

Cambridge Judge Business School
Cambridge Centre for Health Leadership & Enterprise

COVID-19 TRACKER: INDIA

25 July 2021



Centre for
**Health Leadership
& Enterprise**



This tracker¹ 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.

The effective reproduction number (R_t) for India, which has increased steadily over the past few weeks, now stands at the threshold value of 1. The trend value of the growth rate of new cases has increased to zero. It has become increasingly probable that in the coming days these rising magnitudes will cross the endemic thresholds that they are at now (page 4). The implication is that cases are likely to start increasing in India presently.

Daily reported cases appear to be accelerating in growth in Delhi, Kerala, Manipur, Meghalaya, Mizoram, Sikkim and Uttarakhand (pages 39-41). The growth rates of new cases, though negative as of now, have been rising in some large Indian states. The variation among regional trajectories underlines the importance of locale-specific and targeted infection control policies and operations, with a focus on preventing geographic spill overs.

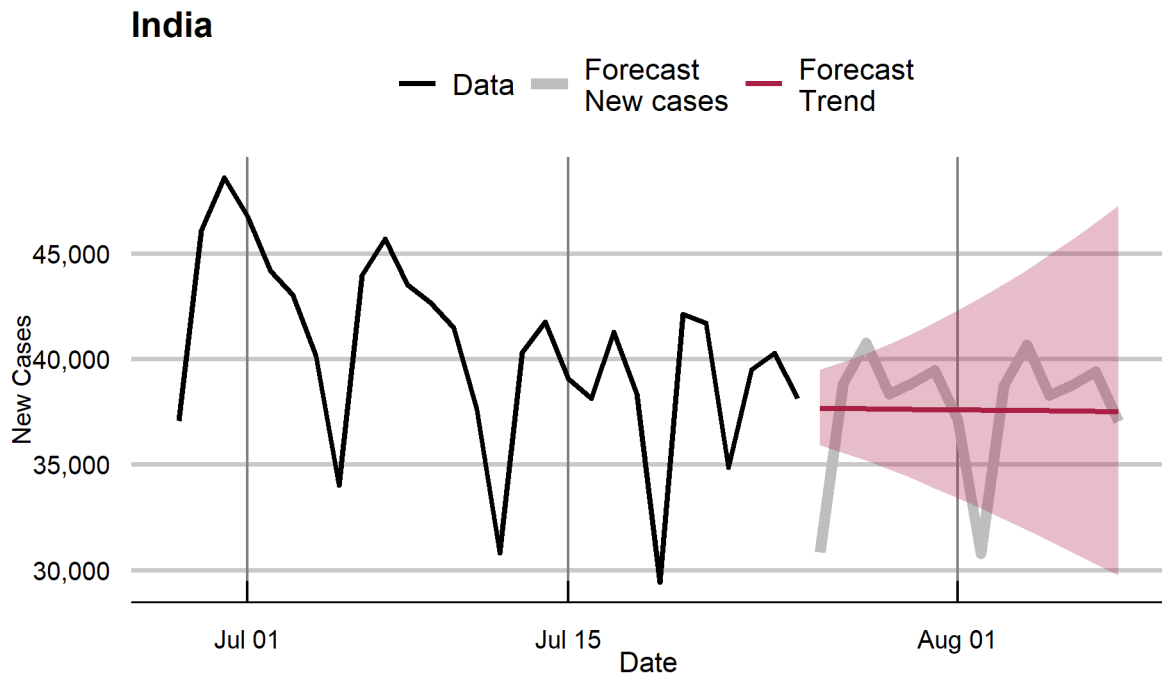
Mean absolute percentage error of the forecasts of daily cases in India given in the July 10 tracker, for the period July 11-17, was 11.4%. The accuracy of forecasts rely on the quality of the reported data. Changes in government pandemic policies and in transmission relevant social behaviour may cause realised numbers to depart from forecasts.

¹ CJBS COVID-19 Tracker for India can be accessed at: www.jbs.cam.ac.uk/covid-india

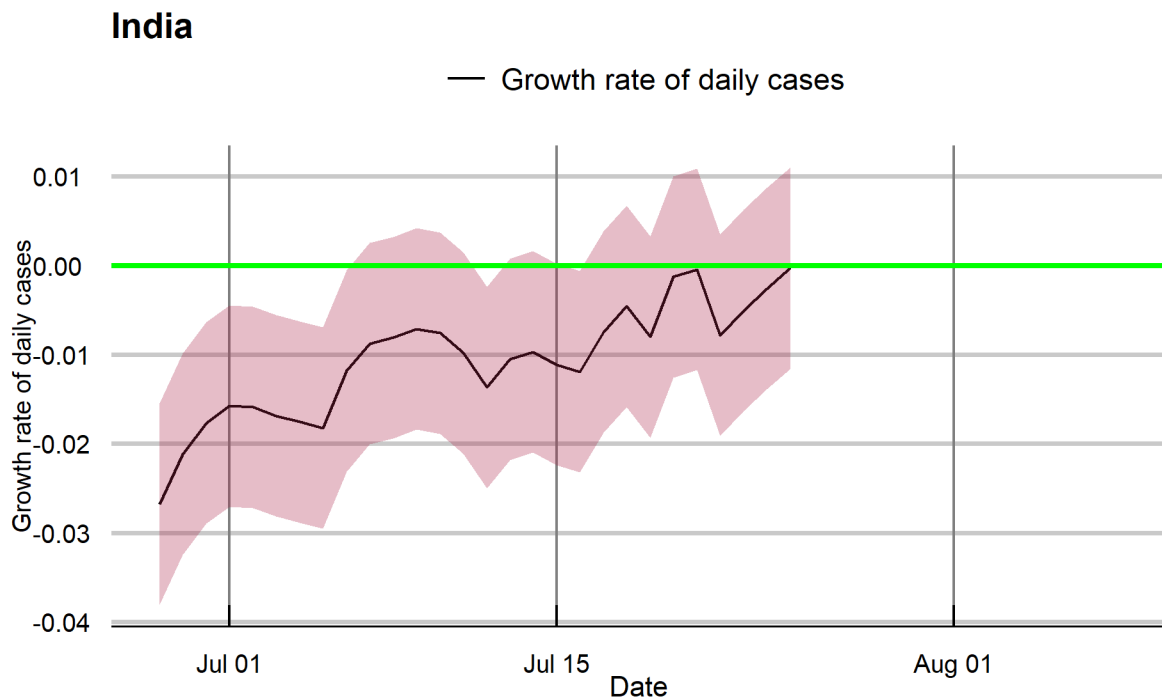
The companion spreadsheet contains all the estimates and forecasts.

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

Daily Covid-19 cases in India: Forecast



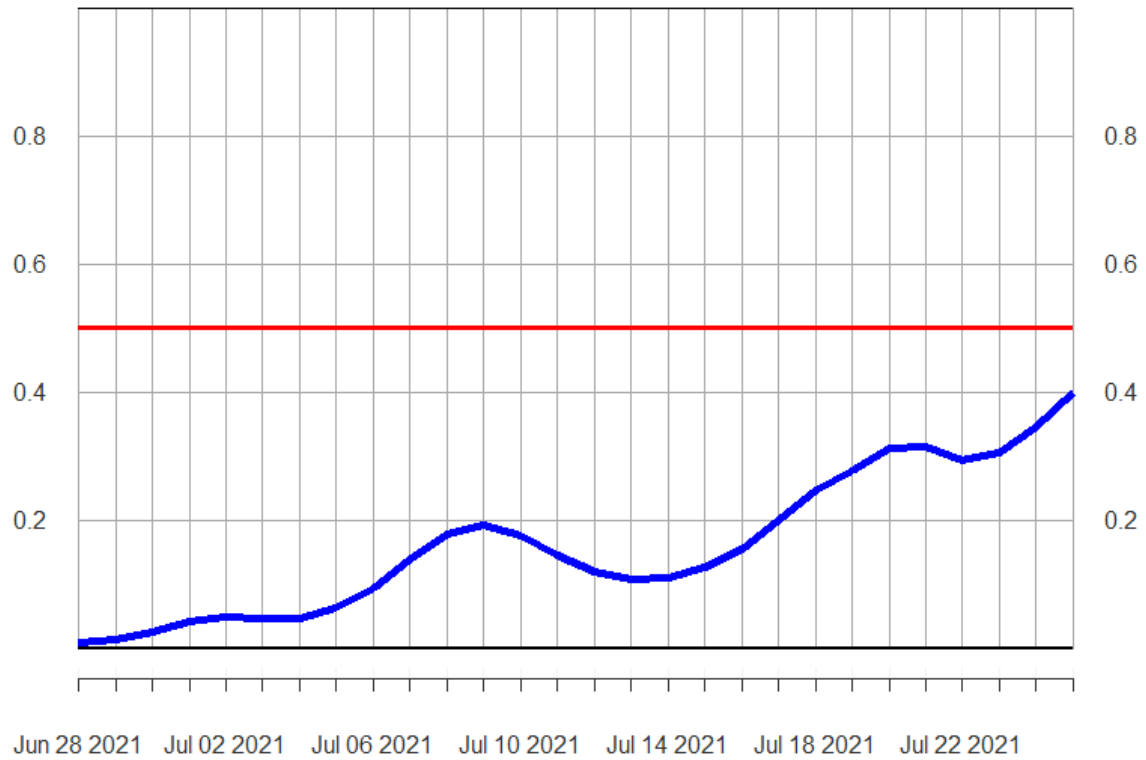
Forecasts of daily new cases for the period 26 July 2021 to 8 August 2021, based on data till 25 July 2021. New COVID-19 cases is likely to be about 37,500 per day by 8 August 2021.



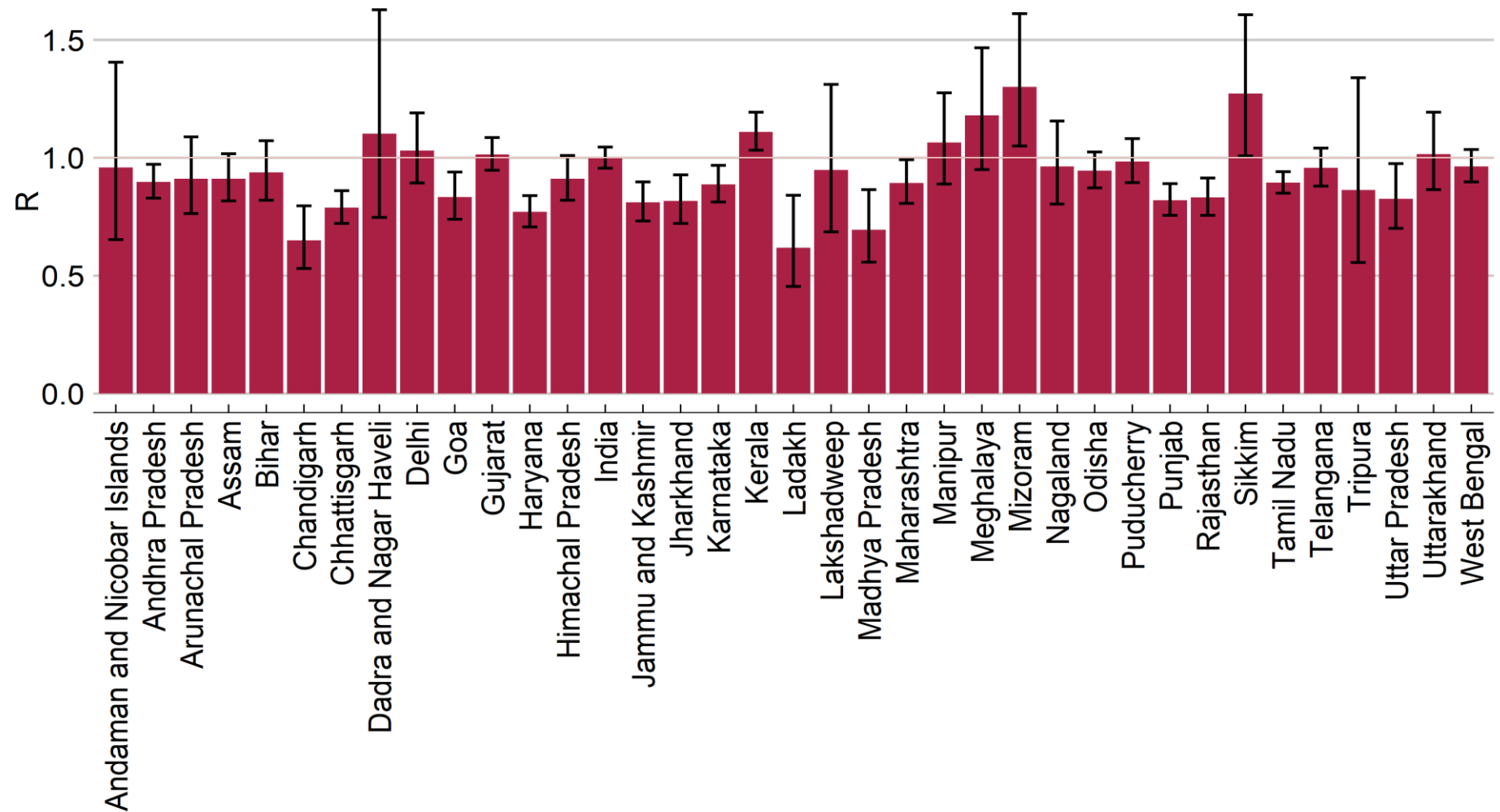
The filtered trend in the growth rate of daily new cases is zero as on 25 July 2021.

**India: Probability that
the case growth rate is accelerating
as on 2021-07-25 : 0.4**

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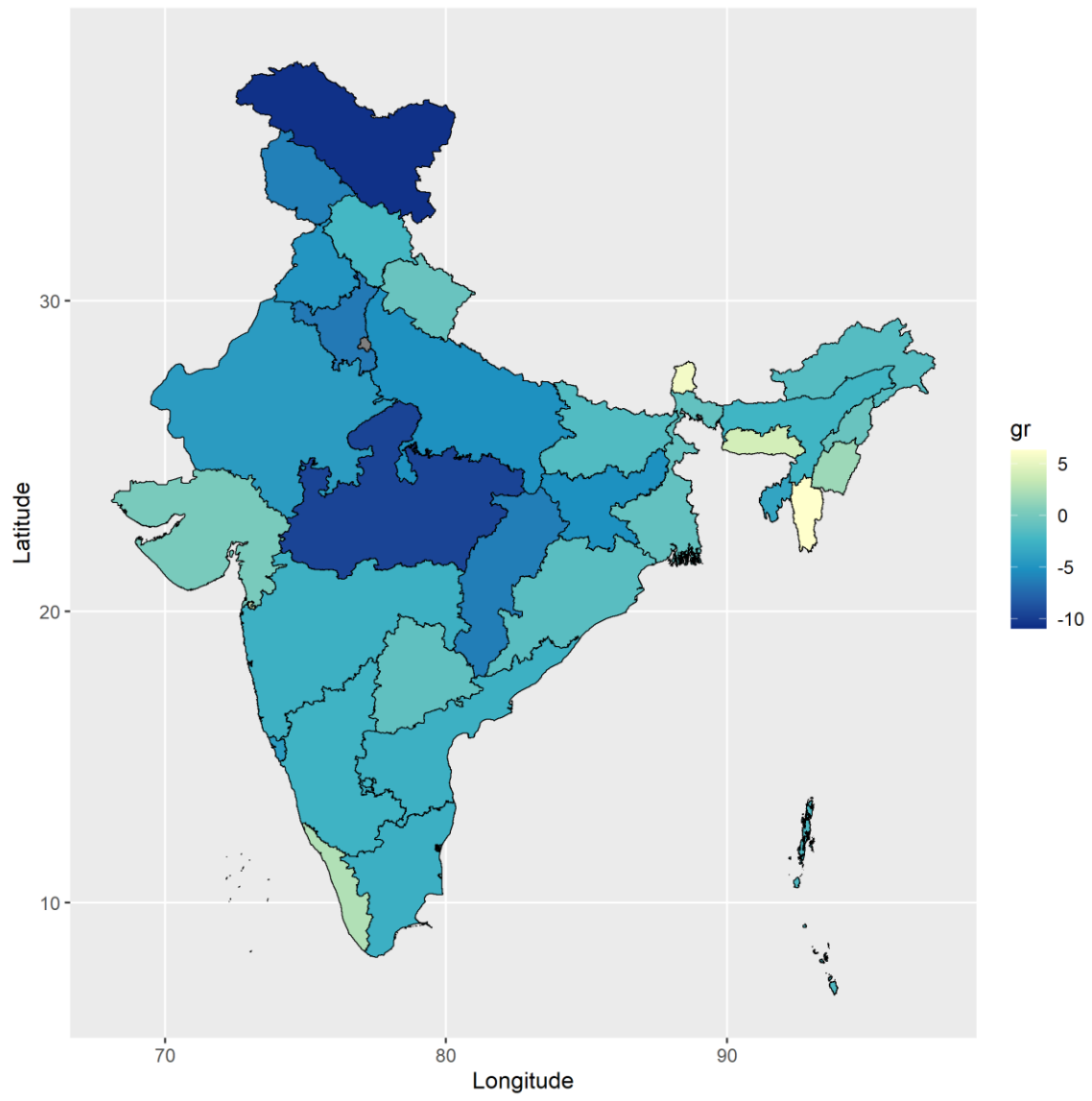


R_t: 25 July 2021



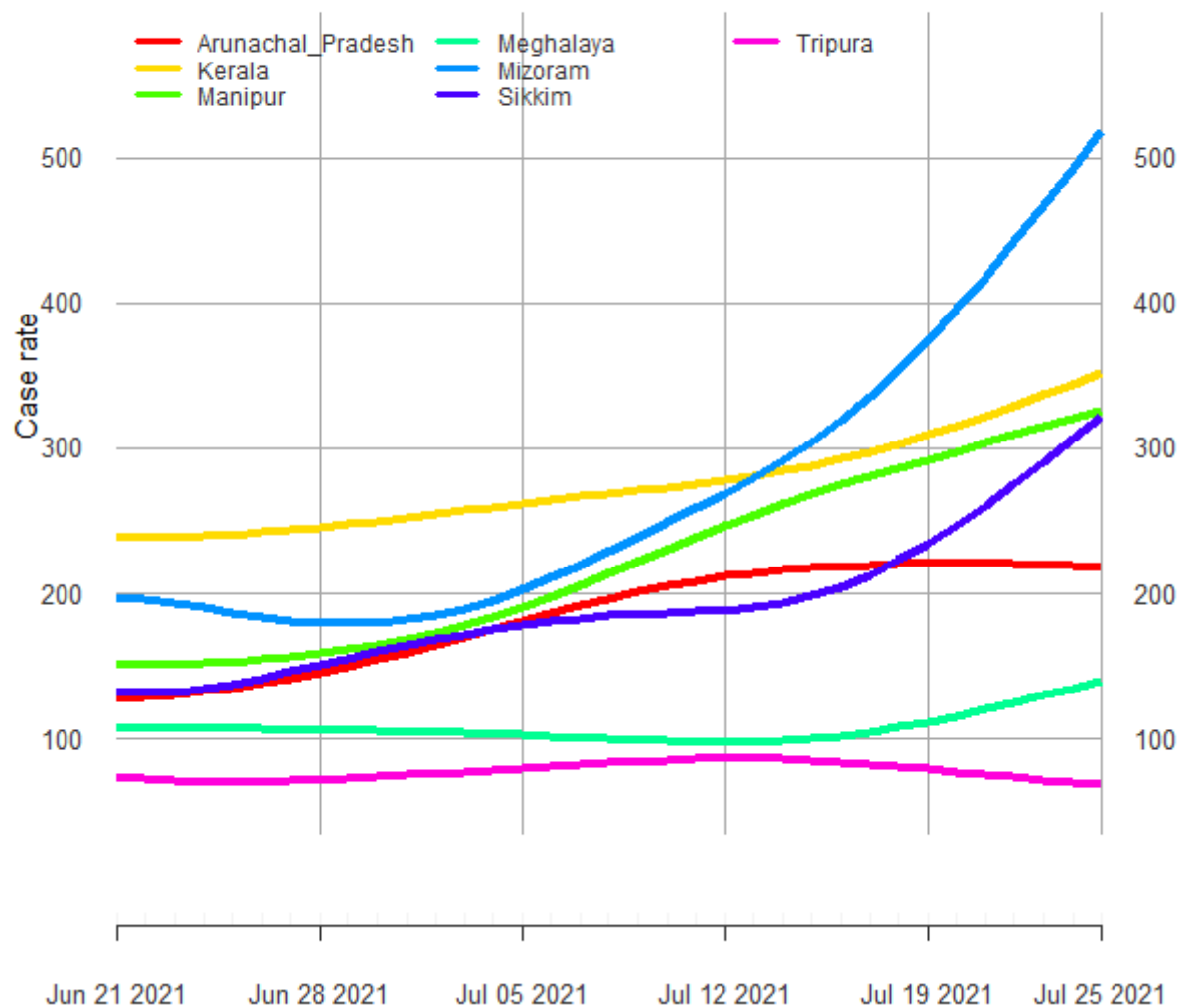
Bar chart shows point estimates of R and the ± 1 standard deviation confidence intervals

