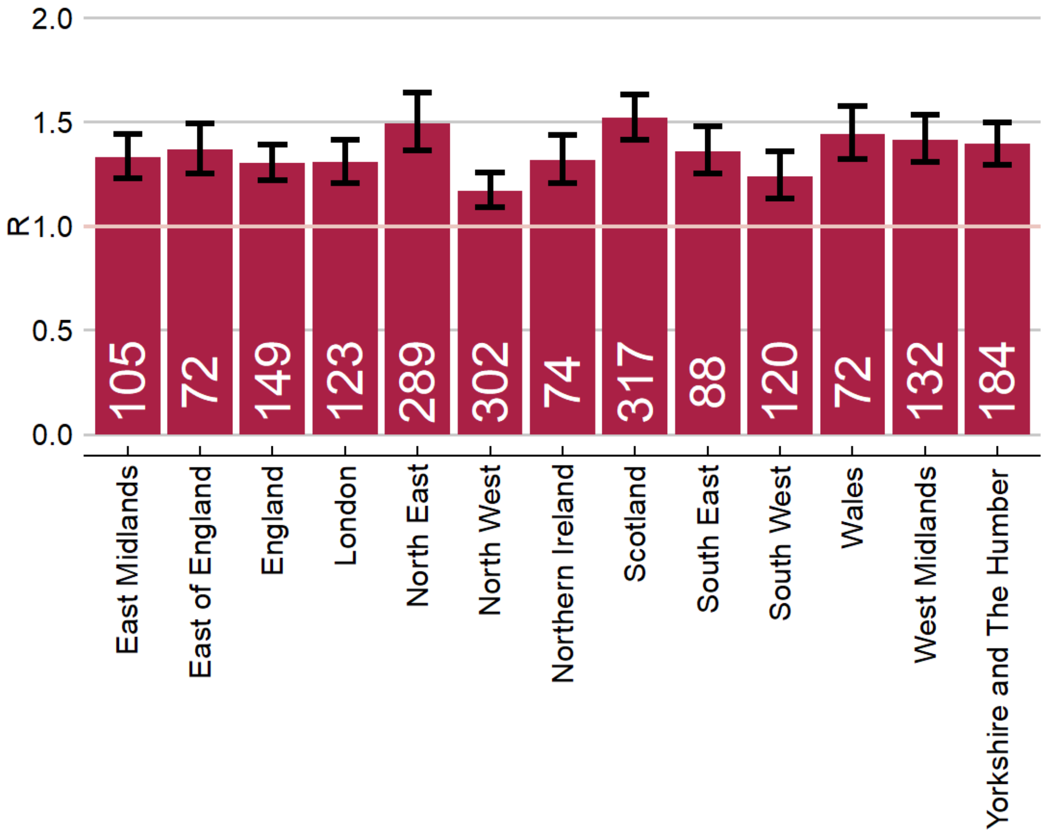
National Institute

NIESR Bi-Weekly Covid-19 Tracker No. 18

Thursday, 1st July 2021 niesr.ac.uk

Reproduction Number (R) and Forecasts of New Cases: Geographic spill over

Figure 1 – R: UK Regional R and seven-day Case Counts per 100,000 Population



Bar chart shows point estimates of R and the ± 1 standard deviation confidence intervals. The numbers in each bar represent the count of cases in the last seven days of the estimation sample per 100,000 population.

Main points

- We comment on the structure and composition of the widely anticipated wave emerging in the UK. The advancing pattern is consistent with a race between, on the one hand, local surges that spill over geographically due to higher transmissibility of the now dominant Delta variant, and on the other, the vaccination programme that reduces the susceptible pool.

- Figure 1 provides R number estimates and the case rates per 100,000 population, for the nations of the UK and English regions, based on specimen date data series released on 29th June 2021. We discard data for the last 3 days due to data revisions in that time window. The estimates reported are to be read in the context of the policy of increased testing in local authorities with relatively high case rates.
- A sudden surge in infection in any specific location can lead to a sharp increase in the estimated reproduction number. A part of this increase in R may be due to increased testing in the location. A part of it may be driven by the fact that the increase is from a low base. Importantly, if infection can be contained through a focussed and timely vaccination programme, the reproduction number will fall.
- At the same time, the more transmissible Delta variant was always likely to spill over and take hold in surrounding geographical areas. With lower base numbers the initial growth rates will be high.
- We should expect regional and national level incidence patterns to reflect an aggregation of a succession of local surges that spill over geographically even as they are contained through vaccination. As the unvaccinated proportion of the adult population diminishes the incipient wave is more likely to be contained.

"The current picture is one of localised outbreaks that have spilled over geographically due to the higher transmissibility of the Delta variant. As vaccination coverage becomes universal, shrinking the susceptible pool, local surges will tend to peak quickly and die out. However, the geographic spill over dominates the figures as the aggregation of numerous staggered local surges mount. Reassuringly, the forecast rise in hospital admissions relative to the earlier peak is very small in relative magnitude.

