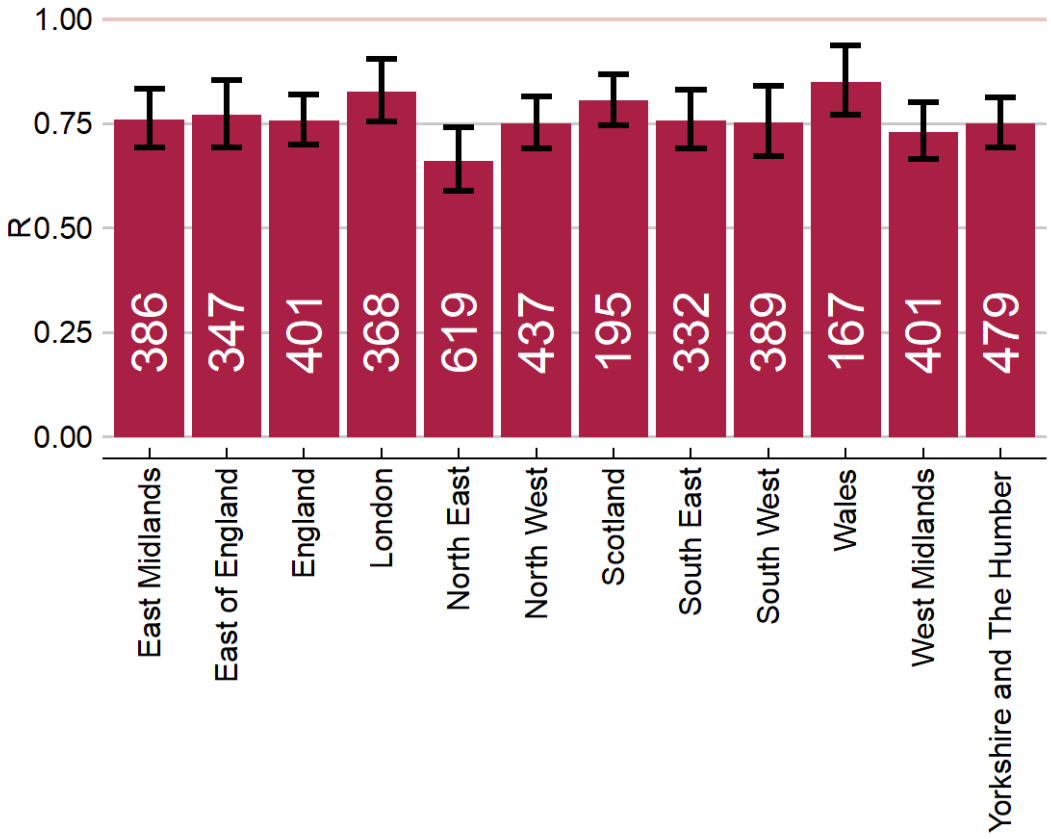
# Reproduction Number (R) and Forecasts of New Cases:

# After the Euros spike, herd immunity may be in sight

**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

- Two weeks ago, on July 15th, we highlighted the strong signs of the Delta wave was approaching a peak in the North West. We pointed out that other regions would likely follow suit. Data across nations, regions and local authorities as well

as R number estimates show that a peak has occurred somewhat sooner than we forecast.

- Many factors drive infection transmission. The most relevant in recent weeks have been: warm weather (numbers go down), schools break up (down), official relaxation of restrictions a week ago (up), more testing due to pingdemic (up), and not the least, the breakdown of social distancing in the run up to important matches in the European football tournament (Euros). Identifying the separate magnitudes of these effects is difficult. We present results from a pure time series model.
- 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 27th July 2021. We discard data for the last 3 days due to data revisions in that time window.
- Figure 2 shows forecasts of a uniform reduction of cases across all English regions. It would appear that a large enough proportion of the population is currently immune, due either to vaccination or prior infection, thereby reducing the probability of transmission between persons.
- Figure 3 points to a pronounced Euro 2020 effect. Recall that Scotland played England on the 18th June, and were eliminated on the 22nd June. England lost in the final on the 11th July. In all nations social distancing protocols did not survive the run up to big games. Cases increased substantially with a lag after these important games and tapered off quickly thereafter.
- Figure 4 shows that the reduction in forecast daily cases is uniform across all the age brackets in England.
- Figure 5 shows that around 88 per cent of adults have received their first dose of vaccination whilst 71 per cent have received their second.

