Cambridge Judge Business School
Cambridge Centre for Health Leadership & Enterprise

COVID-19 TRACKER: INDIA

1 August 2021

Centre for
Health Leadership & Enterprise

UNIVERSITY OF CAMBRIDGE
Judge Business School

HSTP
Health Systems
Transformation Platform

National Institute of Economic and Social Research

This tracker[1] has been developed by researchers at Cambridge Judge Business School and [National Institute of Economic and Social Research](), working with [Health Systems Transformation Platform]() in India, as part of a pandemic monitoring series devoted to India and its states and union territories. It provides short term forecasts of the trajectory of the pandemic, identifying states and union territories that are at risk of increases in infection incidence. The forecasts are based on a structural time series model that uses historical data in estimation but adapts to the trend emerging in the most recent period. The model is described in Harvey and Kattuman (2021) "Time series models based on growth curves with applications to forecasting coronavirus". *Harvard Data Science Review*, Special issue 1 - COVID -19.

Daily cases have now begun to increase in India, as was predicted in the previous edition of this tracker. The effective reproduction number (Rt) has risen to 1.04. The trend value of the growth rate of new cases has turned positive (0.9%). Reported cases are likely to increase to 46,500 per day by 15th August. While this increase is relatively modest, it is very likely that the growth rate of cases is increasing at present (page 4).

Reported cases are expected to increase in 13 states across the country by varying extents. Growth rates of cases appear to be increasing at the present time in Delhi, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Tamil Nadu, Uttar Pradesh and Uttarakhand (pages 38-43).

The large differences between Indian states in infection trajectories underline to the importance of local management of the epidemic. Yet the marked increase in the number of states facing contemporaneous flare-ups points to a national level shift to the rising phase of the epidemic curve again (pages 6 and 7).

Mean absolute percentage error of the forecasts of daily cases in India given in the July 25 tracker, for the period July 26 to August 1, was 12.98%. Forecasts become less accurate when growth is super-exponential as is the case now. Changes in government pandemic policies and in transmission relevant social behaviour may cause realised numbers to depart from forecasts.

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[1] CJBS COVID-19 Tracker for India can be accessed at: www.jbs.cam.ac.uk/covid-india
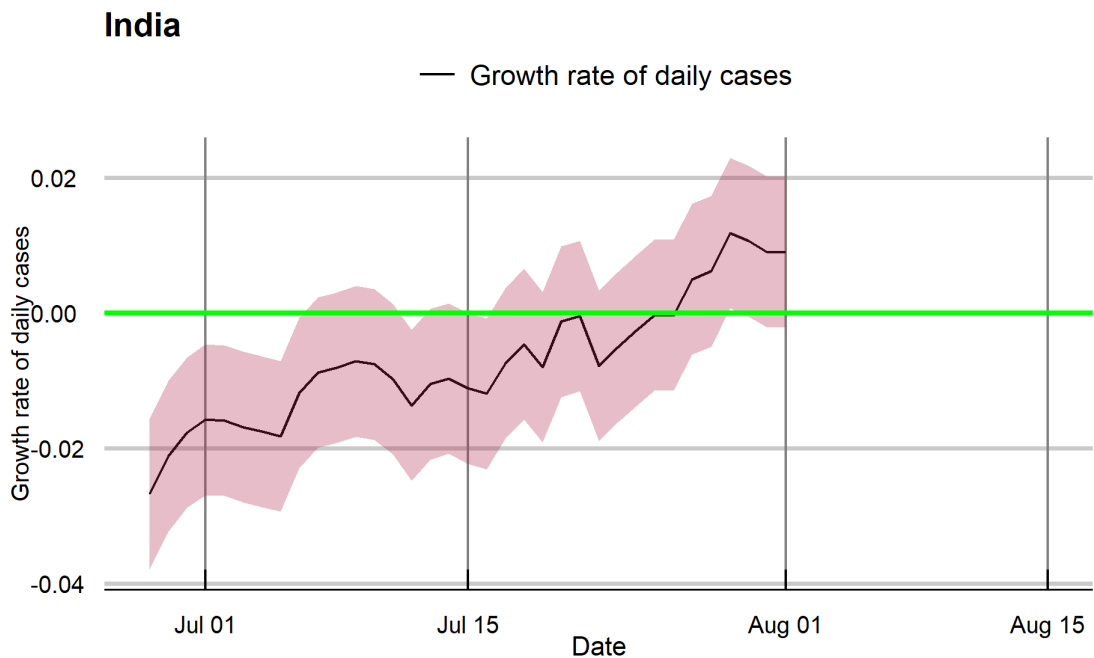The companion spreadsheet contains all the estimates and forecasts.

Contact: Paul Kattuman <p.kattuman@jbs.cam.ac.uk>

# Daily Covid-19 cases in India: Forecast

India
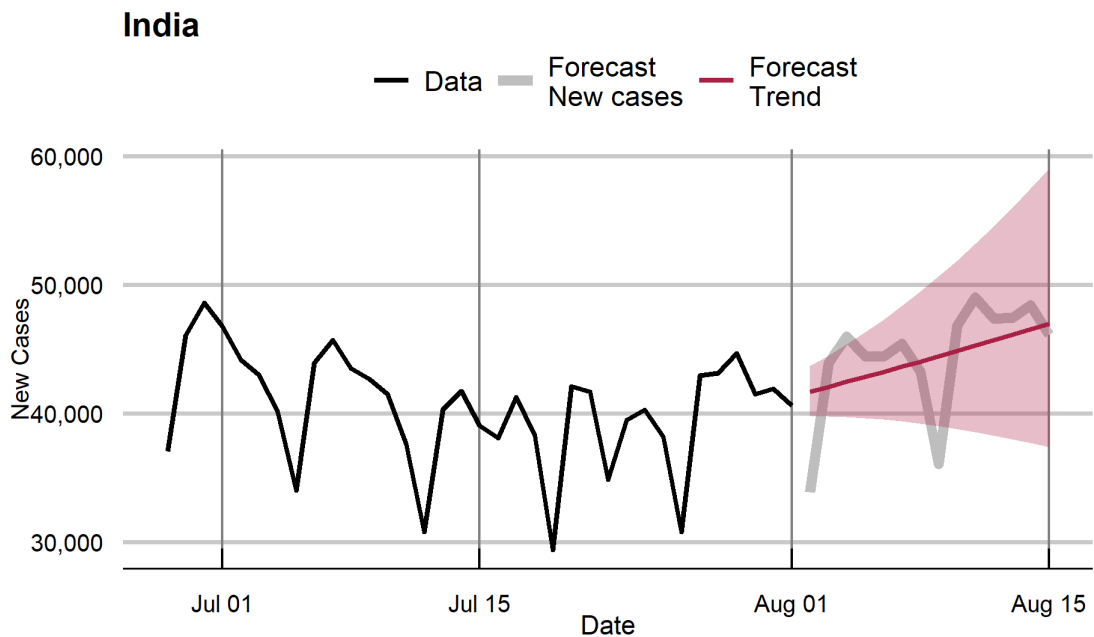
Forecasts of daily new cases for the period 2nd to 15th August 2021, based on data till 1st August 2021. New COVID-19 cases is likely to be about 46,500 per day by 15th August 2021.
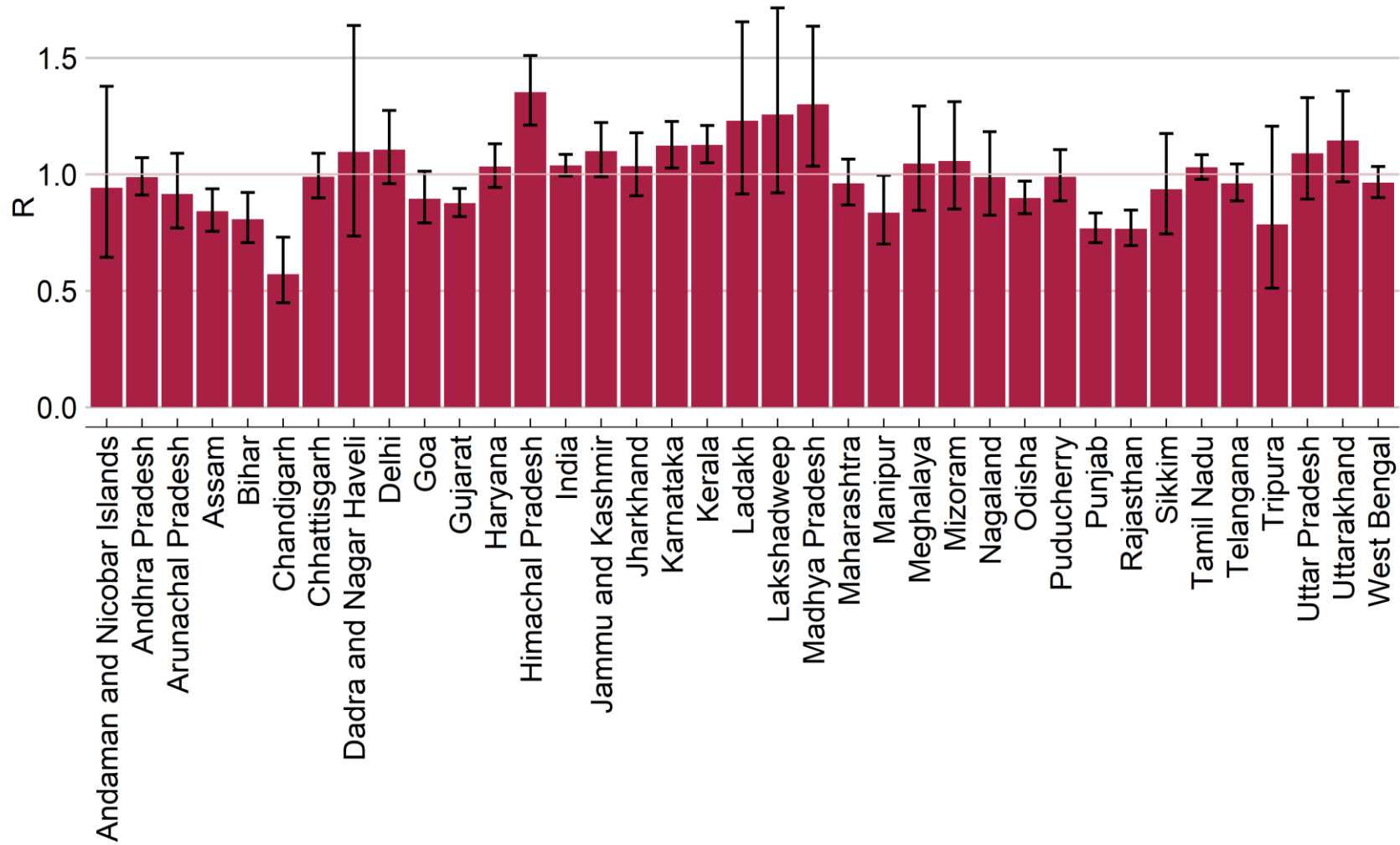
India

The filtered trend in the growth rate of daily new cases is 0.9% as on 1 August 2021.

India: Probability that cases are accelerating as on 2021-08-01 : 0.75
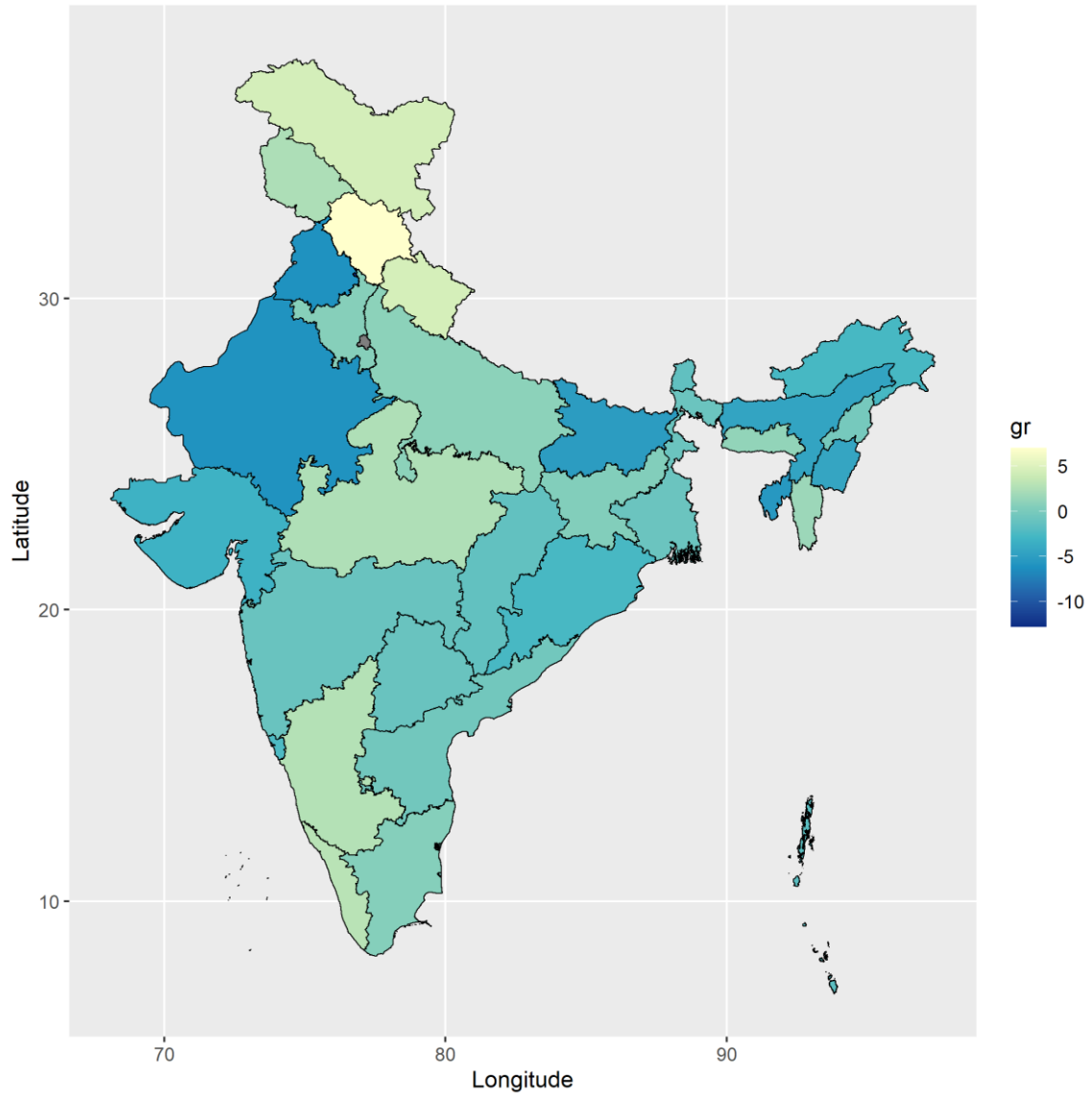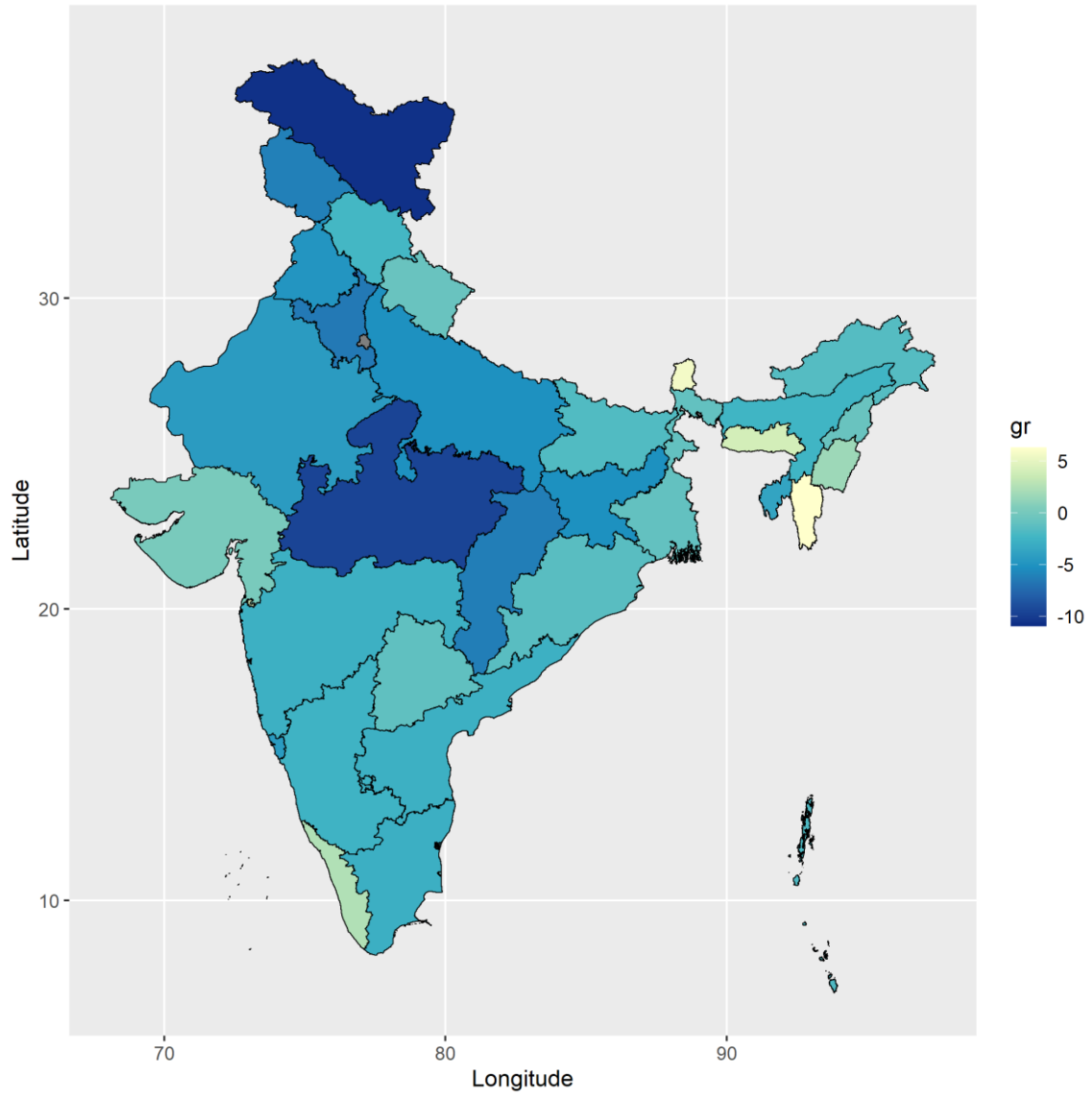
2021-07-19 / 2021-08-01
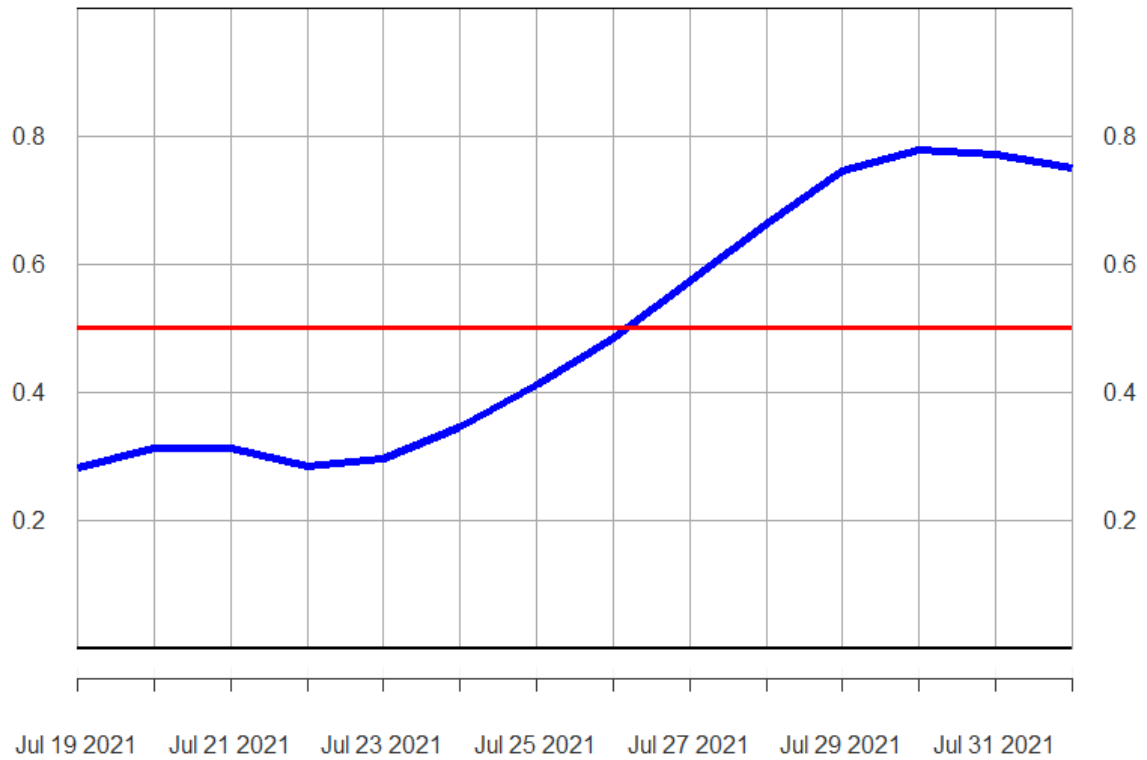
R$_t$: 1 August 2021

Bar chart shows point estimates of R and the ± 1 standard deviation confidence intervals

Daily growth rates of cases (%)
Trend values as on 01 August 2021

Daily growth rates of cases (%)
Trend values as on 25 July 2021

Case forecasts and growth rates: States and Union territories

Andhra Pradesh
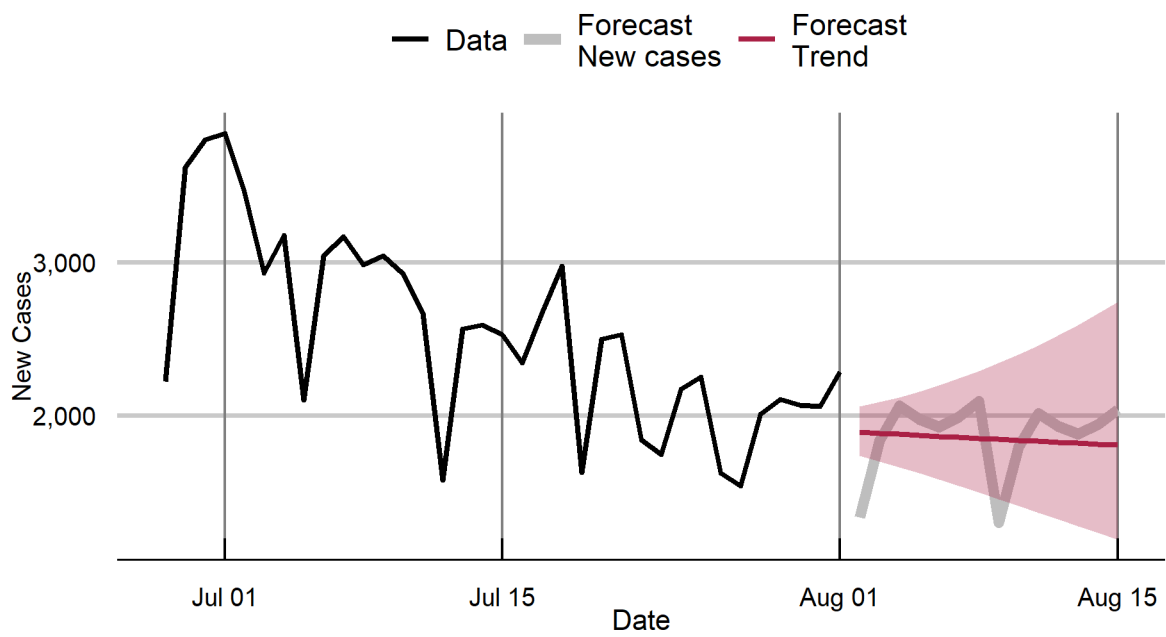
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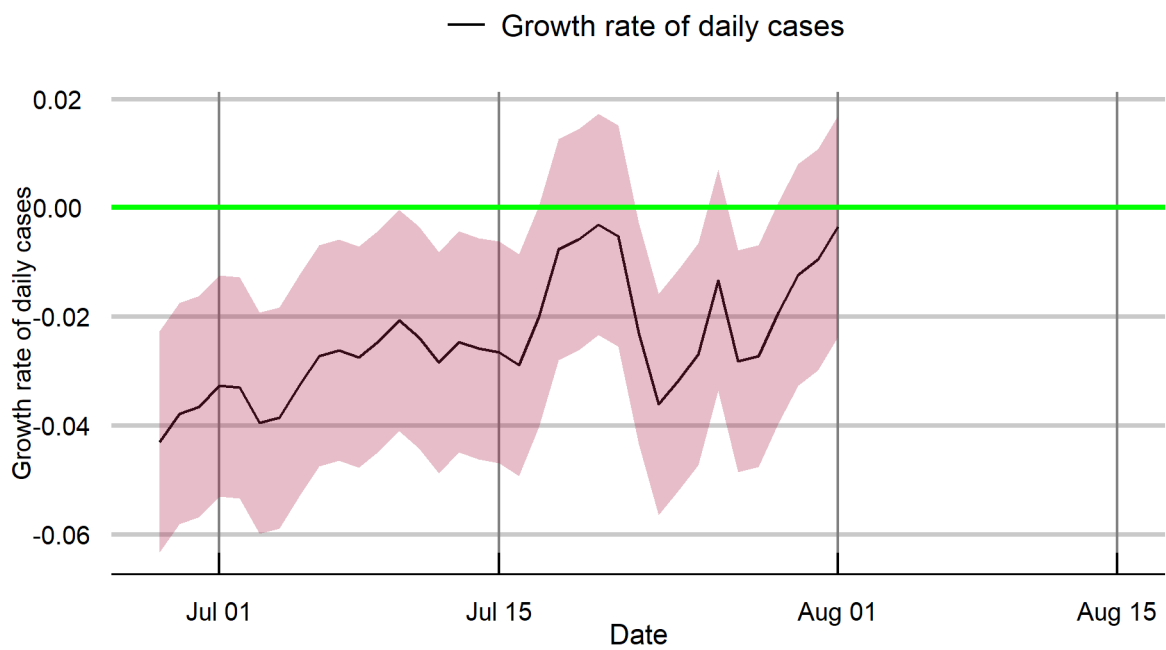
Arunachal Pradesh

