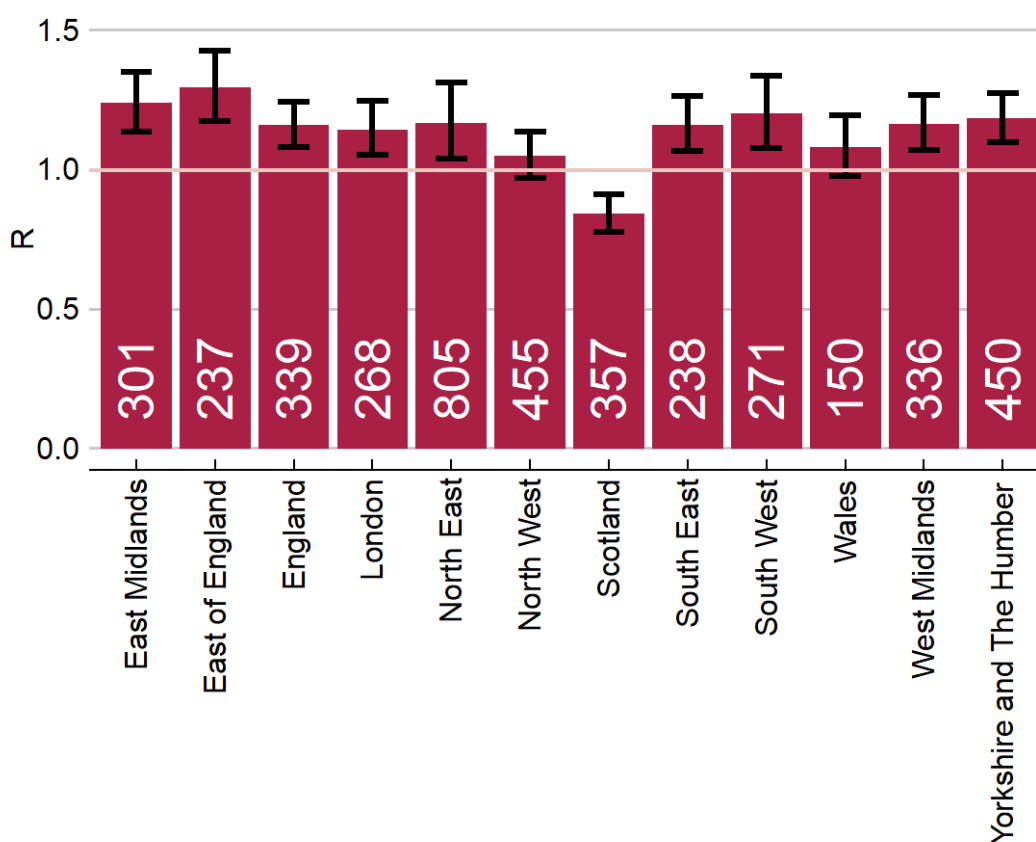# Reproduction Number (R) and Forecasts of New Cases:

Signs of peaking

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 Delta variant wave that has emerged throughout the UK. Focussing on the North West where this wave emerged first can be revealing as to how the wave is likely to advance in other regions of the UK that saw later outbreaks.
- 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 13th July 2021. We discard data for the last 3 days due to data revisions in that time window. These estimates are to be read in the context of the policy of increased testing in local authorities with relatively high case rates.

- 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.
- Figure 3 shows that in the North West the peak in cases is likely to occur early in August. Many local authorities are now past their peaks.
- A similar pattern is likely to emerge in regions that lag the North West in terms of the timing of initial rises in Delta variant cases.
- We forecast hospital admissions for the whole of UK to rise to around 1200 by the 19th July, up from 300 two weeks ago.

