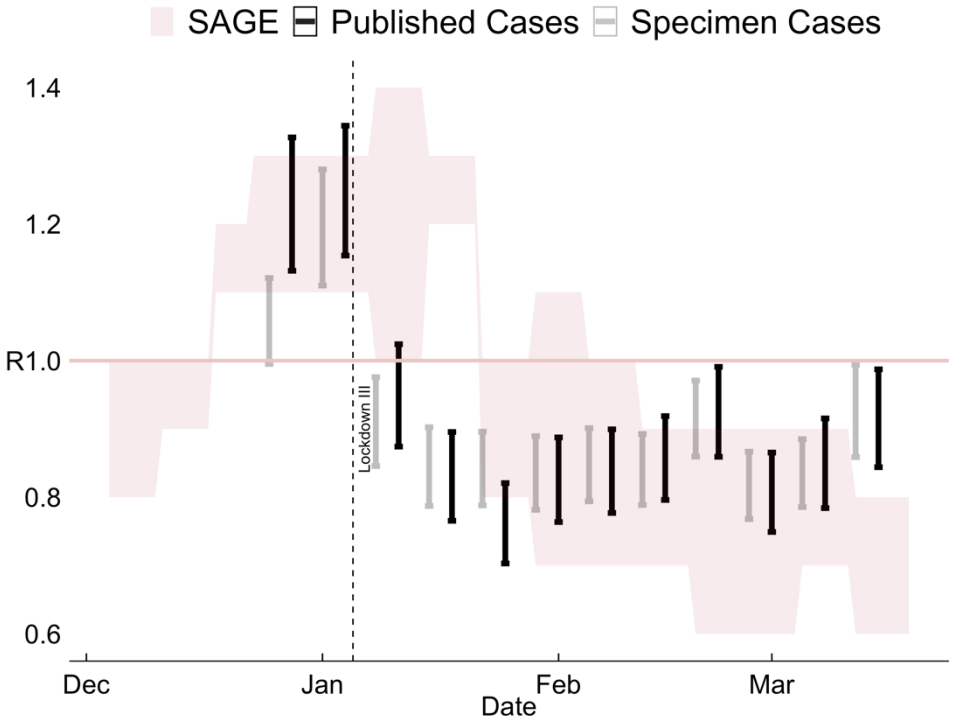
National Institute
NIESR Weekly Covid-19
Tracker No. 5

Thursday, 18th March 2021 niesr.ac.uk

Reproduction Number (R) and Forecasts of New Cases: More tests more cases

Figure 1 - UK R – NIESR and SAGE controlling for enhanced testing in schools



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

- We produce timely estimates of the R number and report forecasts for new cases of Covid-19, hospital admissions and deaths due to Covid-19 using publicly available data on 16th 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 – 1.0 by 15th March** from a range of 0.85 – 0.95 where it had been the week before. This estimate is obtained after controlling for enhanced testing in schools that started when they reopened on the 8th of March. If enhanced testing in schools is not controlled for, the R estimate would be 0.9 – 1.05.

- Based on our model, by 12th April when non-essential retail is scheduled to reopen, we expect trend value of daily cases to be around 2,900, admissions to be around 100 and deaths to fall below 50 (Figures 2-4). Relative to last week, forecasts for admissions and deaths are unchanged but that for cases is increased by 2,000. This is driven by our correction for increased testing due to schools reopening but also due to the increase in transmissions picked up in the data.
- To the extent that the re-opening increases transmission these numbers may increase. At the same time, expansion of the vaccination programme can be expected to reduce transmission. The trajectory that nets out these opposing trends will become evident in the weeks to come.
- Figure 5 shows that regional R number estimates are increasing. Currently, the West Midlands has the lowest R number while Scotland and Yorkshire and the Humber have the highest.

"Based on the latest data on new cases, our estimate of the R number for the UK lies in the range 0.85 – 1.0, taking it slightly above the range it has been from mid-January. This estimate is based on data up to 16th March 2021, about 10 days after the schools were reopened on the 8th of March. The reopening of schools in England has immediately increased testing and the resultant positive cases. Even after controlling for increased testing our estimate of the R number has moved up. In the period ahead, contacts and hence transmission can be expected to increase as a result of the reopening and our forecasts for daily cases is likely to rise. The path of hospital admissions and deaths will depend on the follow through from increased transmission due to the reopening, countered by the efficacy of the vaccination programme as the roll out continues at pace."