Arunachal Pradesh

Assam

Data — Forecast New cases — Forecast Trend

Assam

— Growth rate of daily cases
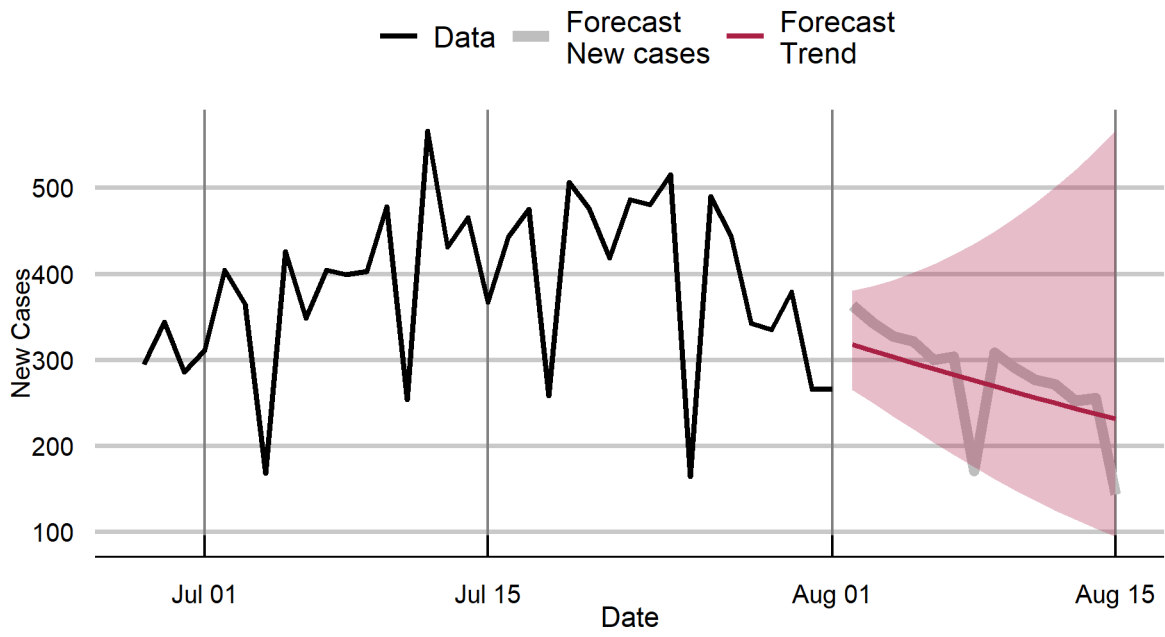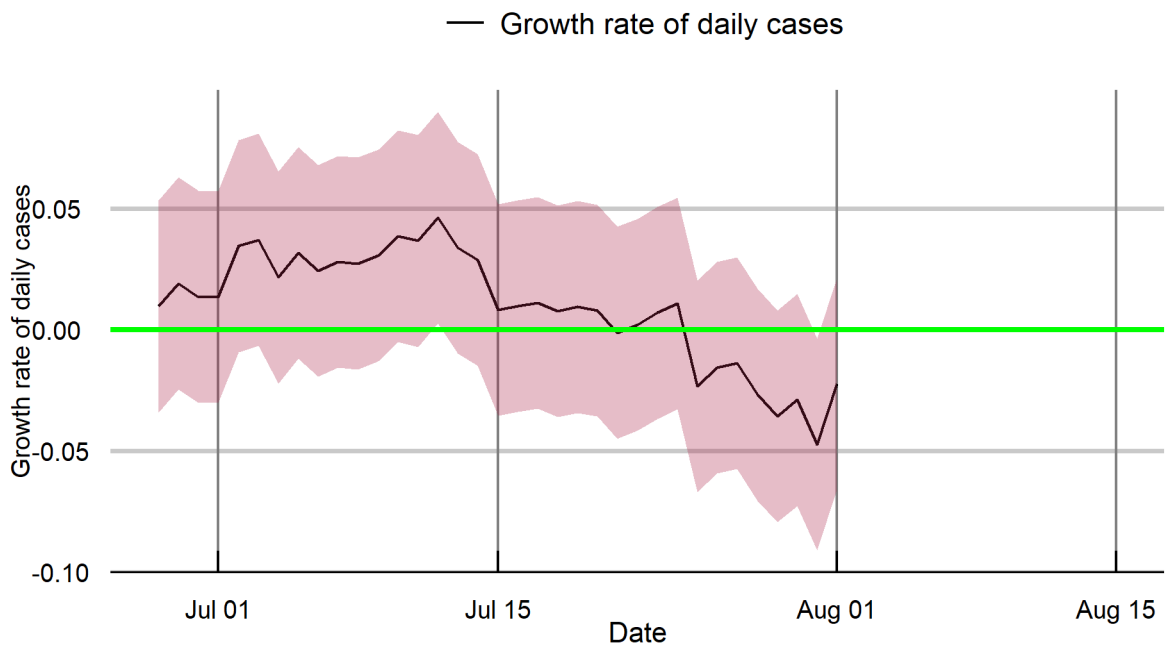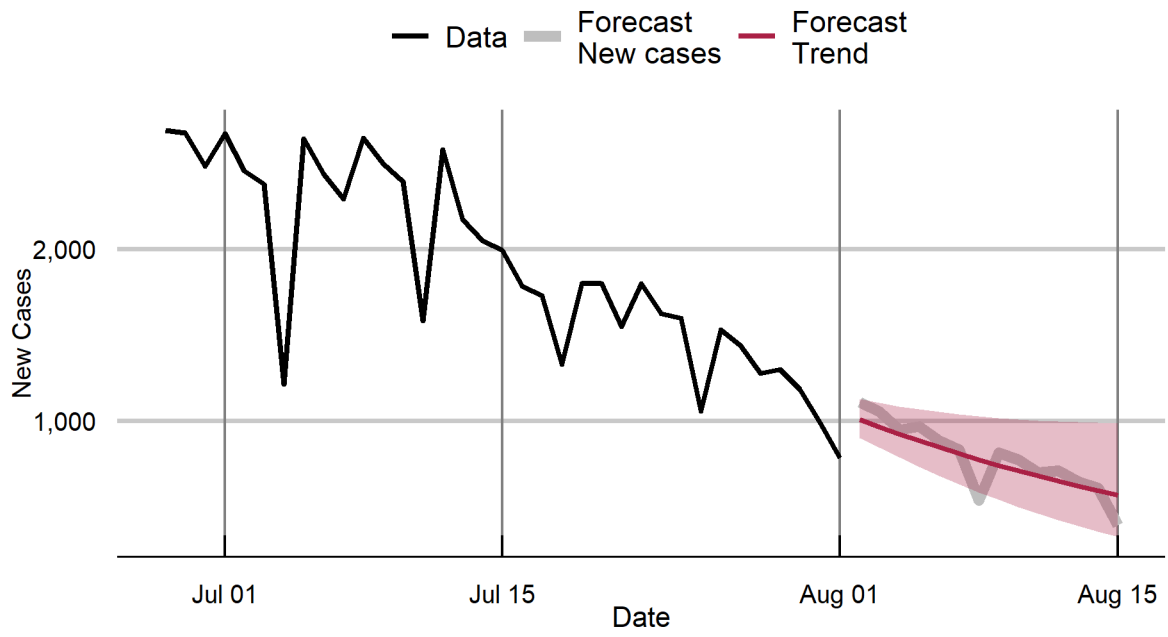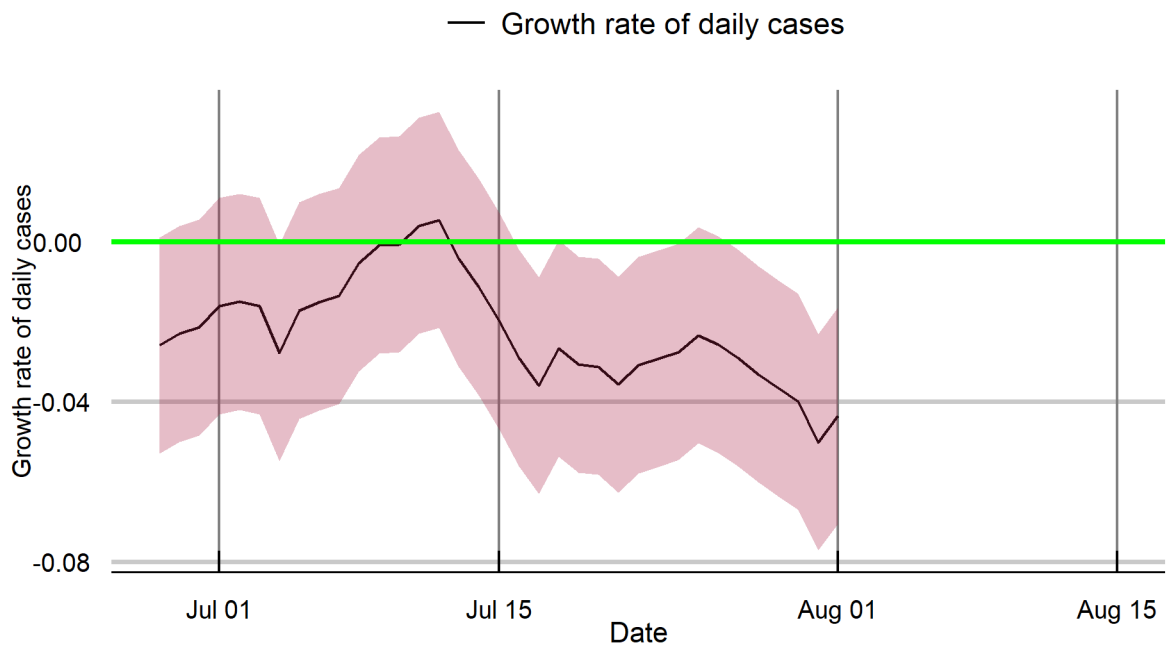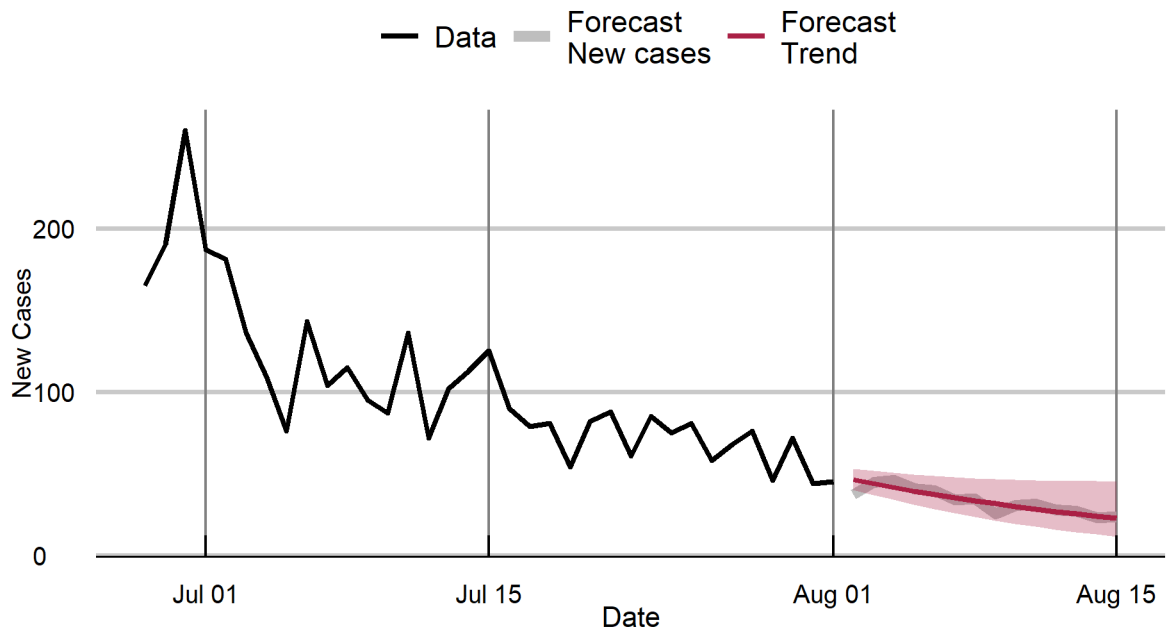
Bihar