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



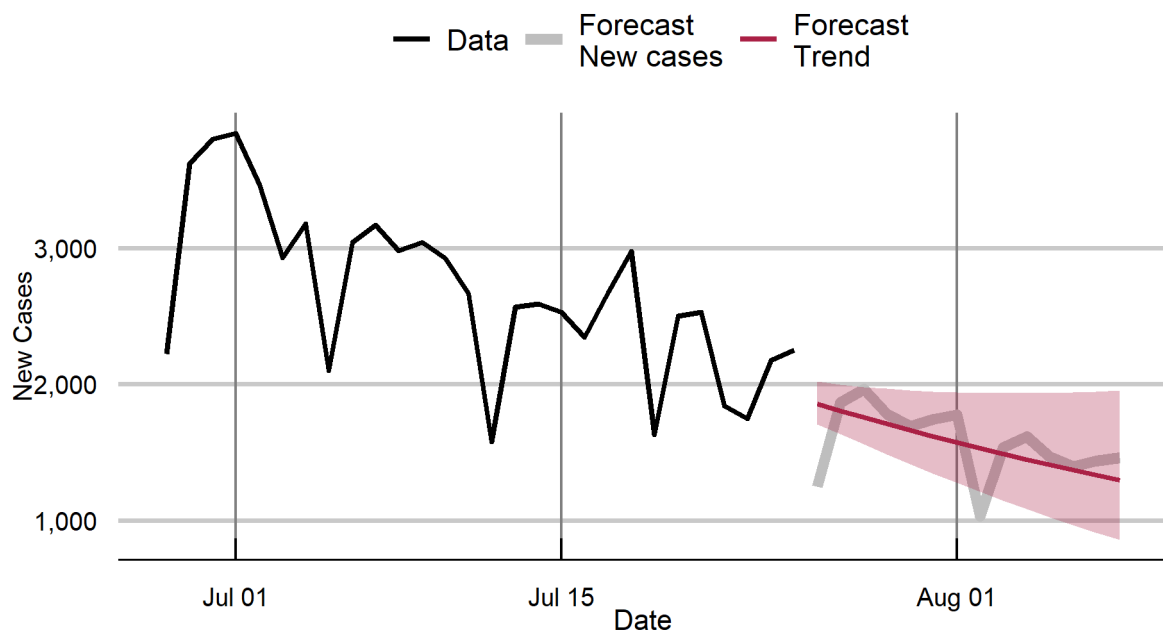
**States with high infection incidence:
Smoothed trends of 7 day case rates
per 100,000 population**

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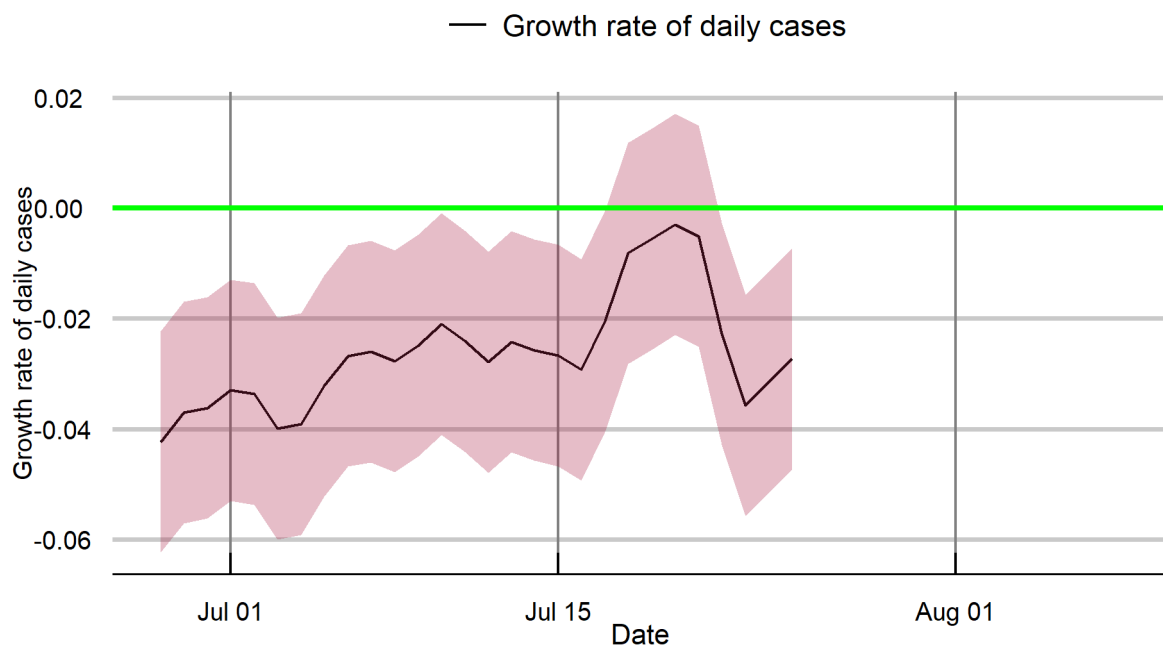


Case forecasts and growth rates: States and Union territories

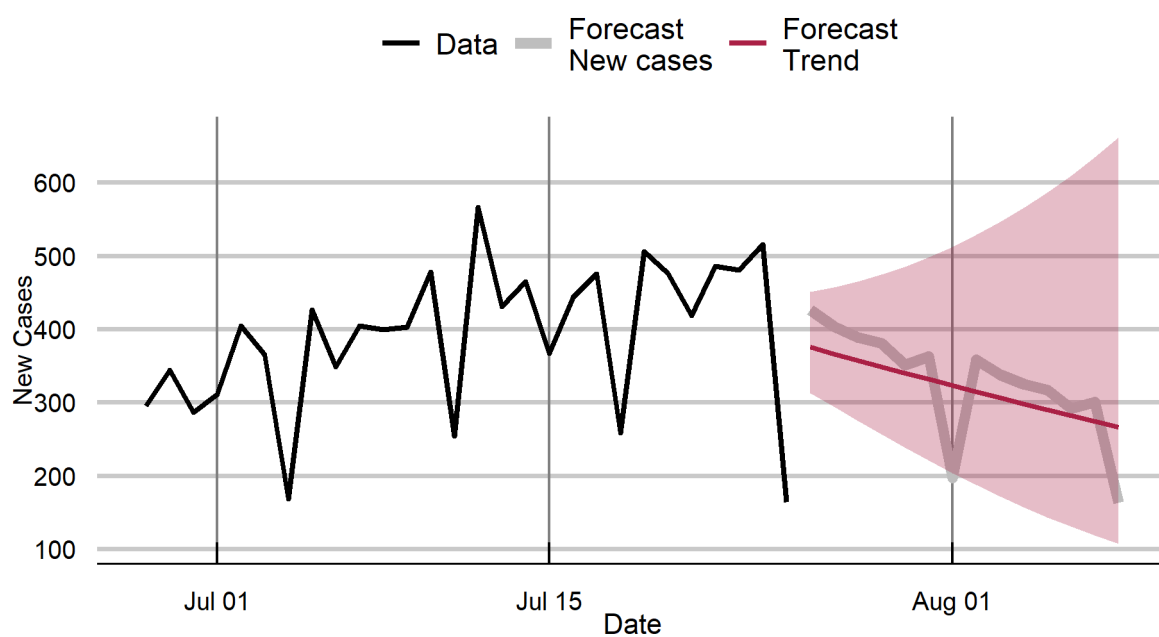
Andhra Pradesh



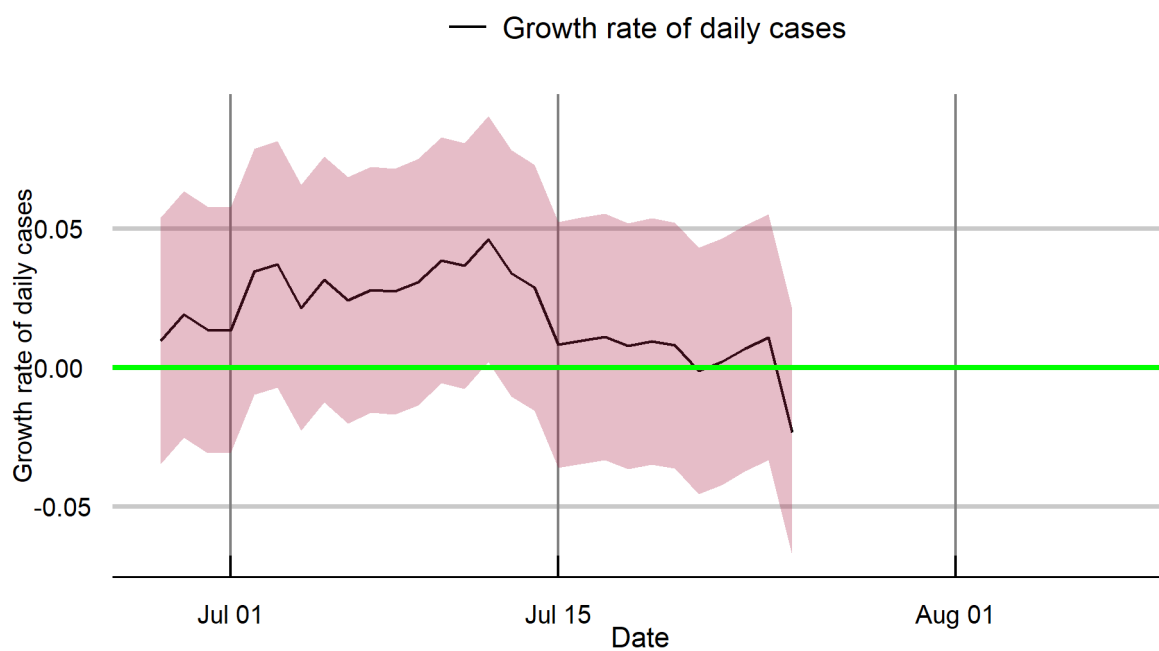
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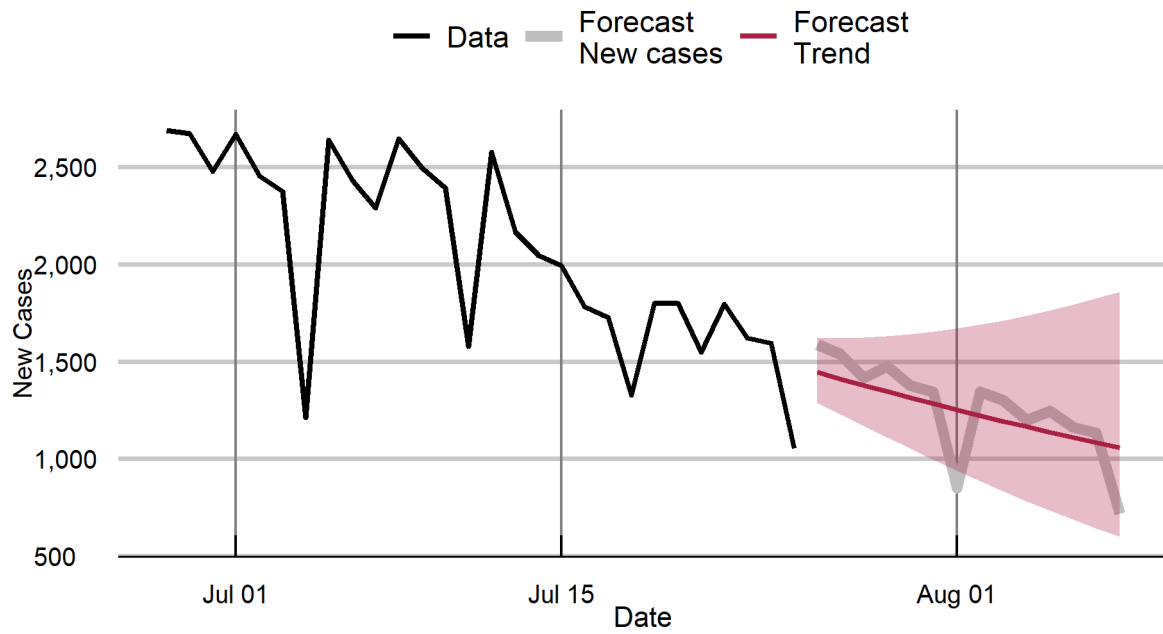
Arunachal Pradesh



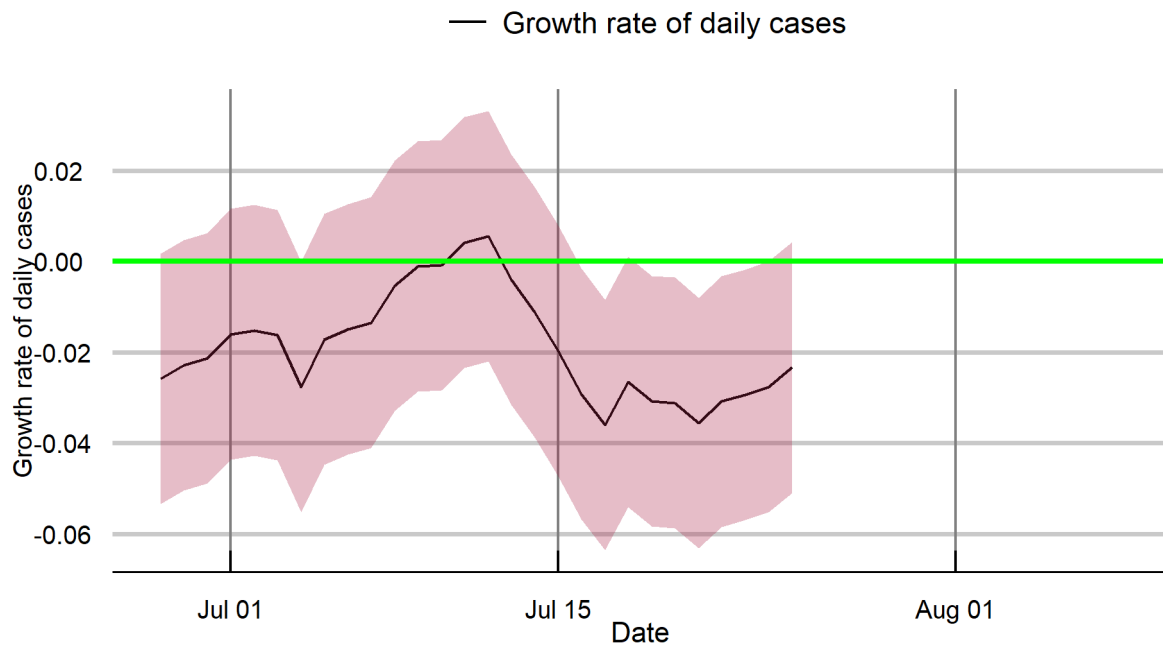
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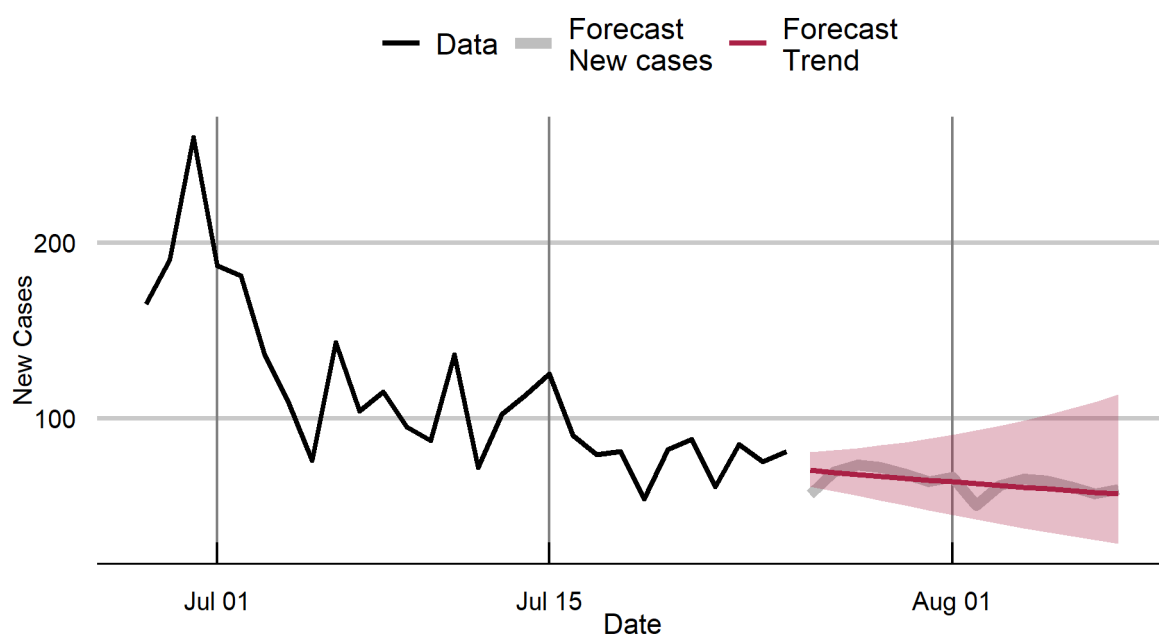
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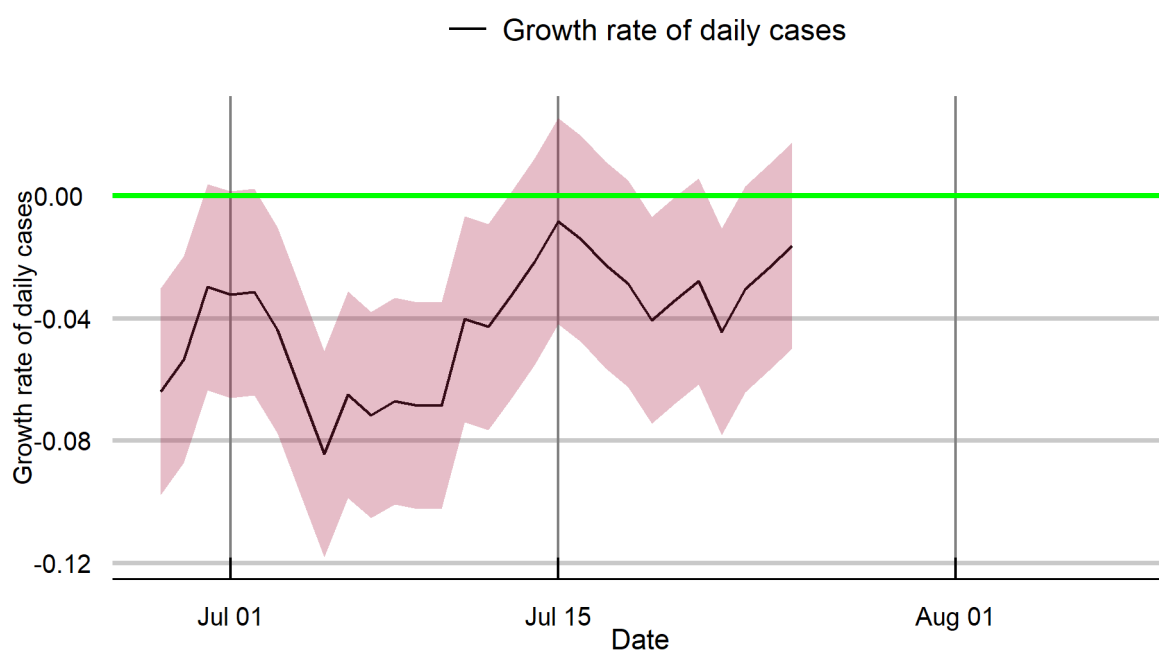
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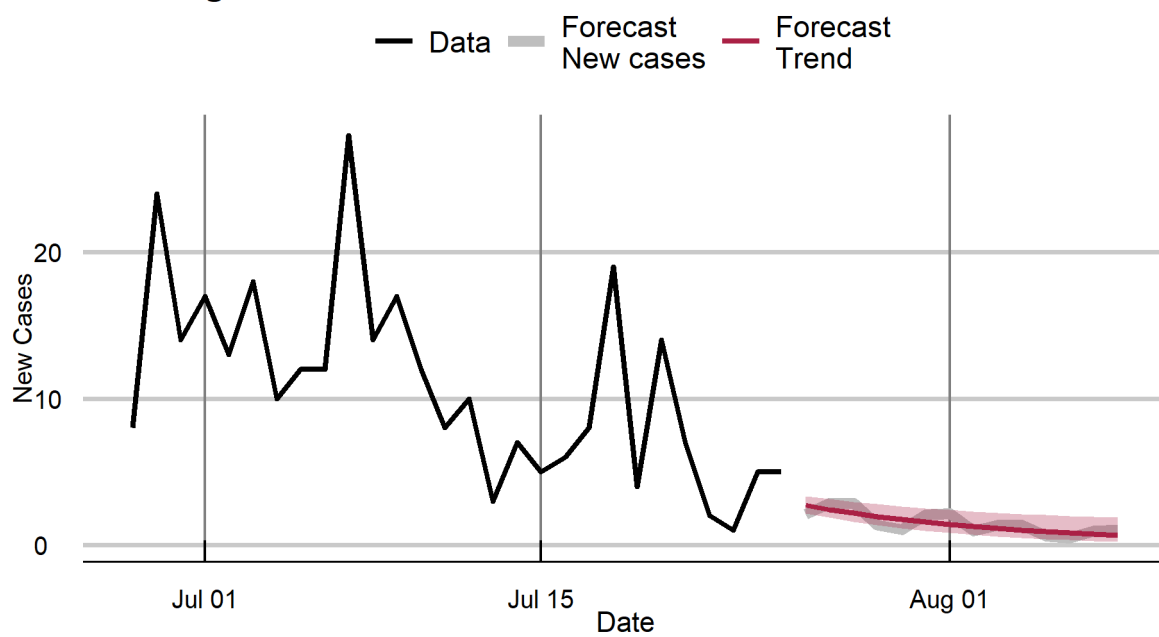
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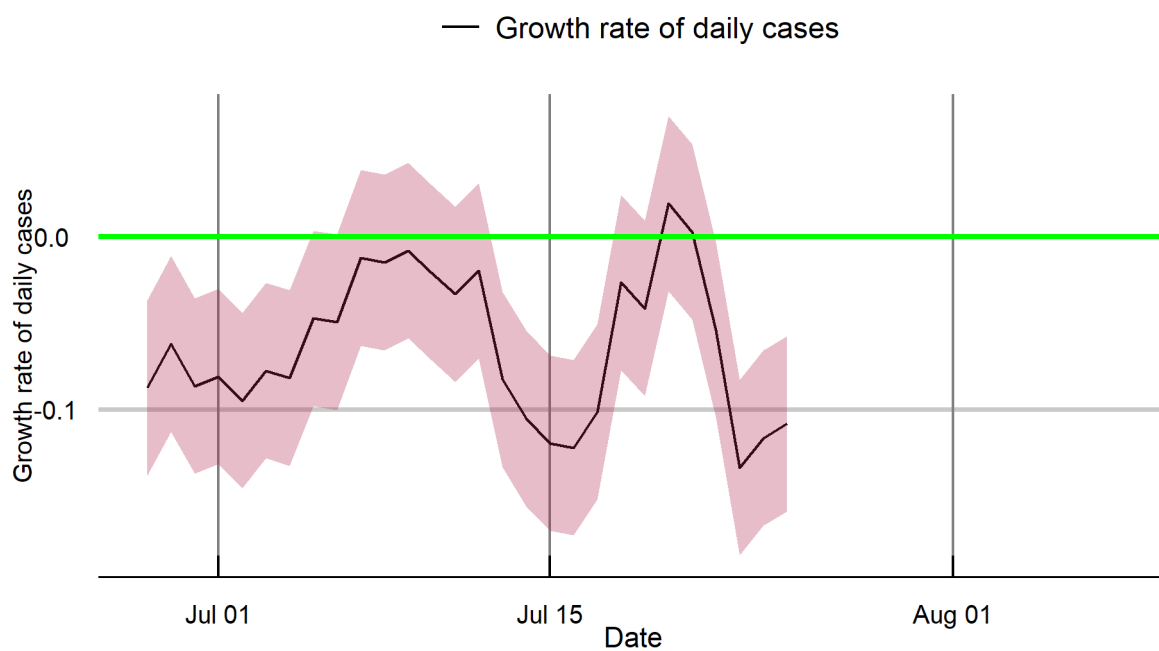
Bihar