Dr Craig Thamotheram
Senior Economist - Macroeconomic Modelling and Forecasting

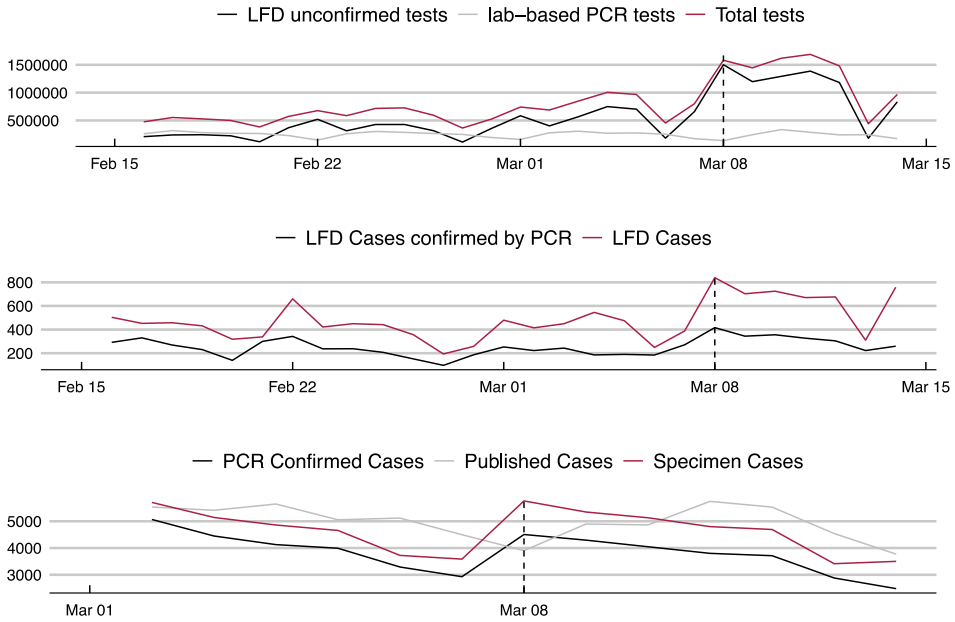
Results

From 10th March cases by test type is available for England. That is, the number of people with at least one positive COVID-19 test result is available by the type of test used in their first positive test. There are three types of tests:

1. Lab-based polymerase chain reaction (PCR).
2. Lateral flow device (LFD) confirmed by a PCR test taken within 3 days.
3. LFD that are unconfirmed by PCR.

Specimen cases are the sum of all three types and published cases are the specimen cases recorded on the previous day. Note,

Figure 1A - England cases and tests by type



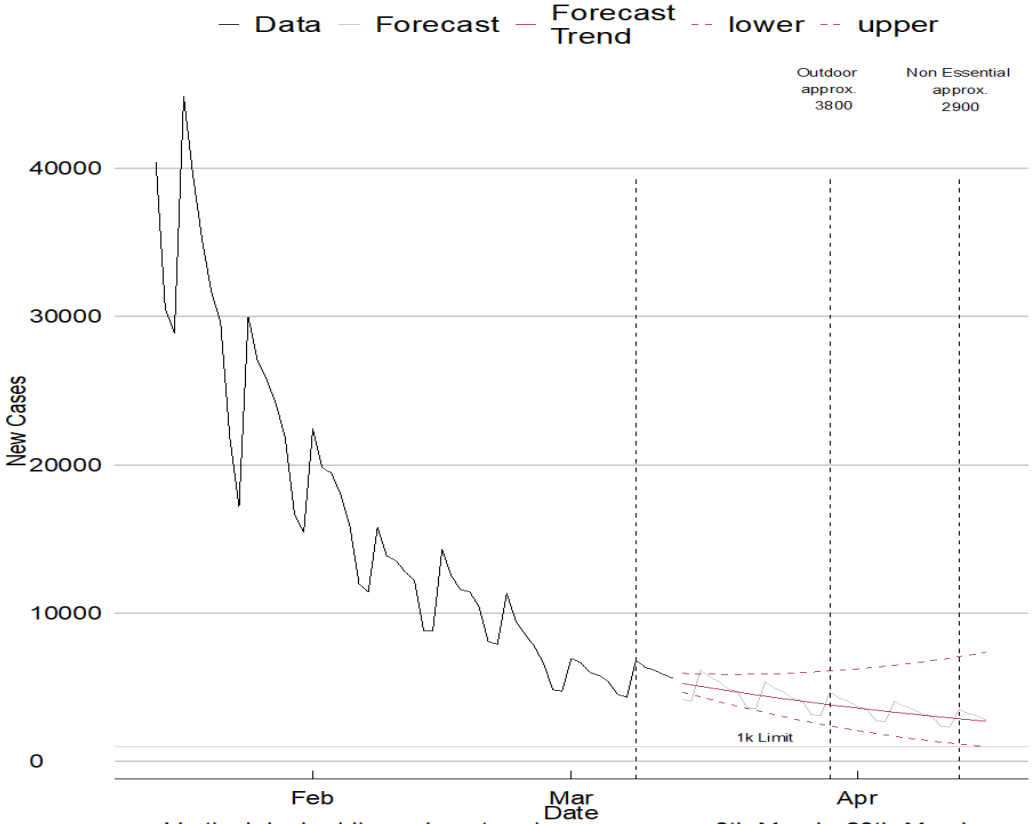
Vertical dashed line on 8th March. The test types are:
– lab–based polymerase chain reaction (PCR)
– lateral flow device (LFD) confirmed (this means the LFD result has been verified with a positive PCR result taken within 3 days)
– LFD unconfirmed (no positive PCR result taken within 3 days).