Bihar
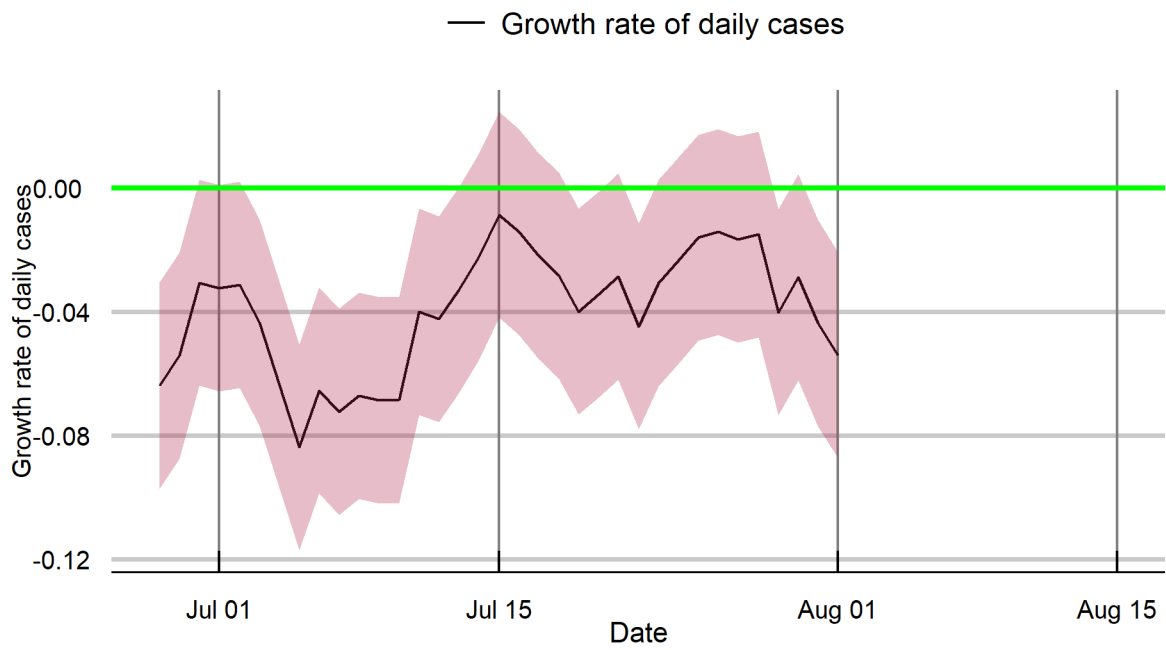
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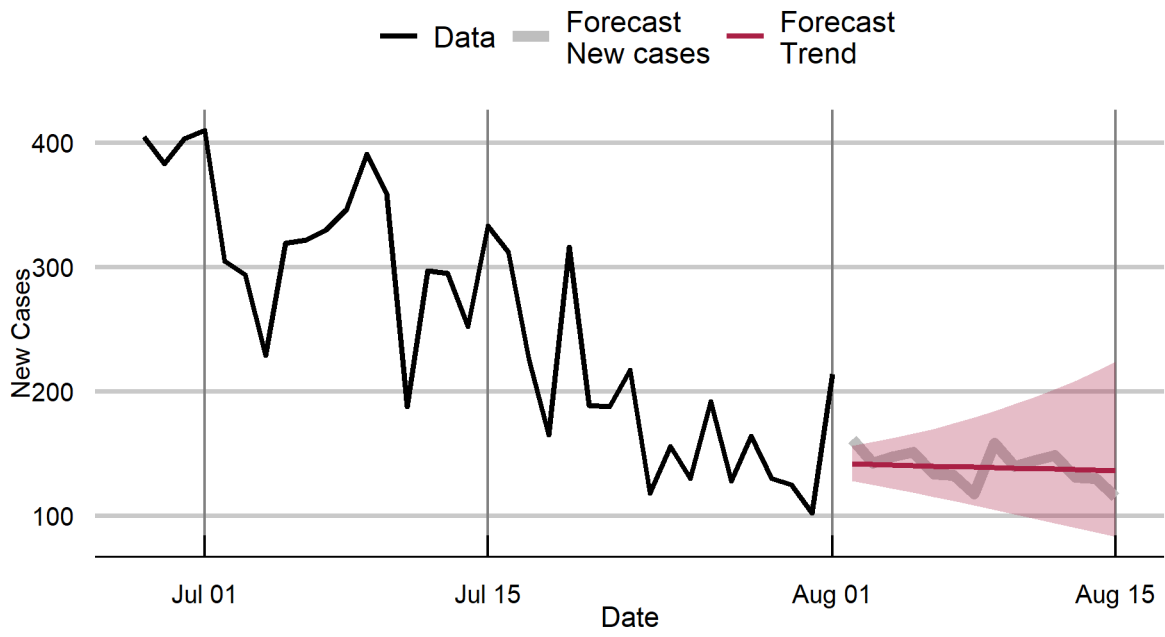
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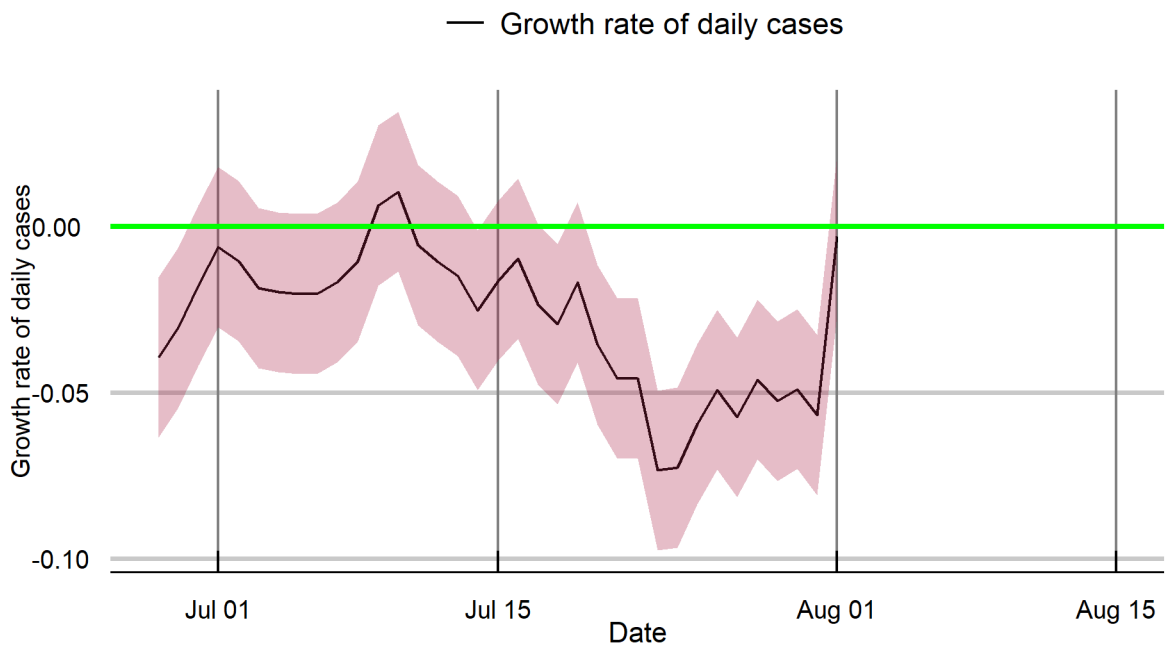
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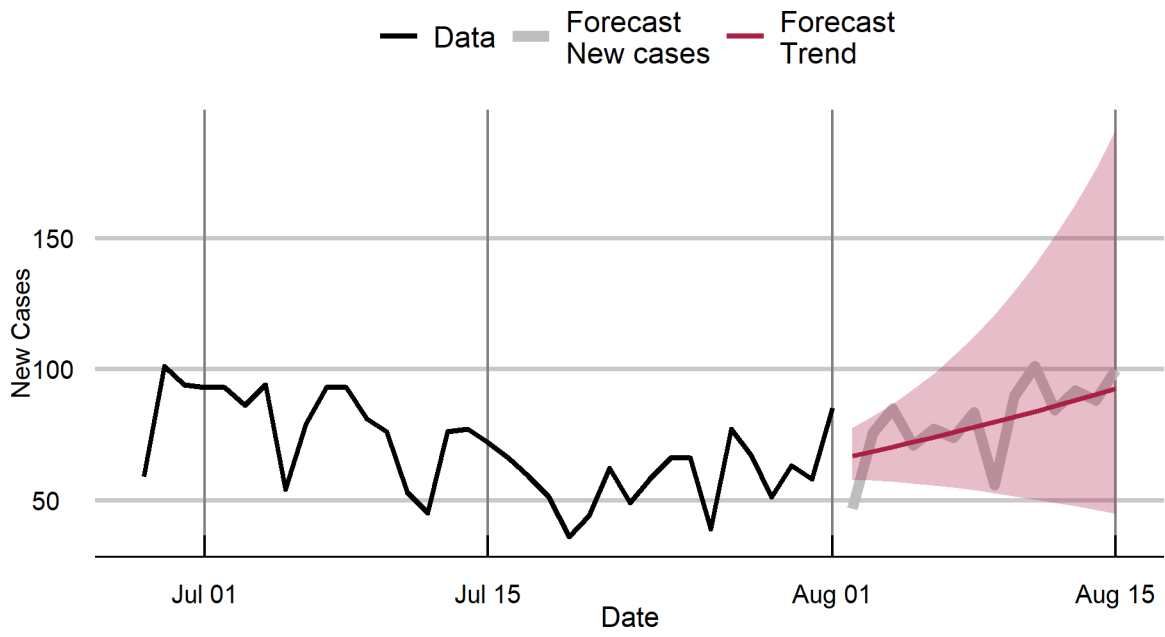
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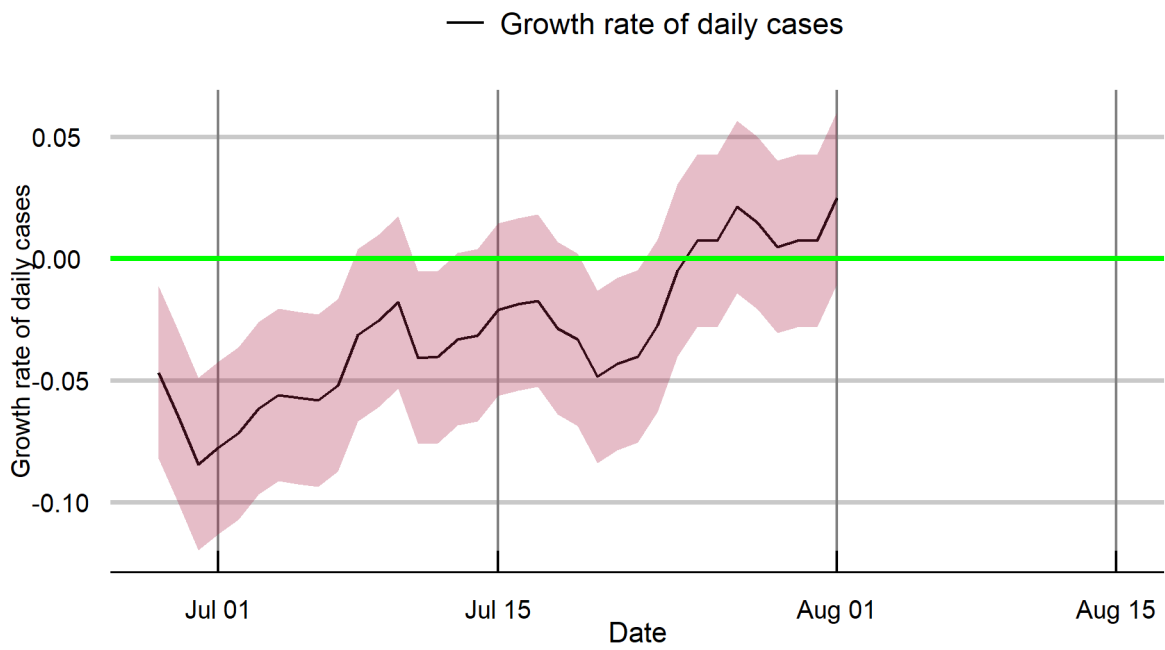
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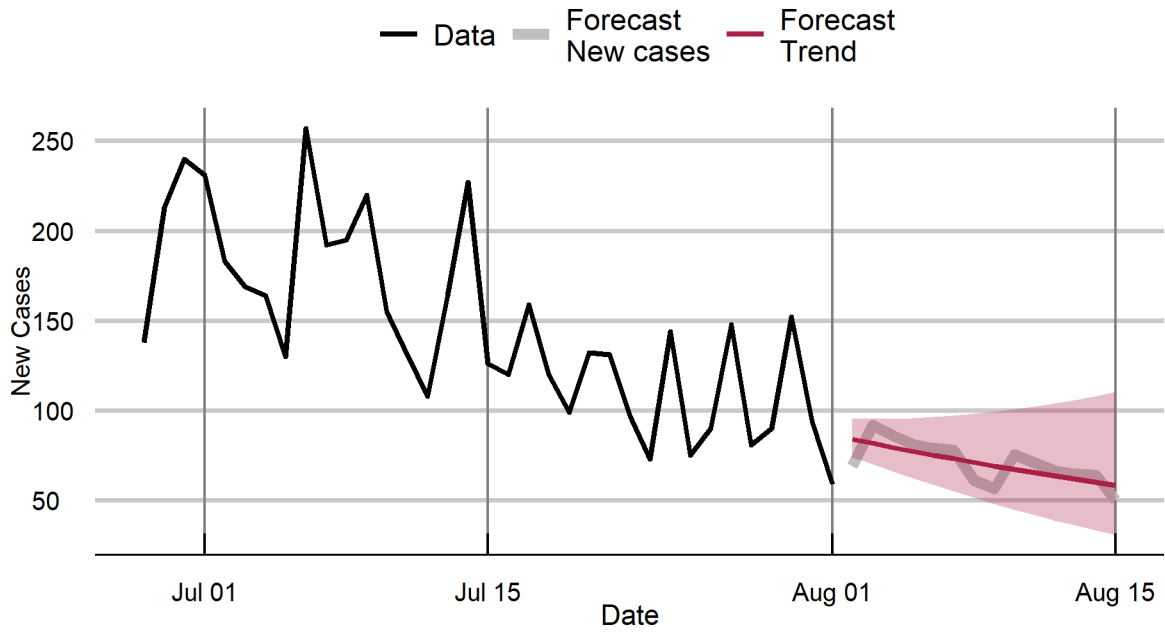
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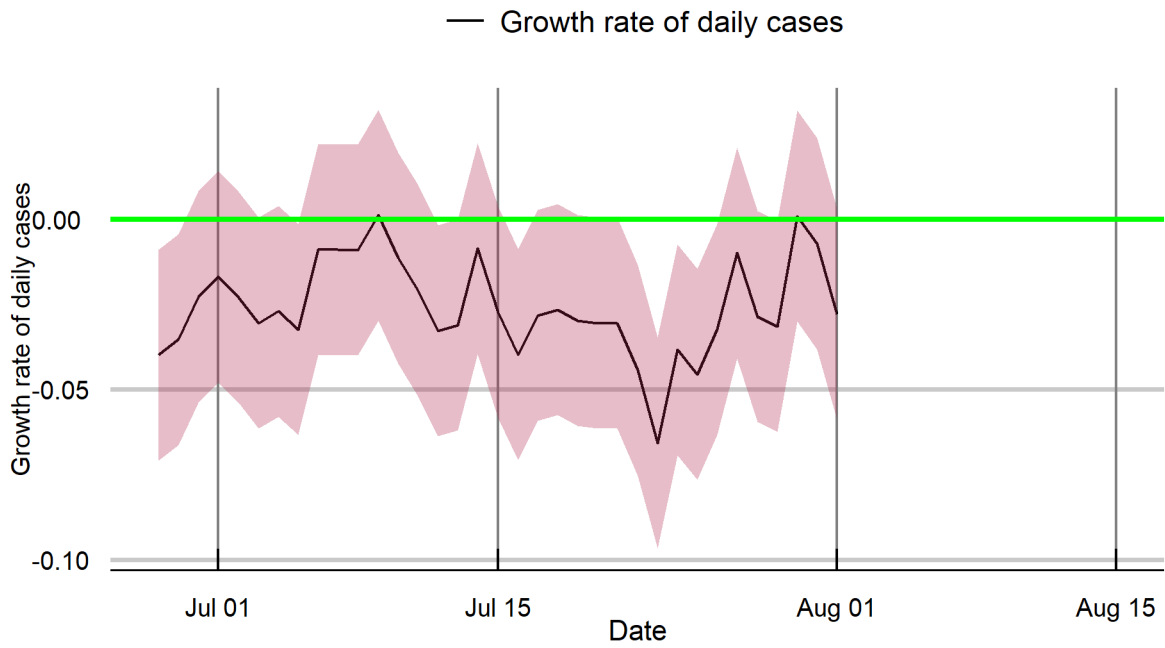
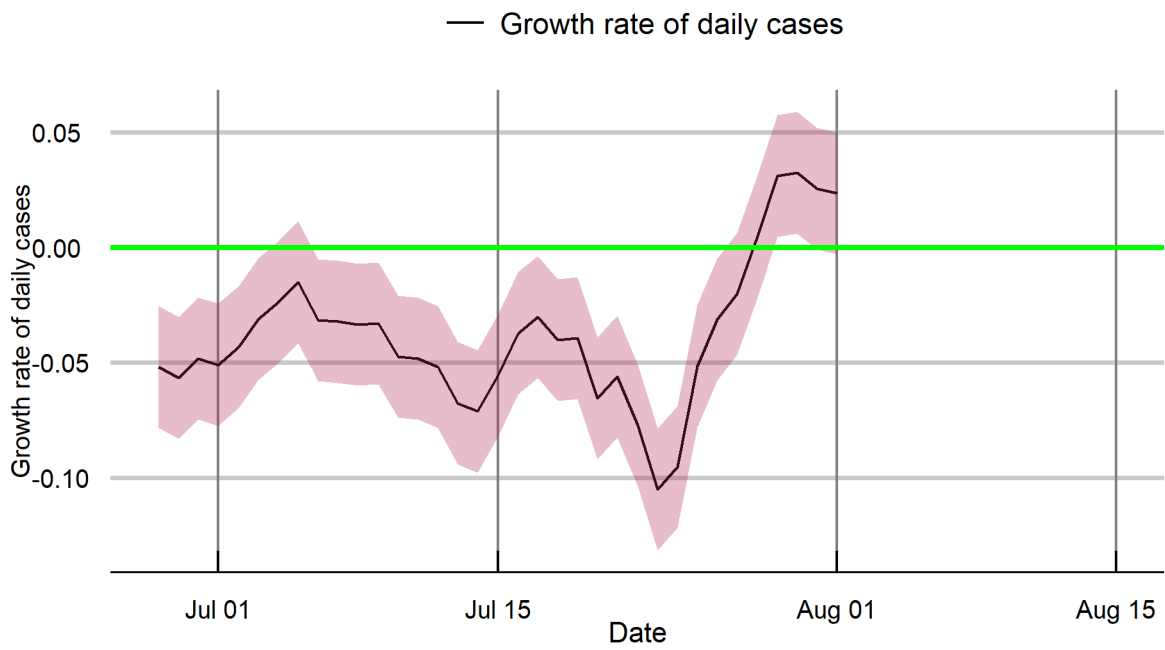# Gujarat
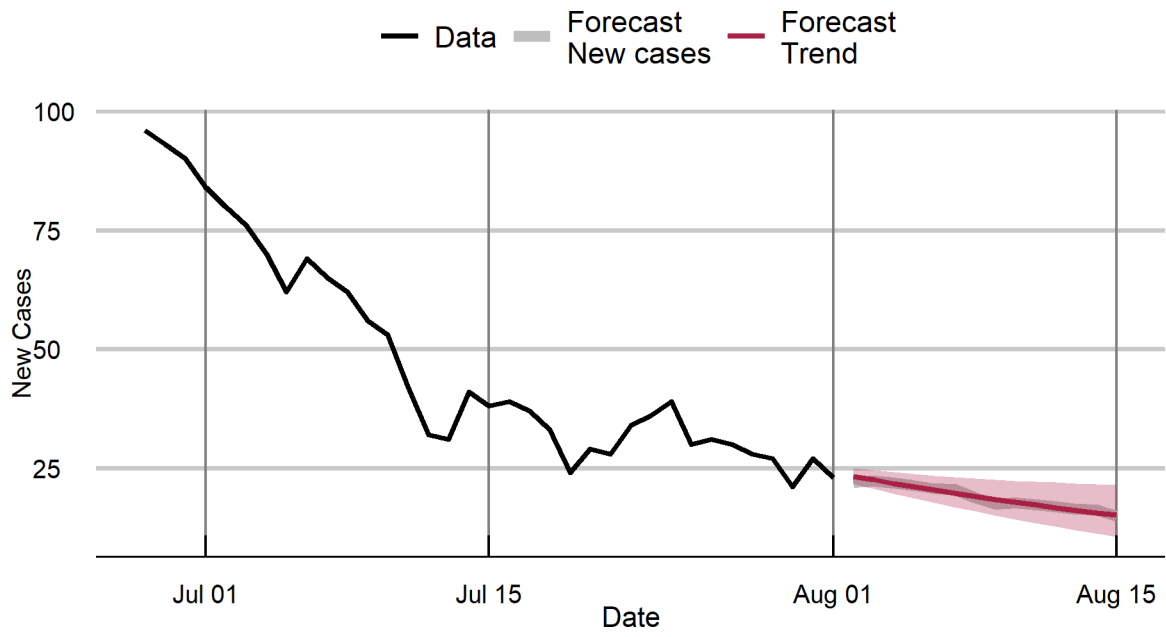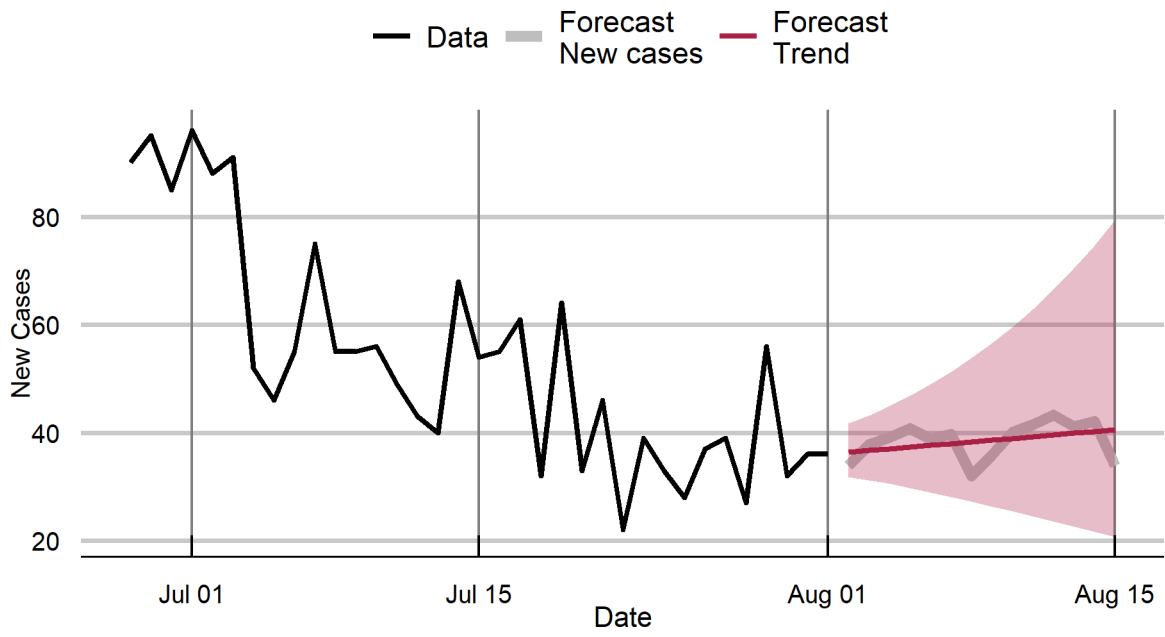

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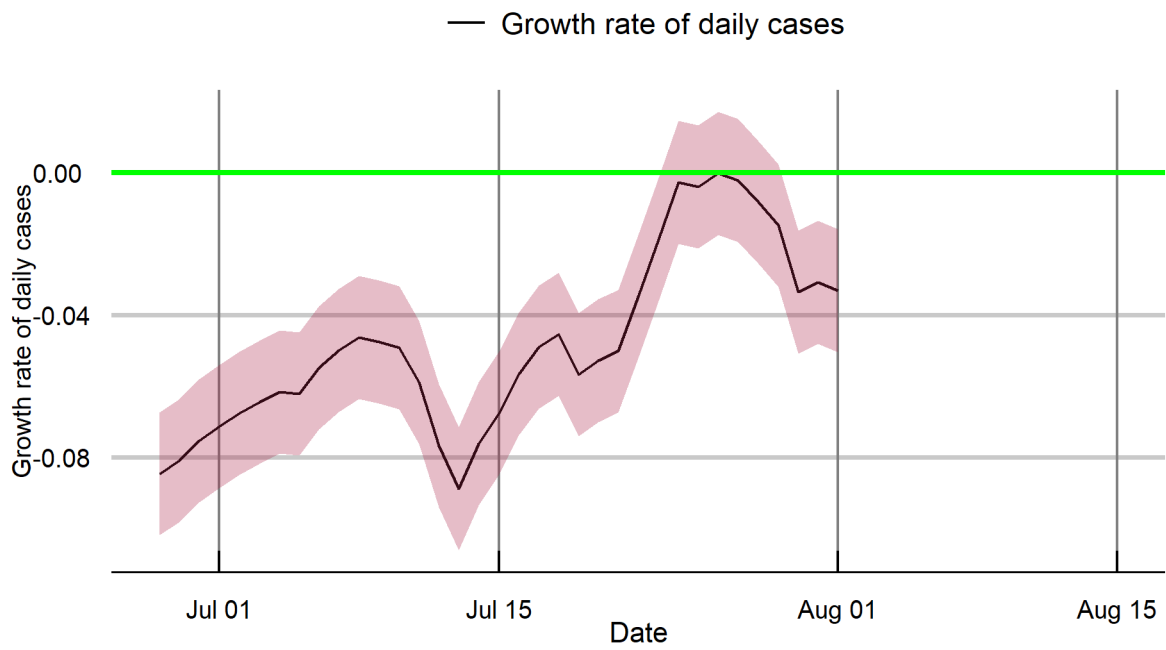
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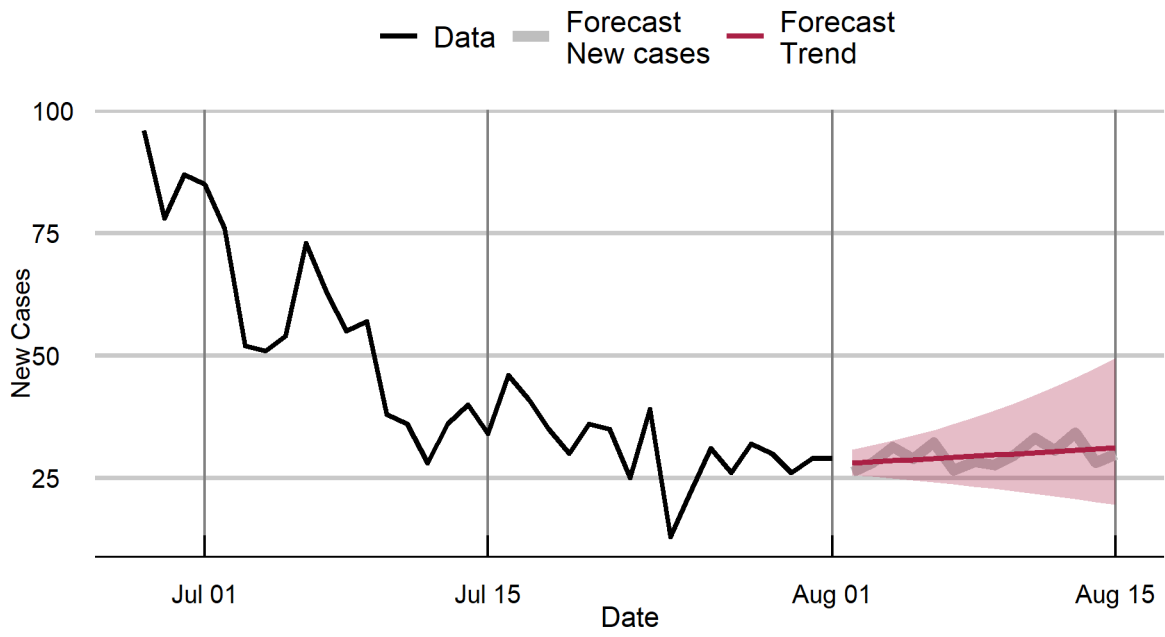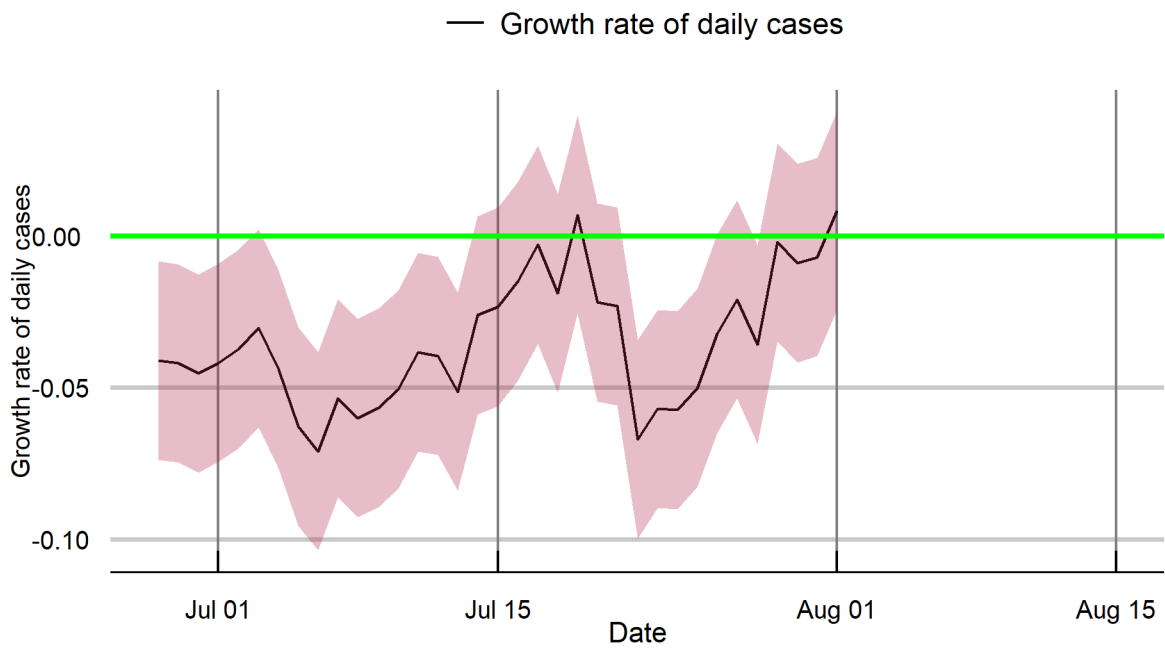