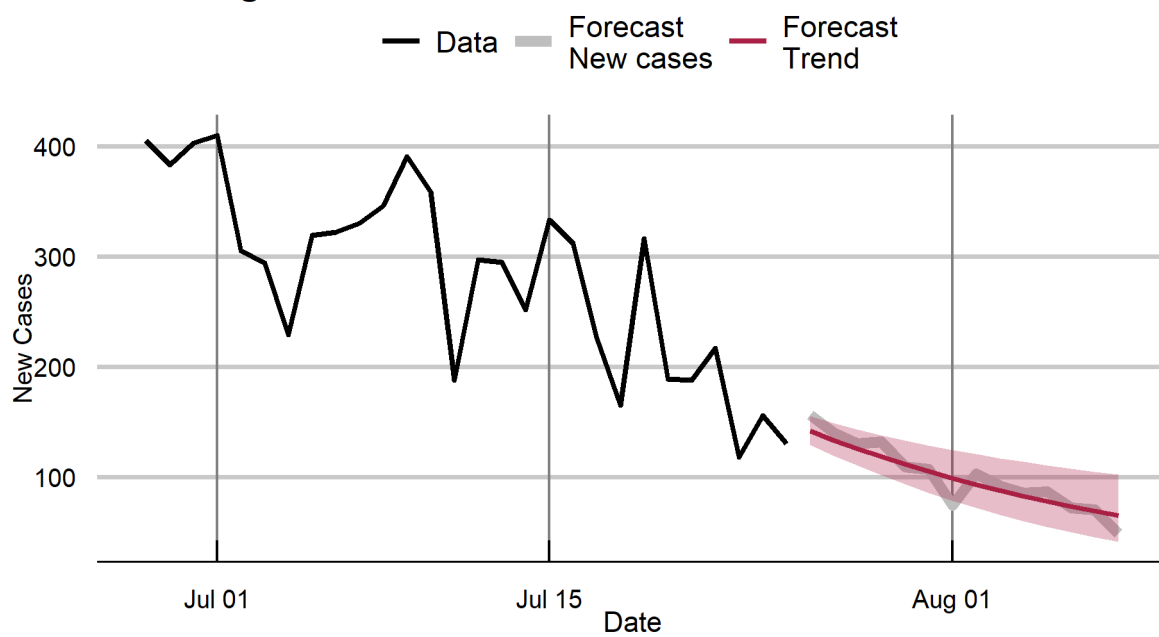
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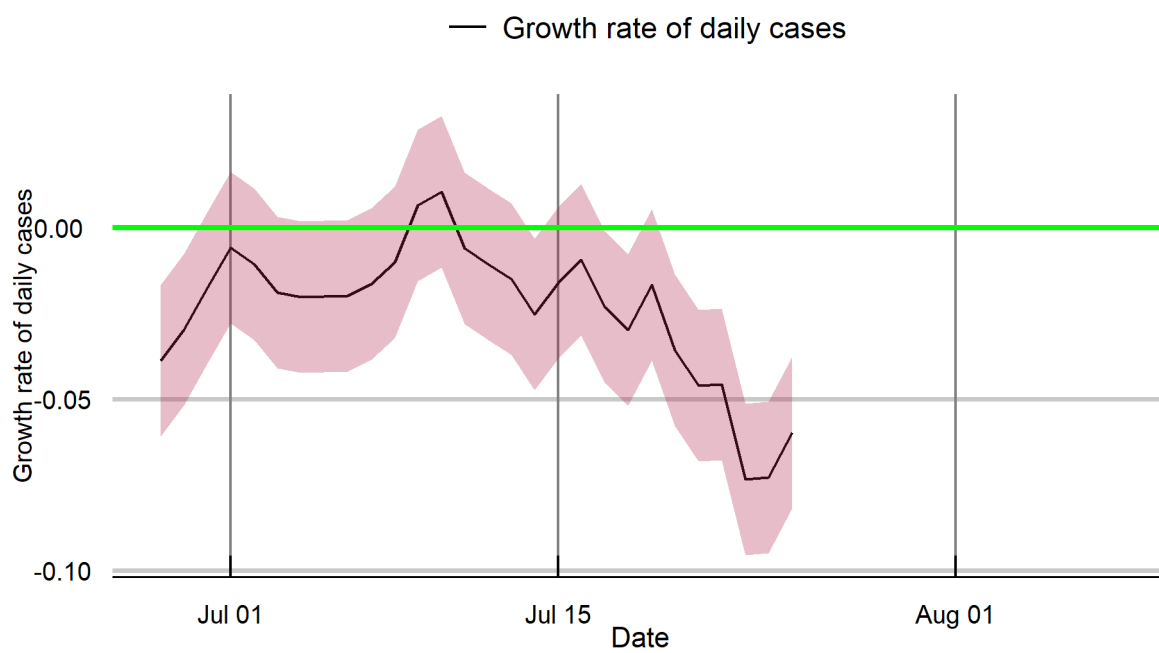
Chandigarh



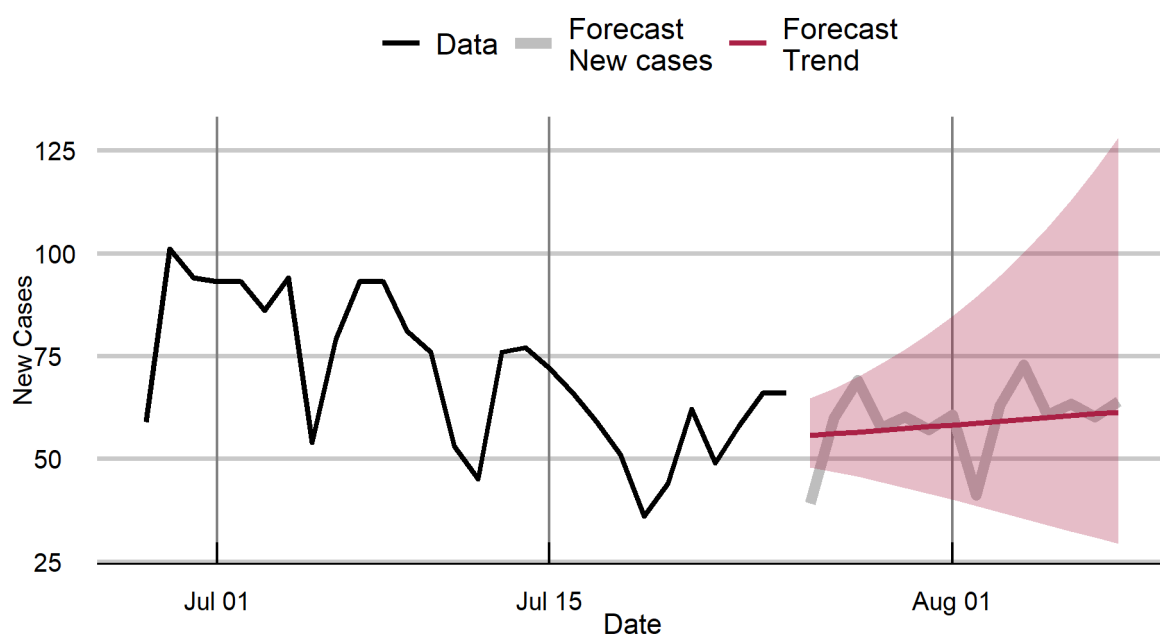
Chhattisgarh



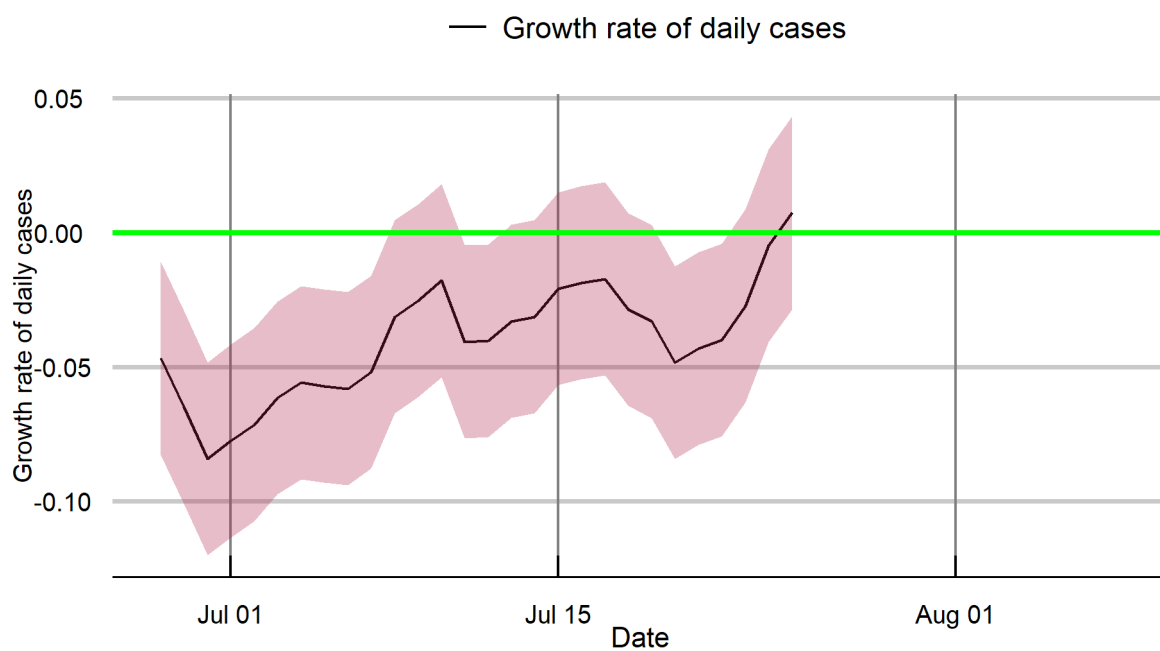
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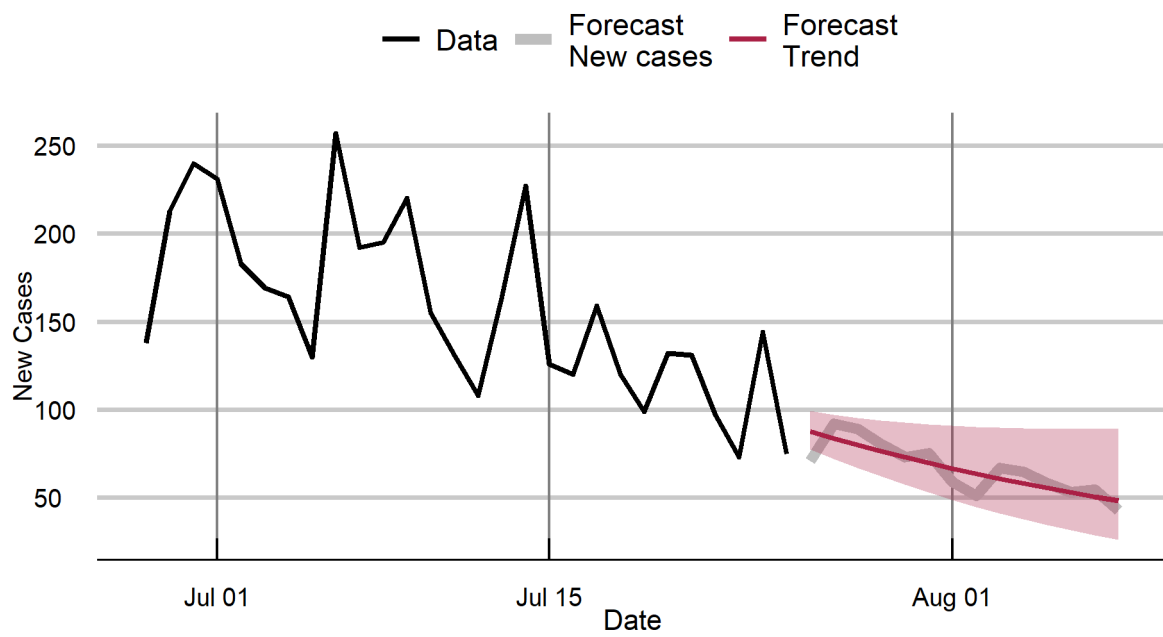
Delhi