*"Across nations, regions, local authorities and age brackets the past week's data show a big reduction in cases after an increase that was probably related to the increased social interaction from Euro 2020. Taken together with the high proportion of immune adults, either through vaccination or infection, we are seeing declines in cases at a faster rate than after the winter peak."*

**Dr Craig Thamotheram**
**Senior Economist - Macroeconomic Modelling and Forecasting**

## Results

# **Figure 2 –**Regional Forecasts of New COVID-19 Cases

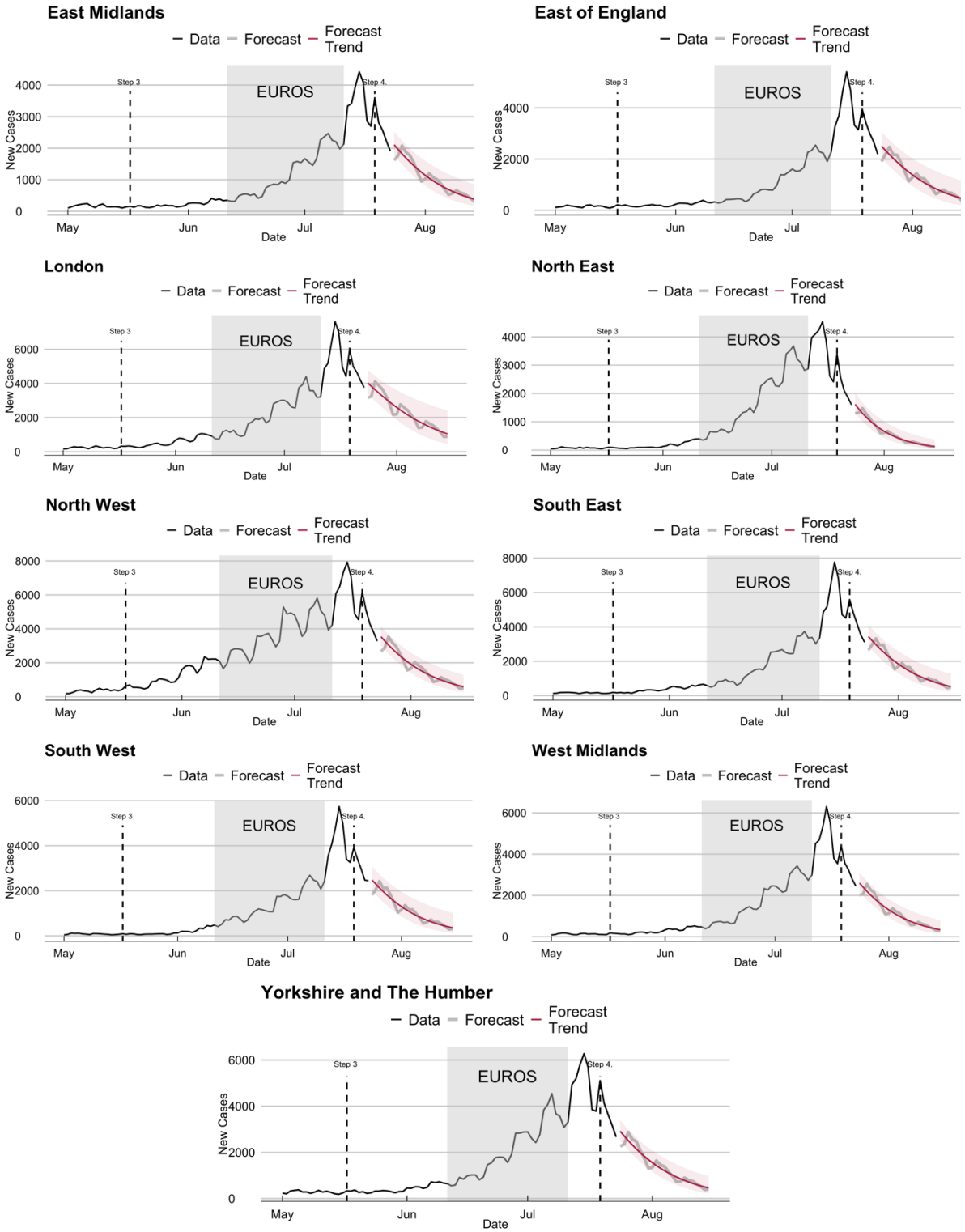


Figure 2 provides forecasts of daily cases of Covid-19 for the period until mid–August for the regions of England. It shows a uniform and strong forecast decline in daily cases with data released on the 27th July.

