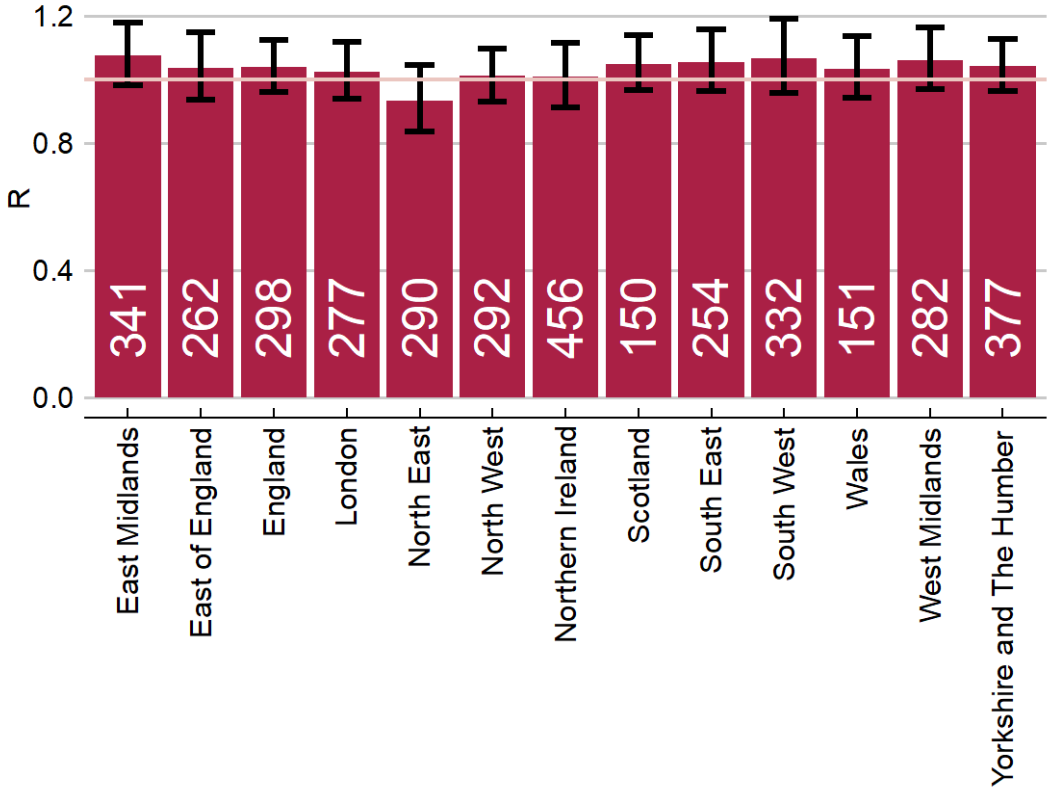
Reproduction Number (R) and Forecasts of New Cases:

Breakthrough Infections Detected

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 highlight a somewhat muted reversal of the decline in cases that was evident two weeks ago, and offer possible explanations. Our next tracker will be released on 9th September.
- It is likely that some of the increased infection transmission resulting from step-4 reopening are becoming evident only now in the data, following the incubation period of the virus which ranges from 2 to 14 days.

- In addition, research on infection transmission has concluded that while currently administered Covid vaccines are highly effective at averting severe illness and death, they offer only imperfect protection against infection itself even after full vaccination. Cases recorded in those that are fully vaccinated are referred to as breakthrough infections. This can explain the slight increase in cases despite the fact that 75% of the target population are now fully vaccinated.
- Figure 1 provides R number estimates and the case rates per 100,000 population, for the nations of the UK and for English regions, based on specimen date data series released on 10th August 2021. We discard data for the last 3 days due to data revisions in that time window. Compared to two weeks ago, all regions have displayed a notable increase in R numbers and case rates.
- We forecast uniform increases of new Covid-19 cases for all English regions other than North East and North West (Figure 2). Meanwhile, forecasts for England and Scotland show a moderate increase in new Covid-19 cases (Figure 3).
- Higher relative increases of daily new cases are forecast for older age groups in England as shown by Figure 4. This is consistent with recent sero-prevalence research that has concluded that the levels of antibody in the fully vaccinated dropped substantially over 2 -3 months, with the possibility that the protection against infection offered by vaccines may wear off over time.
- Figure 5 shows age bracketed breakdown that are vaccinated. The aggregate vaccinated population with 89 per cent of adults have received their first dose of vaccination and 75 per cent have received their second dose, masks important heterogeneity across age brackets. Significantly, for those under 35 less than 50 per cent were fully vaccinated upon step-4 reopening.