Dr Craig Thamotheram
Senior Economist - Macroeconomic Modelling and Forecasting

Results

Figure 2 shows the case counts per 100,000 population across the UK available as an [interactive map](#) from gov.uk.

It shows that the case rates have increased around the initial outbreaks of the Delta variant and have widely spilled over. The remaining green areas with case rates below 100 per 100,000 are likely to move into darker blue in the following couple of weeks.

Figure 2 – Case Counts per 100,000 Population

(Source: GOV.UK Coronavirus (COVID-19) in the UK)

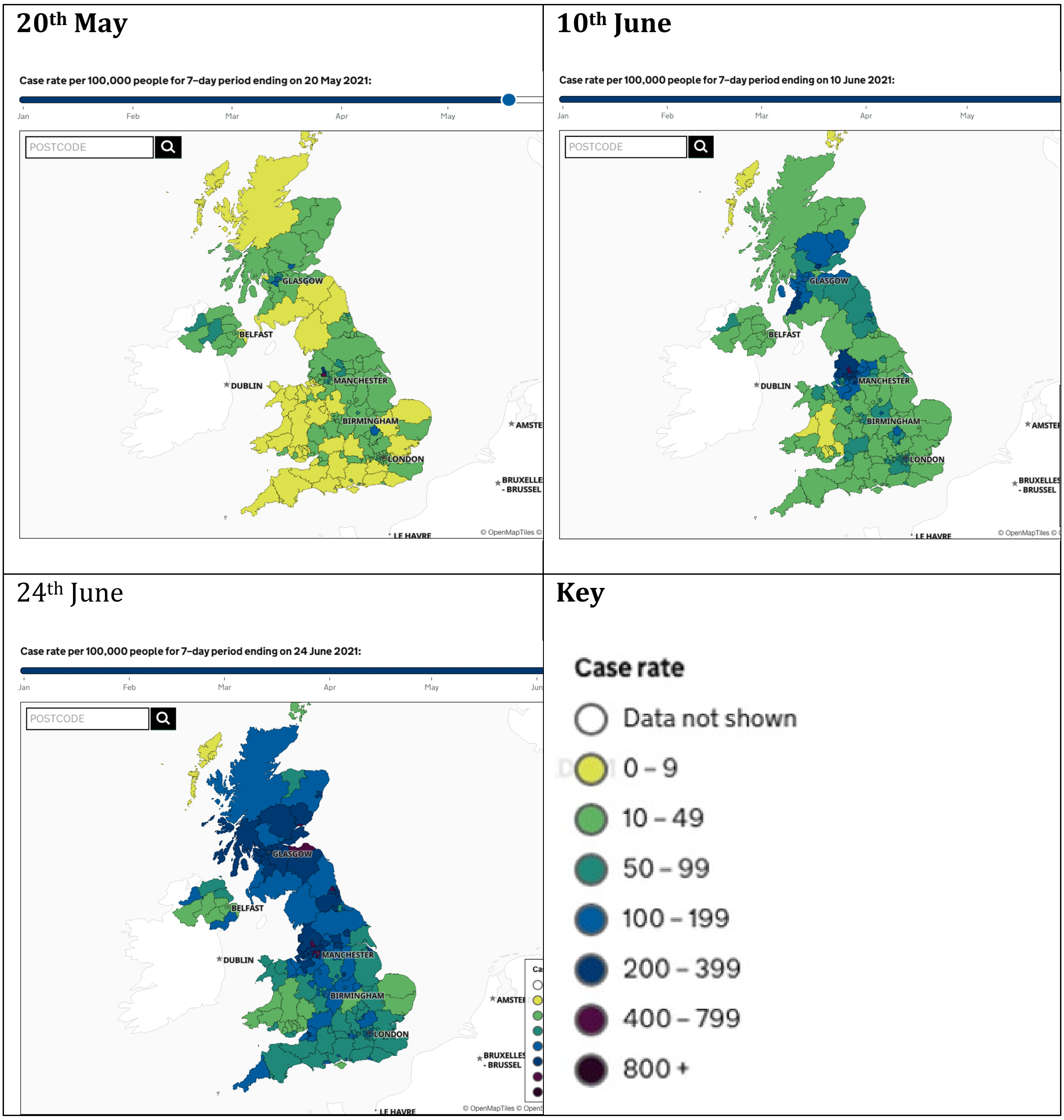
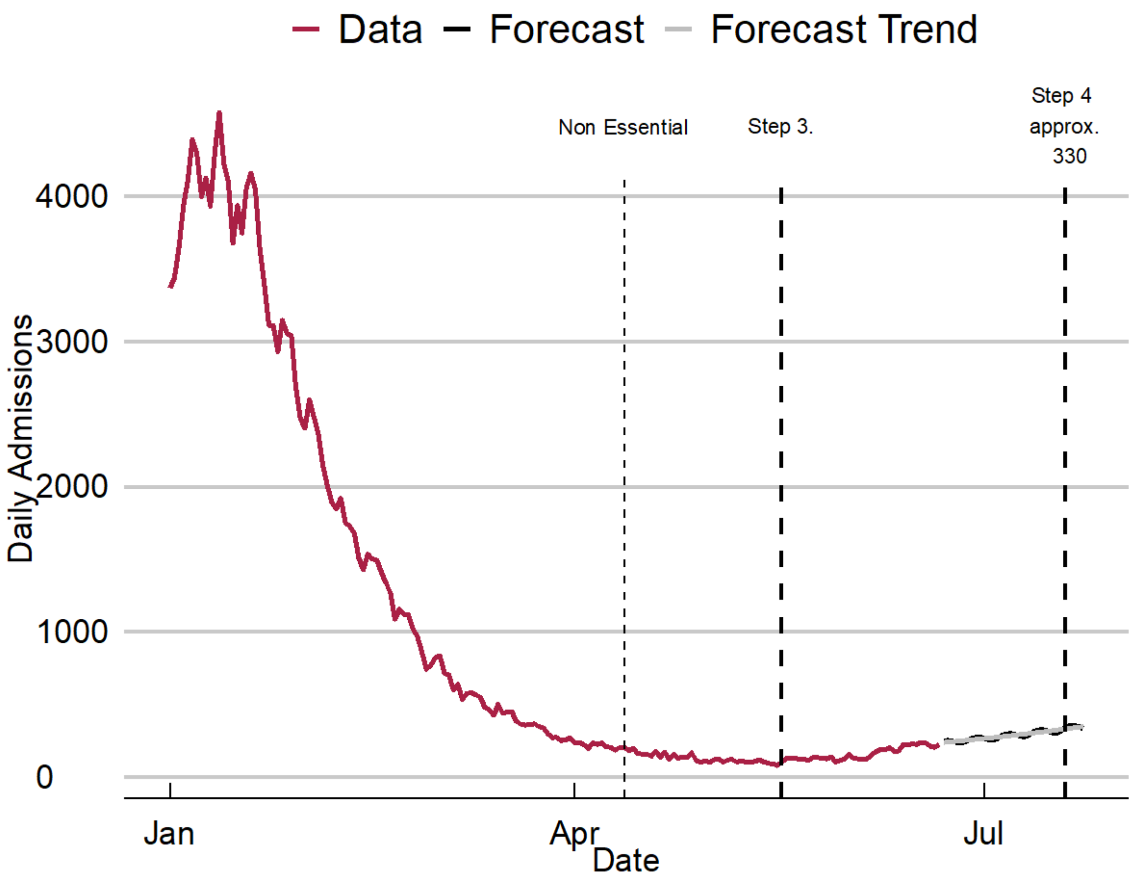