Figure 3 provides forecasts of daily cases of Covid-19 for the period until mid–August for the England and Scotland for data released on the 27th July. 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 surrounding key Euro dates. Scotland played England on the 18th June and were eliminated on the 22nd June. England lost in the final on the 11th July.

## **Figure 3 –** National Forecasts of New COVID-19 Cases

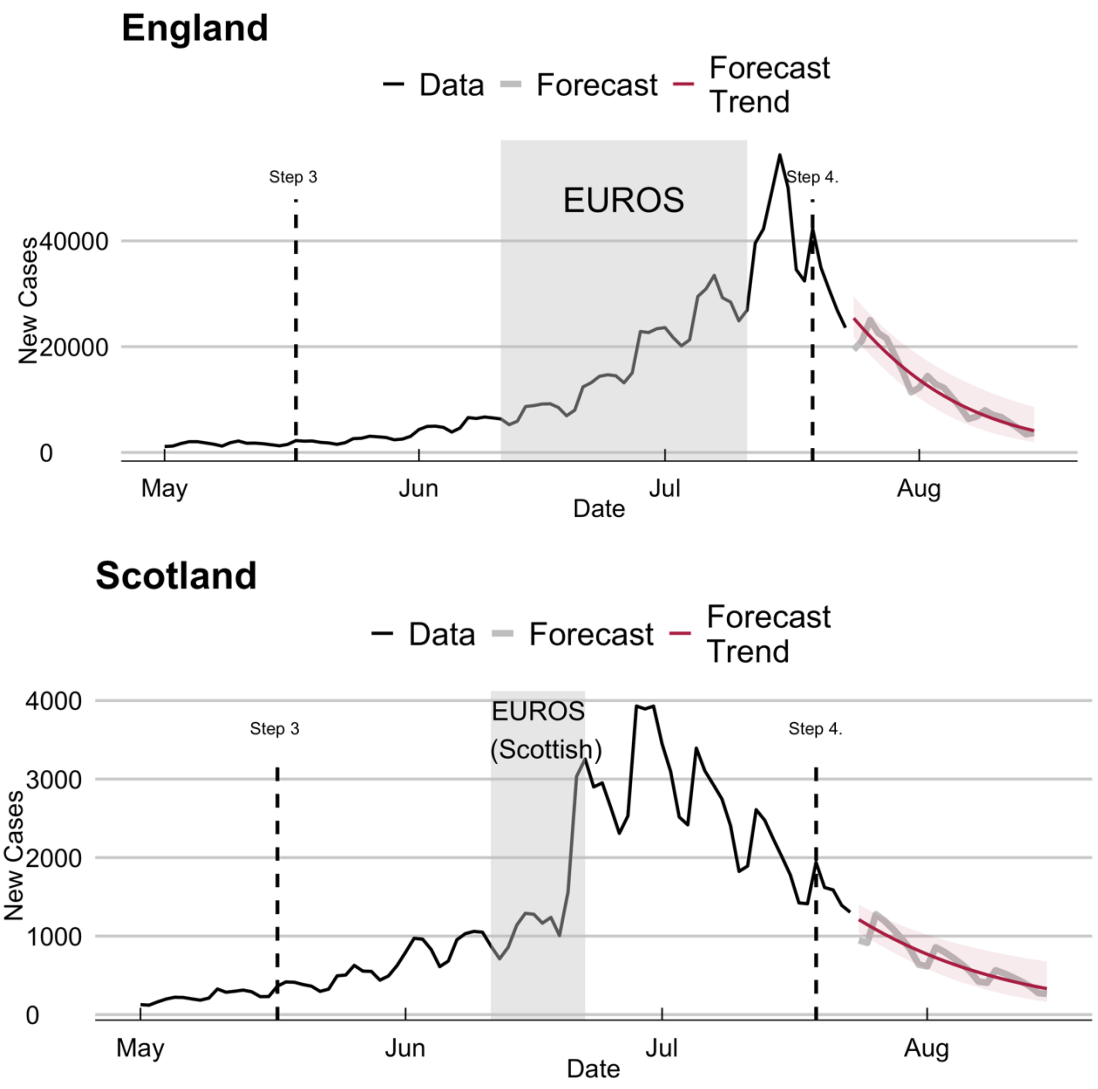