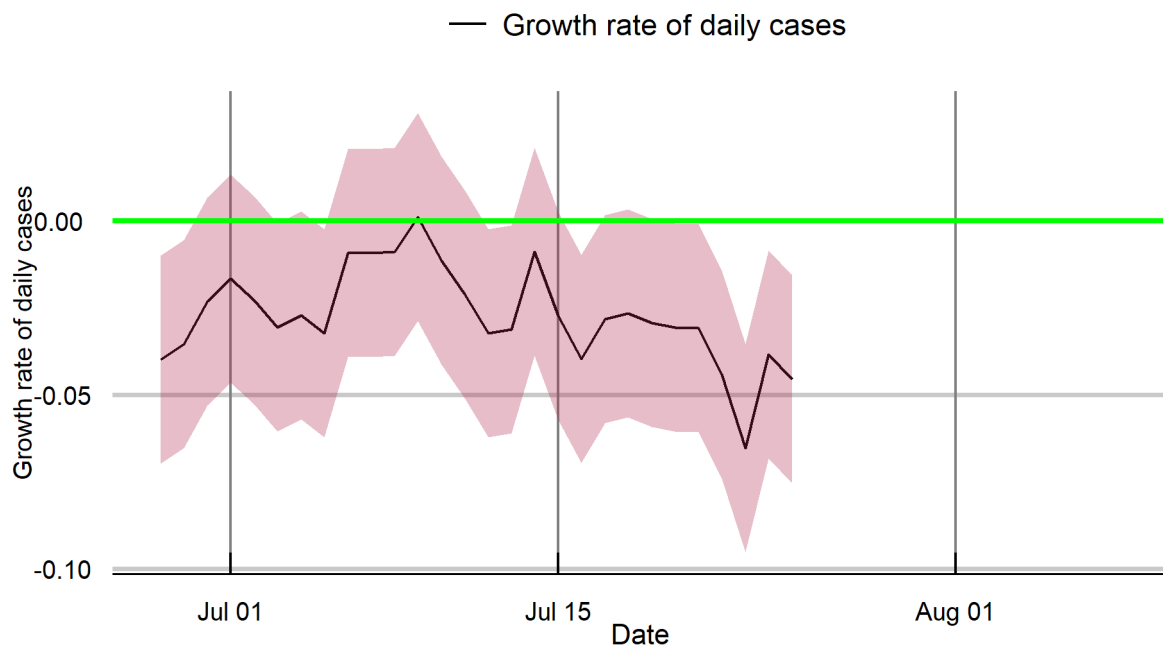
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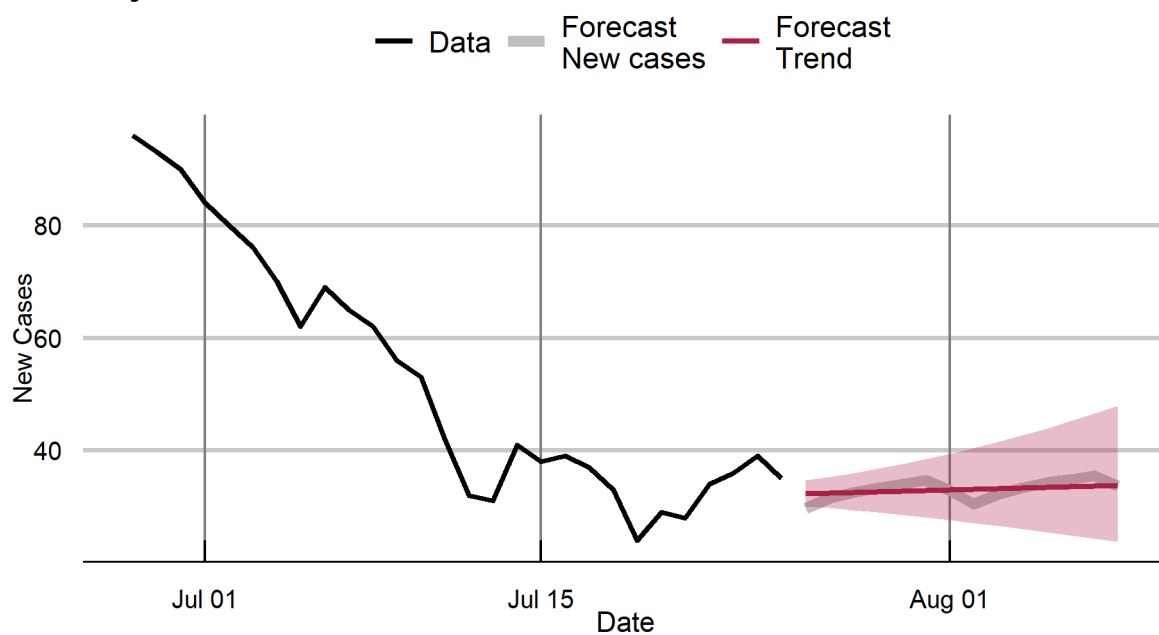
Goa



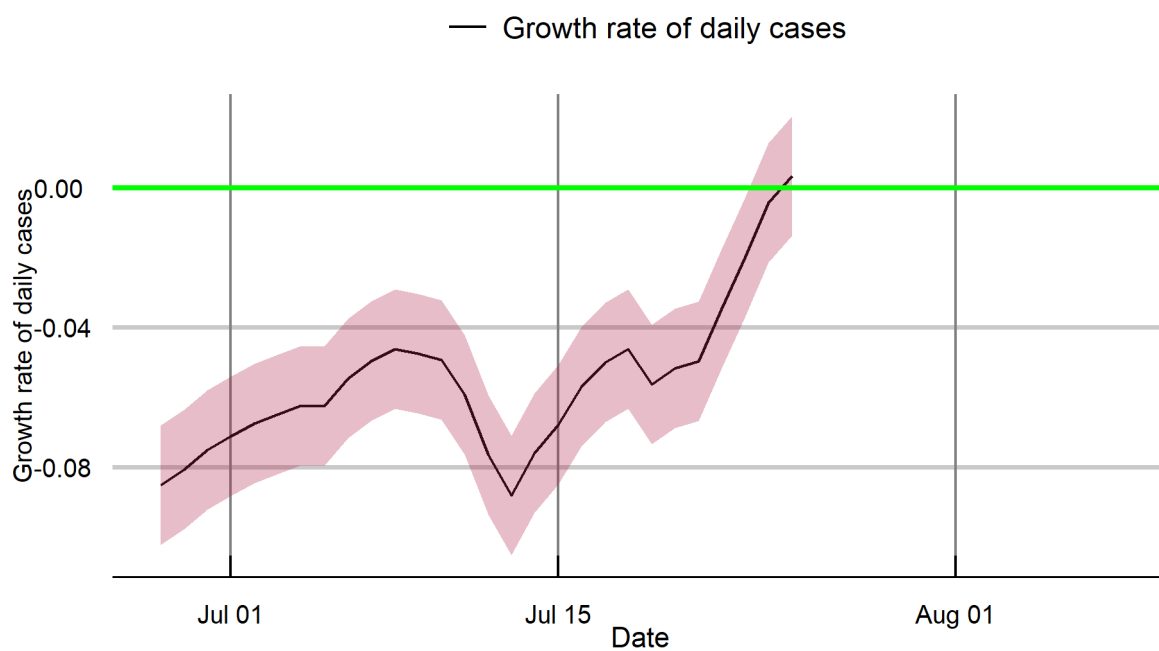
Goa



Gujarat

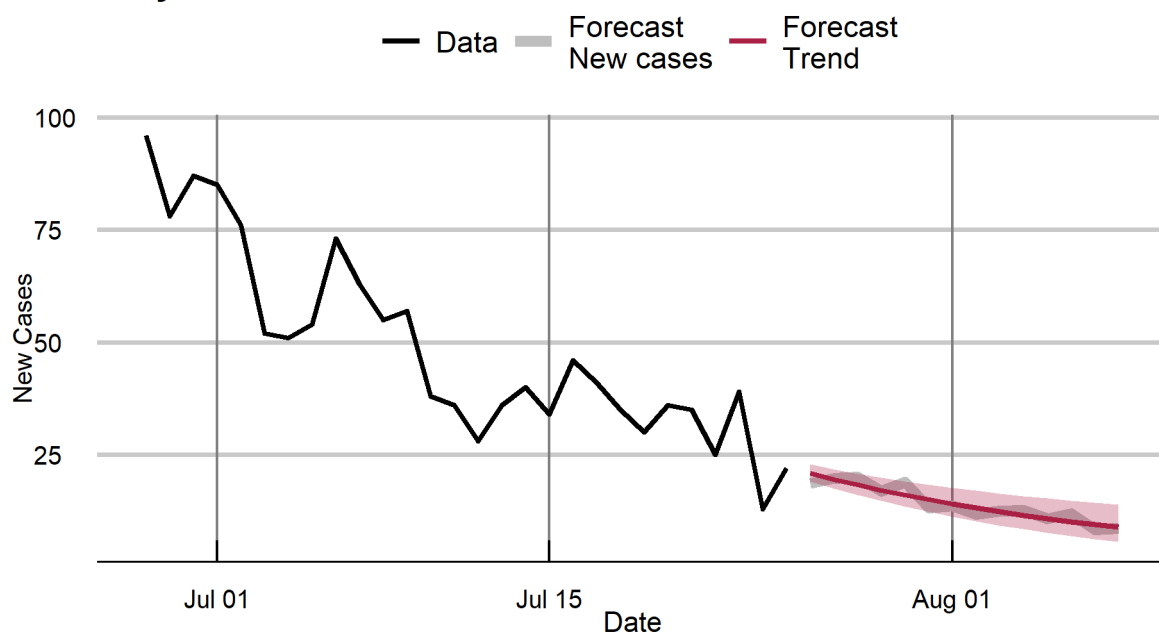


Gujarat

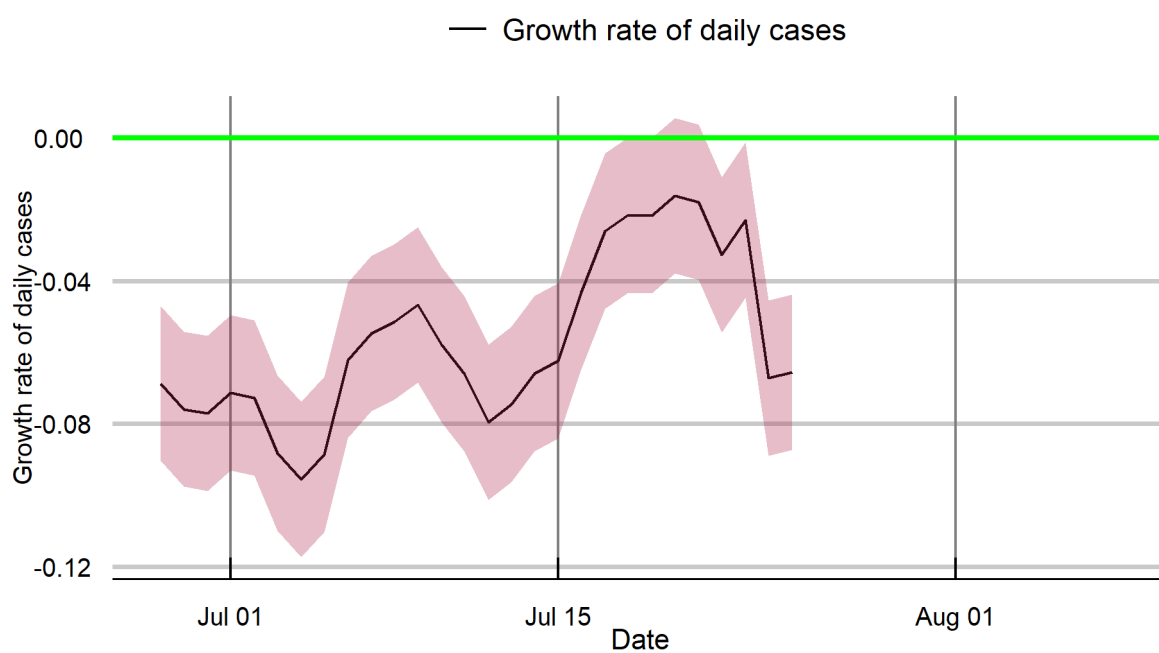


Note: Data unreported for 25 July 2021.