- The top panel of Figure 1A shows that PCR testing remained approximately the same after schools reopened and that LFD tests increased significantly.
- The middle panel of Figure 1A shows that this translated into an increase in LFD cases on the 8th March.
- The bottom panel of Figure 1A shows that this feed through into published cases on the 9th March and specimen cases immediately on the 8th March.

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. Projections include a correction for the increased testing due to the reopening of schools.

- Trend daily cases are forecast to be around 3800 by the 29th of March and 2800 by 12th of April.

Figure 2 - UK forecast of new COVID-19 cases

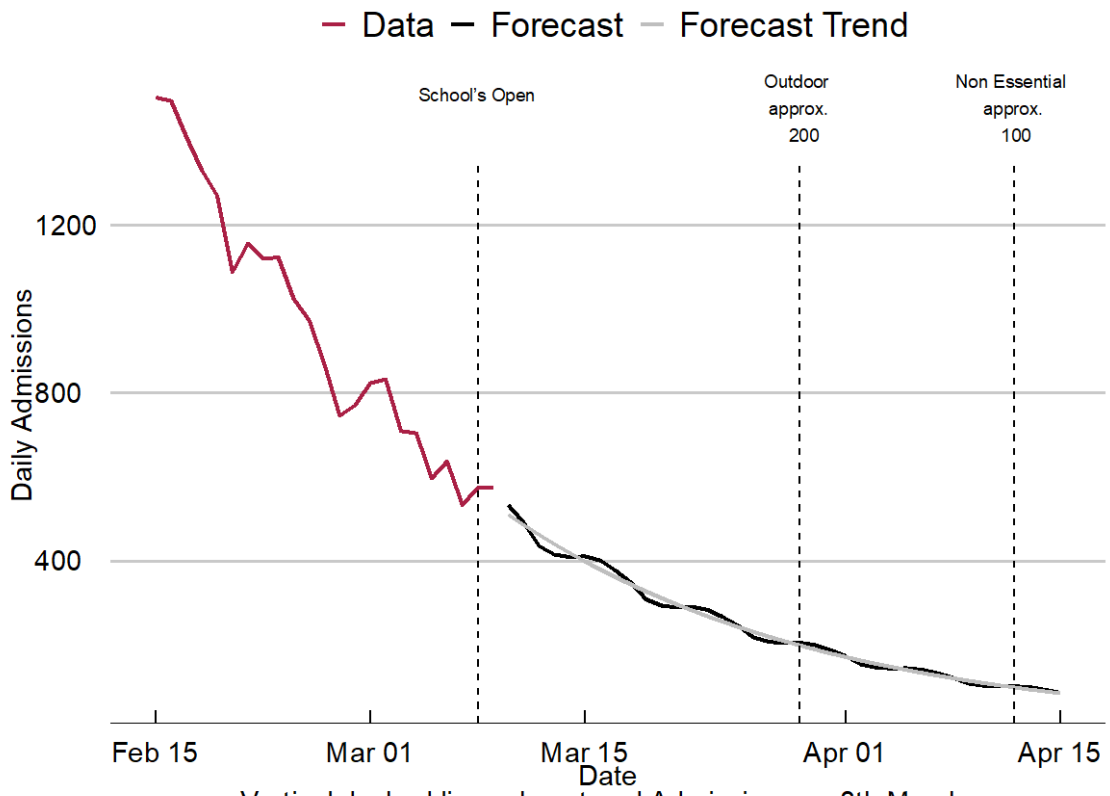


Vertical dashed lines show trend new cases on 8th March, 29th March and 12th April rounded to nearest 100.
Specimen case data avaiable on 16 March 2021, we discard the last 3 days data such that the estimation sample ends on 12 March 2021.