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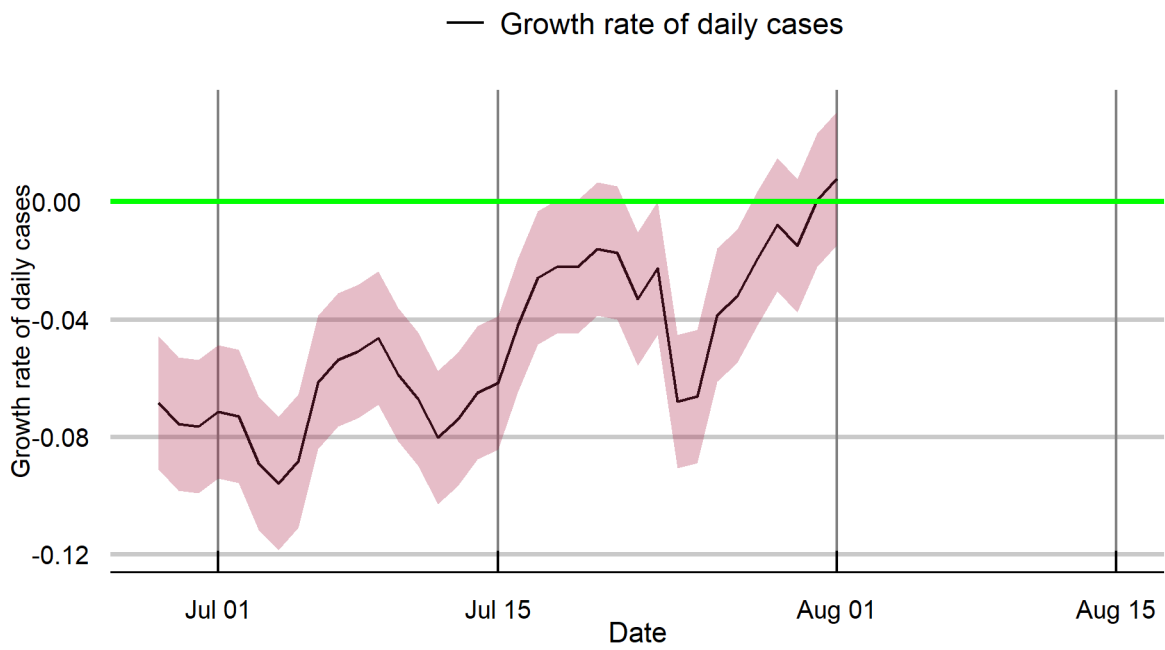
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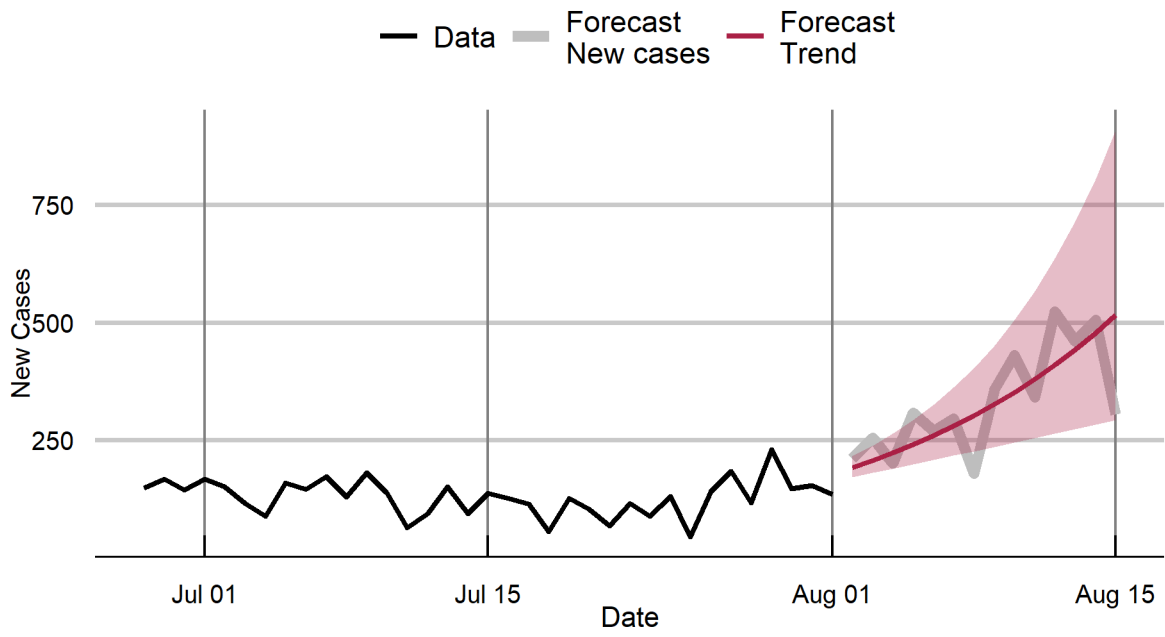
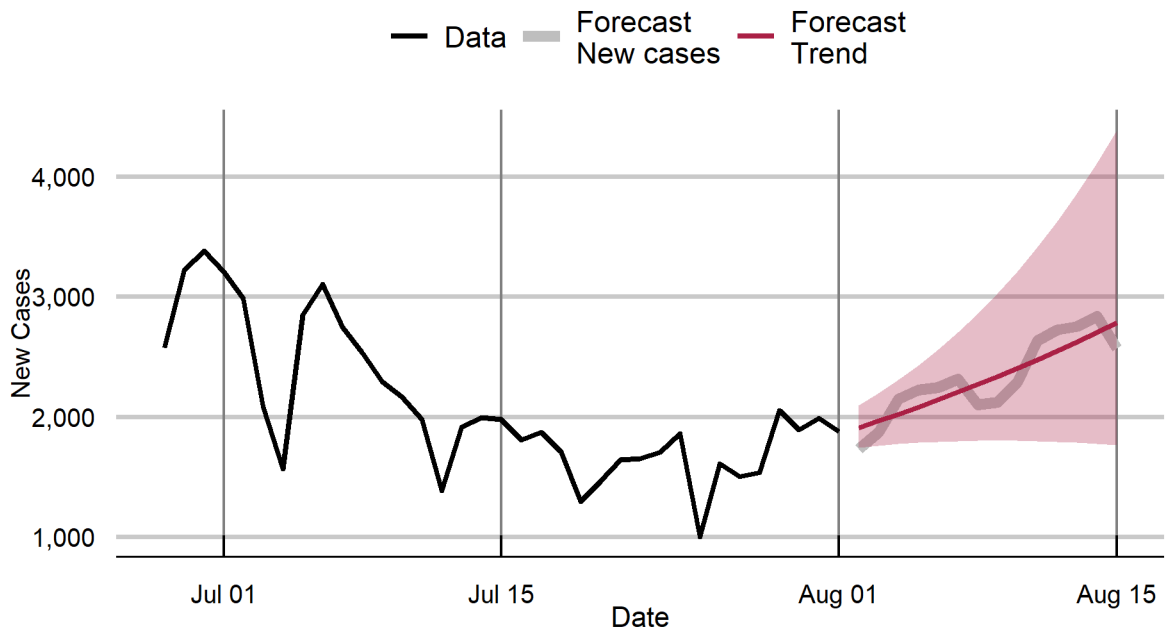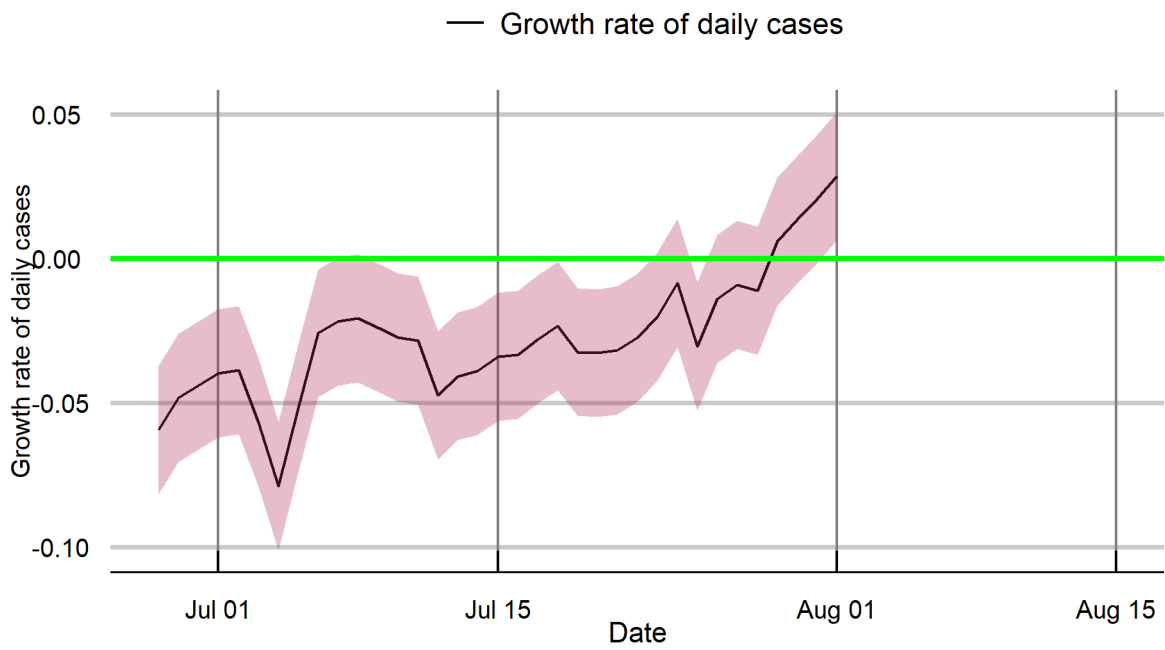
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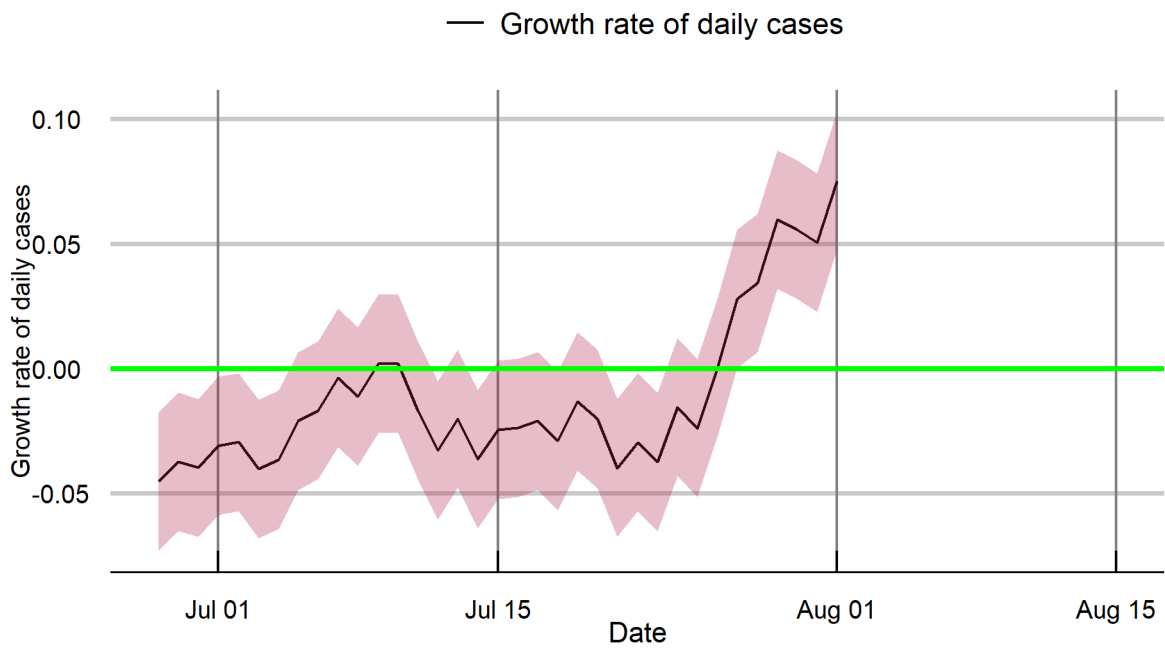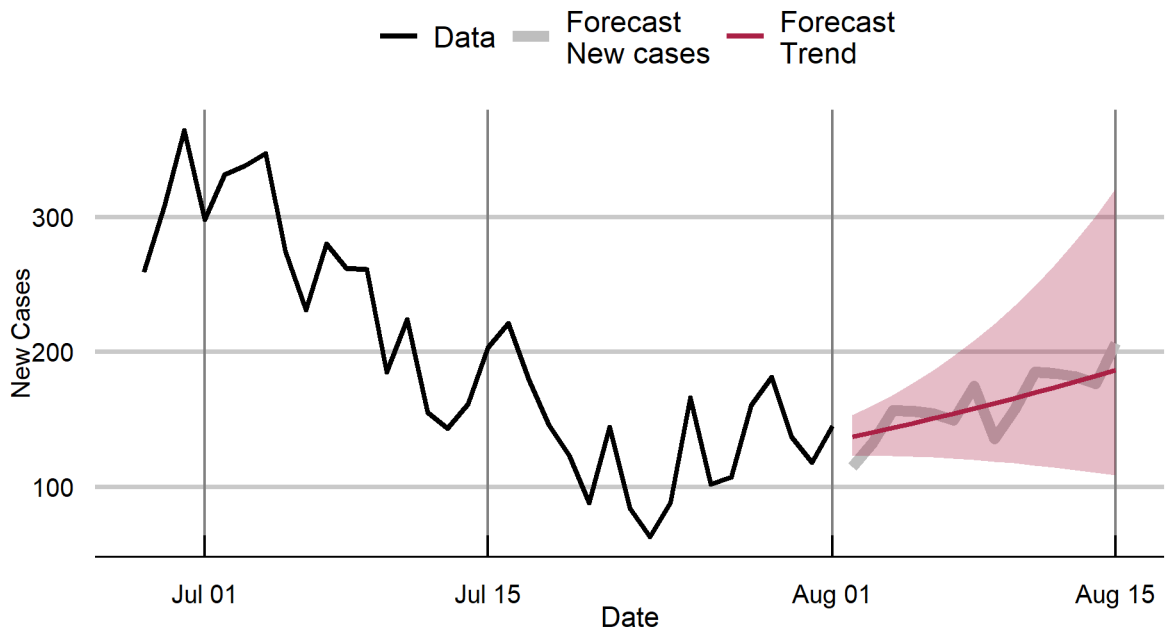
Jammu and Kashmir