"The North West is now showing strong signs of approaching the peak in cases, with many local authorities already past their peaks. Similar patterns are likely to emerge nationwide albeit with a time lag."
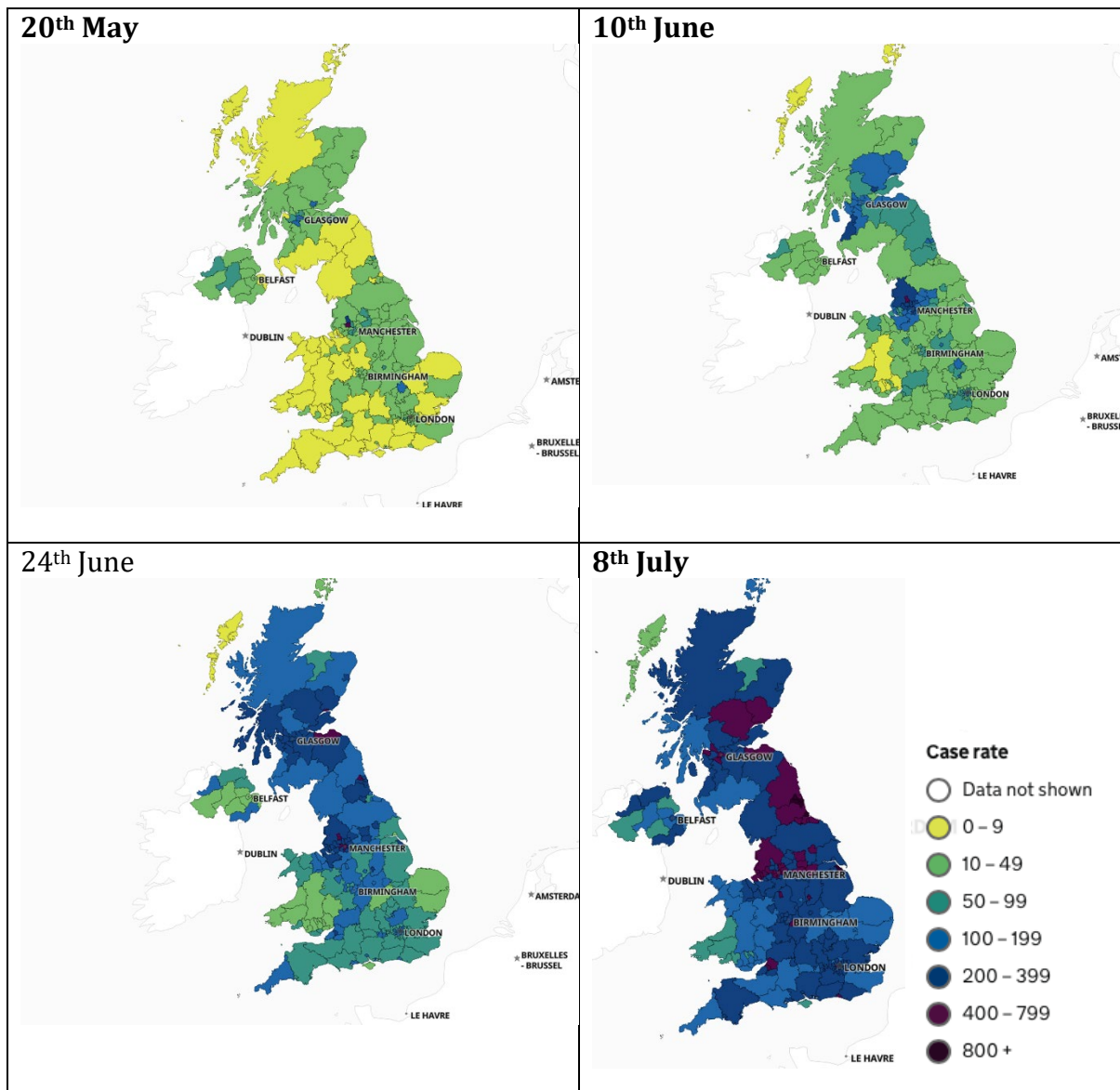
Dr Craig Thamotheram
Senior Economist - Macroeconomic Modelling and Forecasting

Results

Figure 2 shows the case counts per 100,000 population across the UK available as an interactive map from gov.uk Coronavirus (COVID-19) in the UK. There is strong evidence of geographic spill overs.

Figure 2 – Case Counts per 100,000 Population

Note: Data from GOV.UK Coronavirus (COVID-19) in the UK.

Figure 3 provides forecasts of daily cases of Covid-19 for the period until mid–August for the North West of England and four local authorities (LA) within the North West. This region saw notable flare-ups early on as the Delta variant spread.

The Figure shows the underlying trend value of new cases to be expected on the remaining key date in the Government's roadmap: step 4 reopening on the 19th July. Many individual local authorities are past their peaks. At the level of the region the peak in cases is likely to occur in early August. It is important to reiterate that these forecasts do not take account transmission changes due to behavioural variations associated with the Euros, or such changes that are likely accompany step 4 reopening.