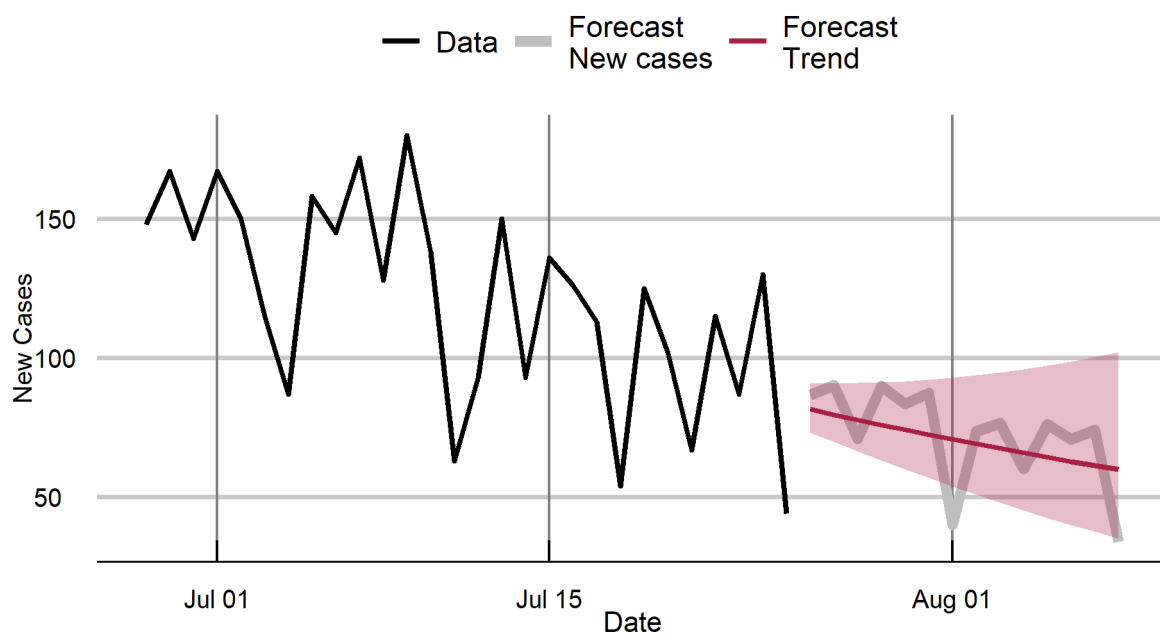
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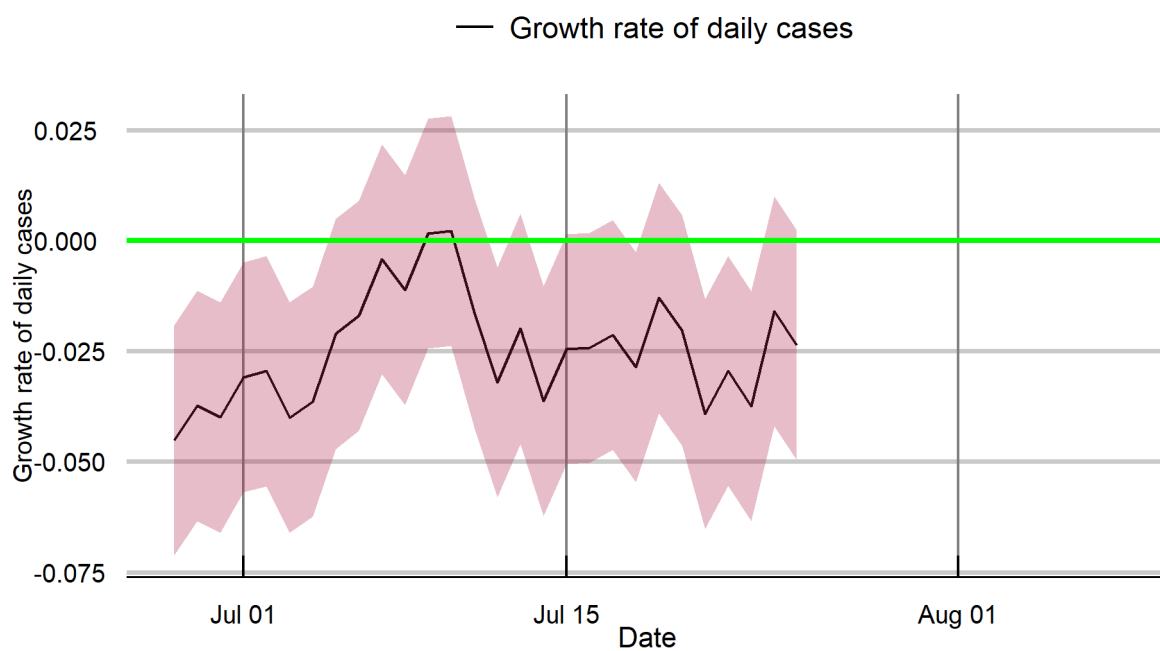
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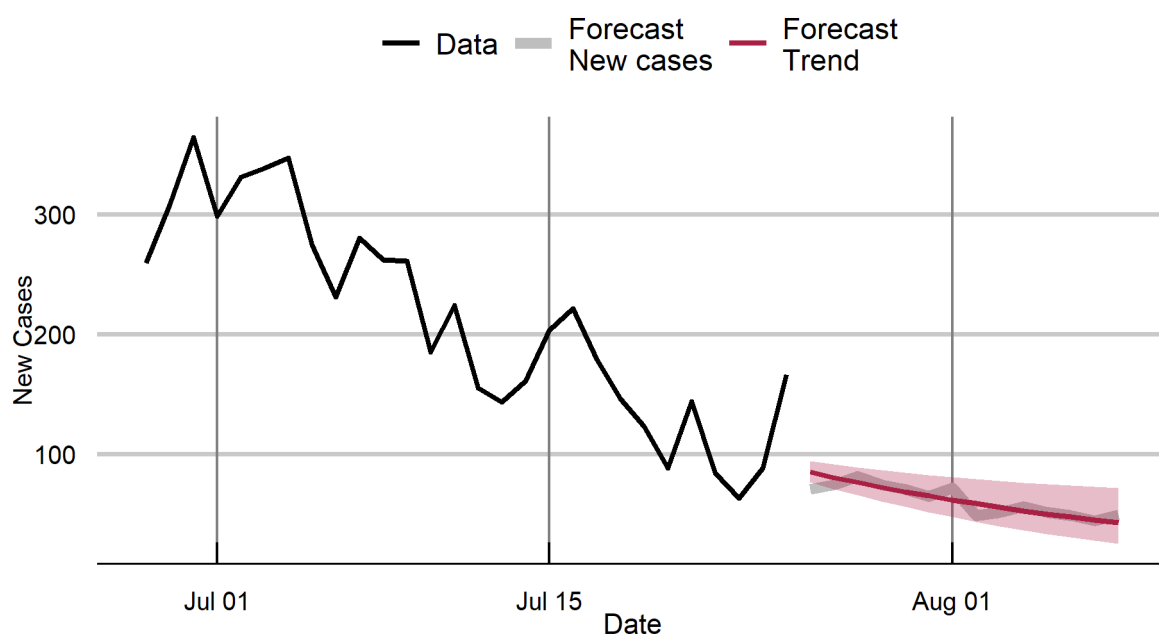
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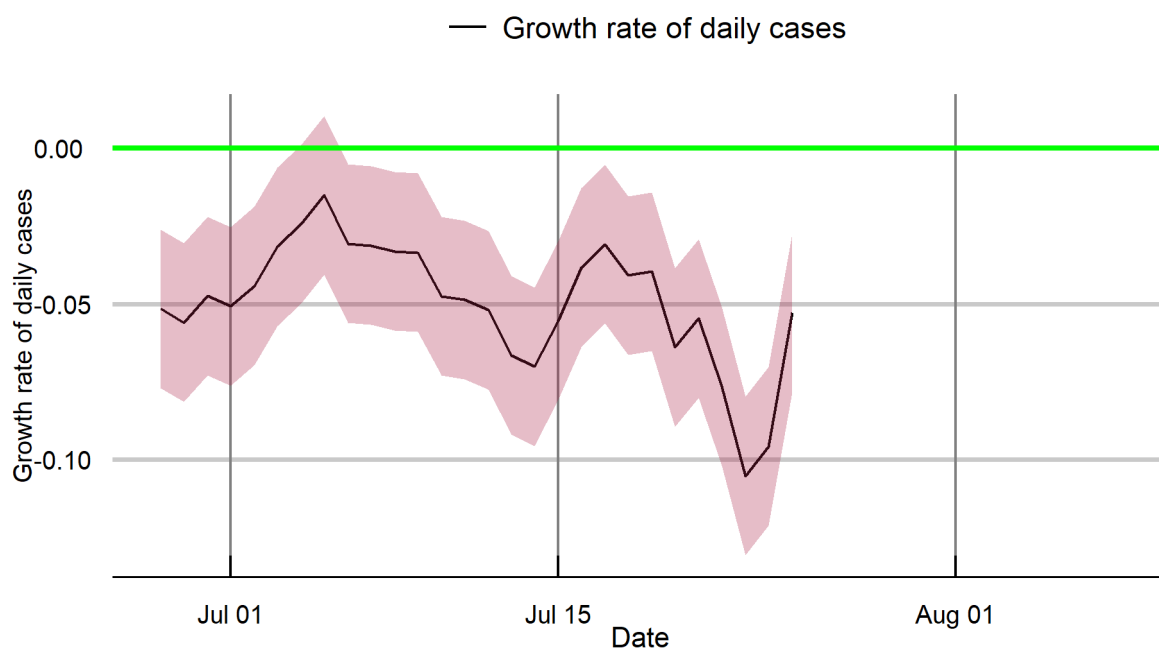
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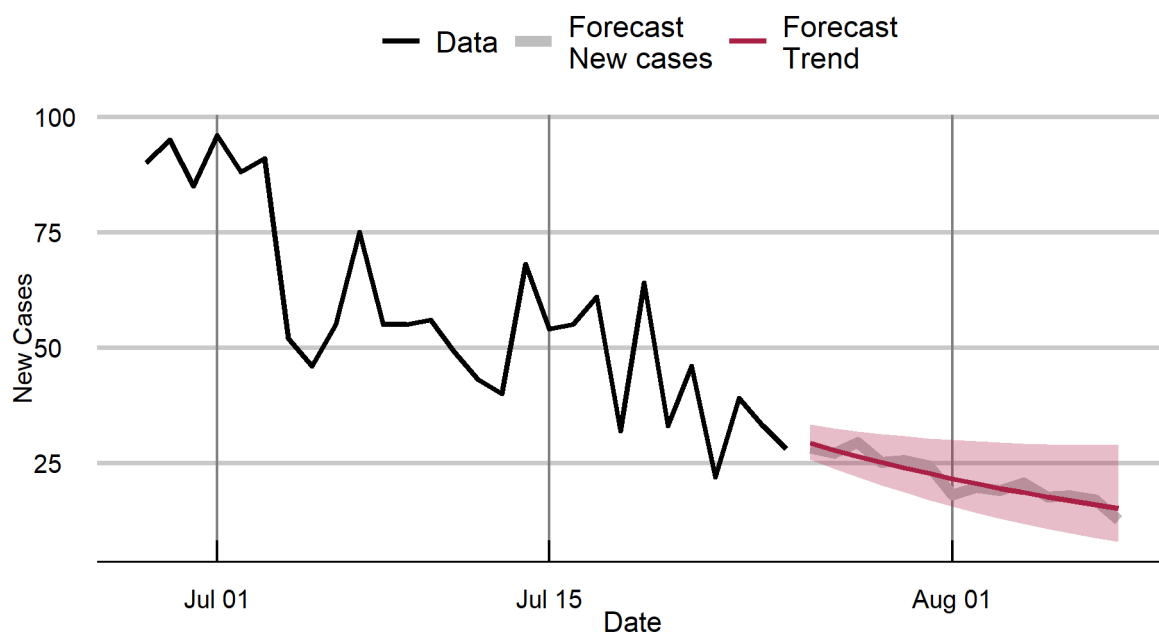
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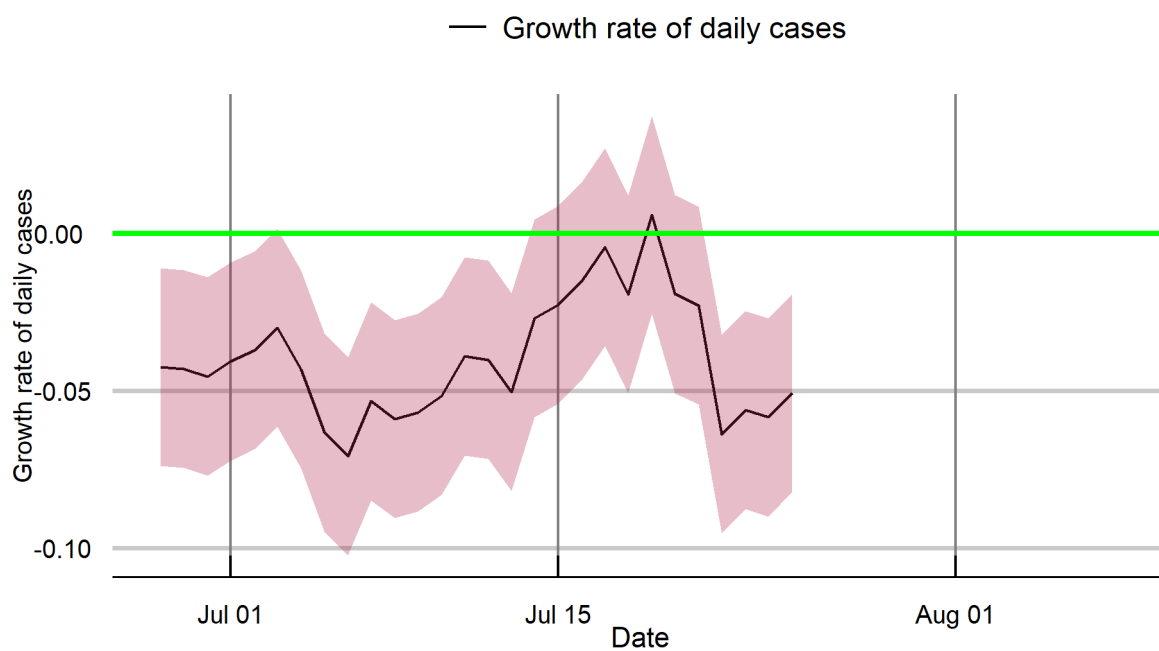
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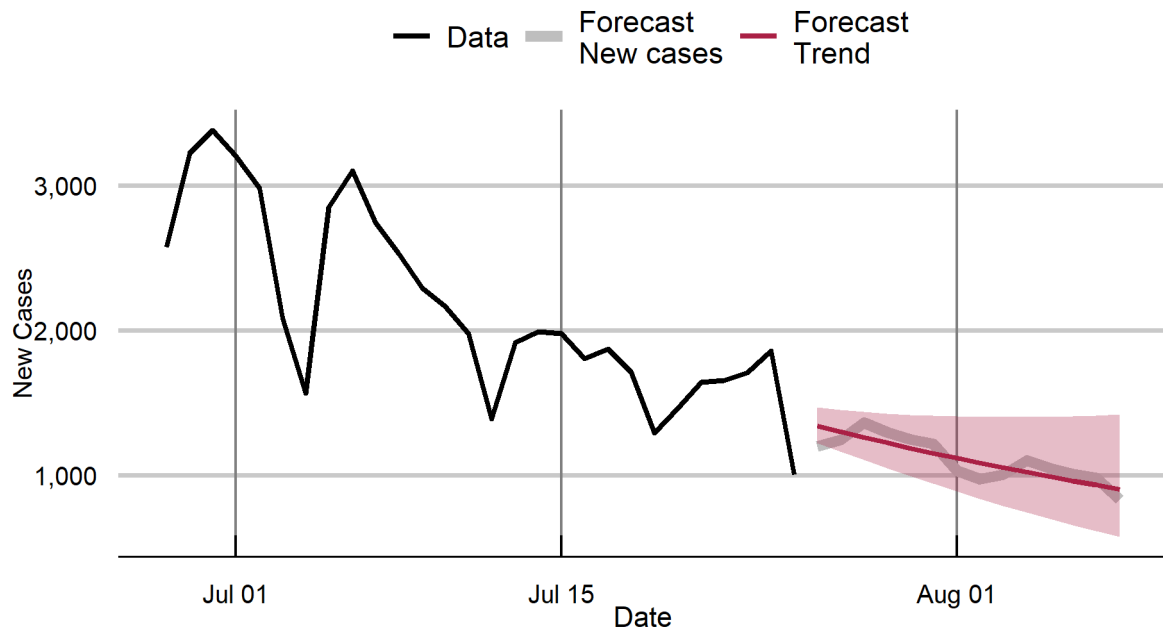
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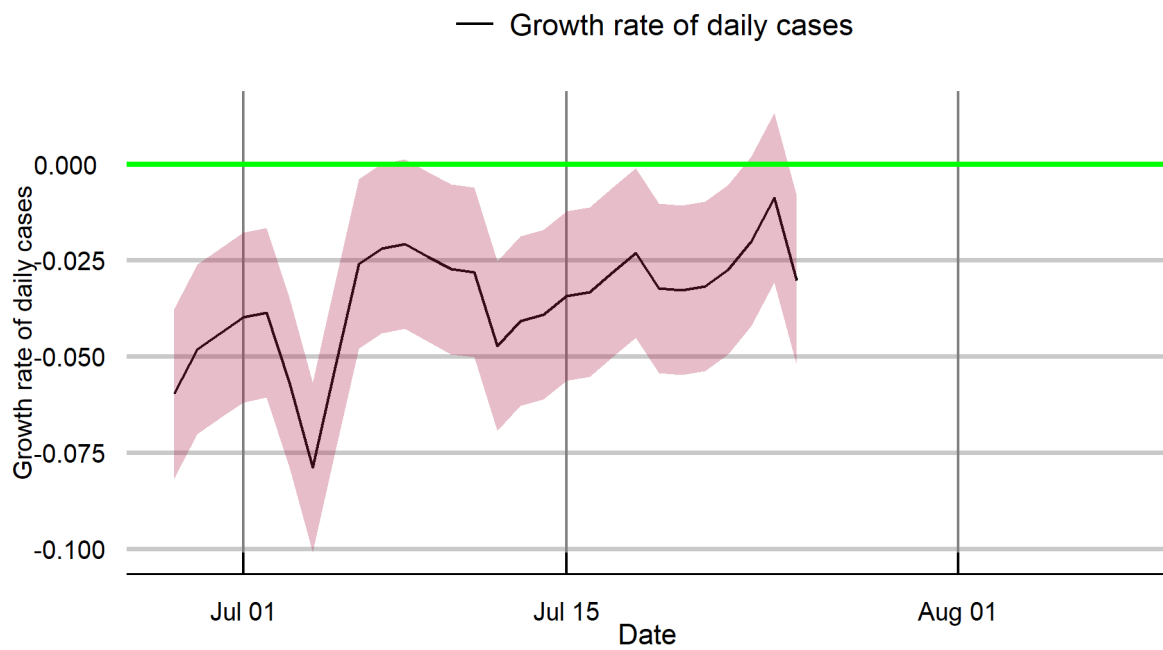
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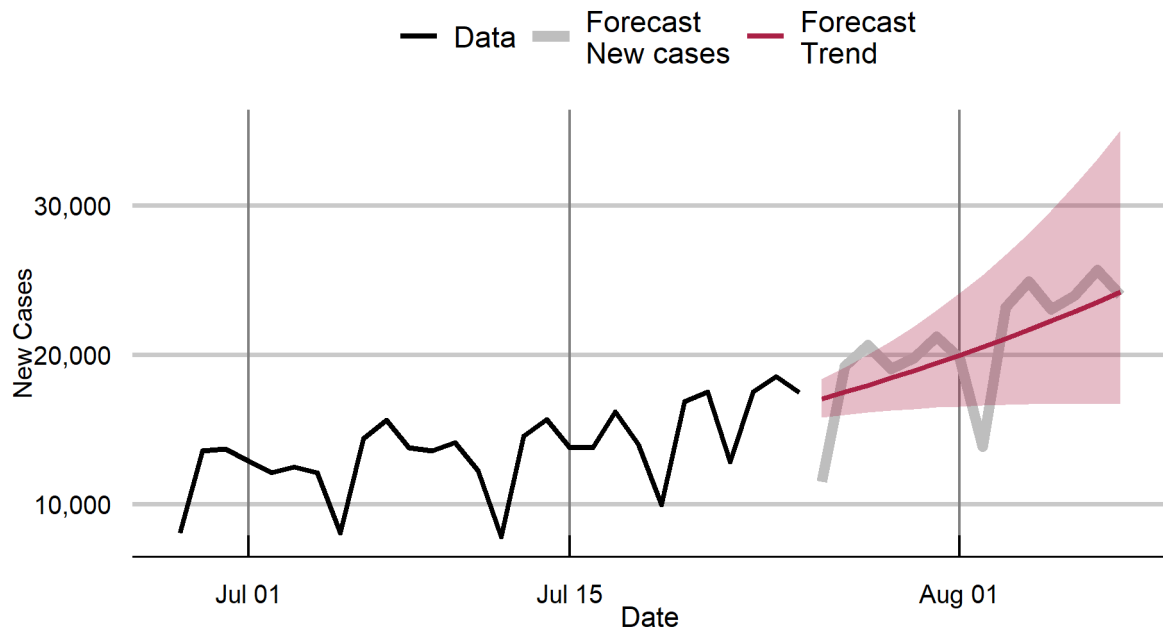
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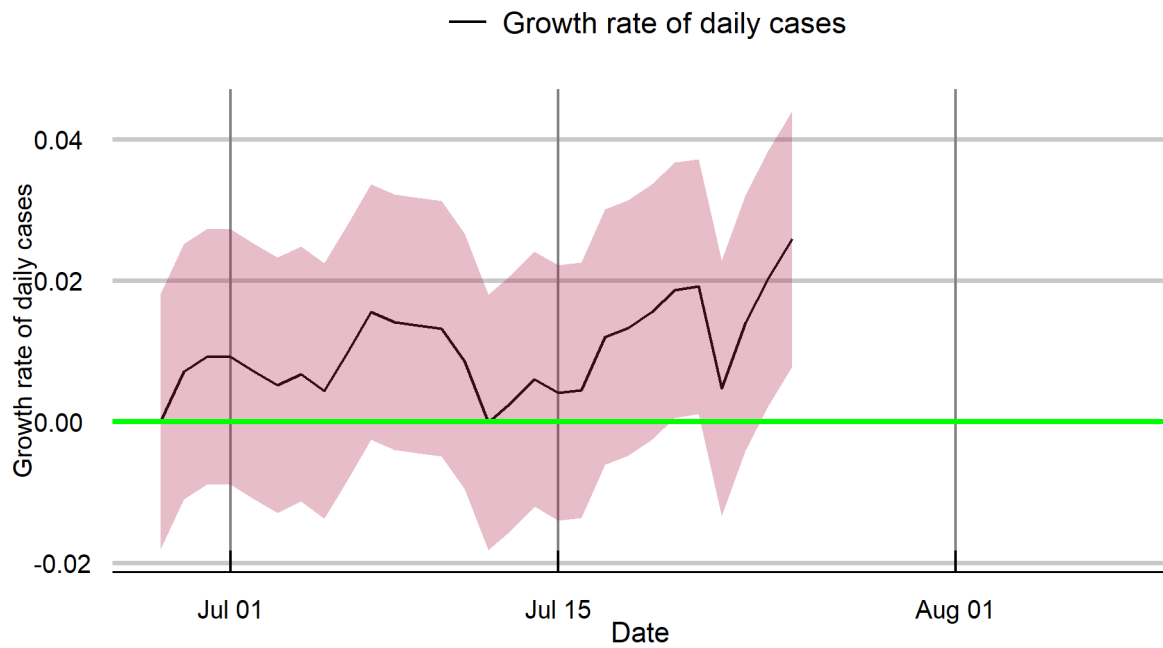
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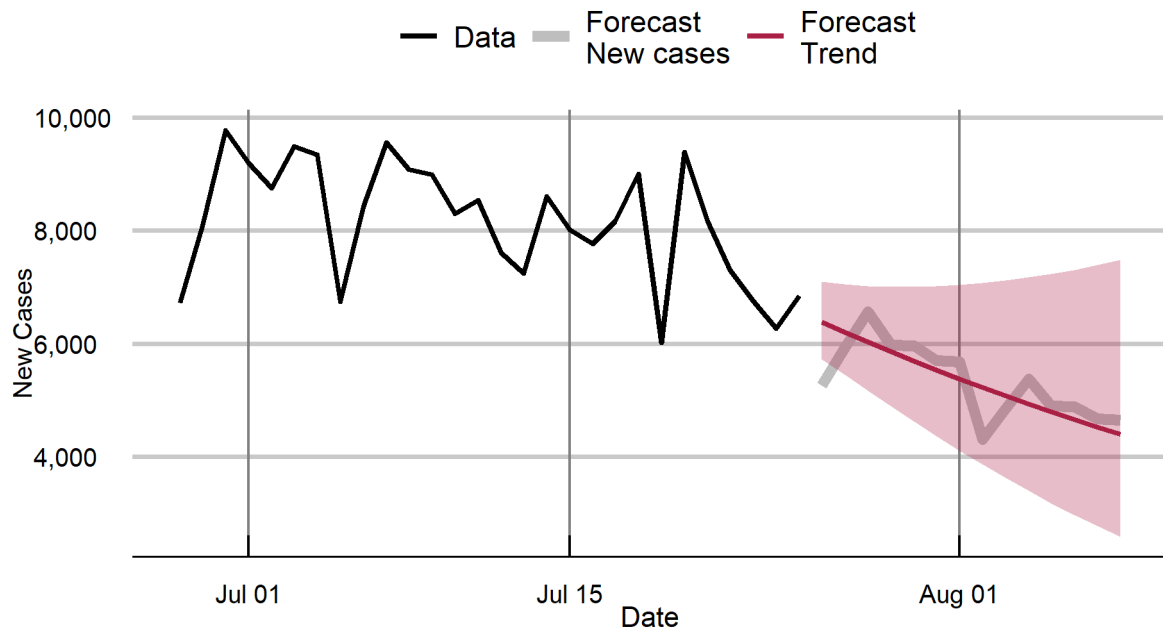
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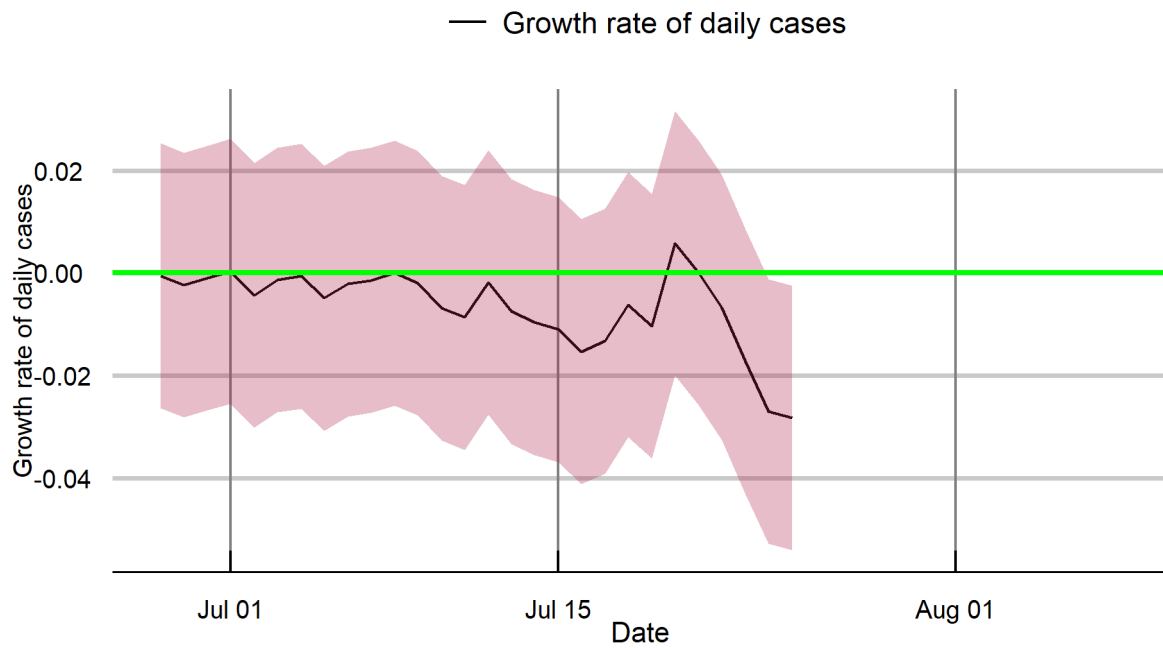
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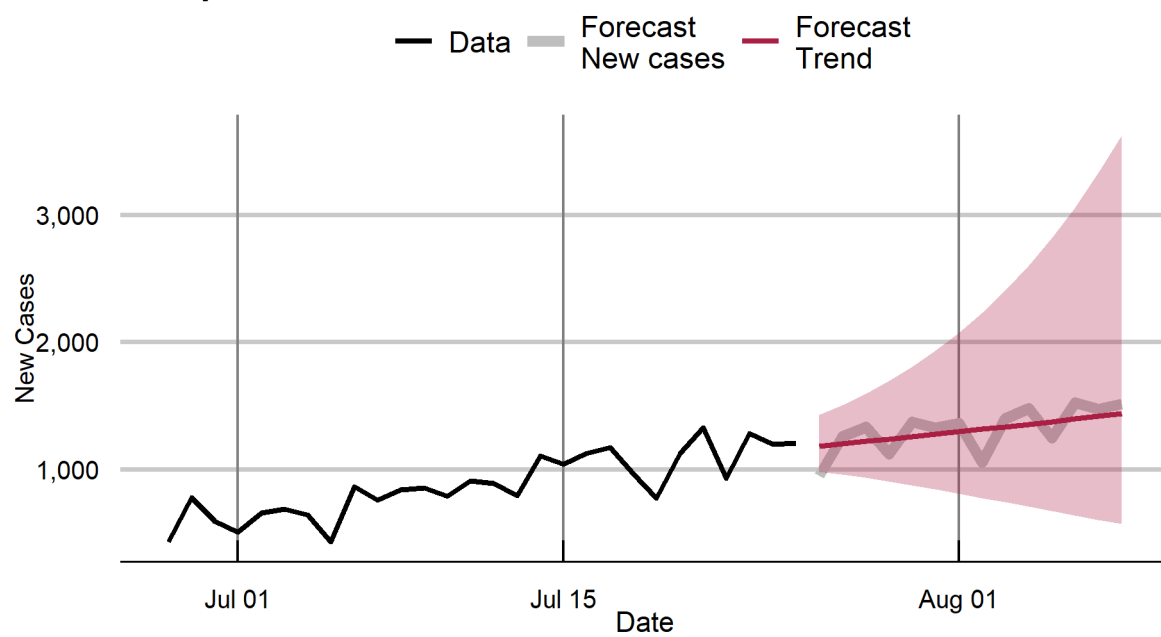
Maharashtra