Jammu and Kashmir

Jharkhand

Jharkhand

Karnataka

Karnataka

Kerala
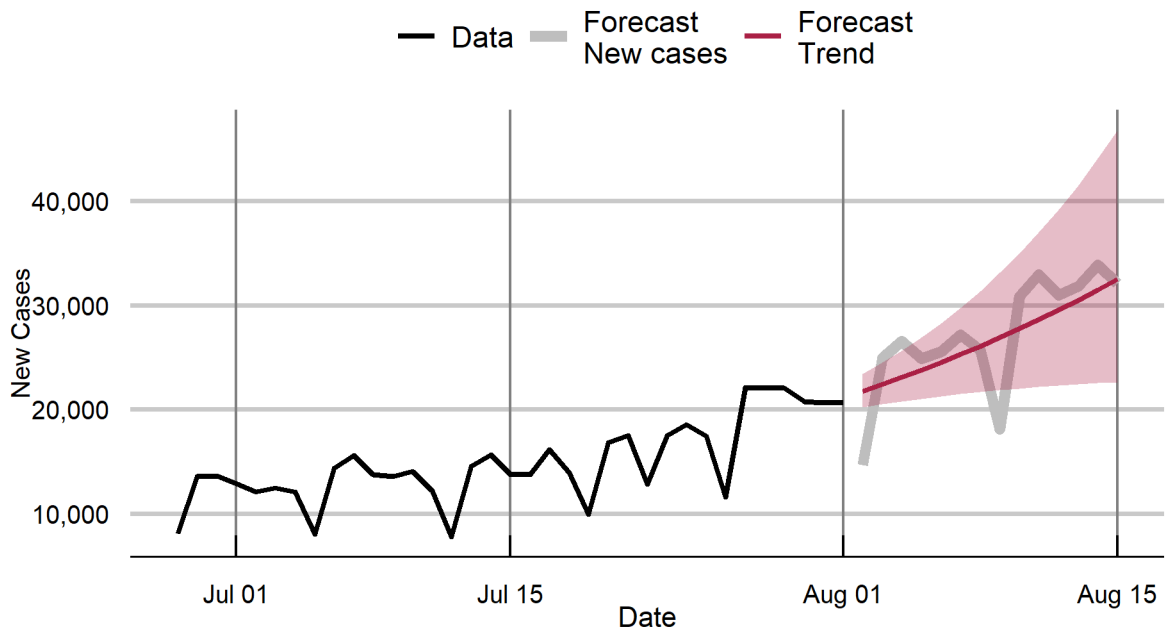
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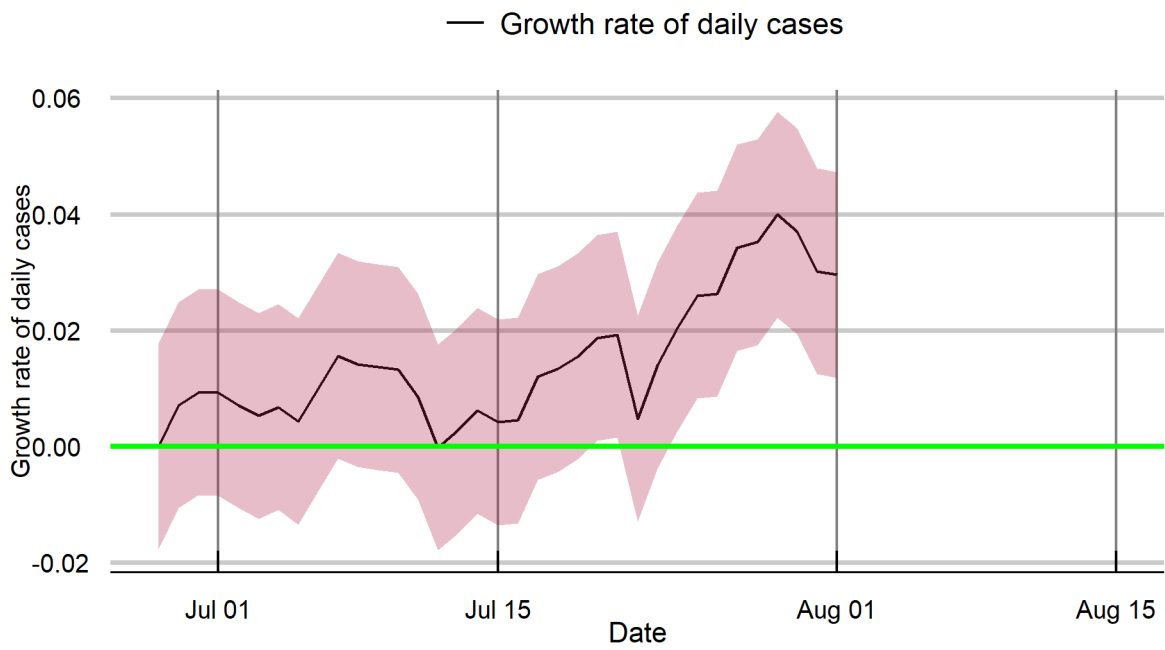
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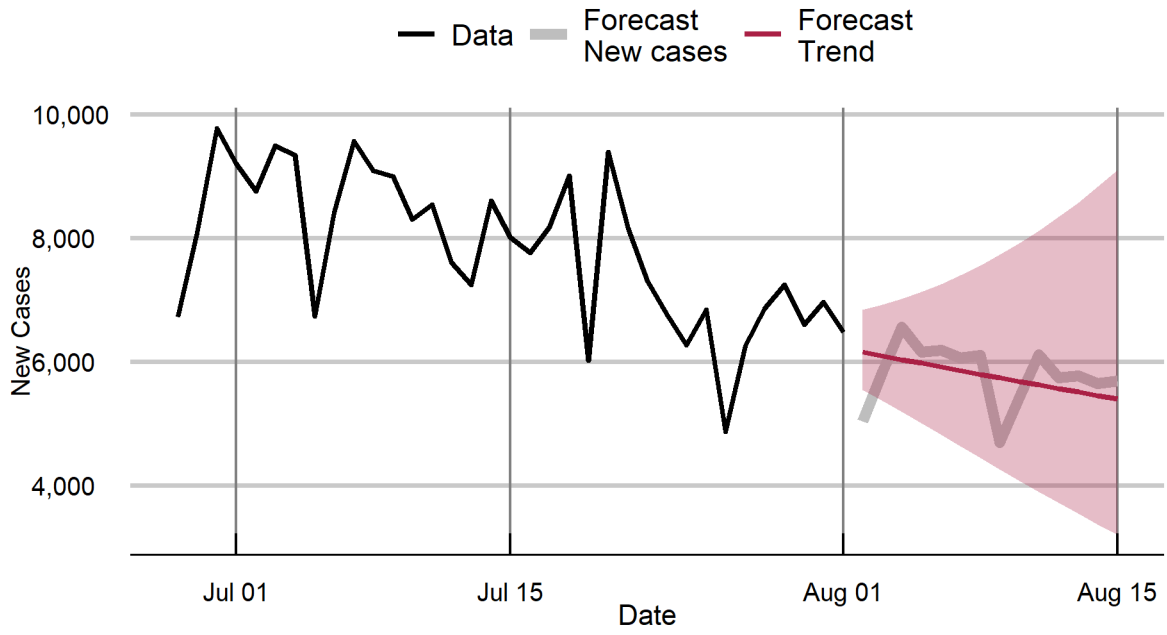
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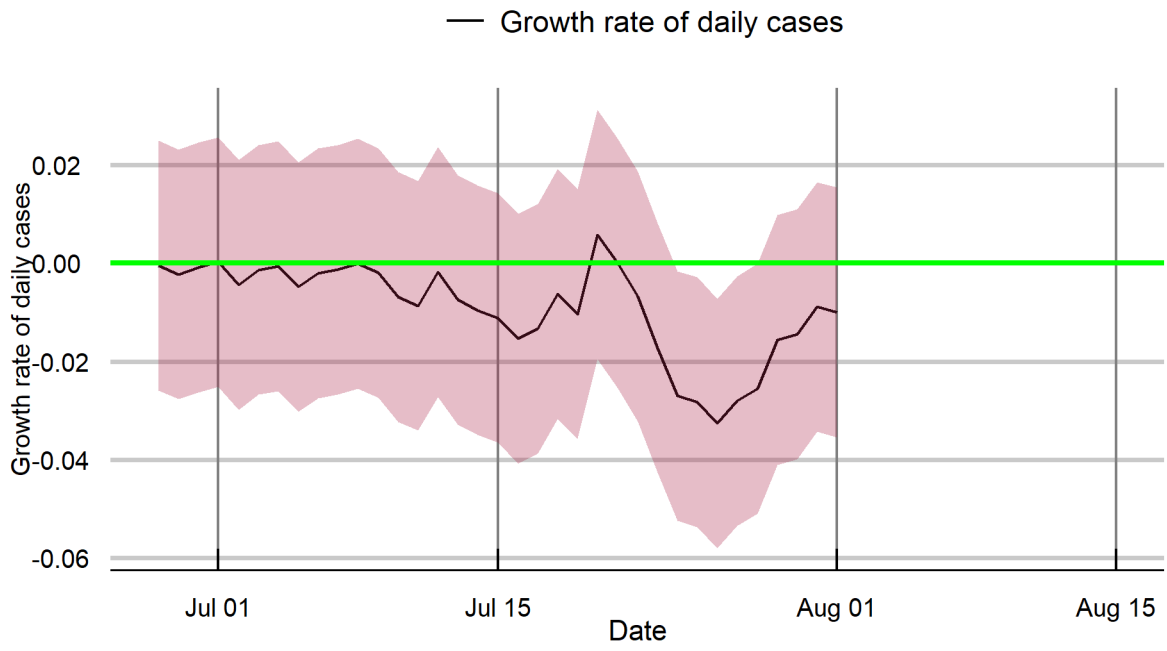
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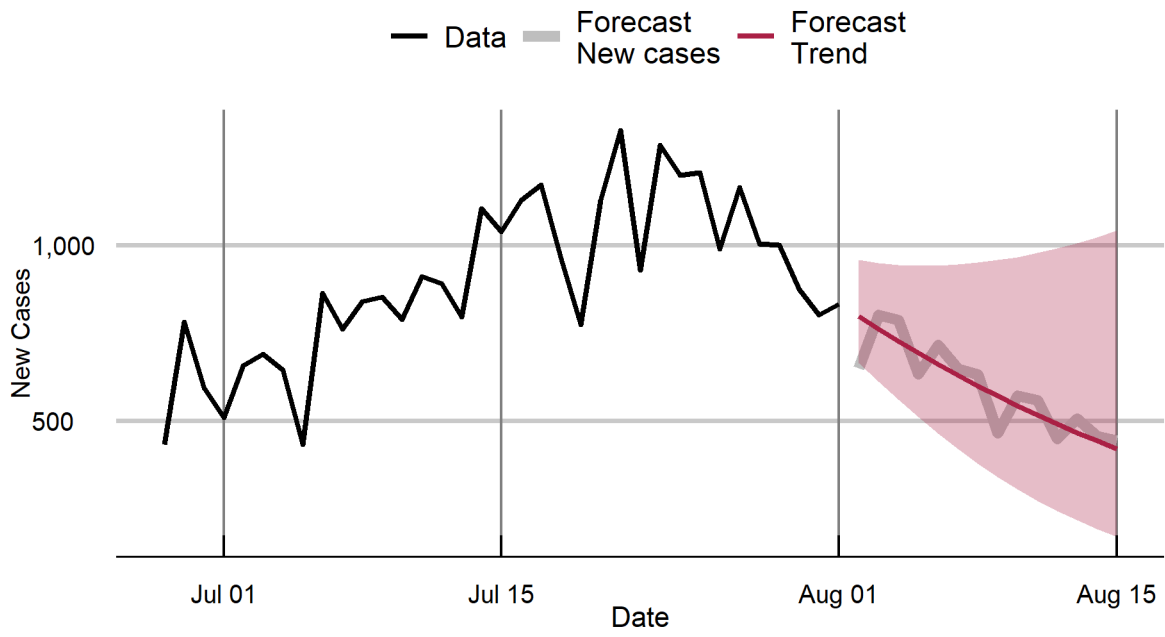
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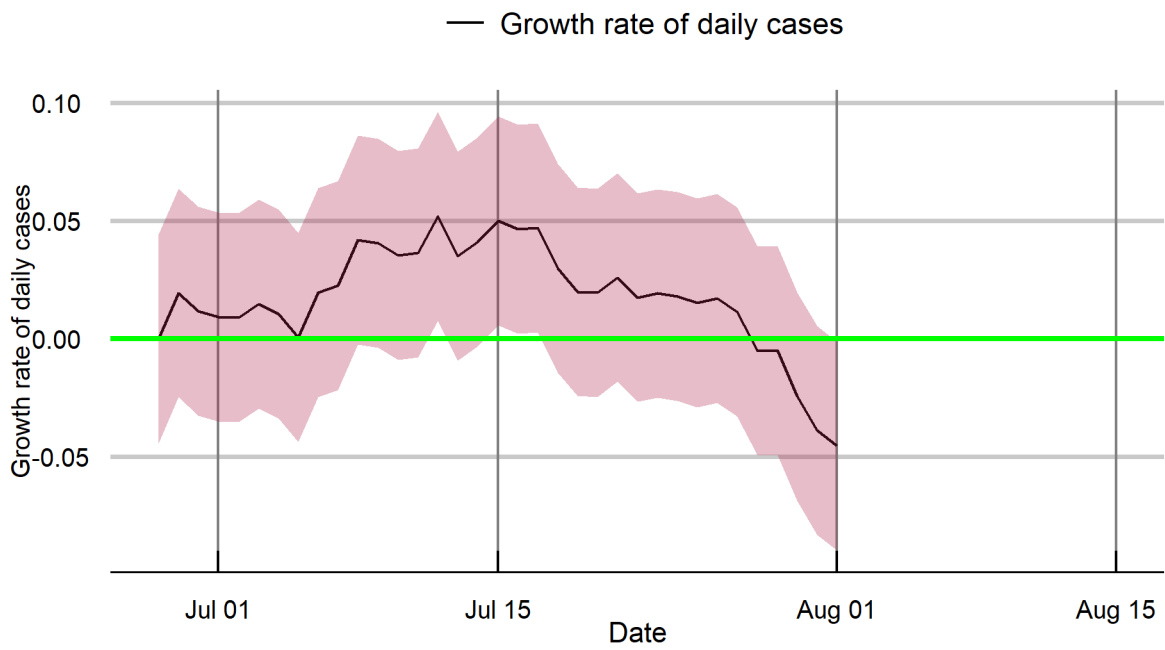
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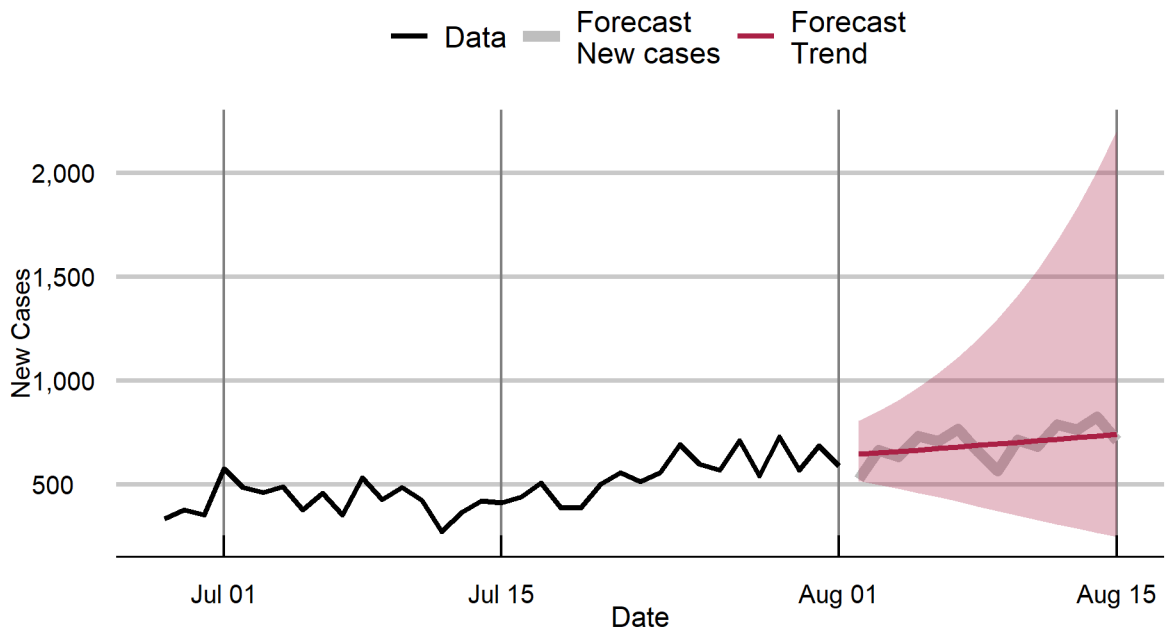
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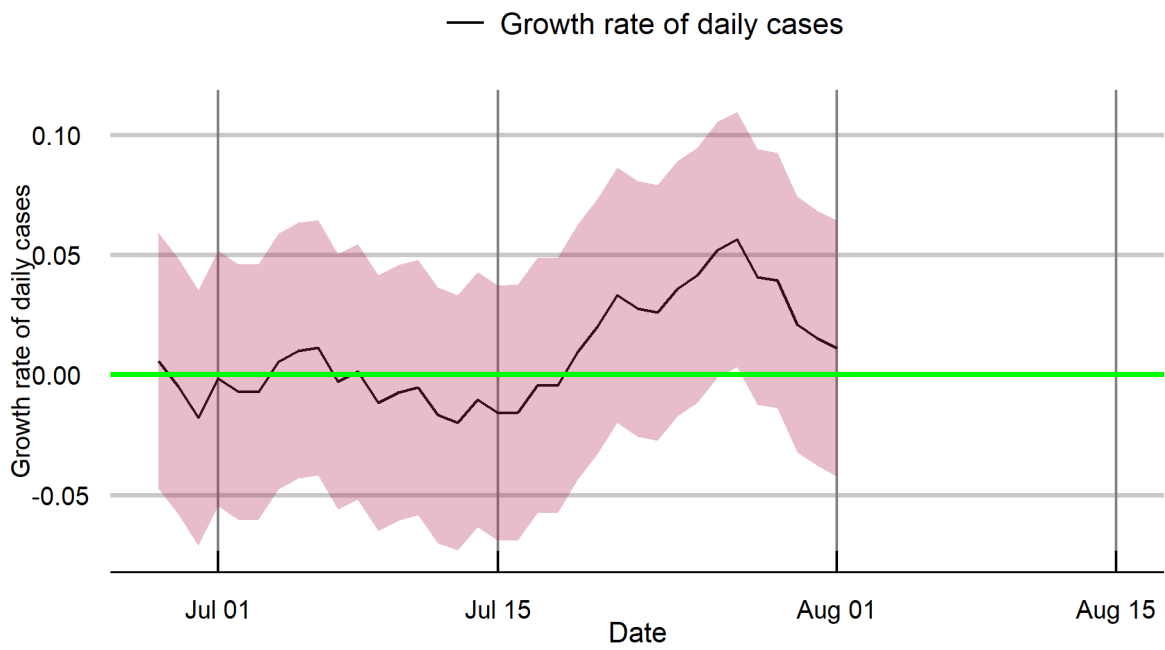
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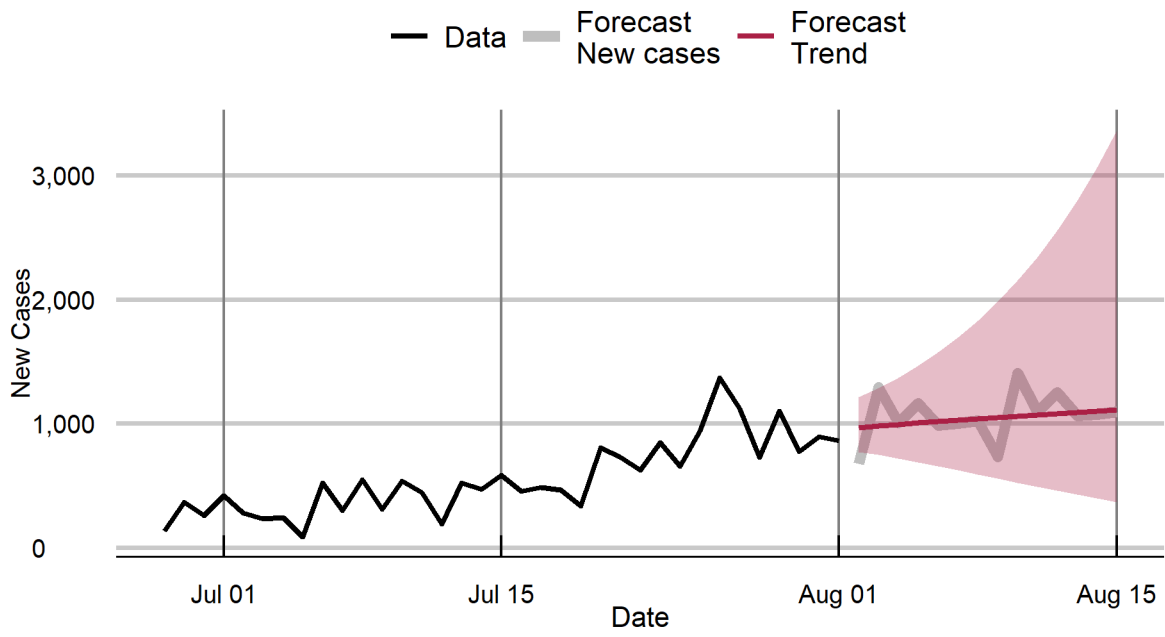
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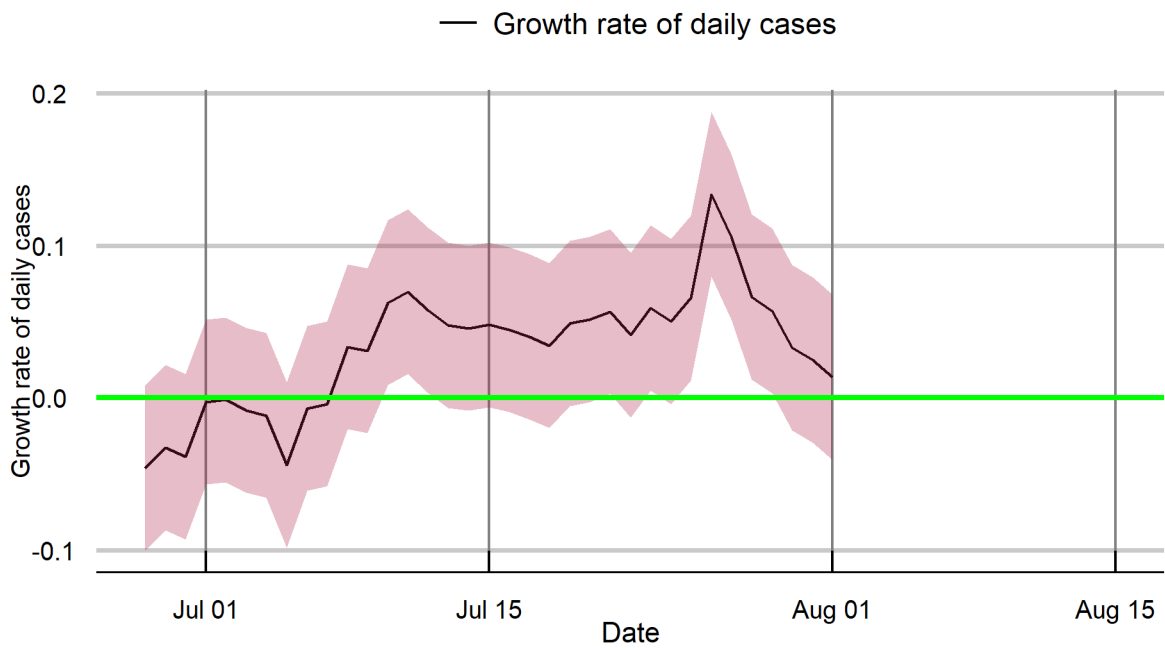
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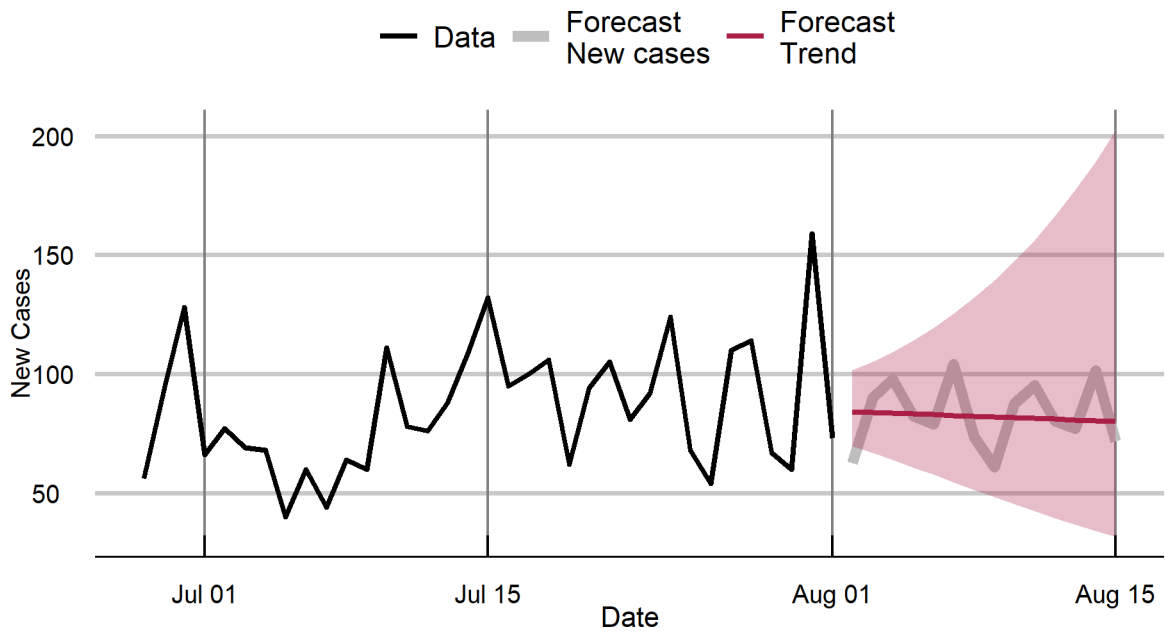
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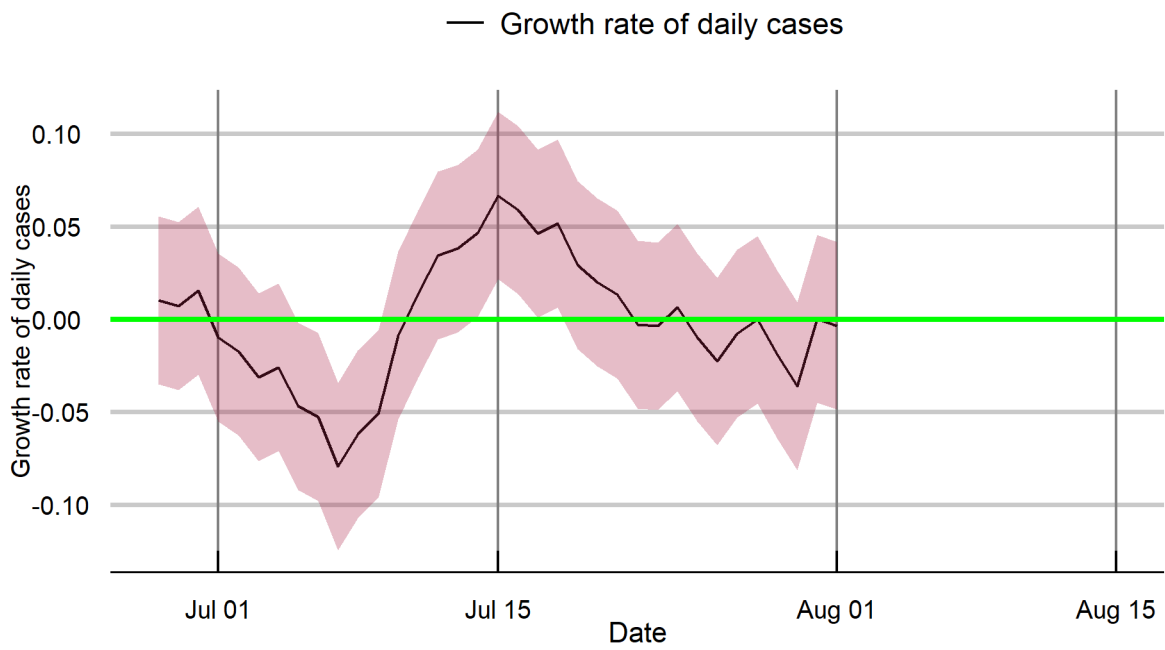
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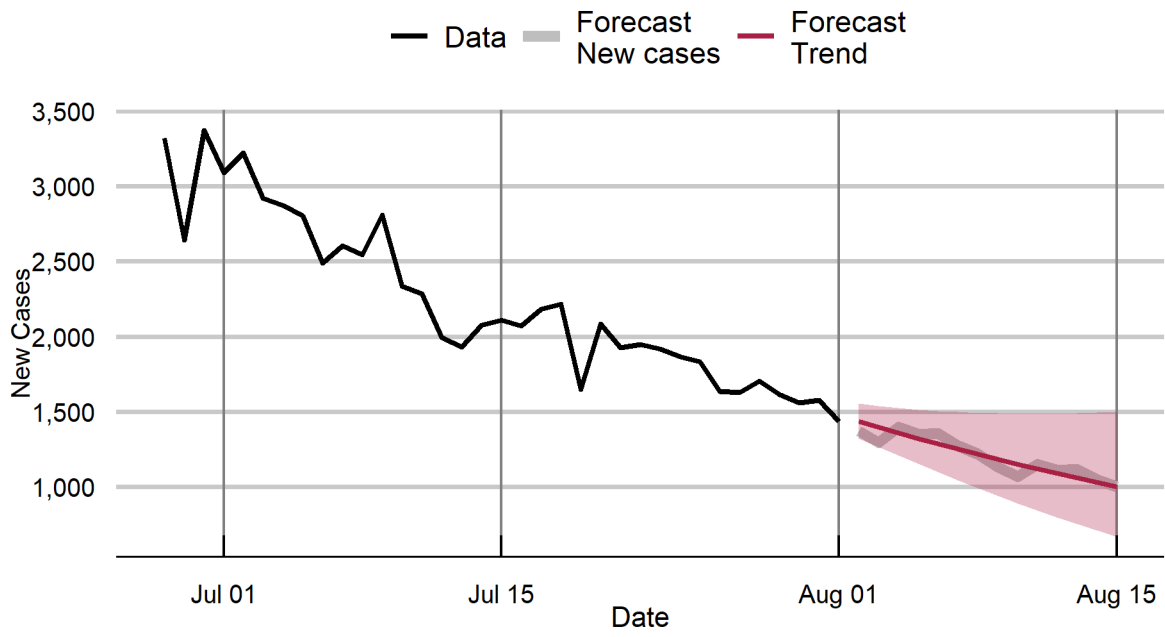
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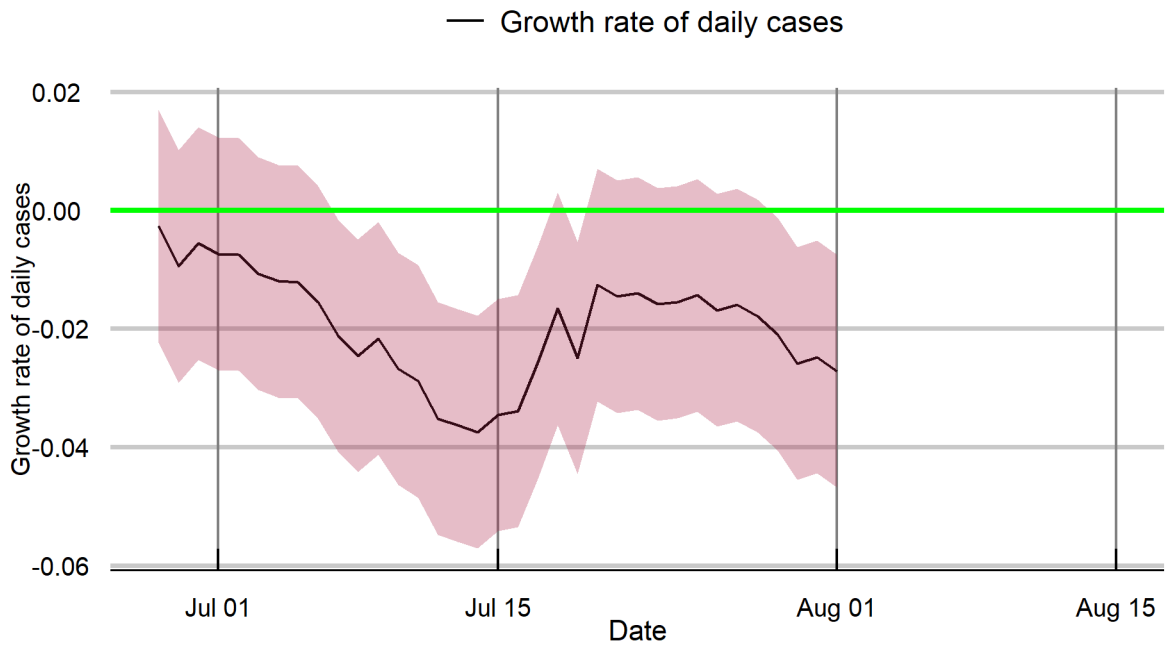
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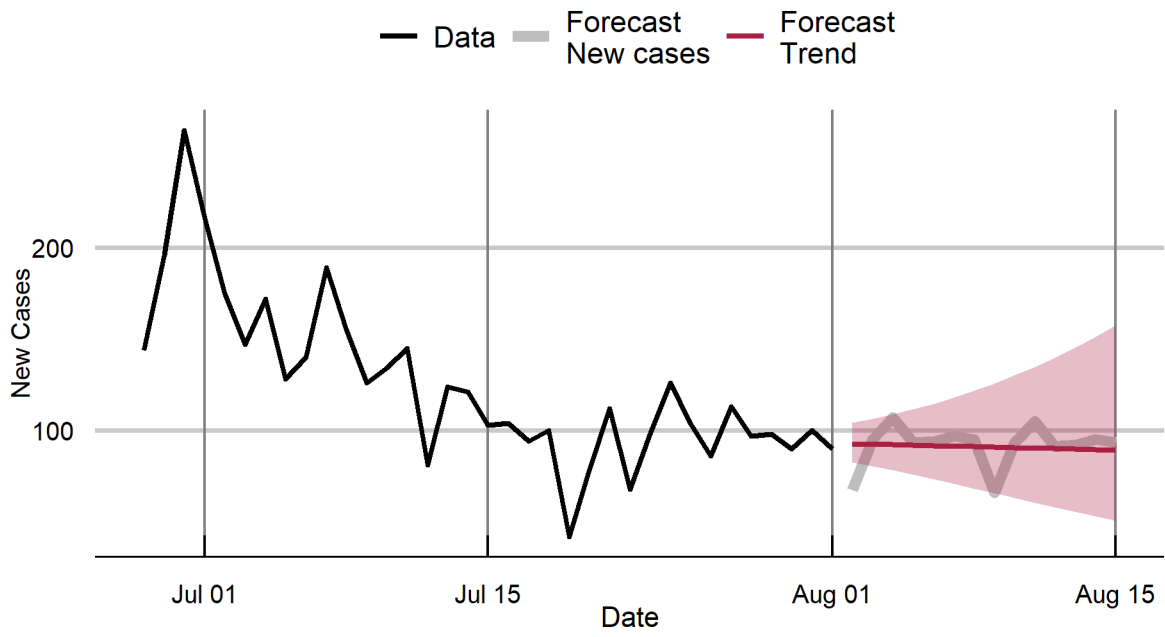
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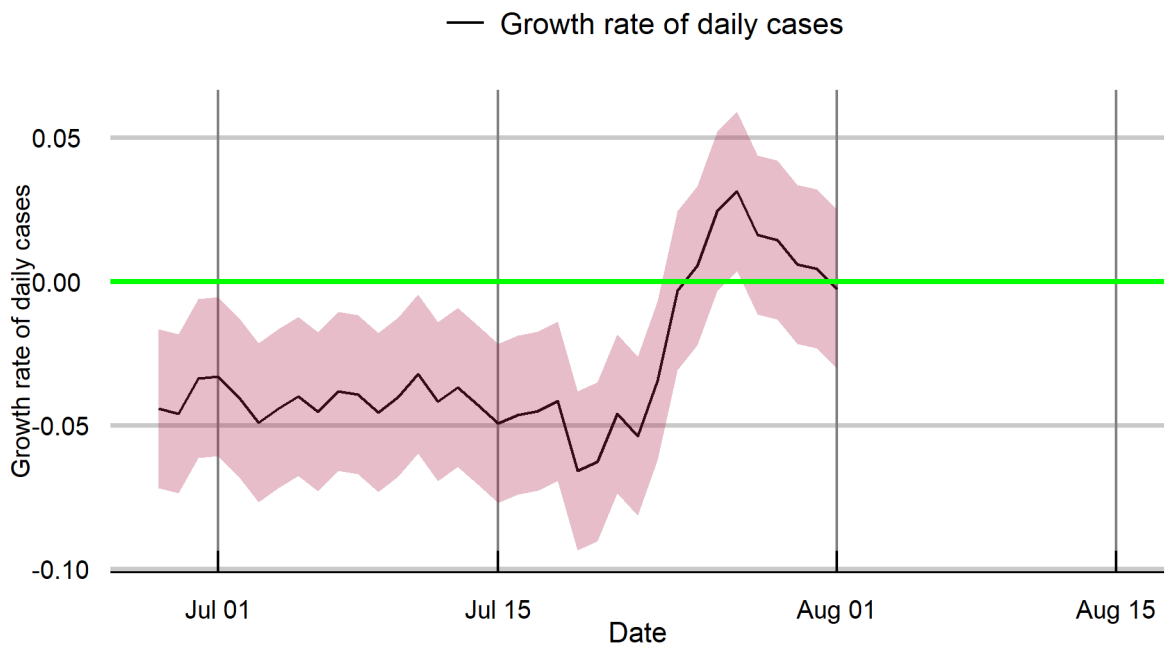
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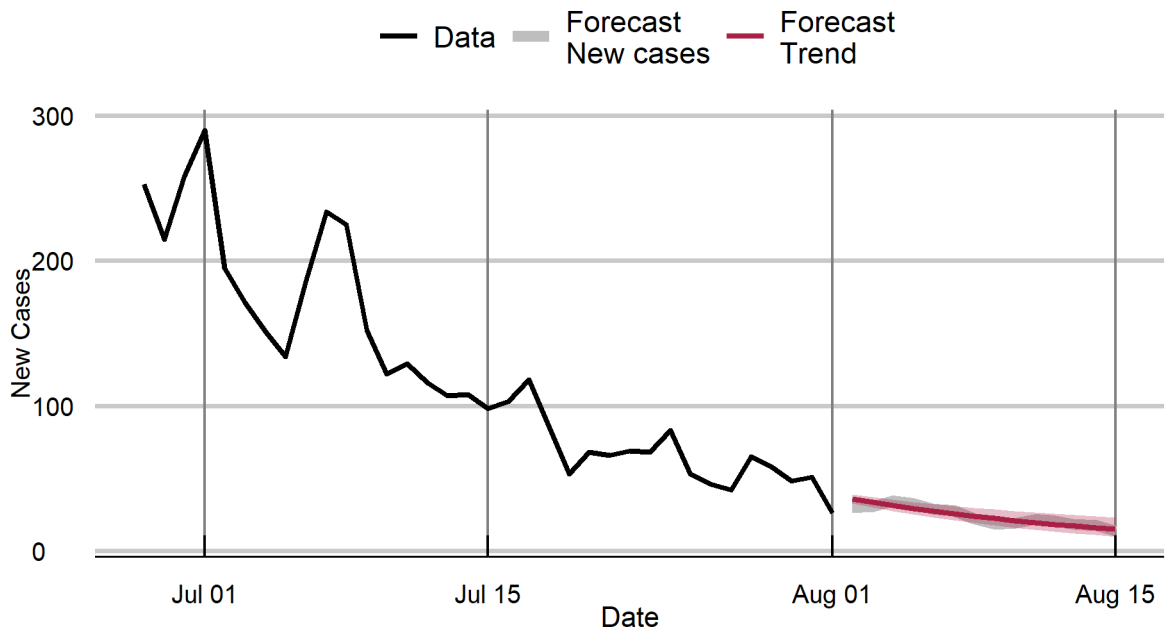