"After nearly 16 months of restrictions Step-4 reopening on 19th July has led to a marked increased social contact. We consider this the predominant reason for the muted reversal in the decline in cases that become evident recently. Recent research shows that the Delta variant has the capacity to breakthrough among those that are fully vaccinated, and that vaccine effectiveness reduces after 2-3 months of being vaccinated. These are the likely driving force behind the increase in cases, particularly amongst the older age brackets."

Dr Craig Thamotheram
Senior Economist - Macroeconomic Modelling and Forecasting

Results

Figure 2 –Regional Forecasts of New COVID-19 Cases

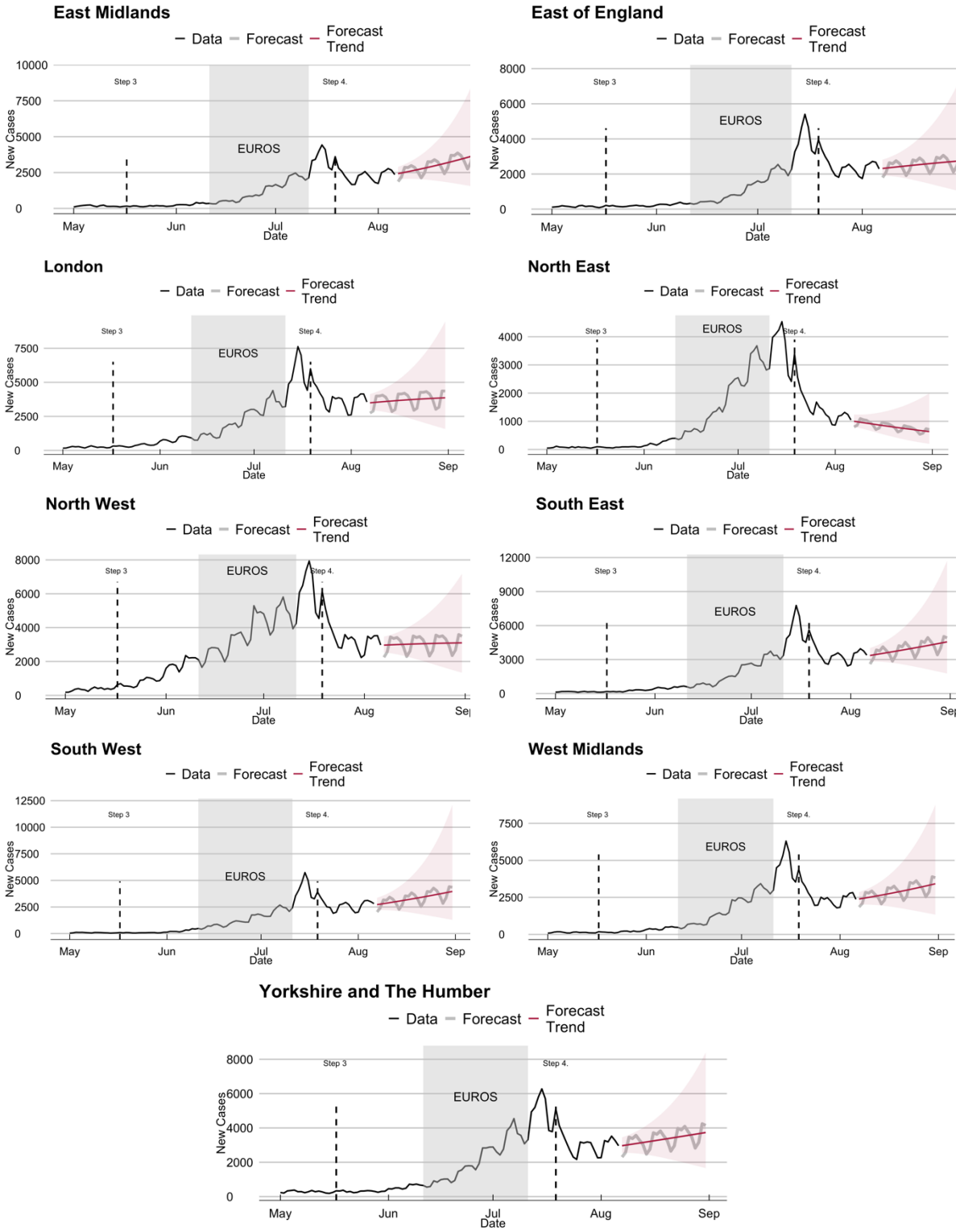


Figure 2 provides forecasts of daily cases of Covid-19 for the period until the end of September for the regions of England. It shows a uniform increase of cases for all English regions other than North East and North West with data released on the 10th August.

Figure 3 provides forecasts of daily cases of Covid-19 for the period until the end of September for England and Scotland with data released on the 10th August. The large uptick in cases in mid-June for Scotland is partly associated with surge testing.

Taken together, both across the English regions, England and Scotland there appears to be a lagged increase in cases relative to that forecast following step-4 reopening on the 19th July.