Figure 3 – North West and Selected Local Authority Forecasts of New COVID-19 Cases
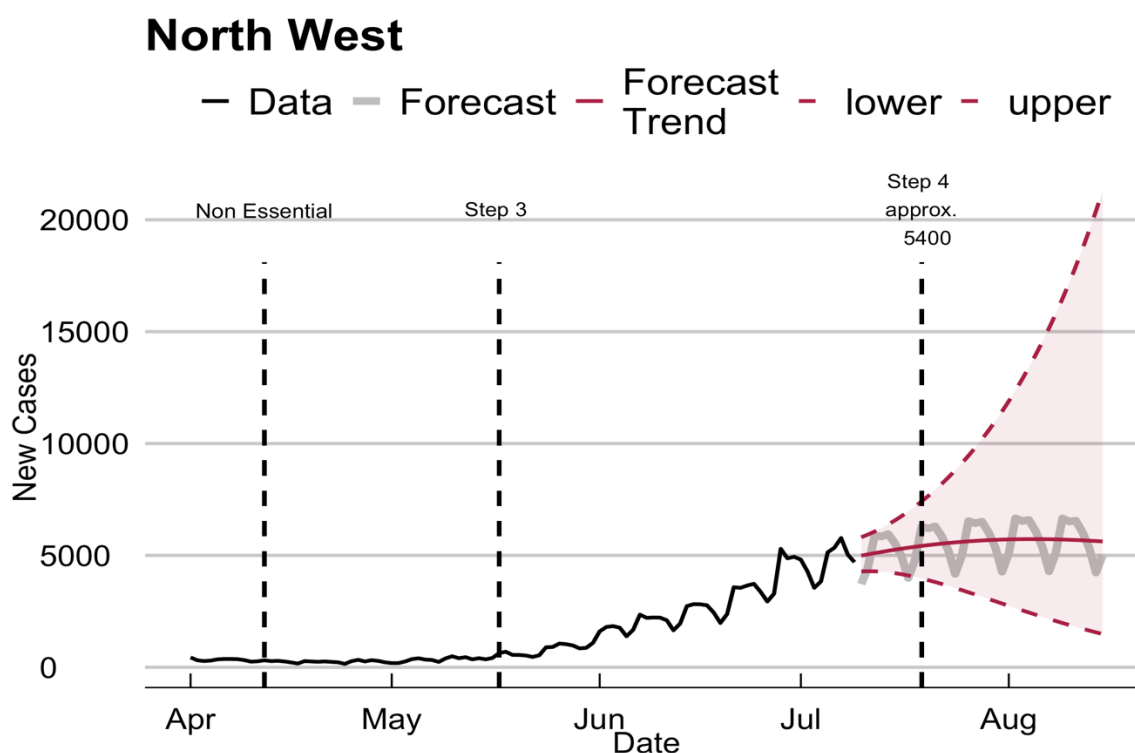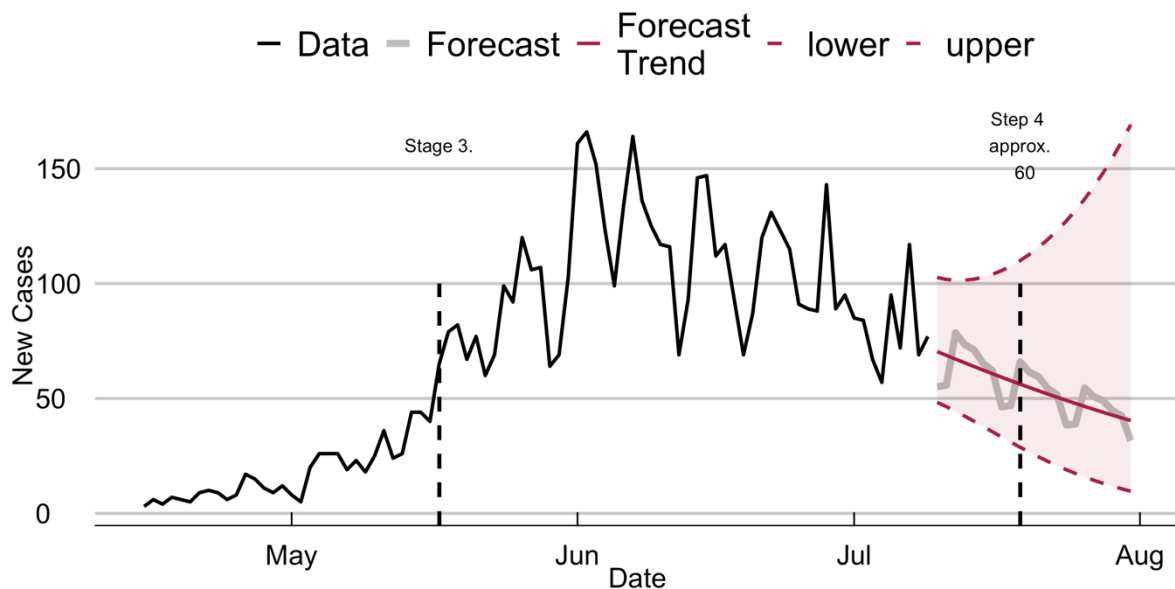