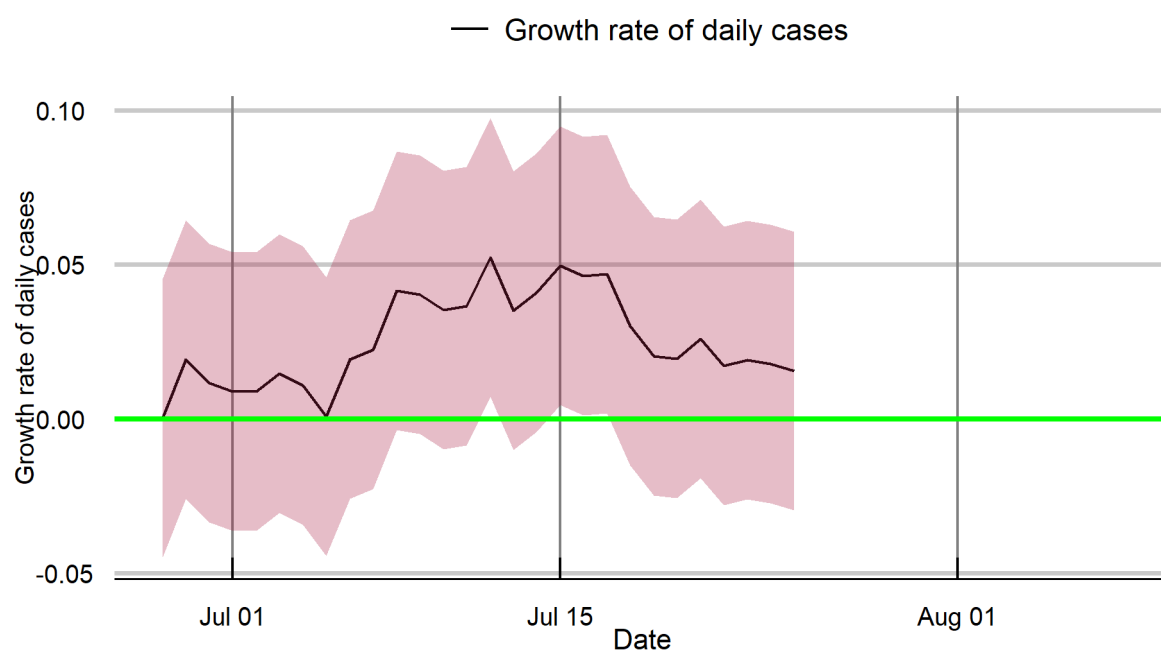
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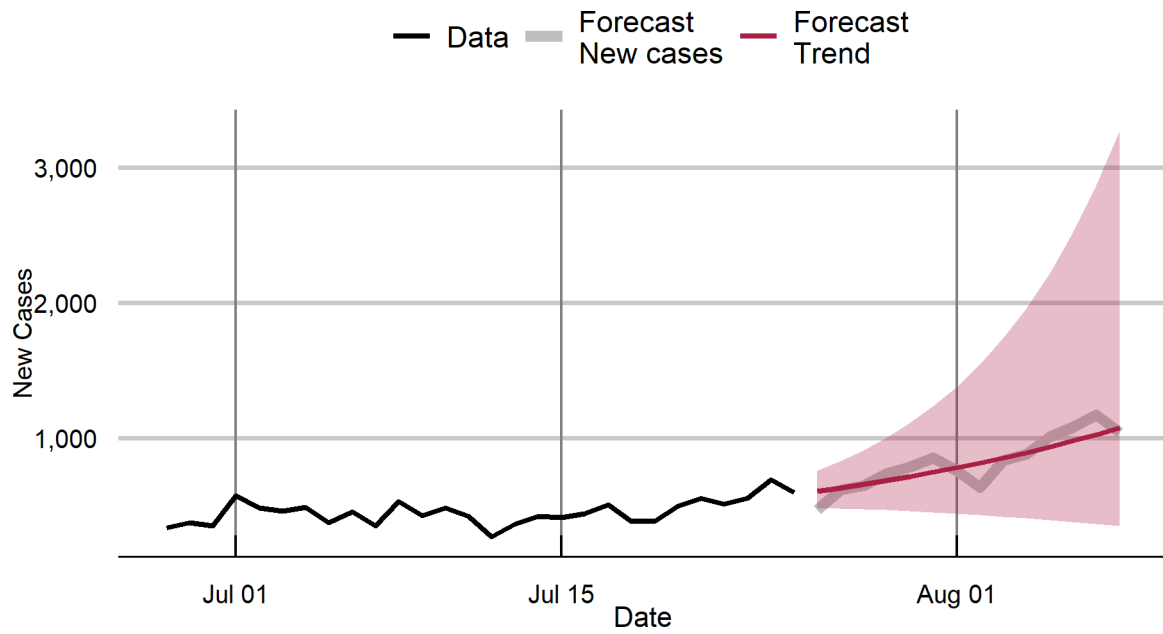
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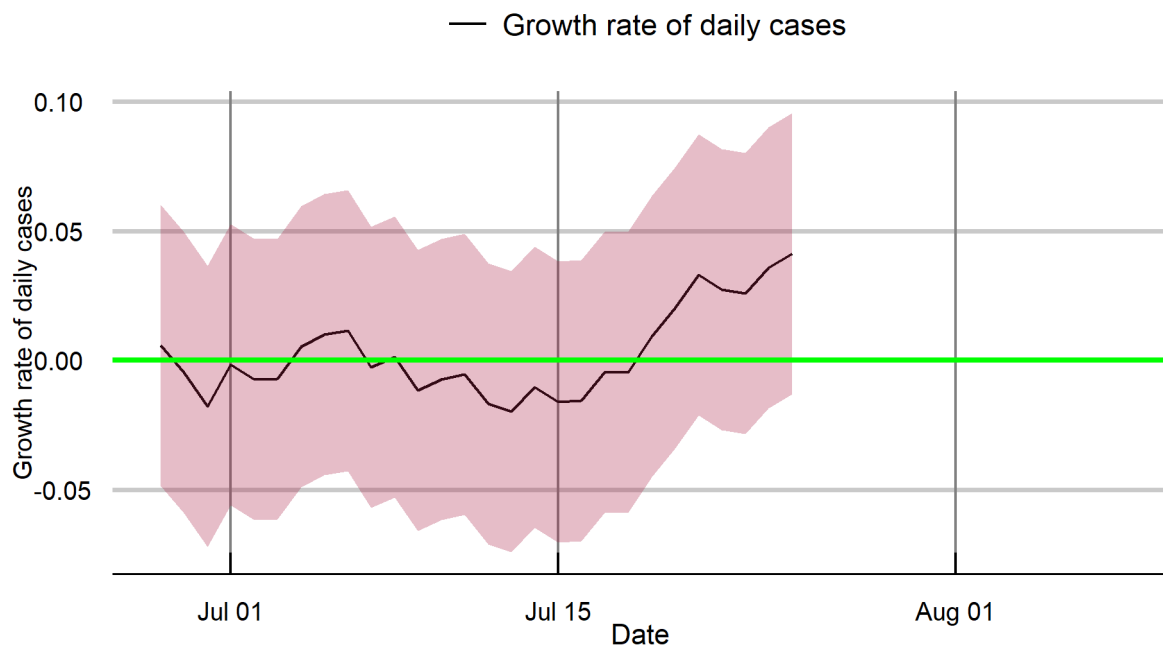
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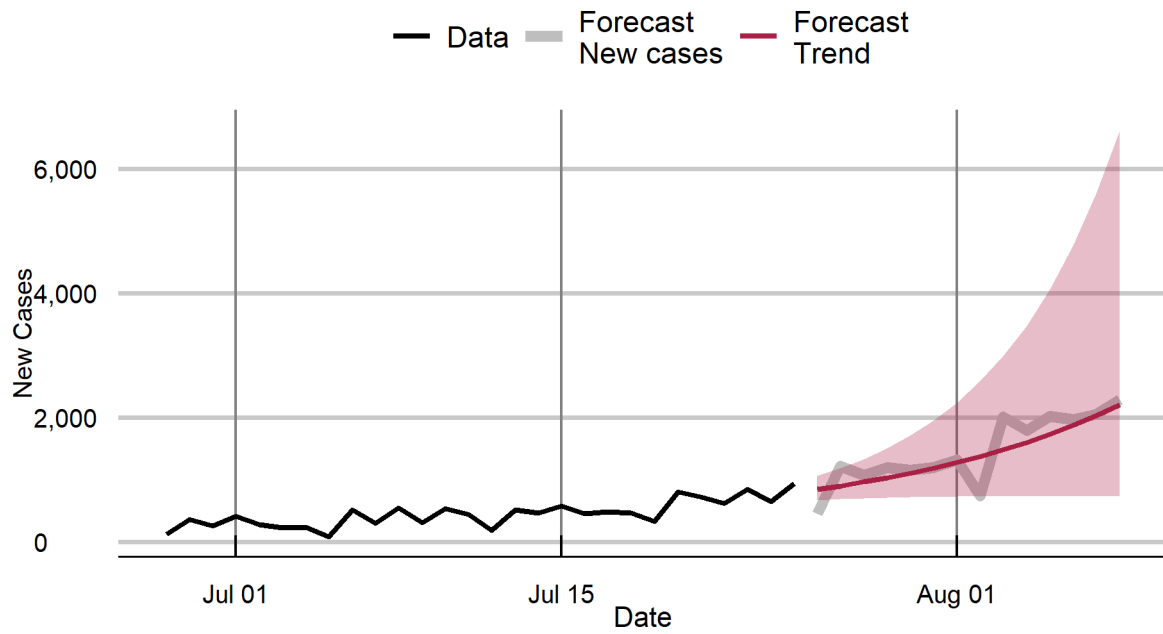
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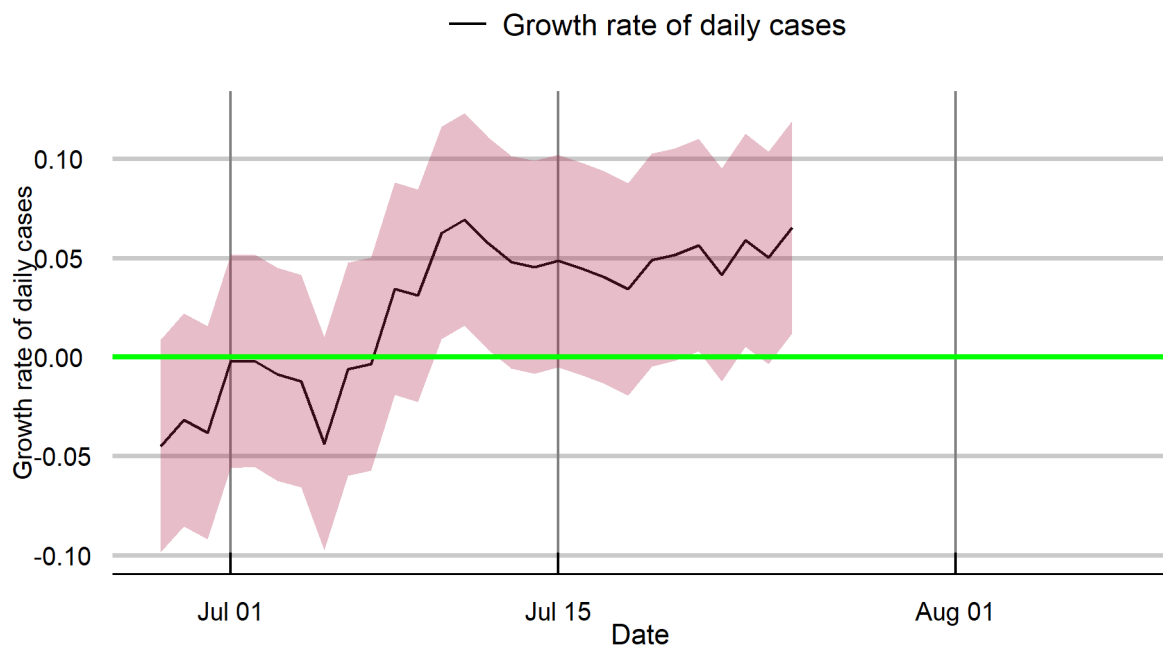
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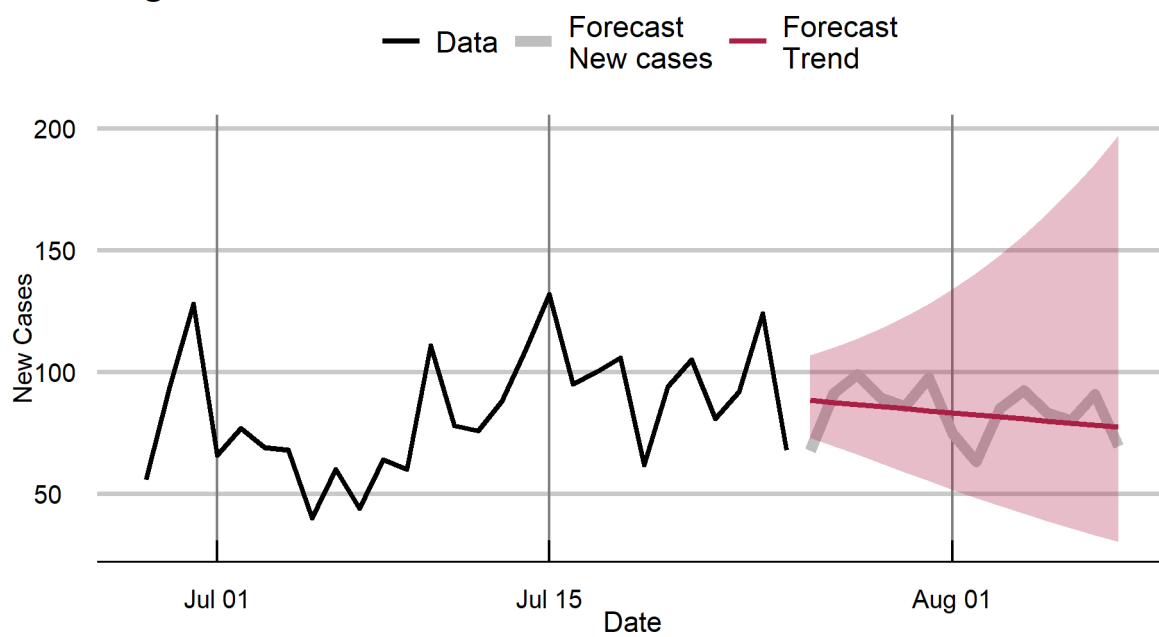
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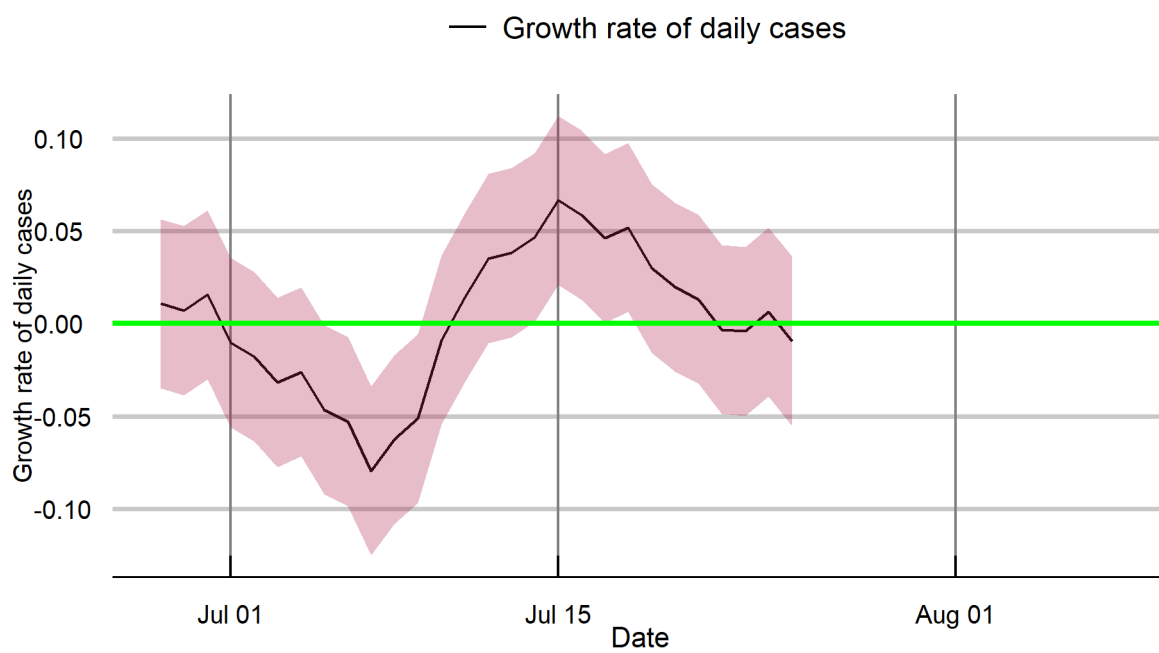
Mizoram