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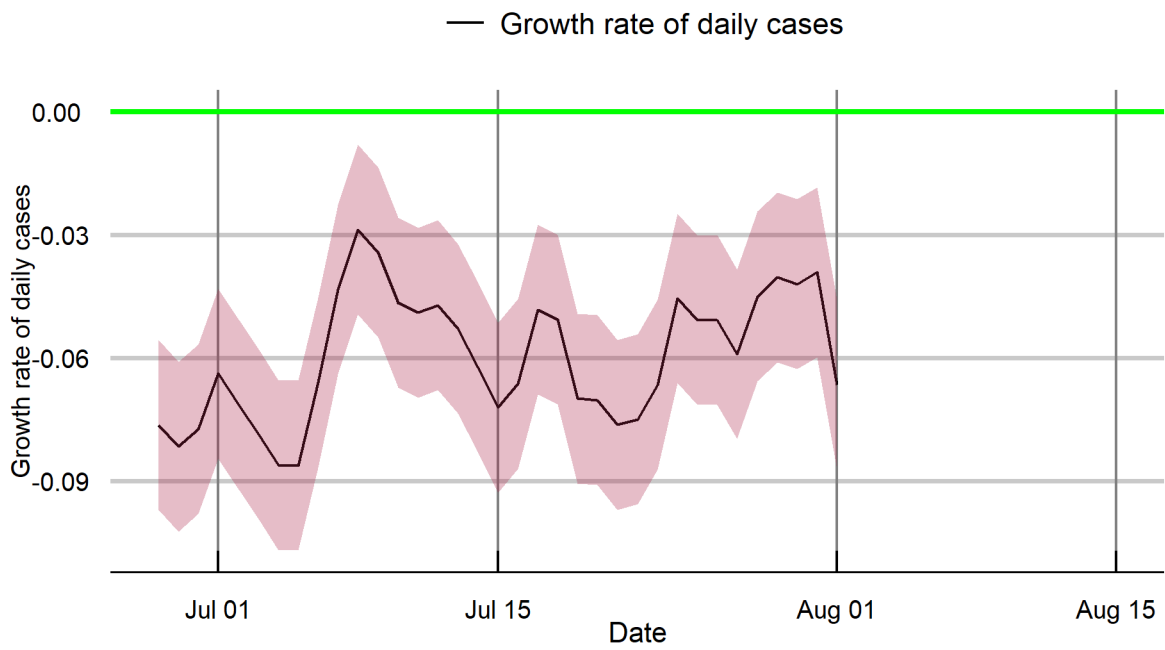
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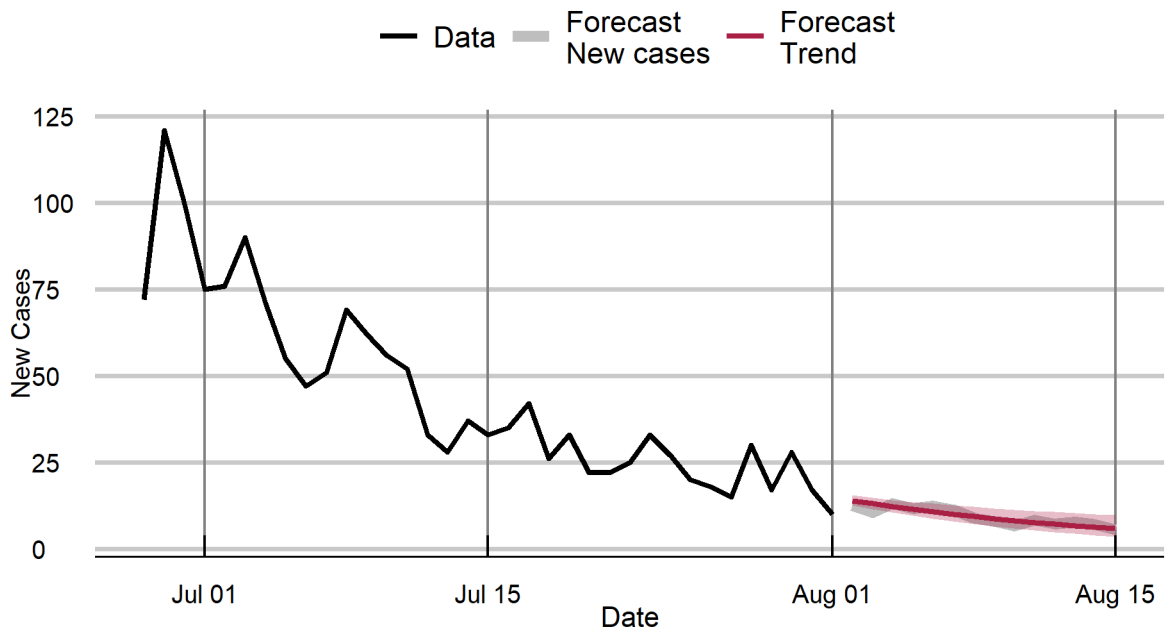
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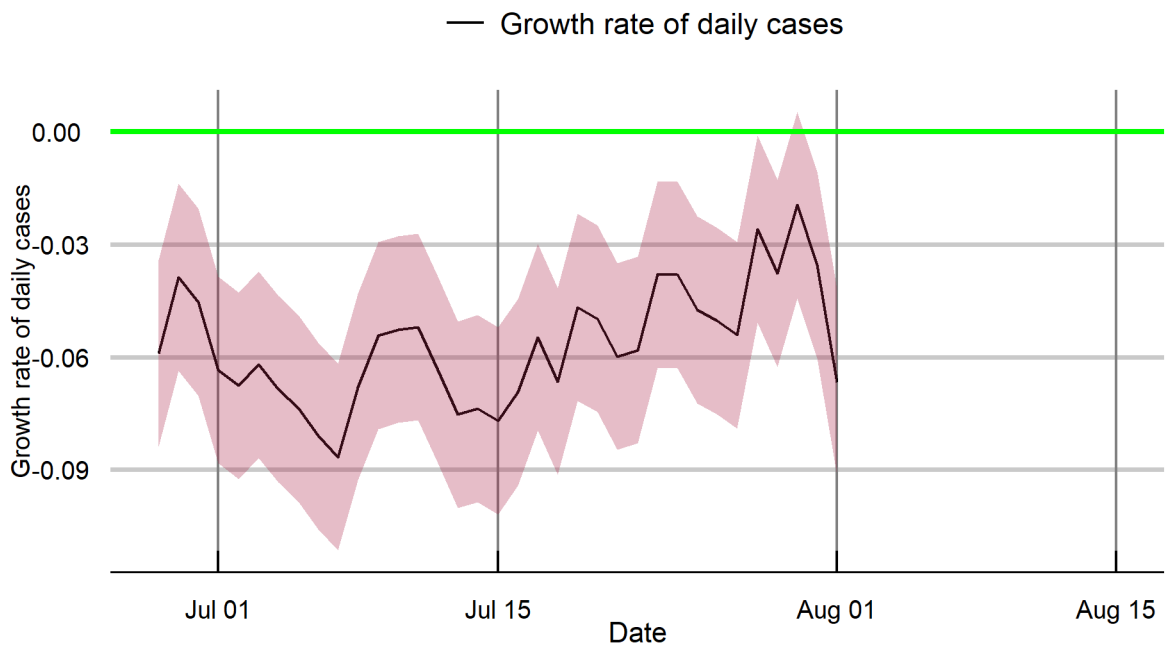
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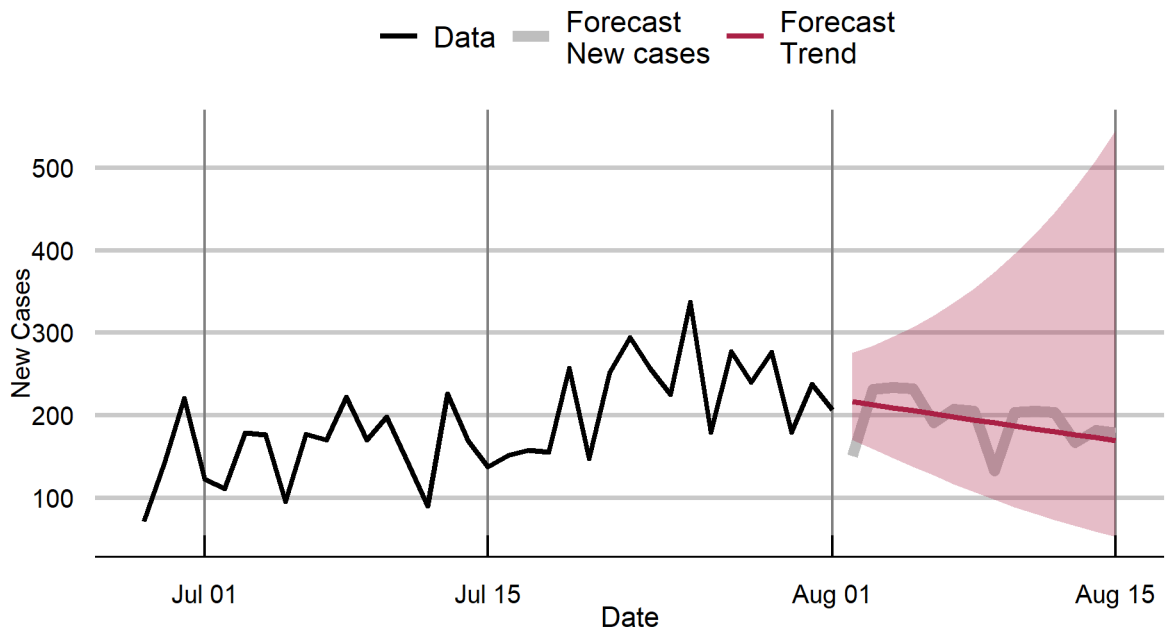
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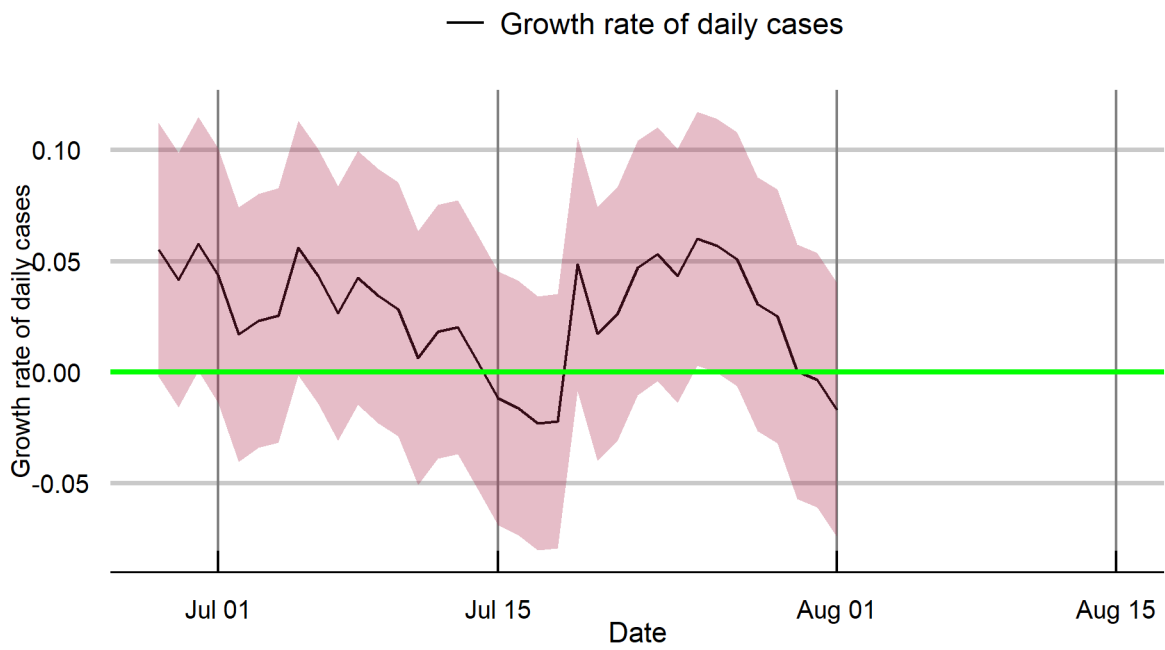
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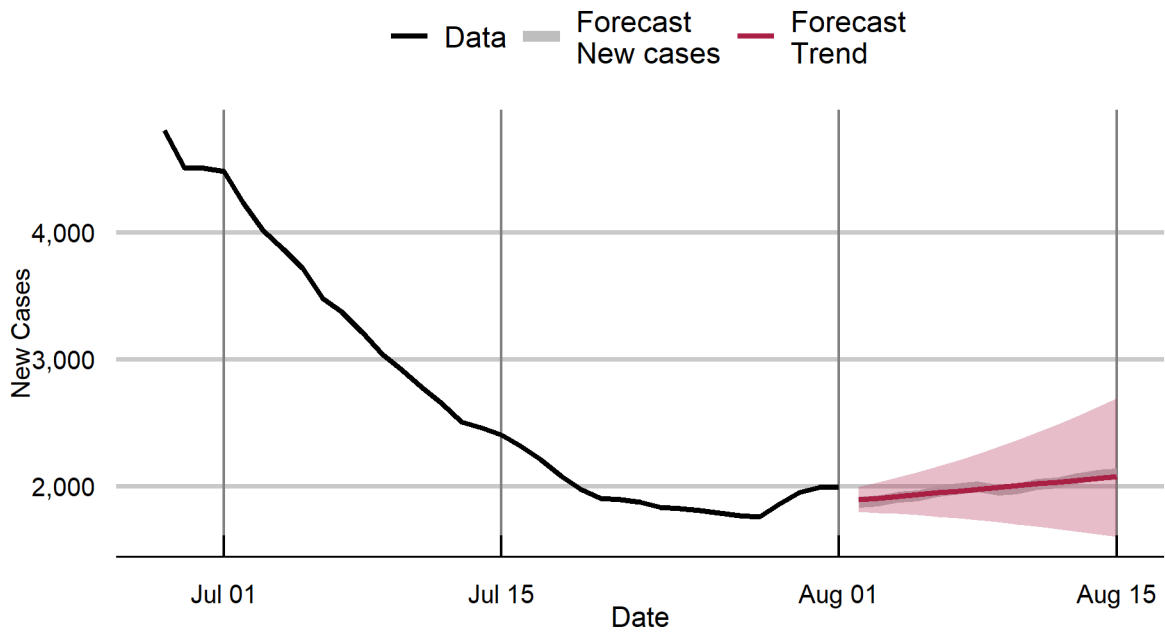
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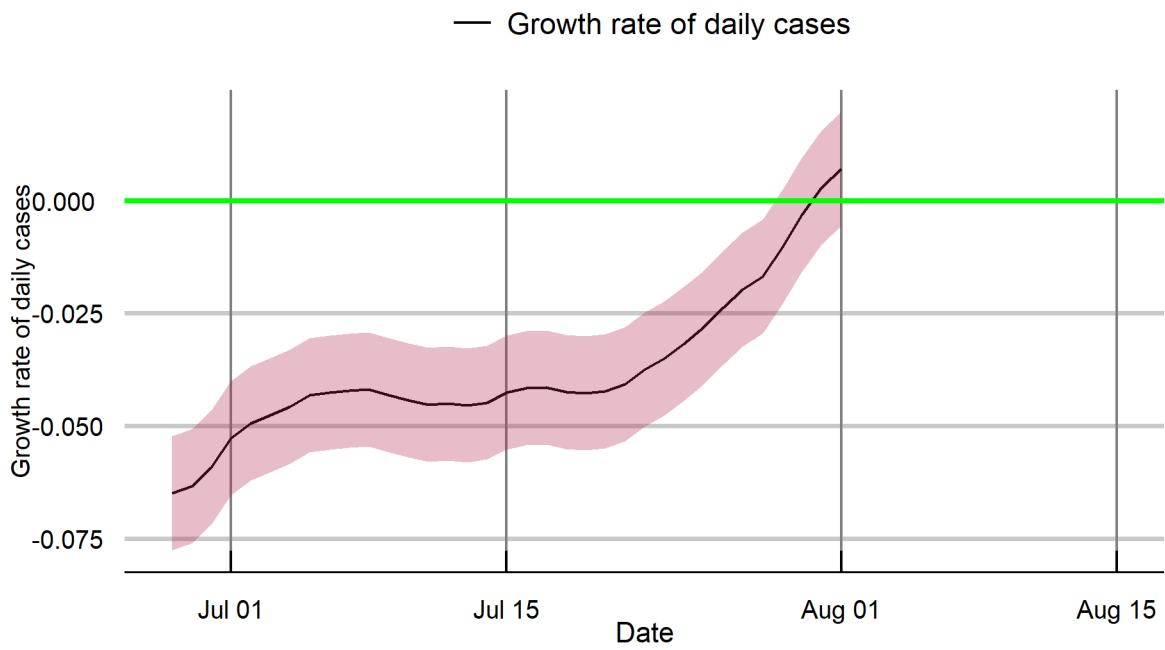
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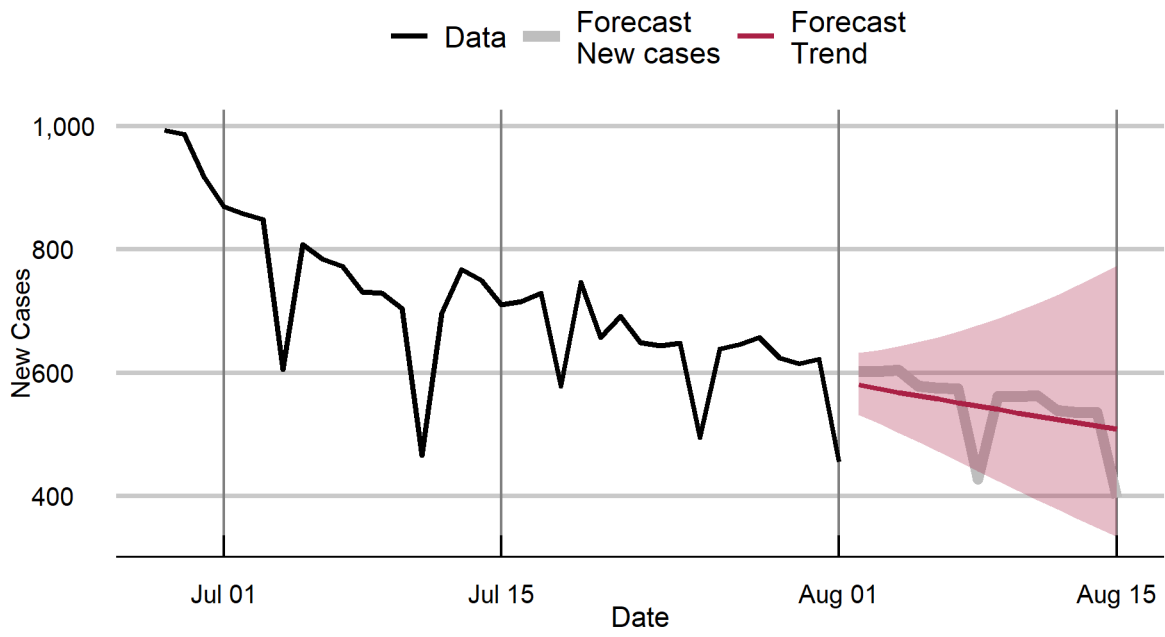
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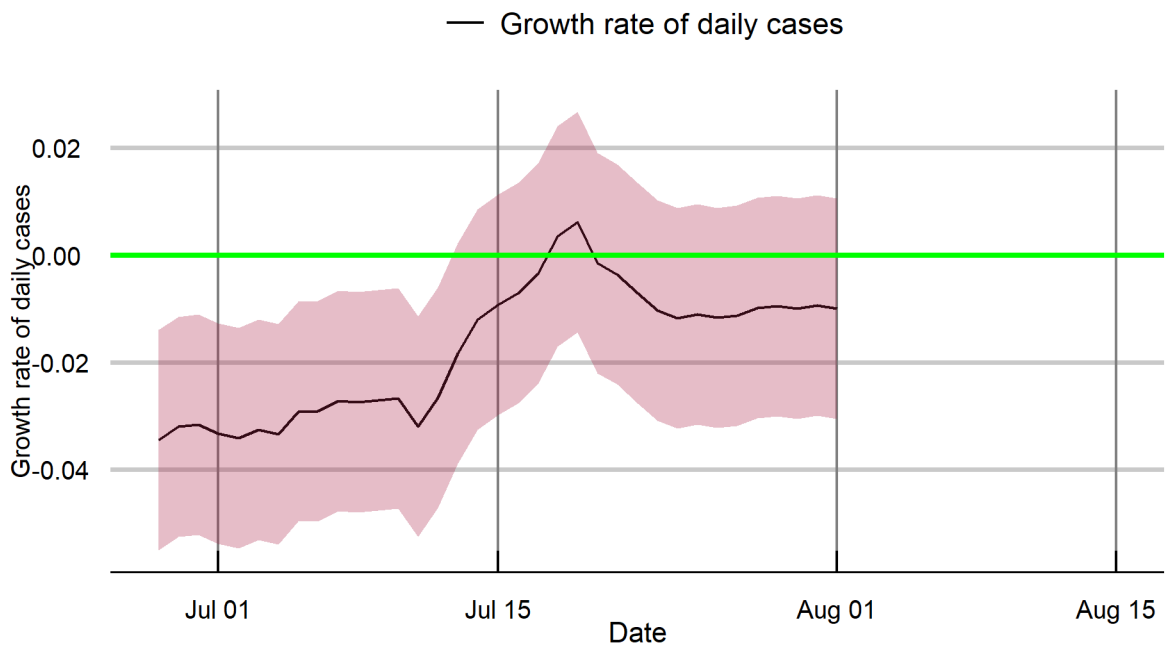
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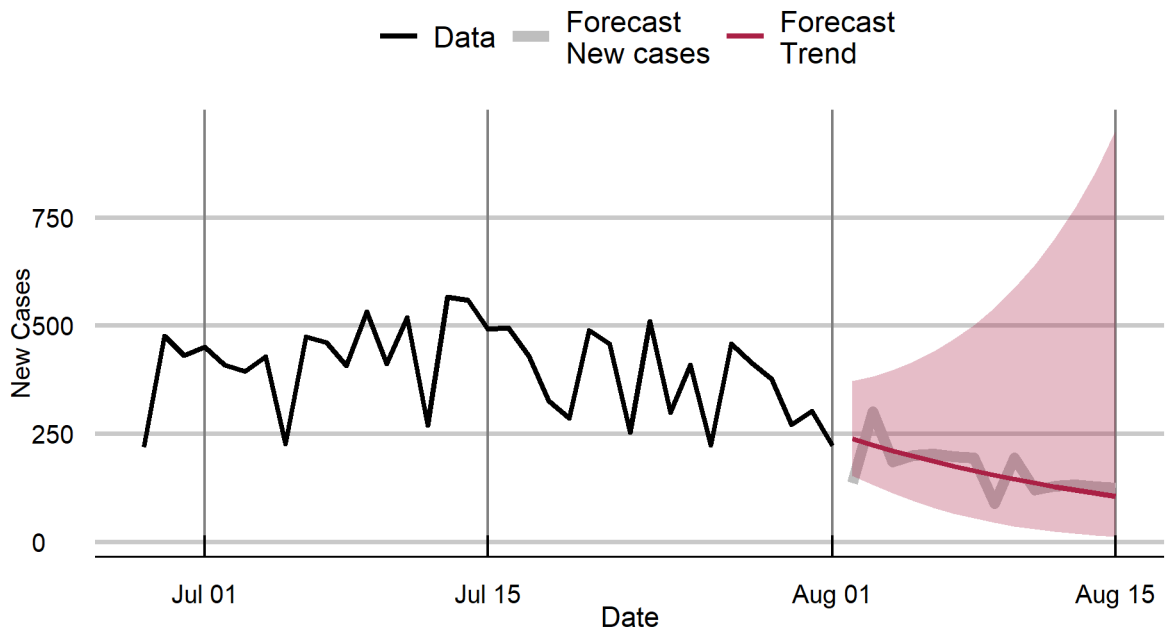
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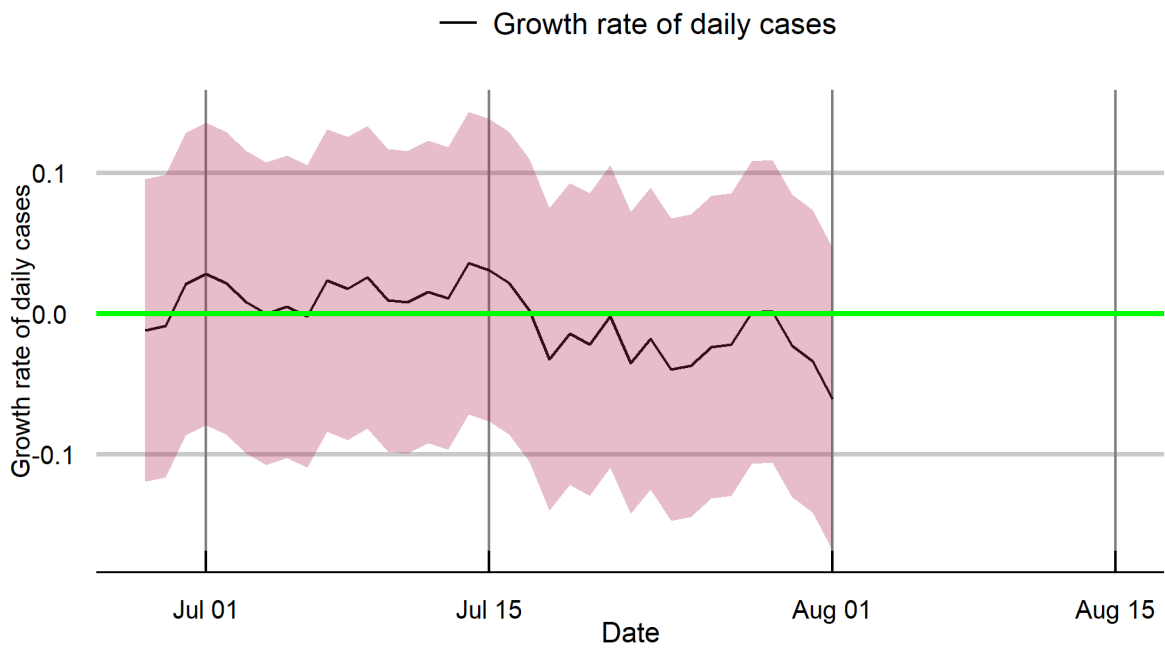
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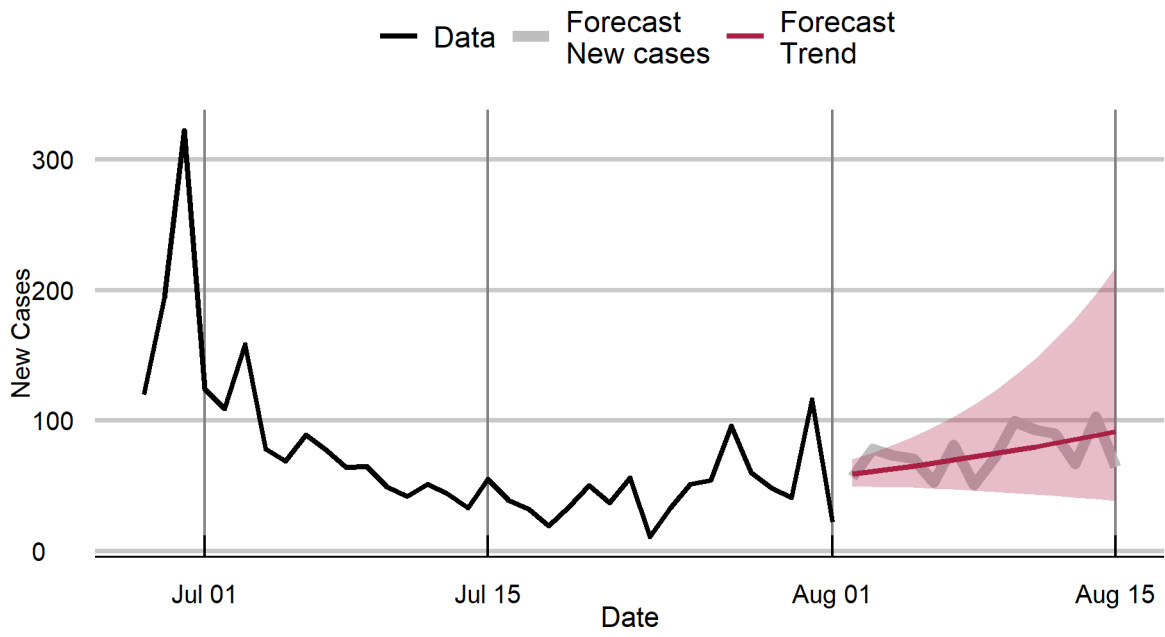
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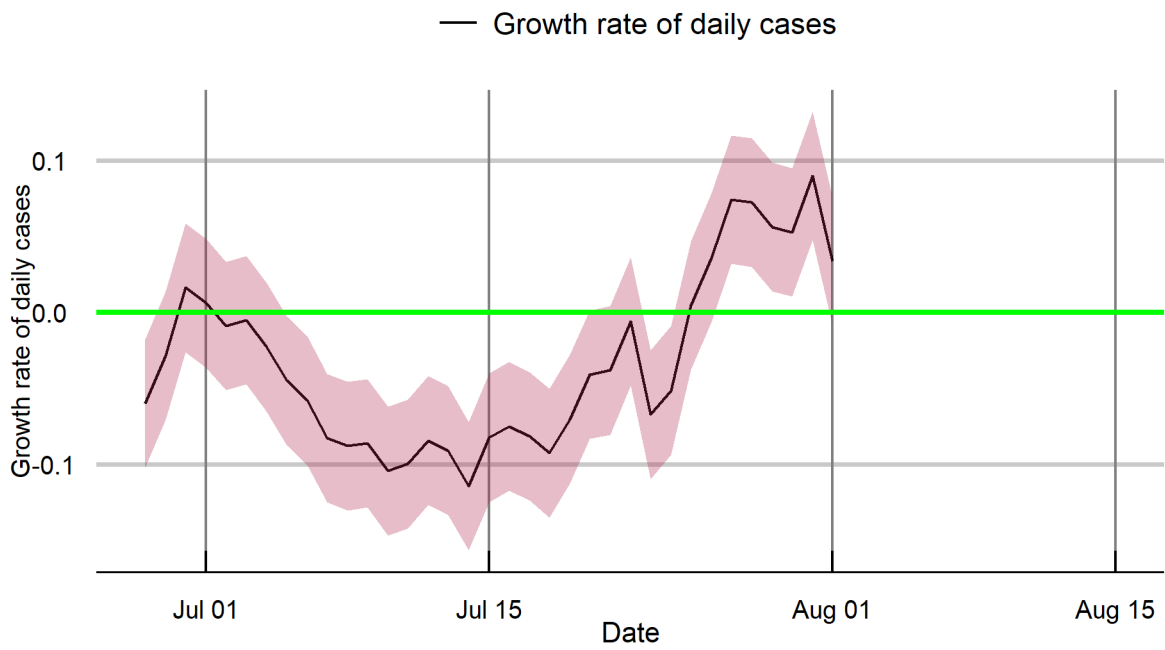
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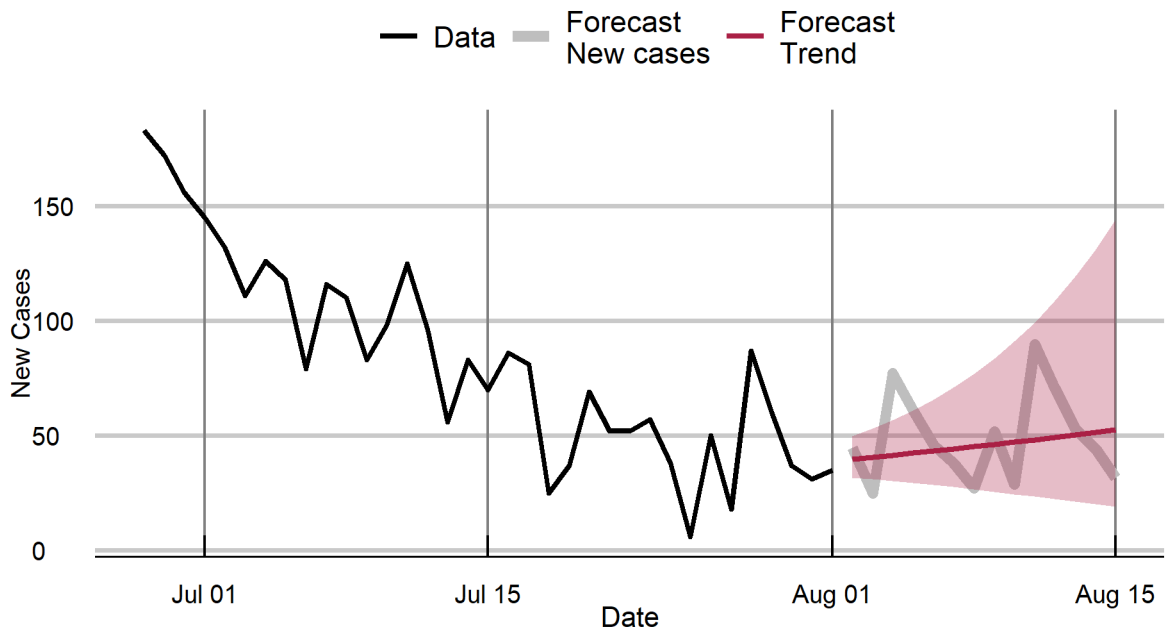
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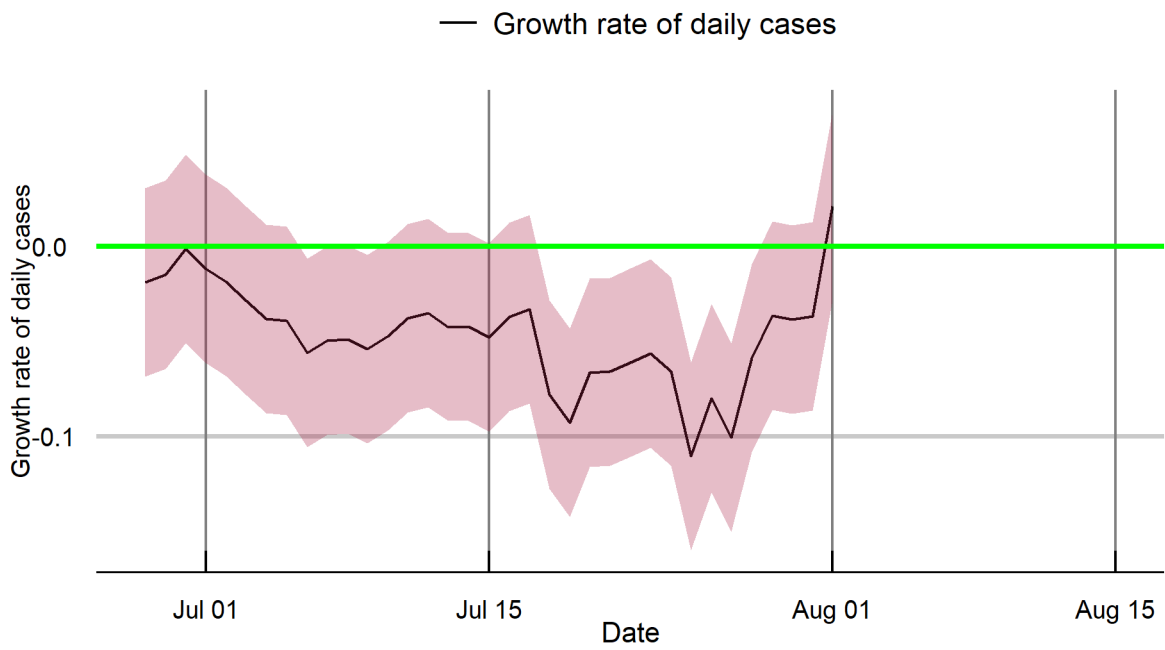
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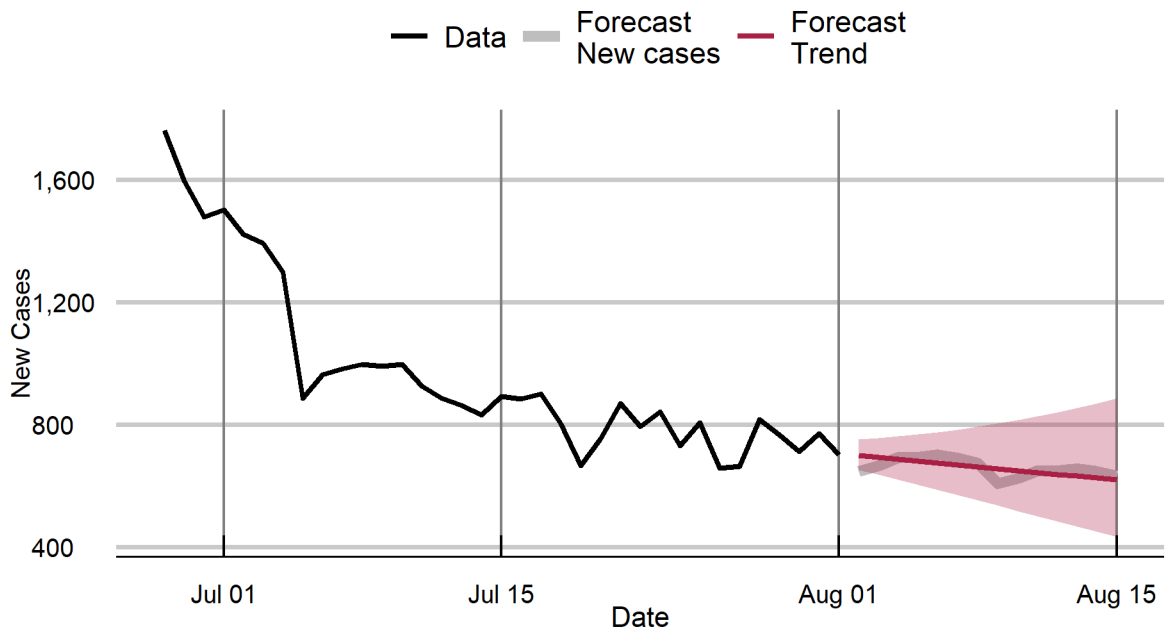
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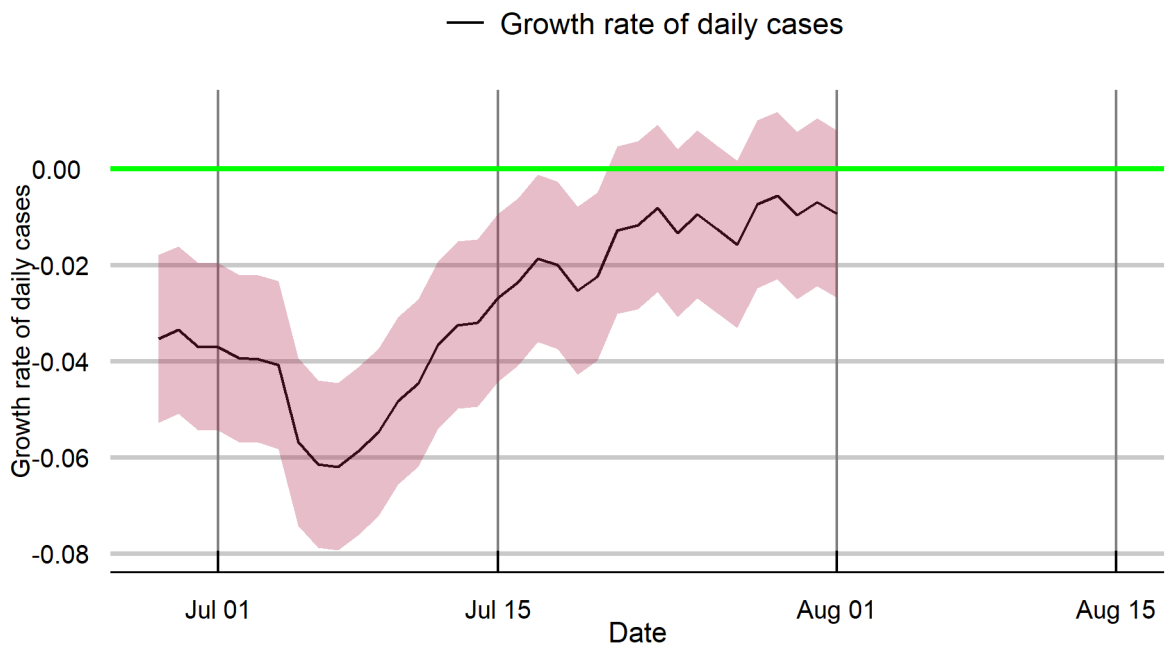
The nature of growth in new cases:

States with accelerating case numbers (increasing growth rates of cases)

Delhi: Probability that cases are accelerating as on 2021-08-01 : 0.7

2021-07-19 / 2021-08-01

Jul 19 2021   Jul 21 2021   Jul 23 2021   Jul 25 2021   Jul 27 2021   Jul 29 2021   Jul 31 2021
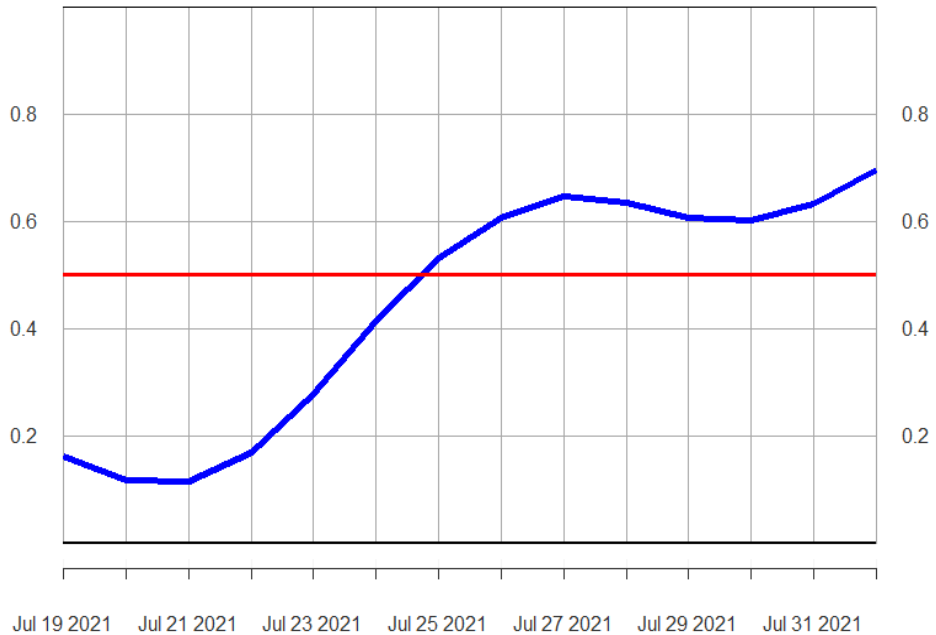
Haryana: Probability that cases are accelerating as on 2021-08-01 : 0.64

2021-07-19 / 2021-08-01

Jul 19 2021   Jul 21 2021   Jul 23 2021   Jul 25 2021   Jul 27 2021   Jul 29 2021   Jul 31 2021
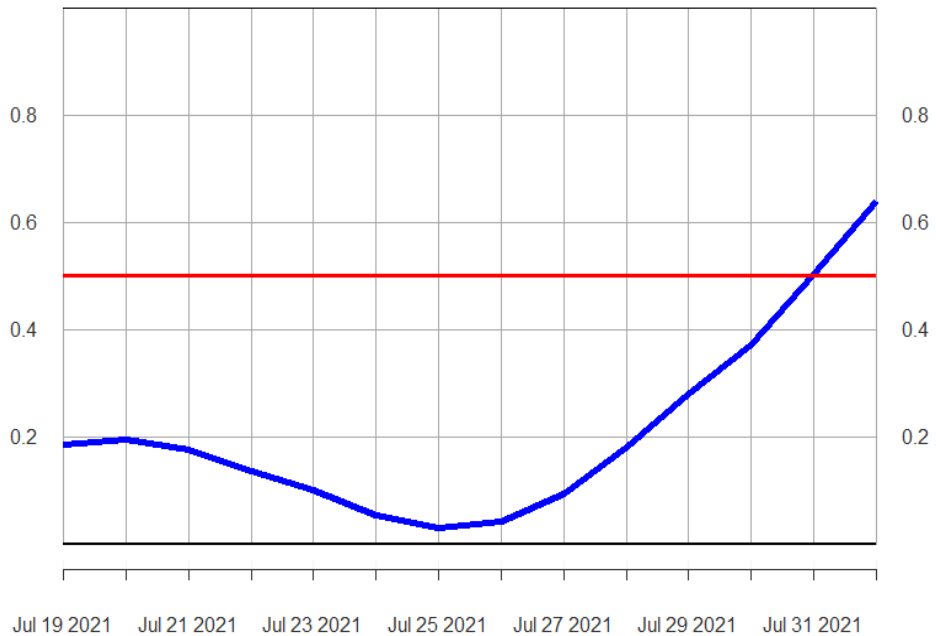
Himachal Pradesh: Probability that cases are accelerating as on 2021-08-01 : 1