Vertical dashed lines highlight reopening dates and show forecast trend new cases rounded to nearest 100. Specimen case data available on 13 July 2021. Data for the last three days which are subject to revision are discarded, so the estimation sample ends on 09 July 2021.

Bolton
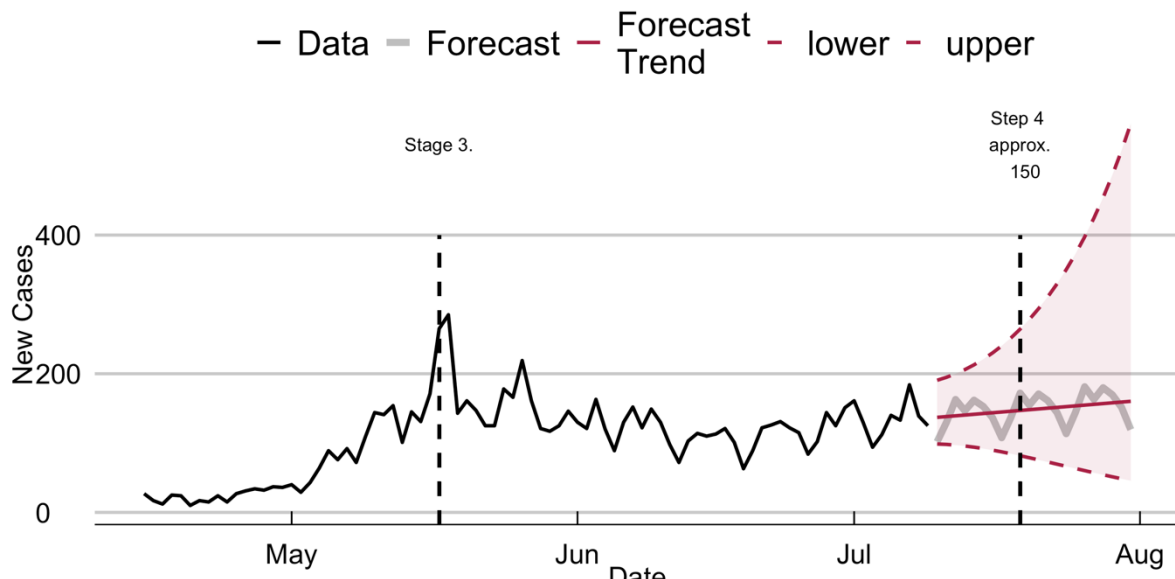
Data — Forecast — Forecast Trend — lower — upper

Vertical dashed lines highlight reopening dates and
show trend new cases for the forecast period rounded to nearest 100.
Specimen case data available on 13 July 2021. Data for the last
three days which are subject to revision are discarded, so the estimation
sample ends on 09 July 2021.