Figure 3 – National Forecasts of New COVID-19 Cases

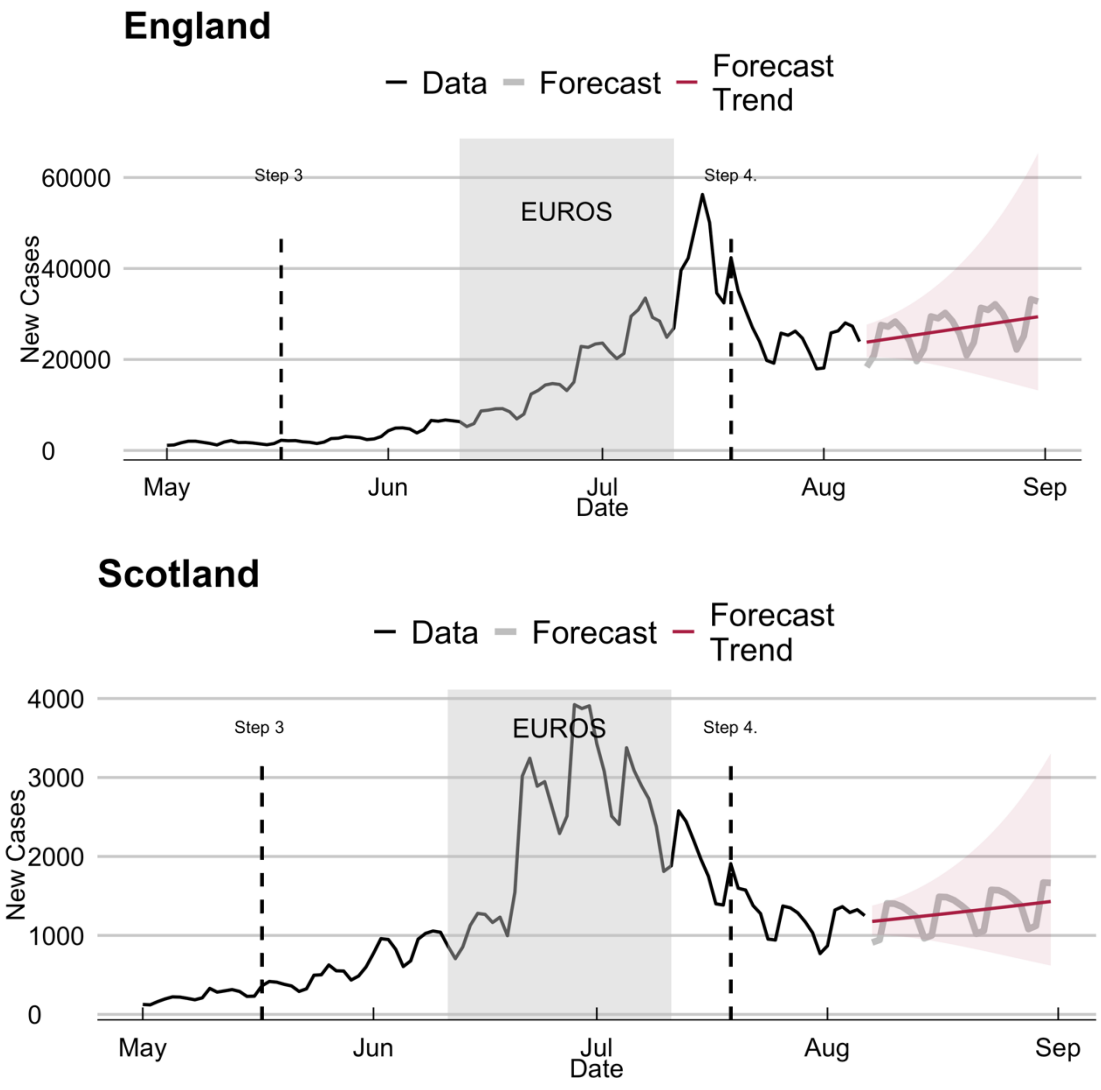


Figure 4 – England Forecasts of New COVID-19 Cases by Age Brackets

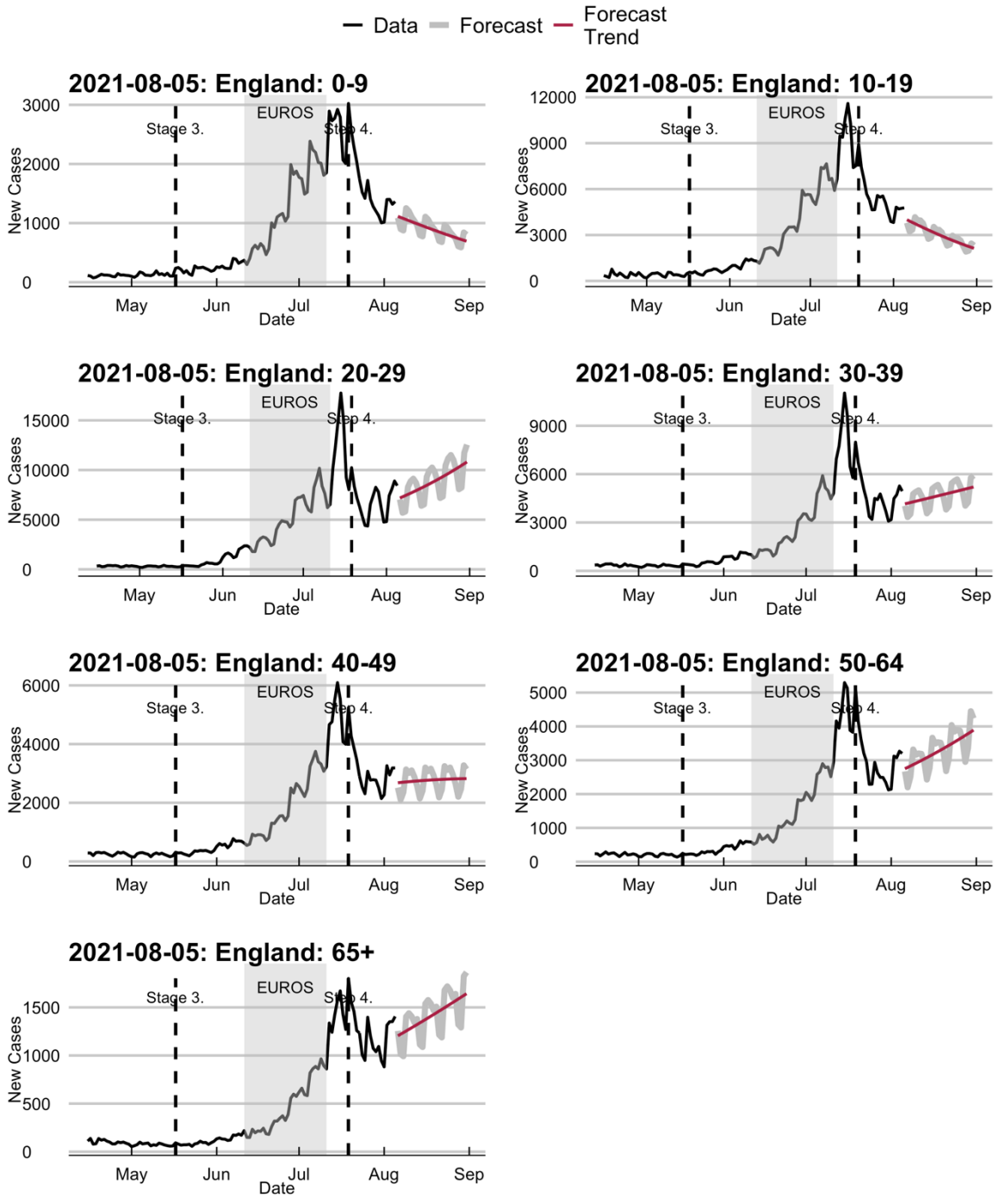
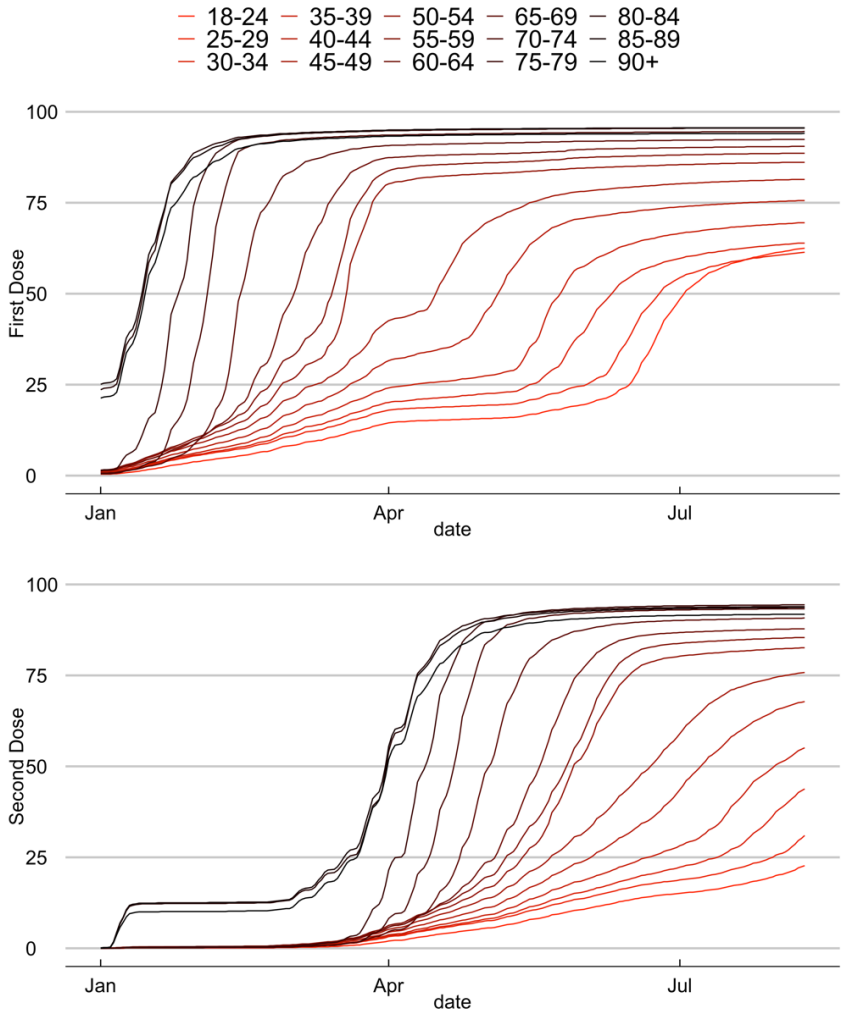


Figure 4 provides forecasts of daily cases of Covid-19 for the period until the end of September for England by age bracket. The increase of cases across the population, when considered in terms of age brackets, shows higher relative increases in forecasts for older age groups and the young.

Figure 5 provides data on the percentage of England's adult population that has been vaccinated broken down by age bracket. It highlights the larger unvaccinated proportion of the younger adult population upon reopening, and the fact that the older population have now been fully vaccinated for a duration consistent with levels of antibody waning according to sero-prevalence research.

Taken together, it is likely that increased socialisation following step-4, predominately among the younger adult population increased the population viral load and that this broke through both to the unvaccinated, as well as the earliest vaccinated in the form of vaccine break through infections.

Figure 5 – England Vaccination Percentages by Age Brackets



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 have been 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.

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Notes for editors

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