2021-07-19 / 2021-08-01

Jul 19 2021　Jul 21 2021　Jul 23 2021　Jul 25 2021　Jul 27 2021　Jul 29 2021　Jul 31 2021
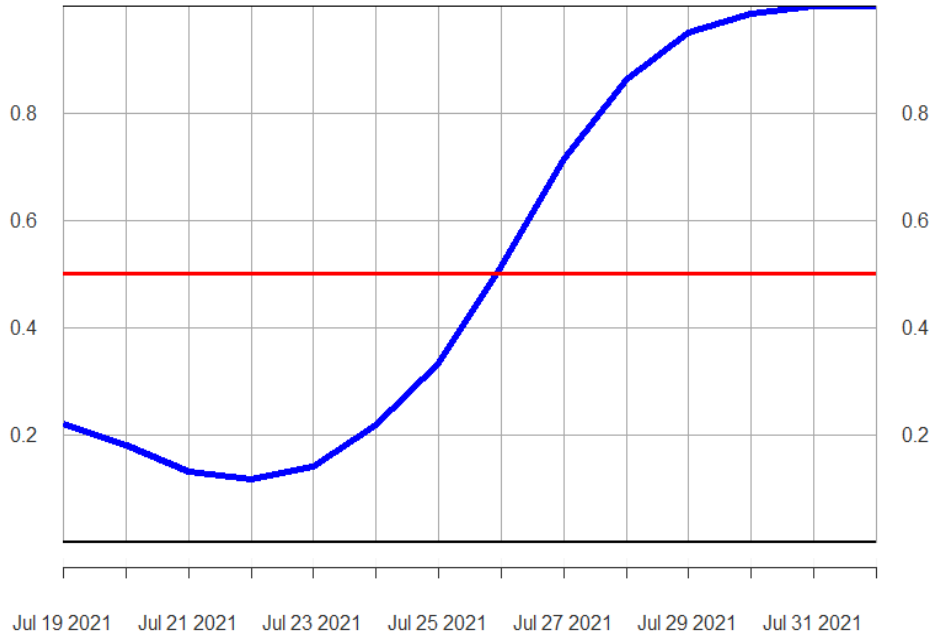
Jammu and Kashmir: Probability that cases are accelerating as on 2021-08-01 : 0.84

2021-07-19 / 2021-08-01

Jul 19 2021　Jul 21 2021　Jul 23 2021　Jul 25 2021　Jul 27 2021　Jul 29 2021　Jul 31 2021
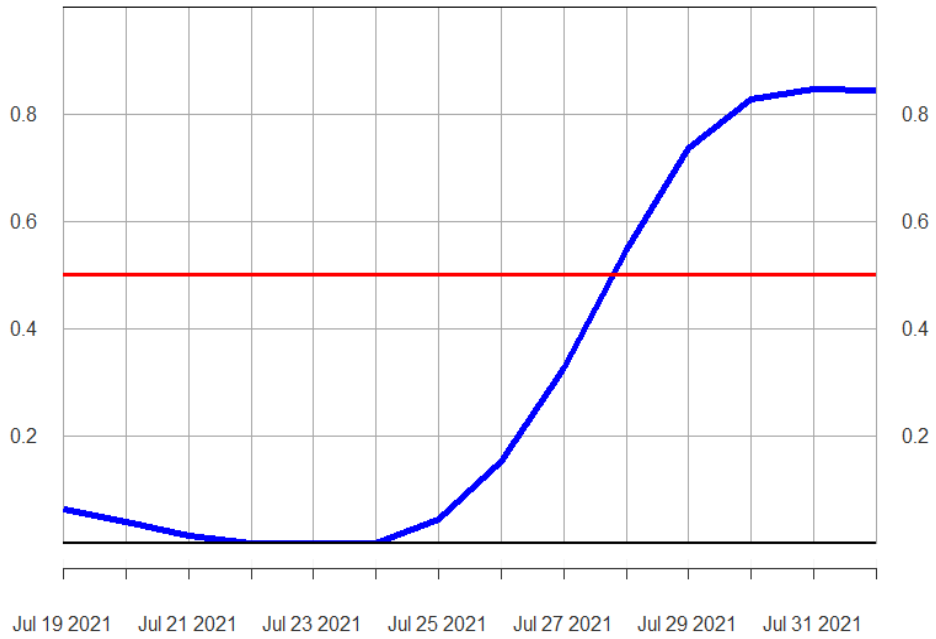
Jharkhand: Probability that cases are accelerating as on 2021-08-01 : 0.57

2021-07-19 / 2021-08-01
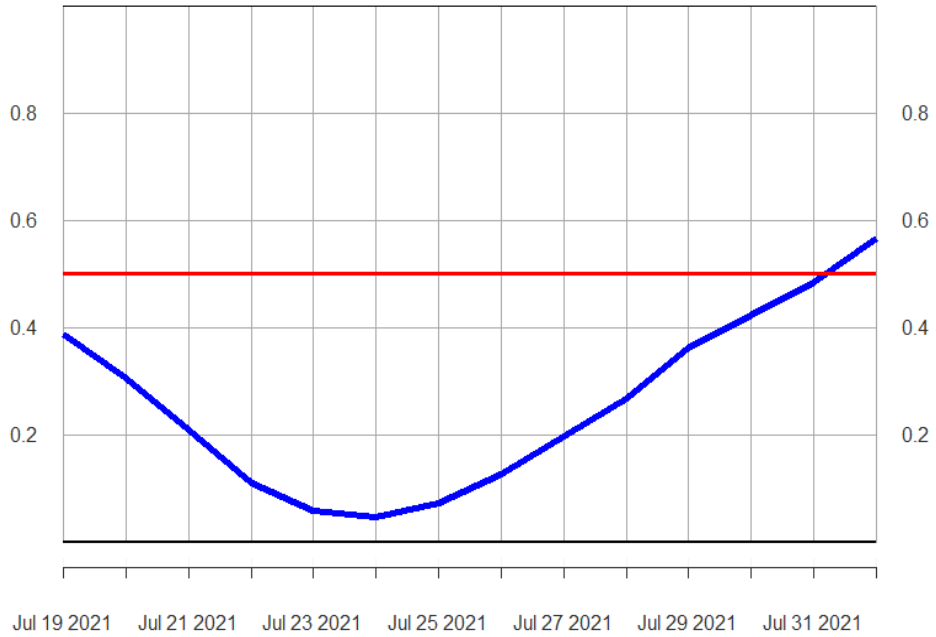
Karnataka: Probability that cases are accelerating as on 2021-08-01 : 0.92

2021-07-19 / 2021-08-01
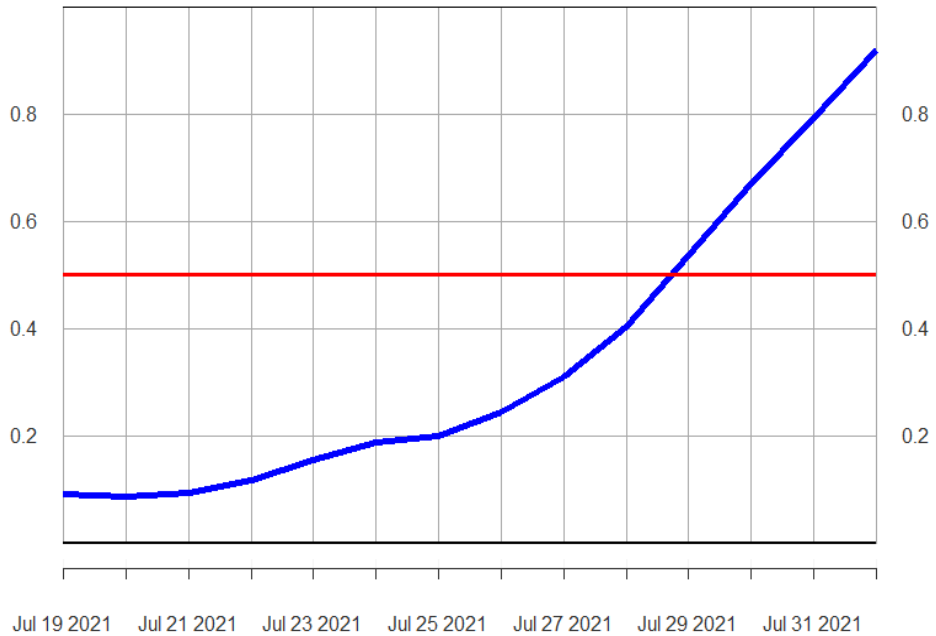
Kerala: Probability that cases are accelerating as on 2021-08-01 : 0.88

2021-07-19 / 2021-08-01
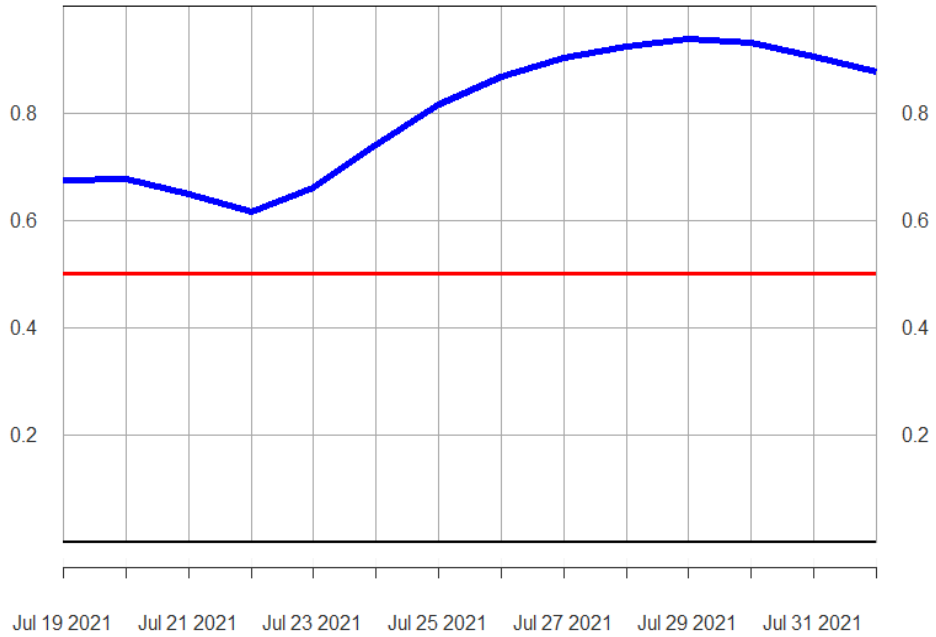
Madhya Pradesh: Probability that cases are accelerating as on 2021-08-01 : 0.89

2021-07-19 / 2021-08-01
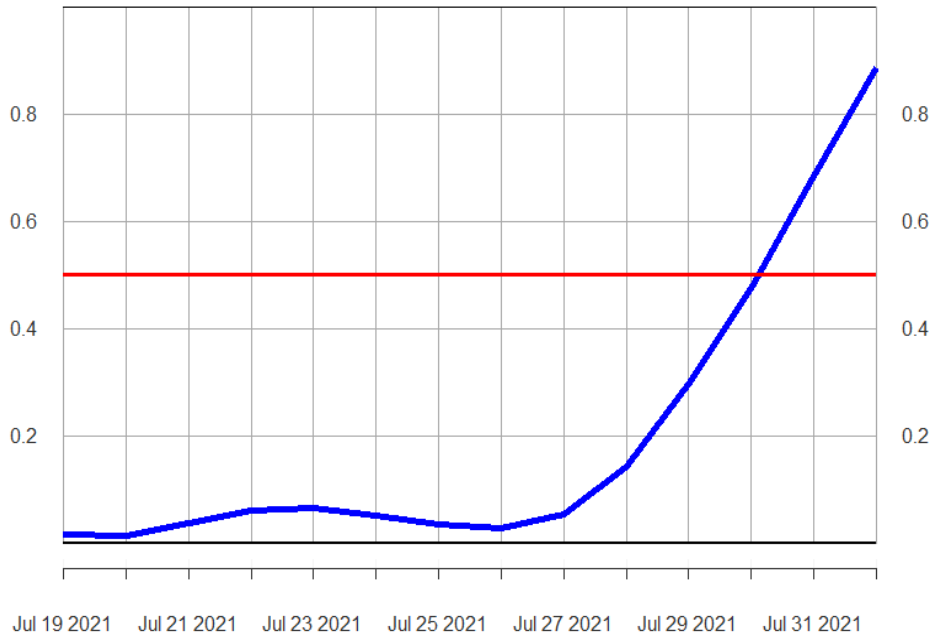
Tamil Nadu: Probability that cases are accelerating as on 2021-08-01 : 0.67

2021-07-19 / 2021-08-01
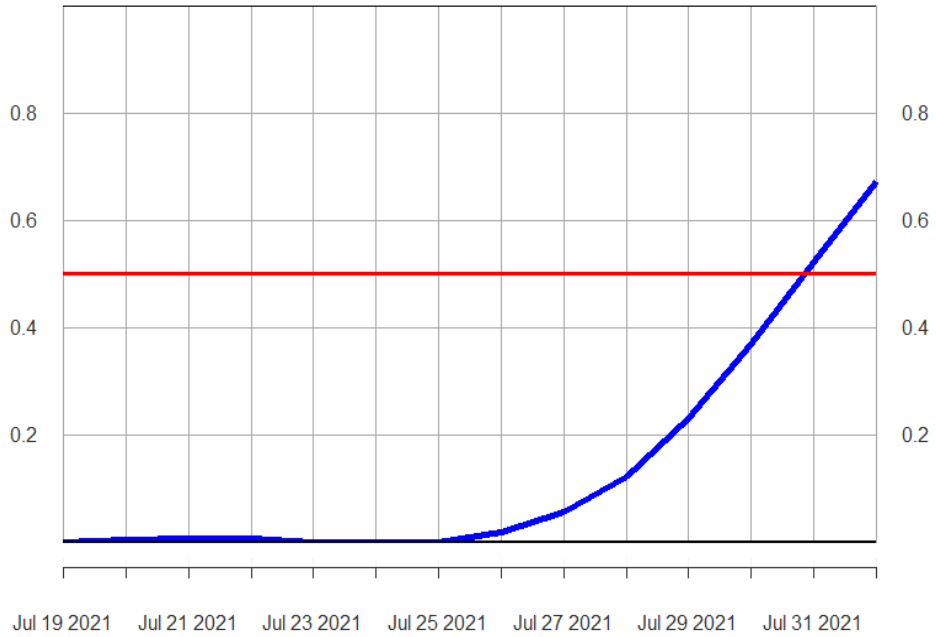
Uttar Pradesh: Probability that cases are accelerating as on 2021-08-01 : 0.56

2021-07-19 / 2021-08-01

Uttarakhand: Probability that cases are accelerating as on 2021-08-01 : 0.87

2021-07-19 / 2021-08-01

India: Accuracy of last week's forecasts
Mean Absolute Percentage Error: 12.98%

2021-07-26 / 2021-08-01

Notes

Data: COVID-19 confirmed cases and deaths data are sourced from COVID19-India API: https://api.covid19india.org/

New cases: forecasts. Forecasts above are based on a structural time series model that uses all the data in estimation but adapts to the trend emerging in the most recent period.
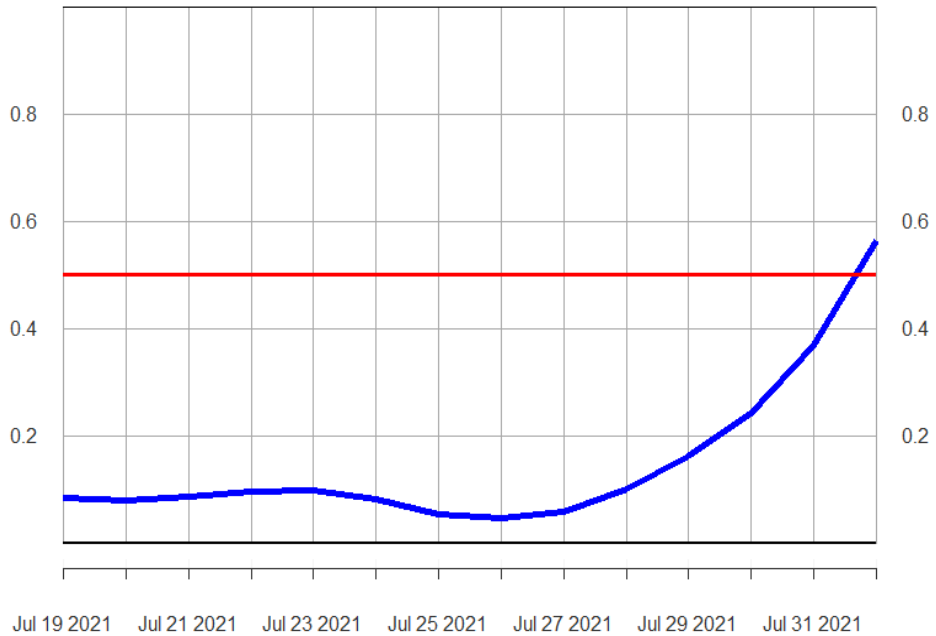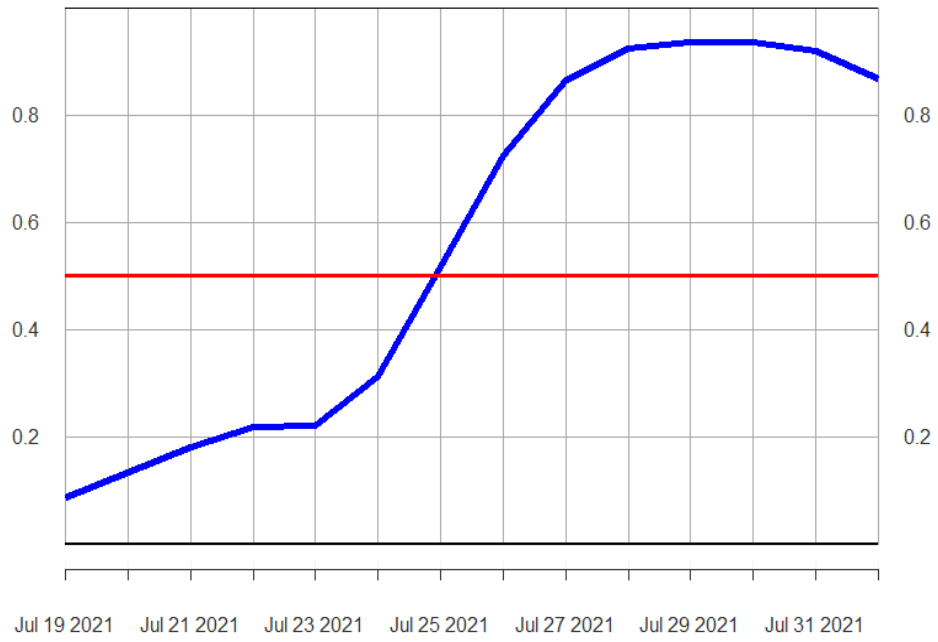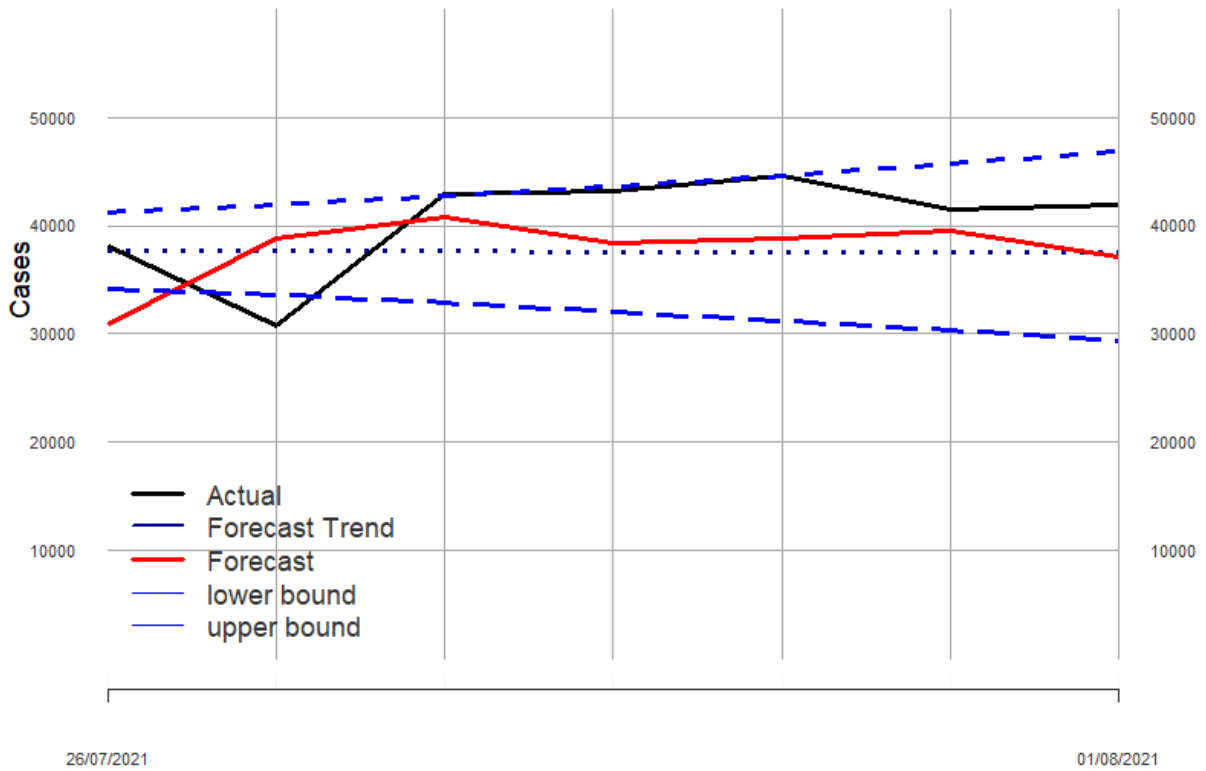
The method is described in: Harvey, A. and P. Kattuman (2020). Time series models based on growth curves with applications to forecasting coronavirus. *Harvard Data Science Review*, Special issue 1 - COVID -19. https://hdsr.mitpress.mit.edu/pub/ozgjx0yn/release/2 , and Harvey, A., P. Kattuman, and C. Thamotheram (2021). Tracking the mutant: forecasting and nowcasting COVID-19 in the UK in 2021. *National Institute Economic Review*. Forthcoming.

Forecast accuracy: is assessed using mean absolute percentage error of the forecasts of cases over the past week. Forecast accuracy will in general be lower for the smaller states / union territories. It is important to pay attention to the confidence intervals around the forecasts. The coverage of the confidence intervals presented is 68%, implying there is 16% probability of the upper bound being exceeded.

New cases: growth rate. The filtered trends presented for daily growth rates of cases are estimated using the Kalman filter, applied to the observed series. The method filters out day of the week effects and random noise to reveal the underlying signal. Unlike methods such as the moving average, this method adapts the trend to changes in real time and characterises underlying patterns of surges or attenuations that are hidden in the volatile series. The method is described in the papers listed above.

R: The *R*-estimates are based on the nowcast of the growth rate; the estimation approach is described in Harvey, A. and P. Kattuman (2020b). A farewell to R: Time series models for tracking and forecasting epidemics. *Center for Economic Policy Research* (CEPR) working paper, 51. https://cepr.org/content/covid-economics. The confidence interval is based on one standard deviation, with coverage of 68%.

Probability The probability that the growth of new cases is increasing at an increasing rate is extracted from the statistical model. The pandemic phase is of extreme concern when this probability exceeds 0.5.

Note: The accuracy of forecasts rely on the quality of the published data. Further, changes in government pandemic policies and in transmission relevant social behaviour may lead realised numbers to deviate from forecasts.

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