Blackburn with Darwen

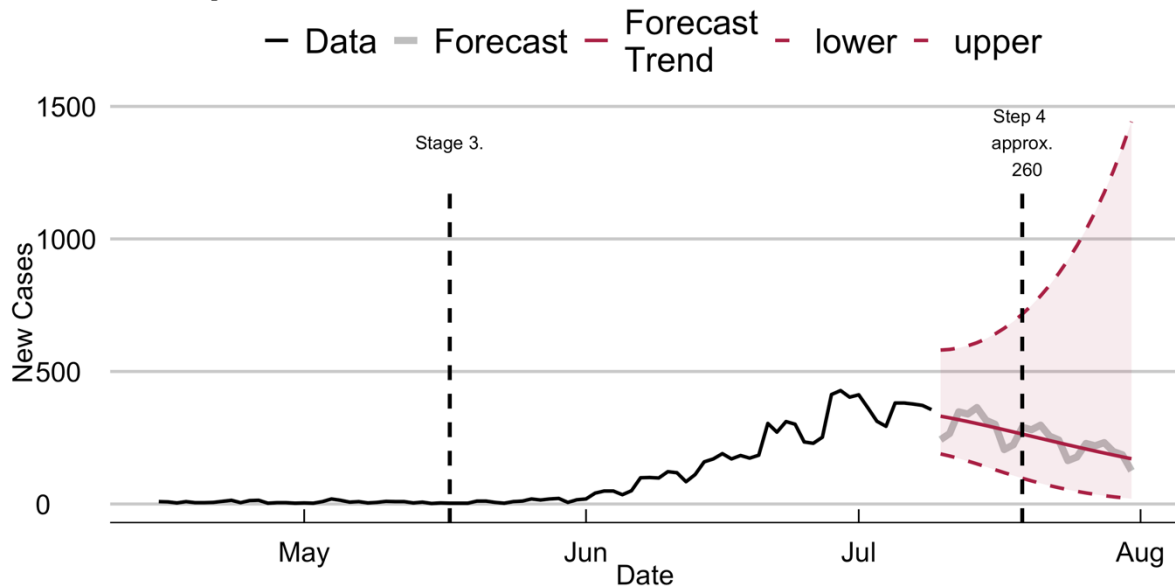Data — Forecast — Forecast Trend — lower — upper

Vertical dashed lines highlight reopening dates and
show trend new cases for the forecast period rounded to nearest 100.
Specimen case data available on 13 July 2021. Data for the last
three days which are subject to revision are discarded, so the estimation
sample ends on 09 July 2021.

Liverpool

Vertical dashed lines highlight reopening dates and
show trend new cases for the forecast period rounded to nearest 100.
Specimen case data available on 13 July 2021. Data for the last
three days which are subject to revision are discarded, so the estimation
sample ends on 09 July 2021.
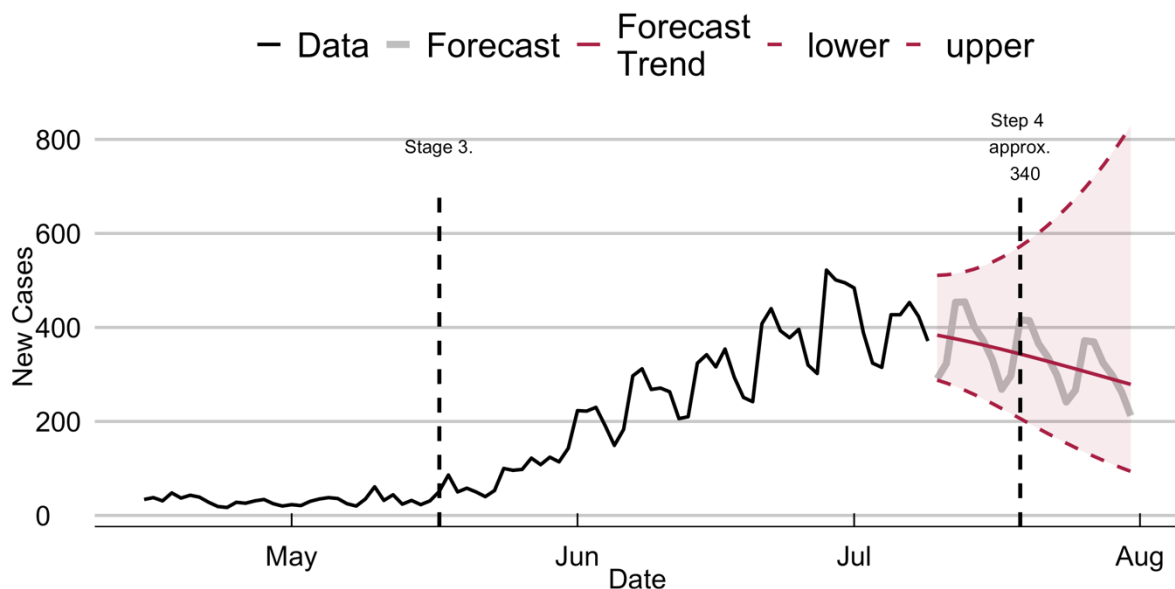
Manchester

Vertical dashed lines highlight reopening dates and
show trend new cases for the forecast period rounded to nearest 100.
Specimen case data available on 13 July 2021. Data for the last
three days which are subject to revision are discarded, so the estimation
sample ends on 09 July 2021.