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

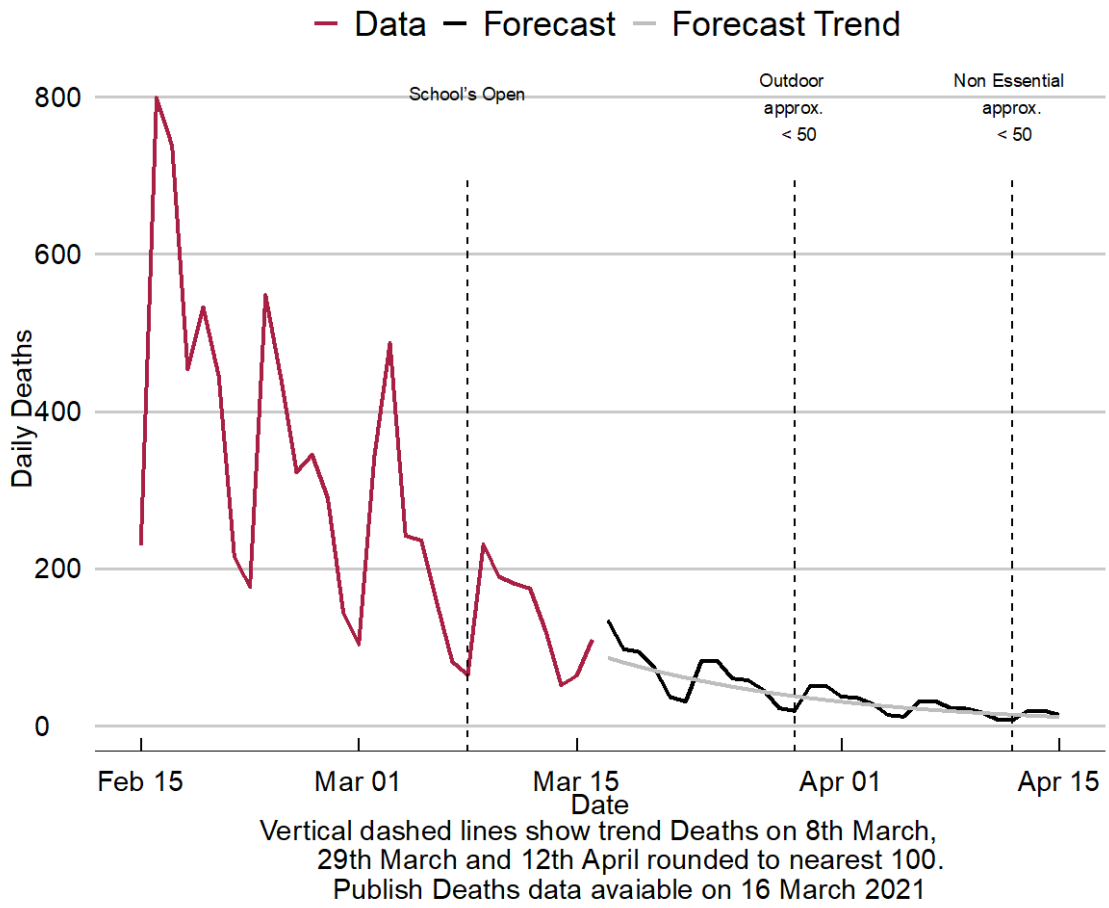


Vertical dashed lines show trend Admissions on 8th March, 29th March and 12th April rounded to nearest 100.
Admissions data avaiable on 16 March 2021, there is a 5 to 7 day lag in data collection. Hence, the estimation sample ends on 09 March 2021.

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.