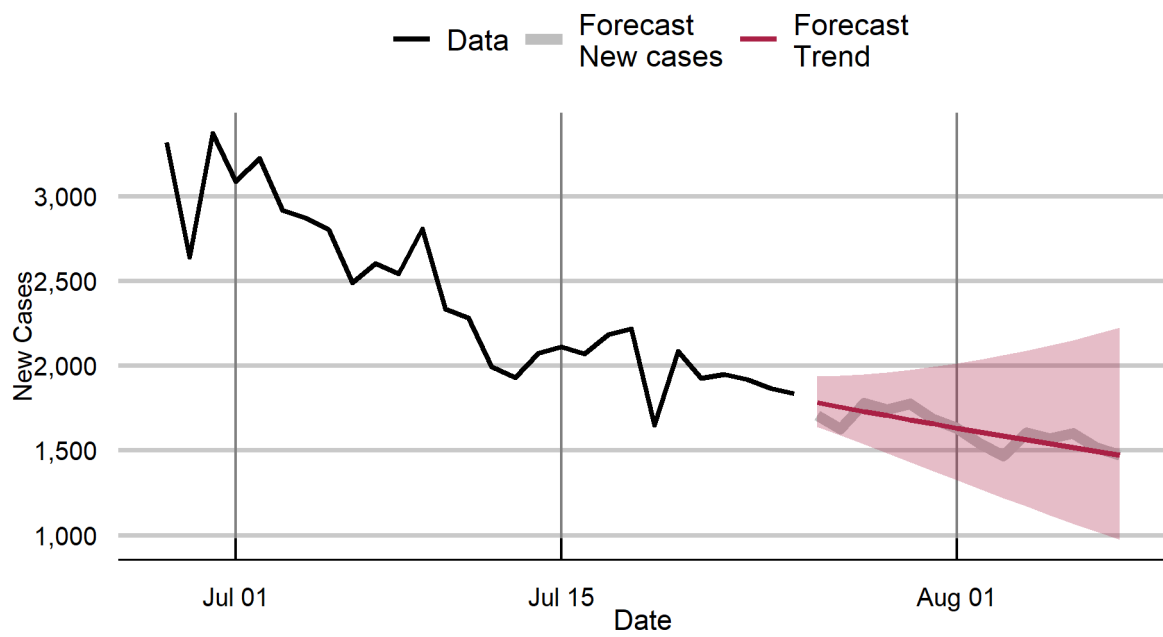
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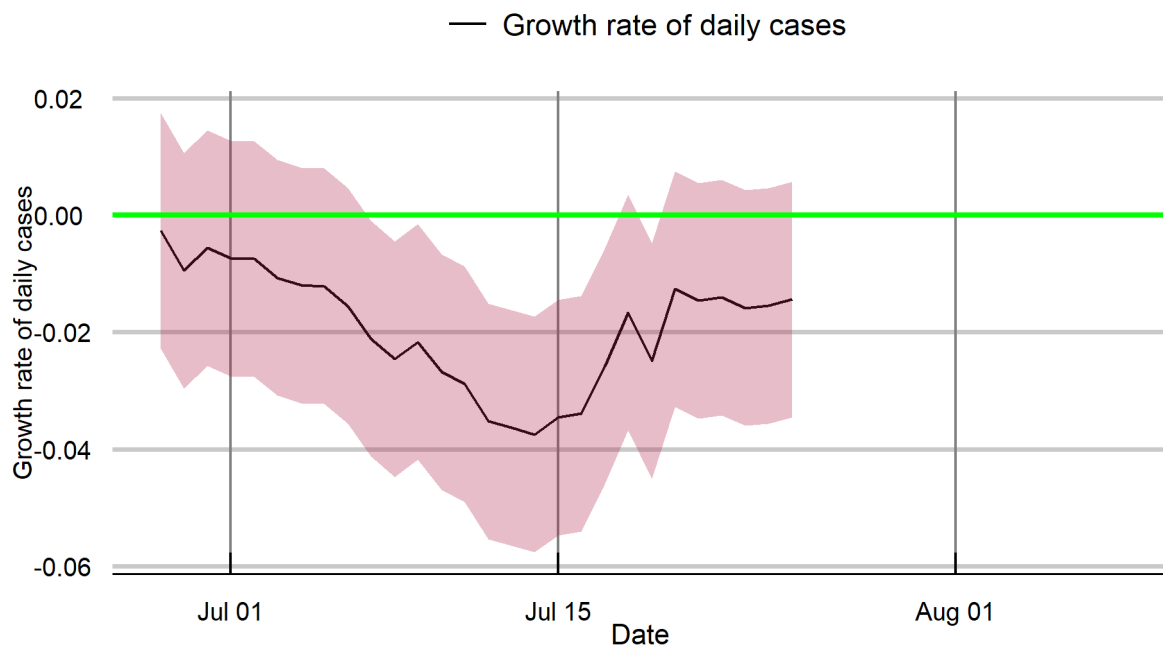
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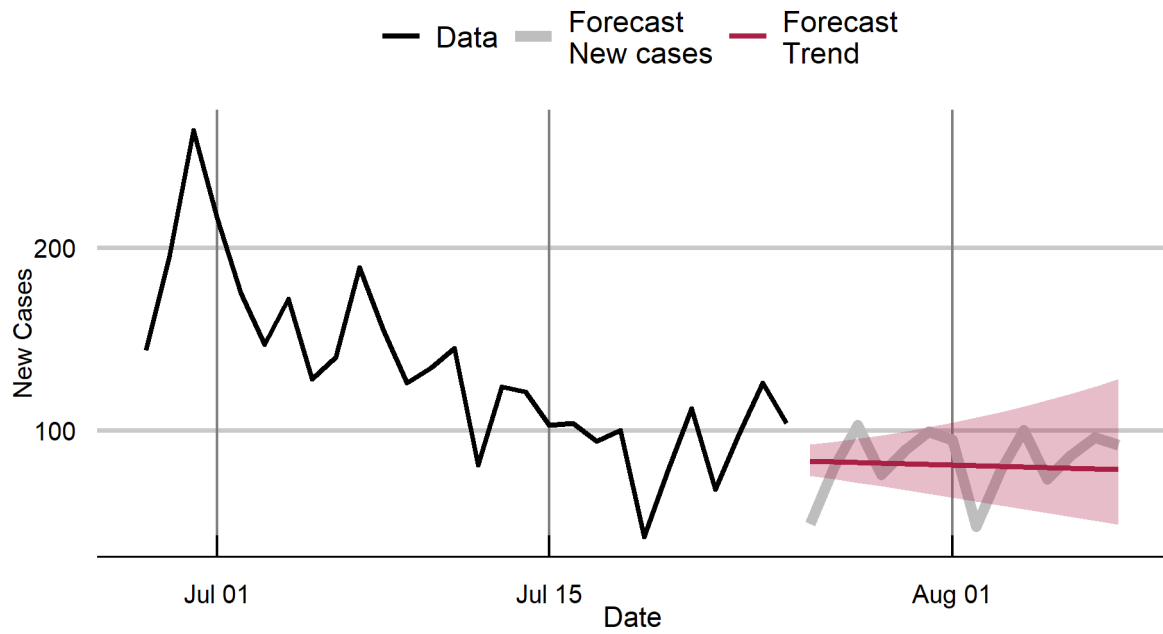
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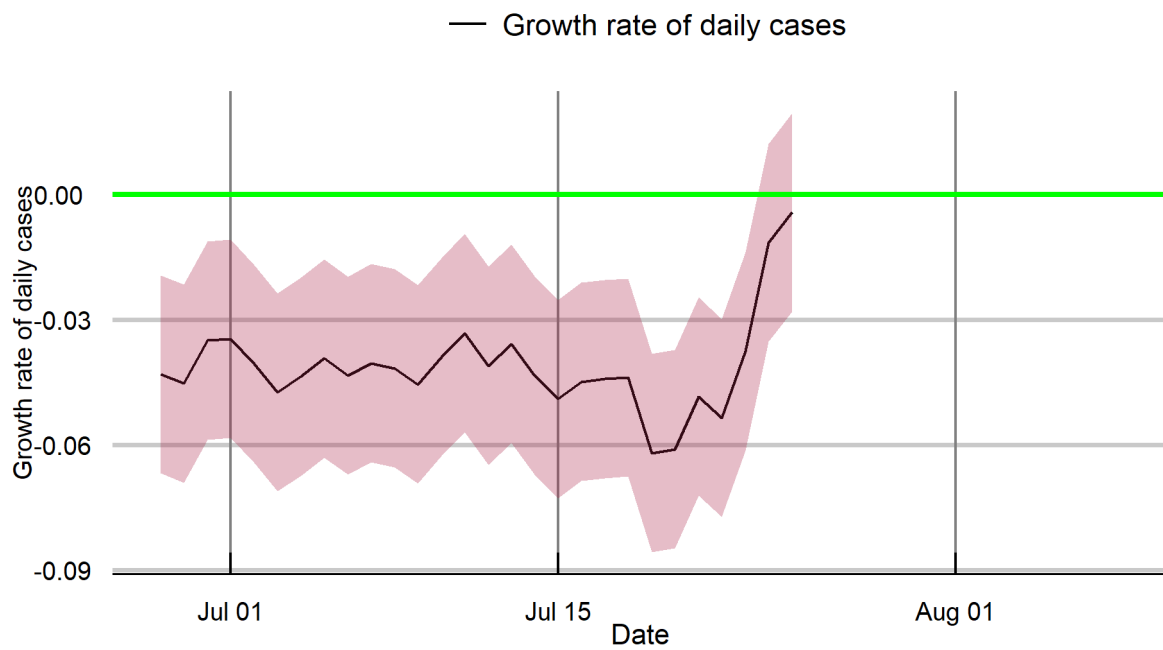
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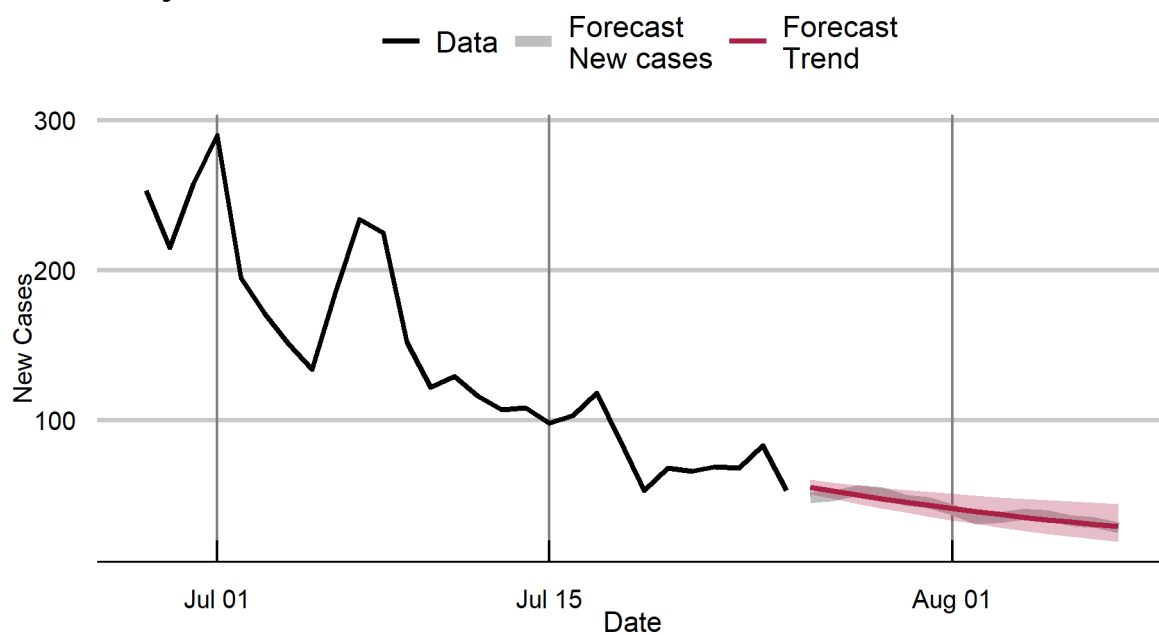
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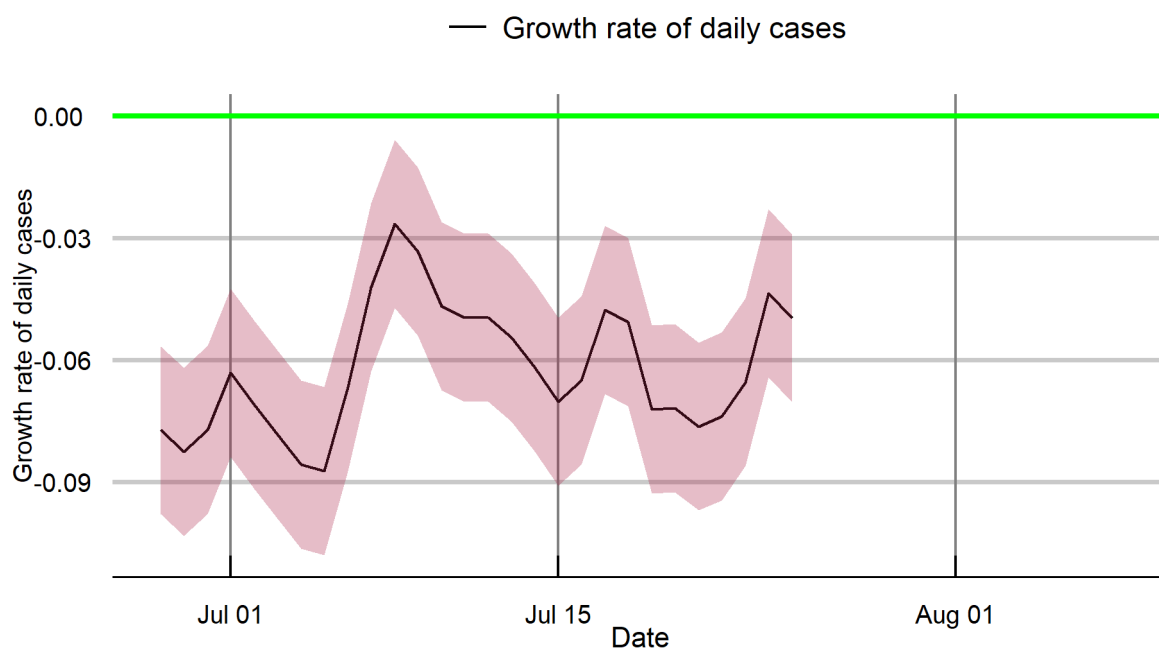
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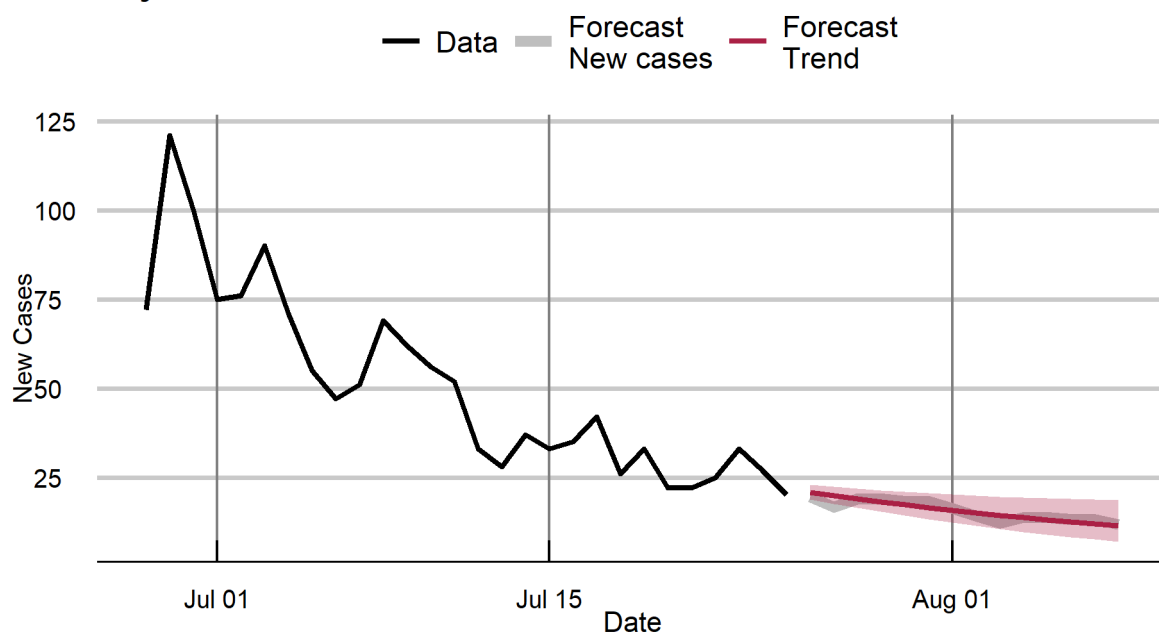
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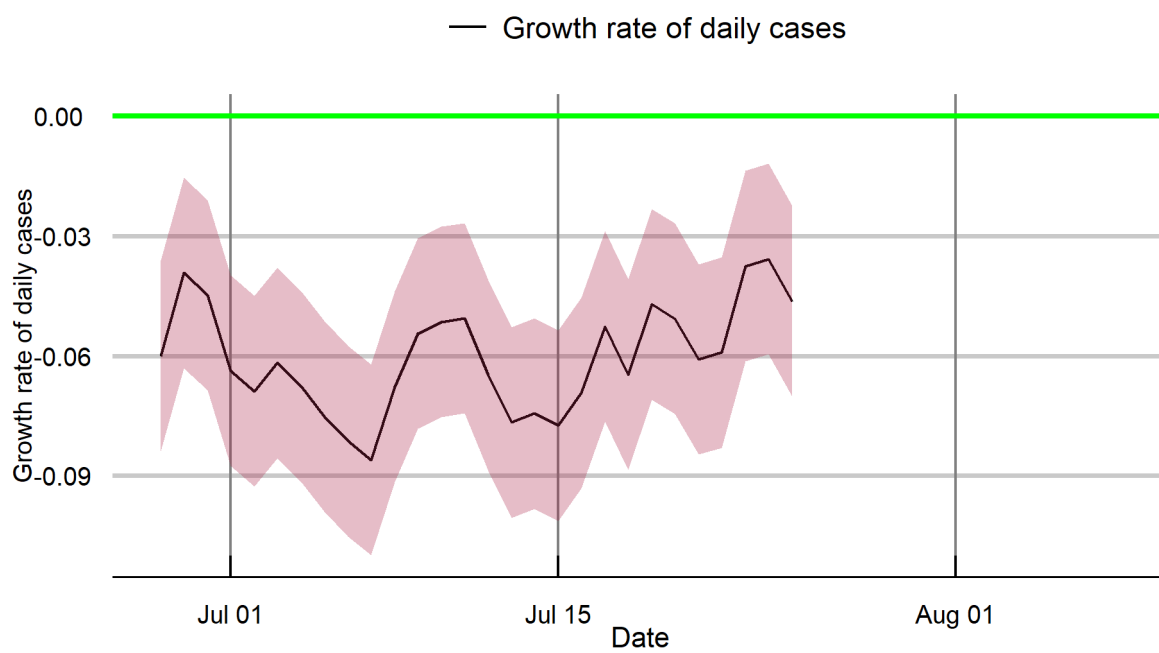
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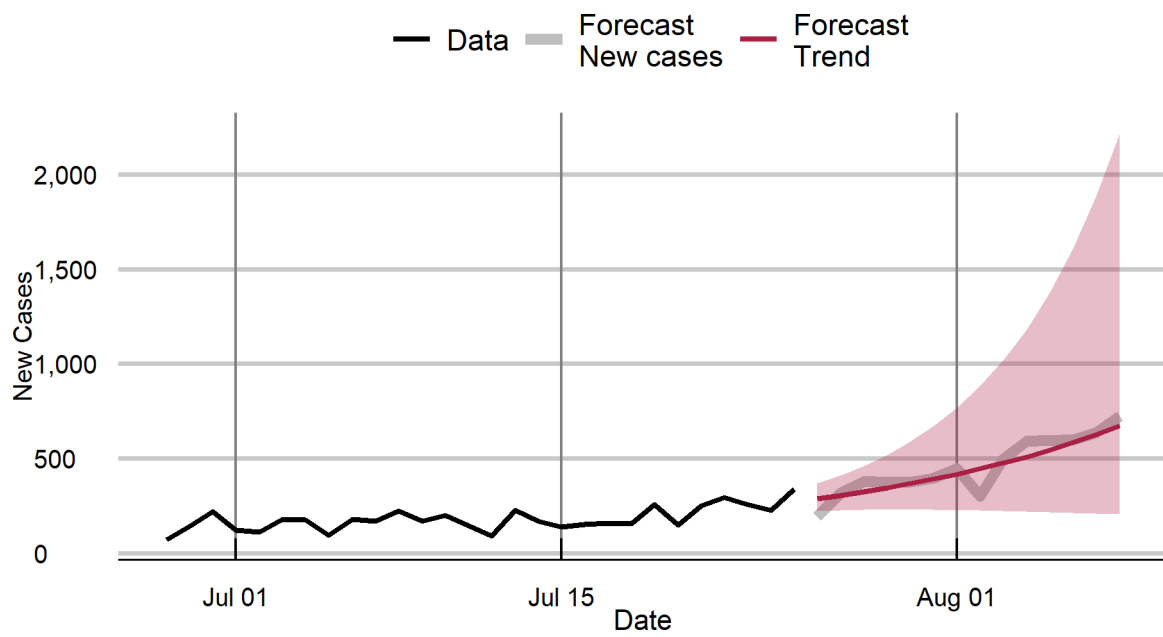
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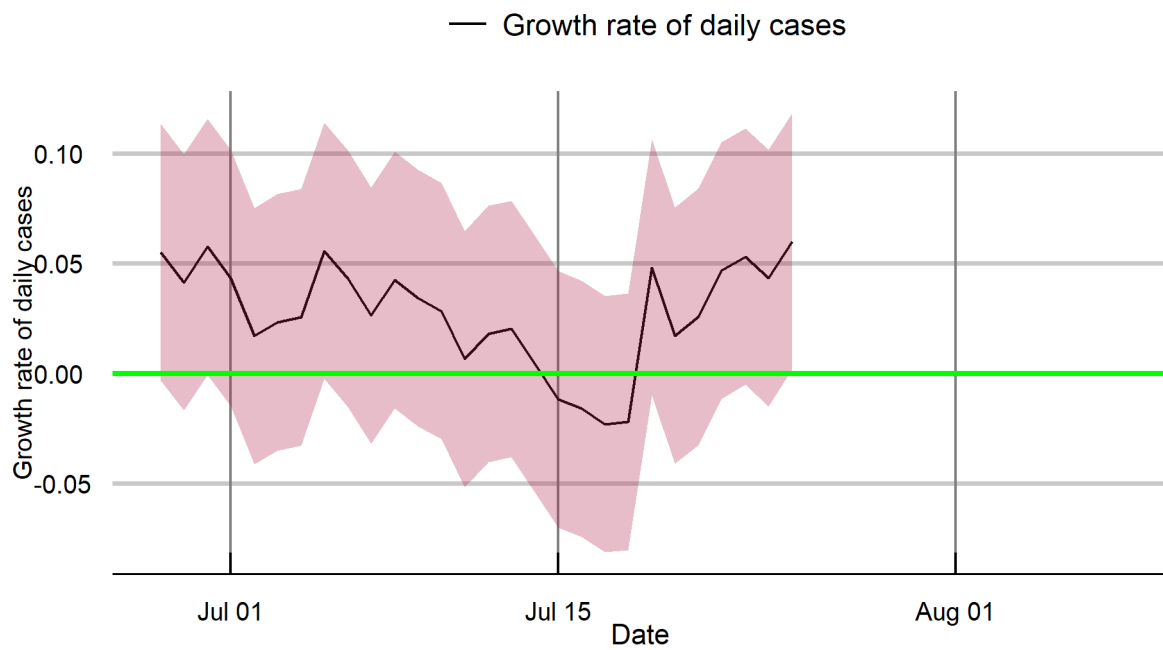
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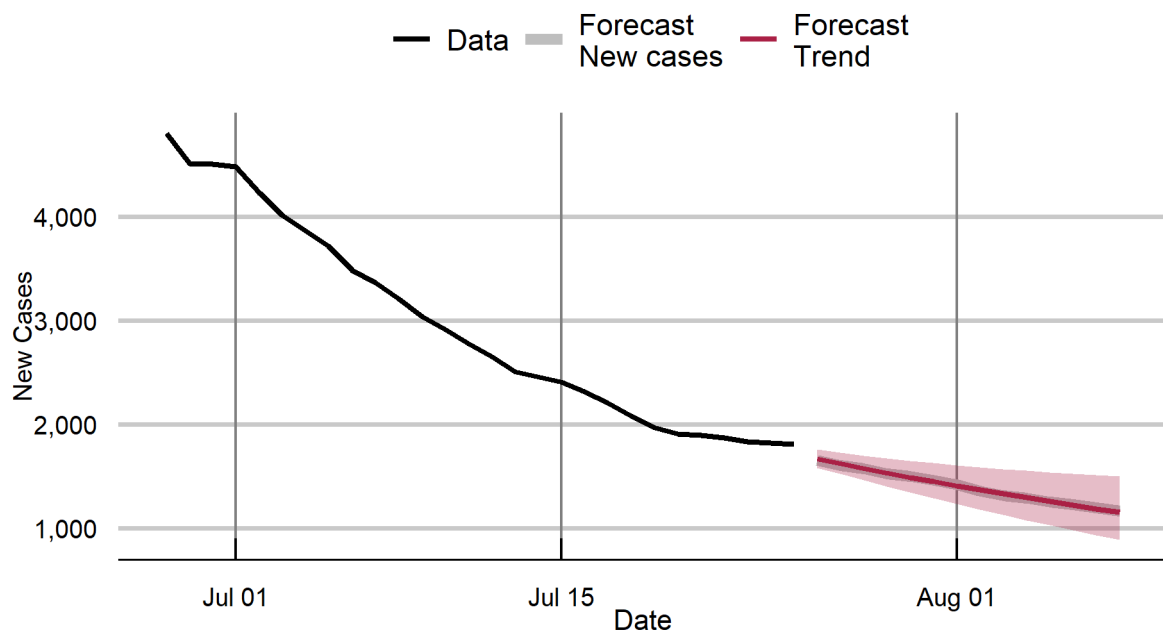
Sikkim