Figure 4 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 on 19th July.

The Figure shows that admissions are forecast to rise to around 1200 by the 19th July, up from 300 two weeks ago.

Figure 4 – UK Forecast of Daily Covid-19 Hospital Admissions
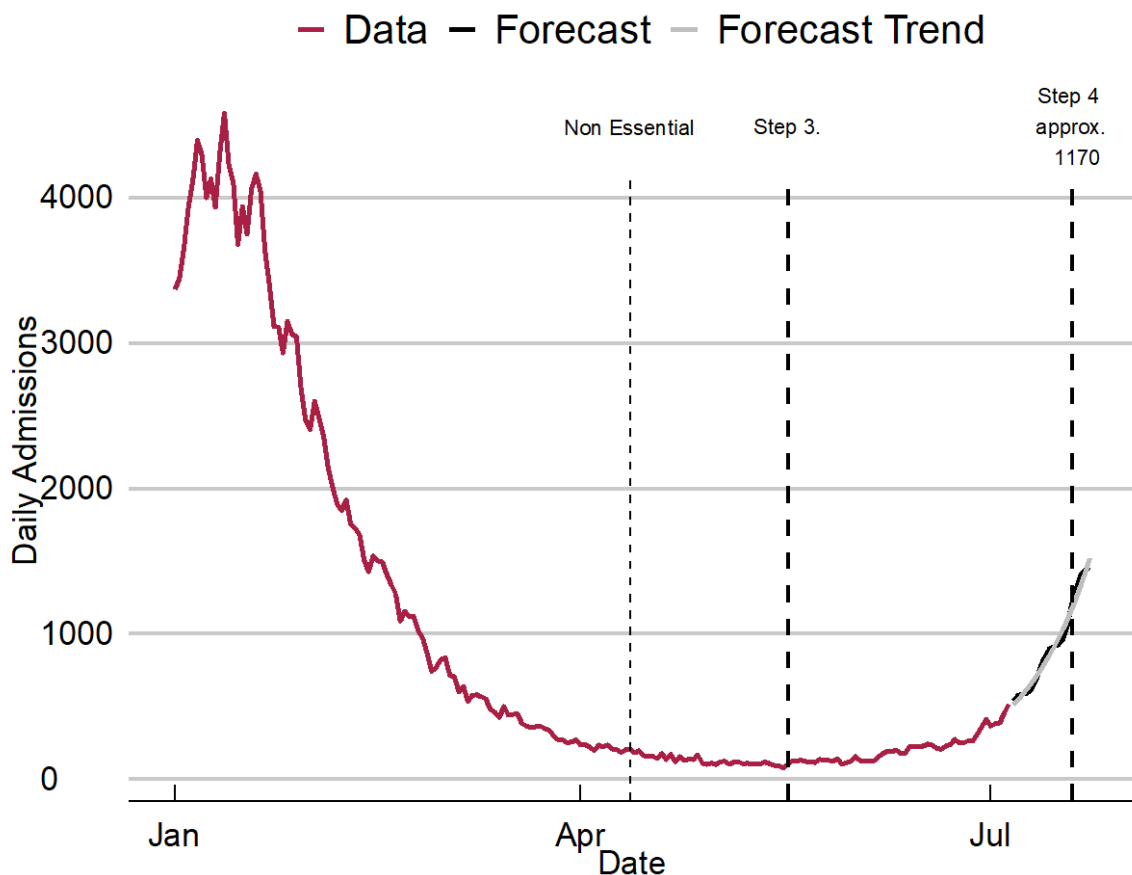
Vertical dashed lines show trend Admissions on 19 July.
Admissions data avaiable up to 13 July 2021, but there is a
5 to 8 day lag in data collection. Hence, the estimation
sample ends on 05 July 2021.

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 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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