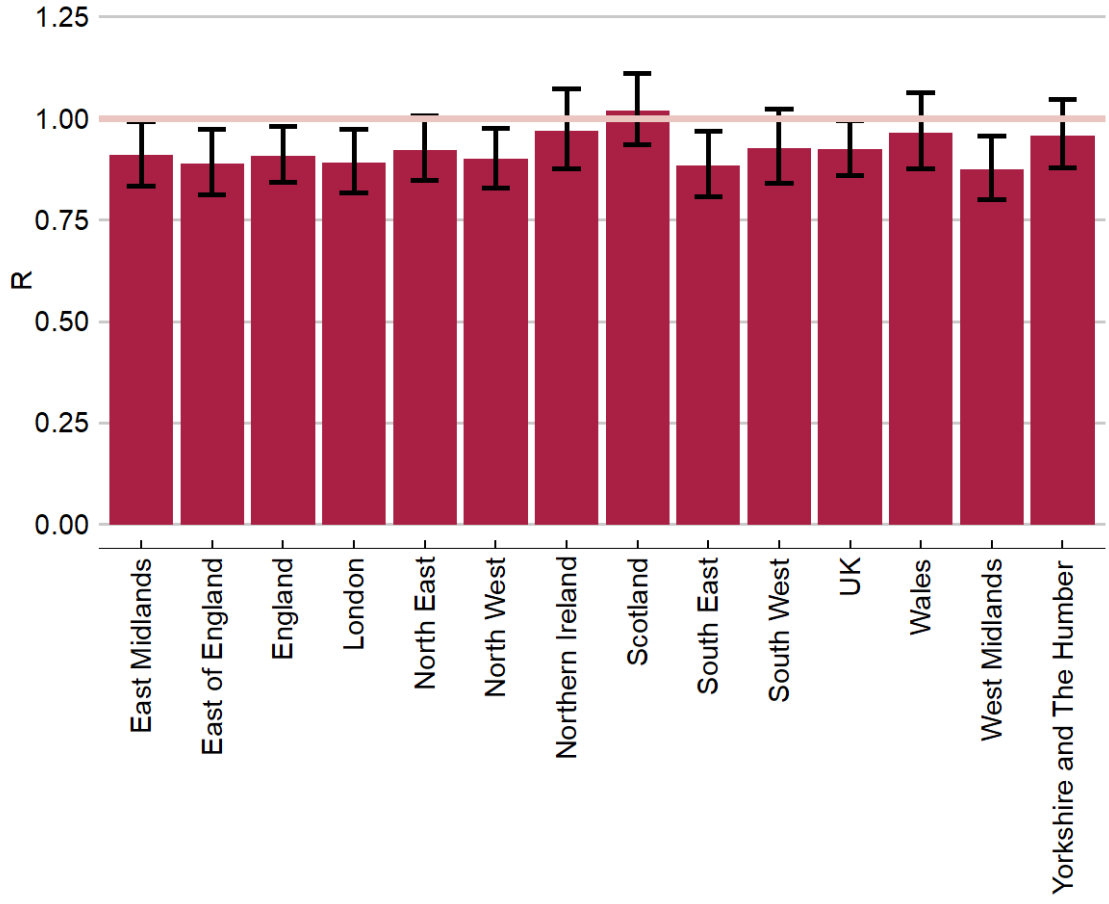
- By 29th March when outdoor association restarts, daily deaths are forecast to be below 50.

Figure 4 – UK forecast of daily Covid-19 deaths



- Figure 5 provides regional R number estimates on specimen date data series released on 16th March 2021 controlling for increased testing due to schools reopening. 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 12th March 2021, regional R number estimates are increasing with Scotland the first to move above one.
- Among nations of the UK, Scotland has the largest R number (1.02) and England has the lowest (0.91).
- Among regions of England, Yorkshire and Humber has the highest R number (0.96) and the West Midlands has the lowest (0.88).

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.

Bibliography

Avery, C., W. Bossert, A. Clark, G. Ellison, and S. F. Ellison (2020). An economist's guide to epidemiology models of infectious disease. *Journal of Economic Perspectives* 34(4), 79–104.

Harvey, A. and P. Kattuman (2020a). Time series models based on growth curves with applications to forecasting coronavirus. *Harvard Data Science Review*, Special issue 1 - COVID - 19. https://hdsr.mitpress.mit.edu/ pub/ozgjx0yn

Harvey, A. and P. Kattuman (2020b). A farewell to r: Time series models for tracking and forecasting epidemics. *CEPR working paper*, 51, 7th October. https://cepr.org/content/covid-economics

Harvey, A., P. Kattuman, and C. Thamotheram (2021). Tracking the mutant: forecasting and nowcasting COVID-19 in the UK in 2021. *National Institute Economic Review*. Forthcoming.

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