**Figure 4 –** England Age Bracketed Forecasts of New COVID-19 Cases

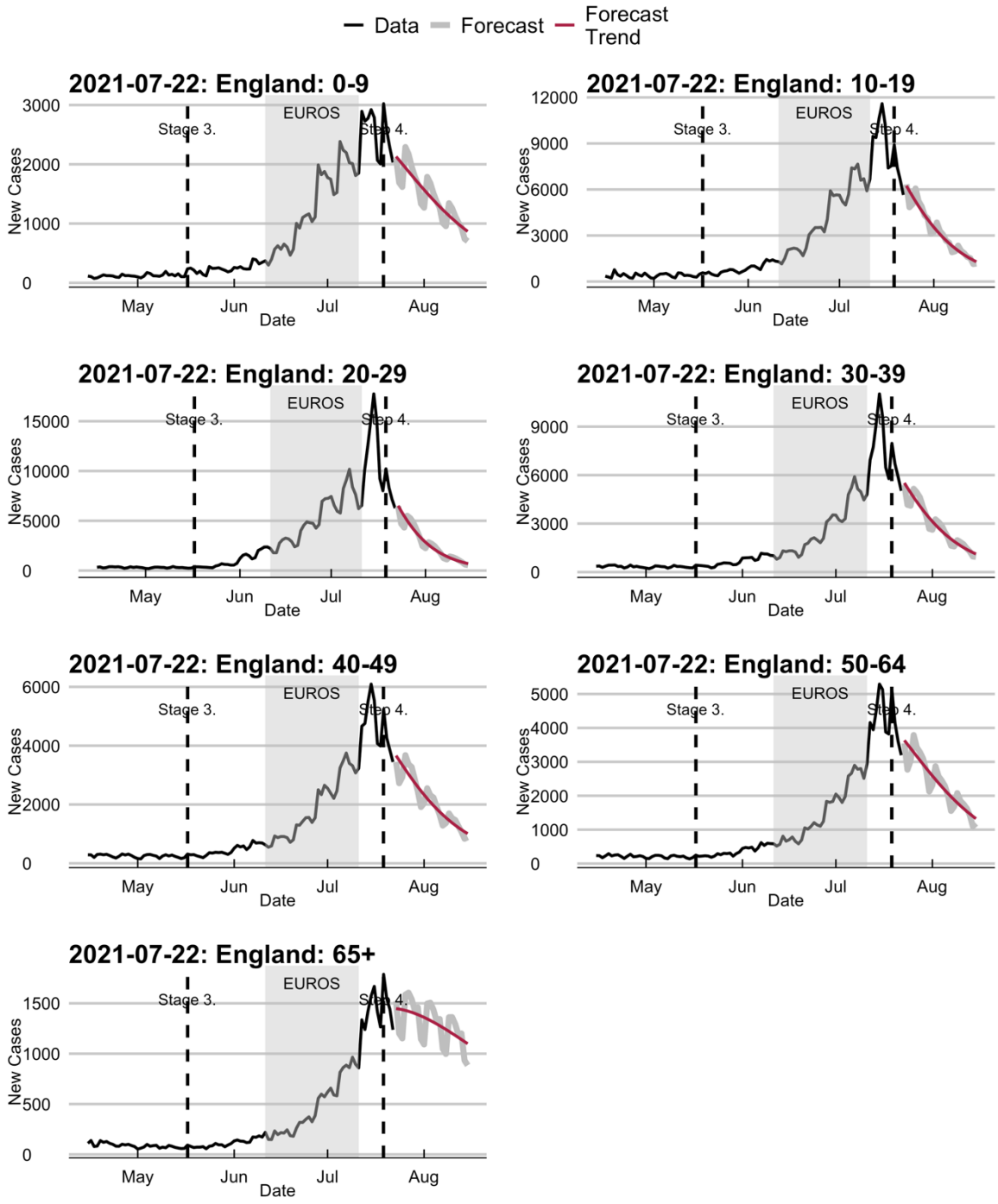
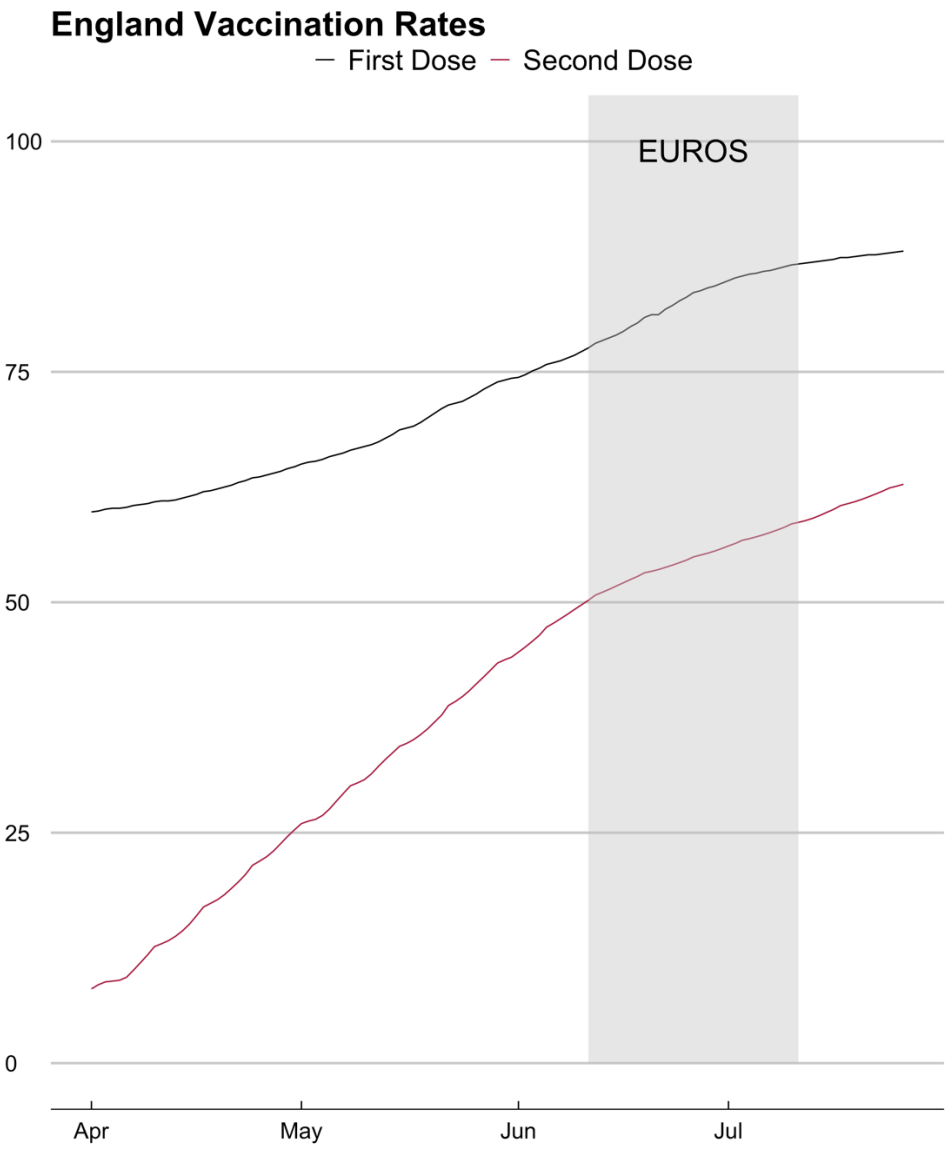


Figure 4 provides forecasts of daily cases of Covid-19 for the period until mid–August for the North West of England by age bracket for data released on the 27th July. It clearly shows that the forecast reduction in cases is uniform across the adult population.

Figure 5 provides data on the percentage of England's adult population that has been vaccinated. We highlight the UEFA Euro 2020 competition during which there was a higher degree of social interaction that would have led to those unvaccinated individuals increasing their risk of catching Covid-19.

## **Figure 5 –** England vaccination percentages



## 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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