Figure 3 provides forecasts of daily hospital admissions for Covid-19 and highlights the underlying number of new admissions to be expected on the key dates in the Government's roadmap: stage 4 reopening expected on 19th July.

It shows that although admissions are forecast to rise to 300 by the 19th July, relative to the earlier rise in admissions this is small in relative magnitude.

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



Vertical dashed lines show trend Admissions on 19 July. Admissions data avaiable up to 29 June 2021, but there is a 5 to 8 day lag in data collection. Hence, the estimation sample ends on 21 June 2021.

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 has been 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). From June 3, 2021 onwards NIESR will be producing fortnightly updates on Thursdays, focusing on monitoring whether sudden increases observed are local spikes or are indicative of the start of a new wave.

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

Data on Covid-19 cases are reported by the government by 'specimen date' and by 'published date'. Specimen cases relate to the date when the sample was taken from the person being tested, while published cases relate to the first date when they are included in the published numbers. At the present time we regard the specimen date data as a more reliable indicator of the trend in new cases. The model based on specimen dated observations has better captured the effect of the sharp increase in testing on the day that schools reopened and also suffers less from data errors or revisions.

On 27 March 2021, 850 historic cases were removed due to a laboratory processing error. This affected specimen date data between 23 and 25 March in local authorities primarily in the North East and Yorkshire. The cumulative total number of people tested positive was revised down on 27 March 2021. Historic published date totals have not been changed. The downward correction on 27th March is mixed with the positive upward revisions of cases as more test results are returned over time making it impossible to date these corrections accurately. Thus, we cannot back out on which day these corrections were made. For published data, we choose to remove 300, 300 and 250 cases on 24, 25 and 26th of March respectively.

Between 2nd to the 5th April significant disruption to cases and deaths for Wales and Northern Ireland occurred. This was corrected on the 6th April but with a 48-hour reporting period. As the last date in the estimation sample for specimen cases is April 2nd we will decide how to account for this change in next week's forecast. We leave published cases unchanged.

On April 9th rapid LF tests that are confirmed as negative by Polymerase Chain Reaction (PCR) test within 3 days were removed. For published cases, we set 9th April as missing as no correction is applied to the historic data by Public Health England.

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 non-essential retail 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, 256, 110--126. https://doi.org/10.1017/nie.2021.12*.

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 / 0207 654 1954

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