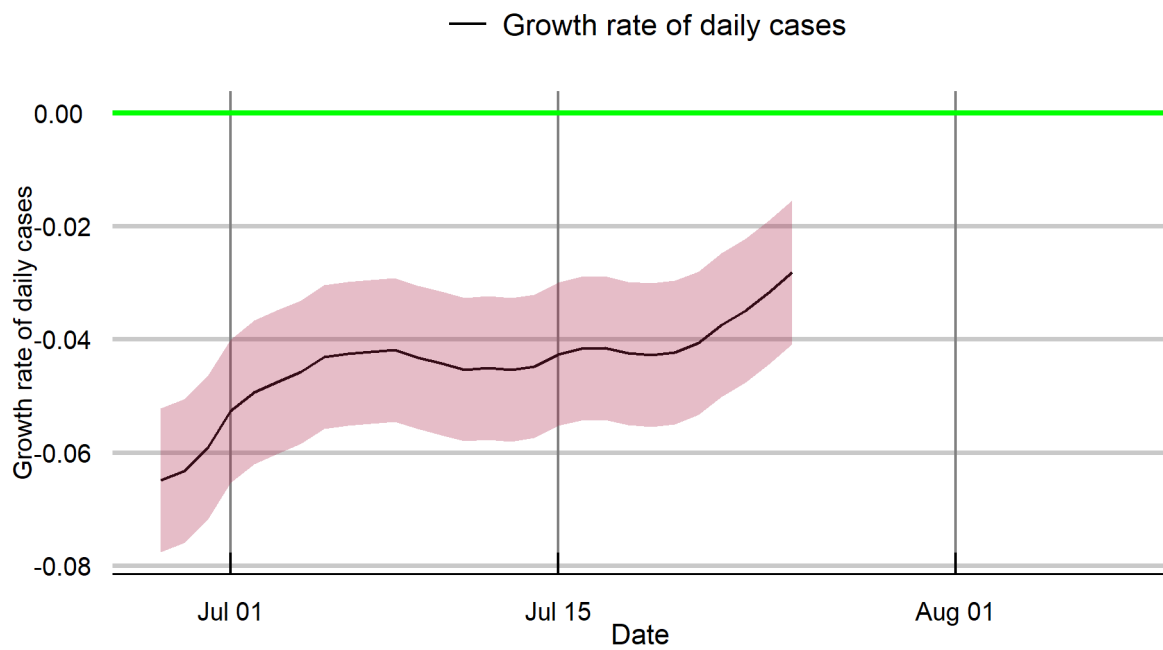
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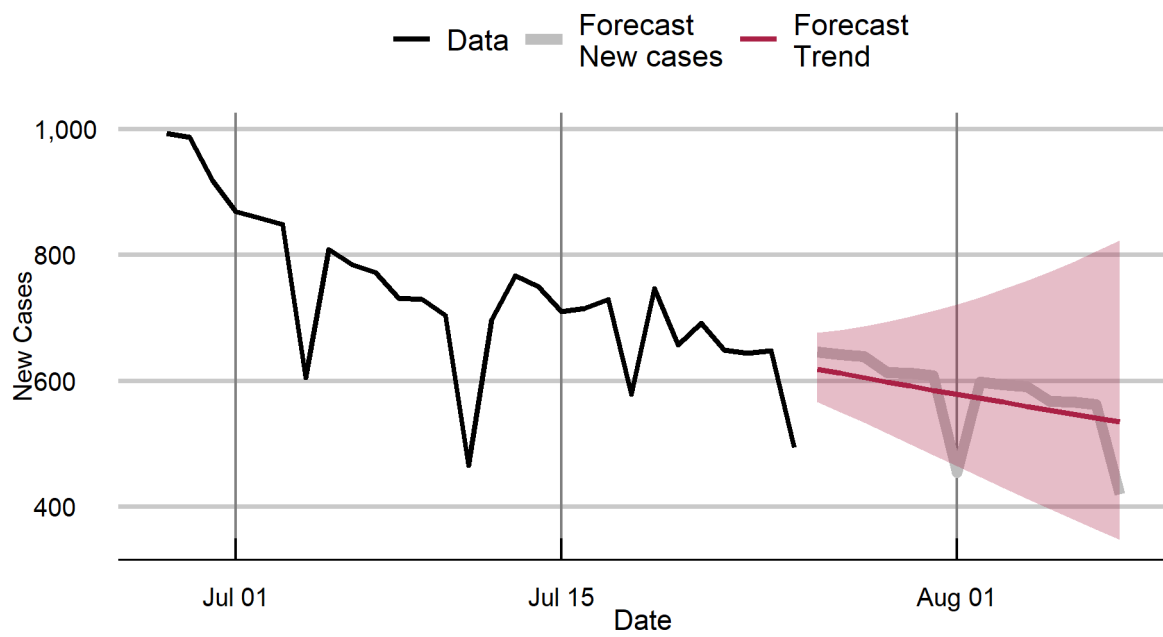
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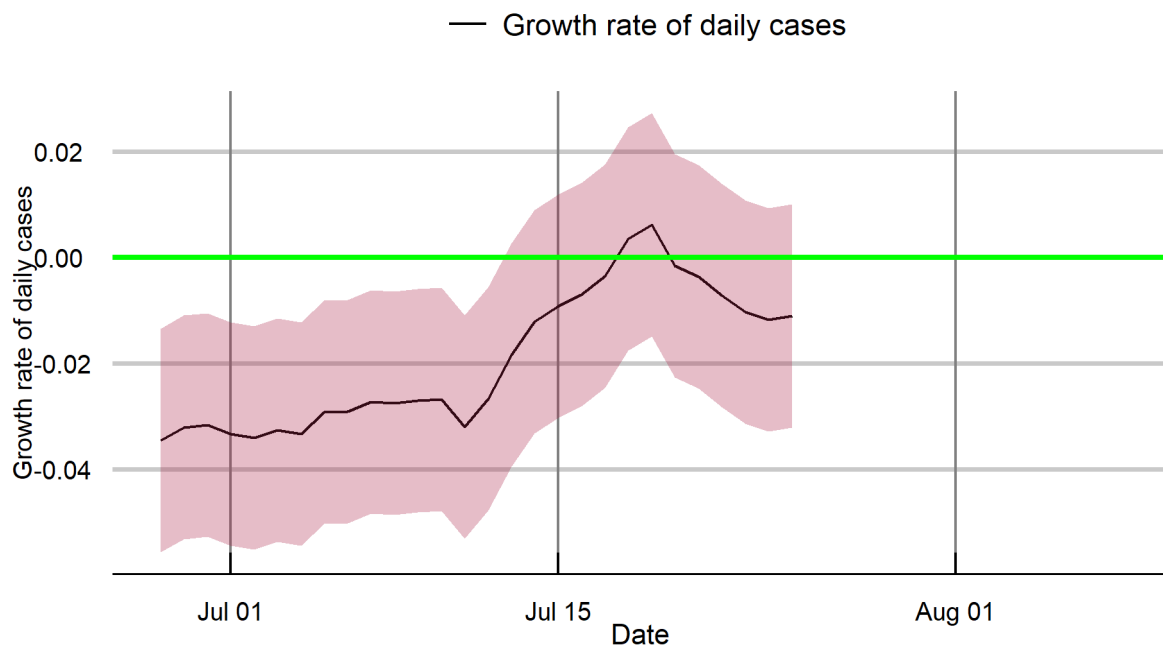
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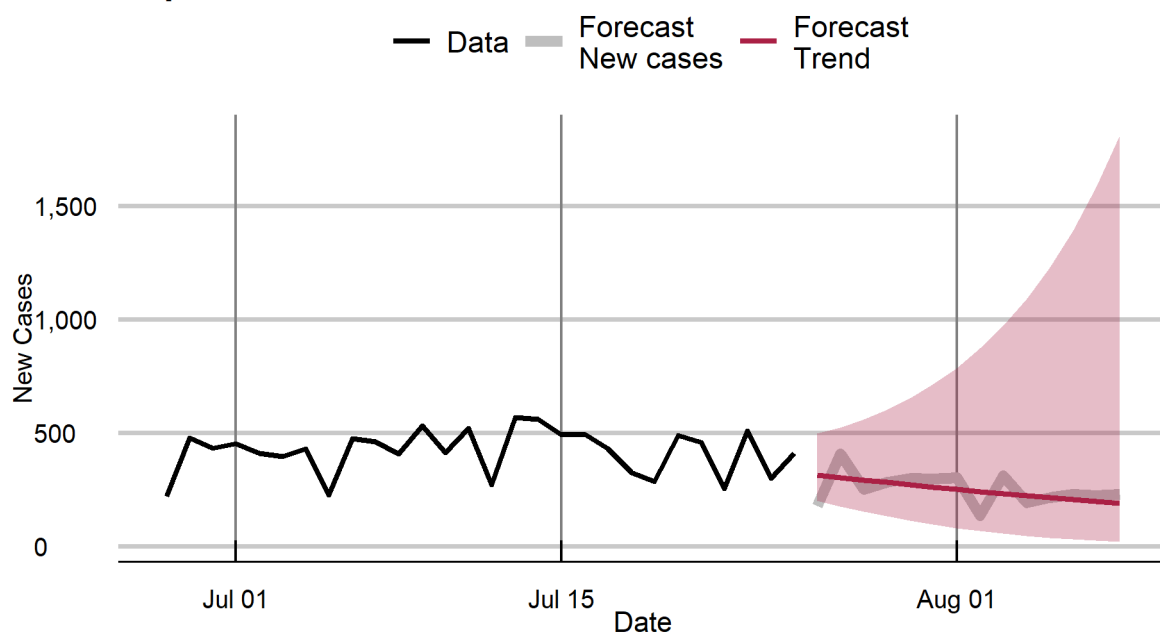
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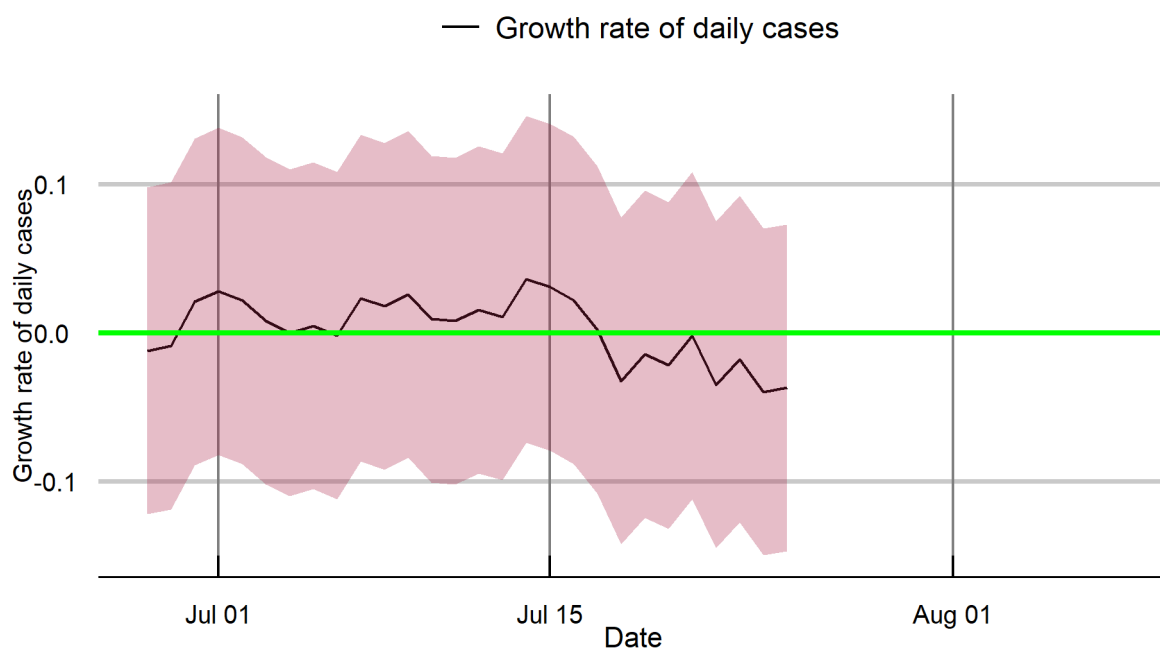
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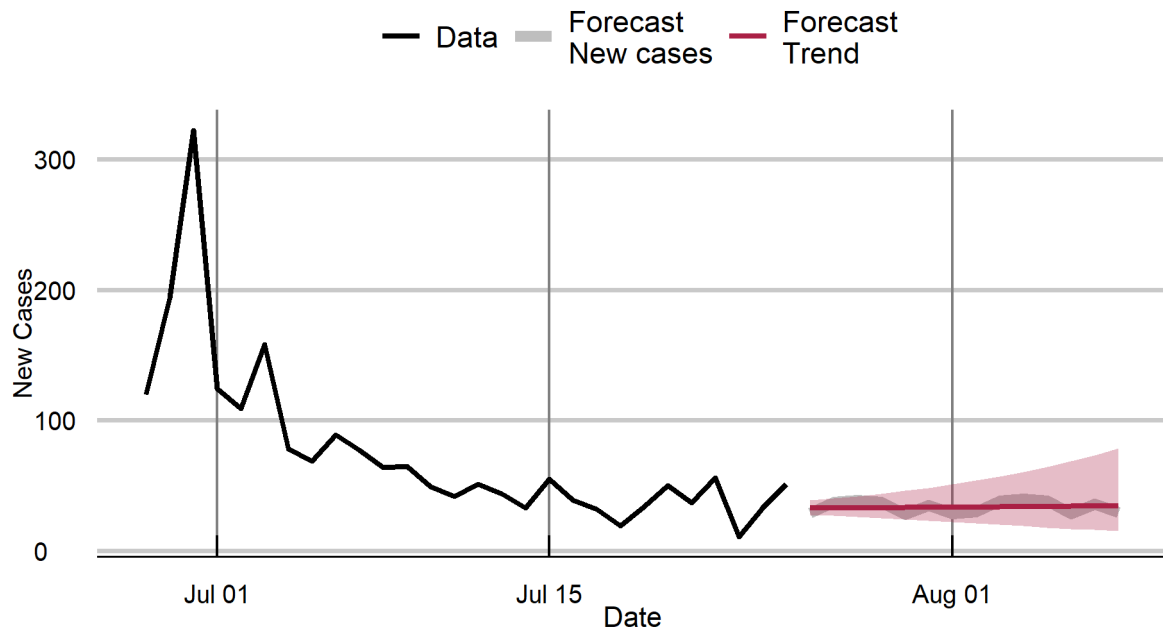
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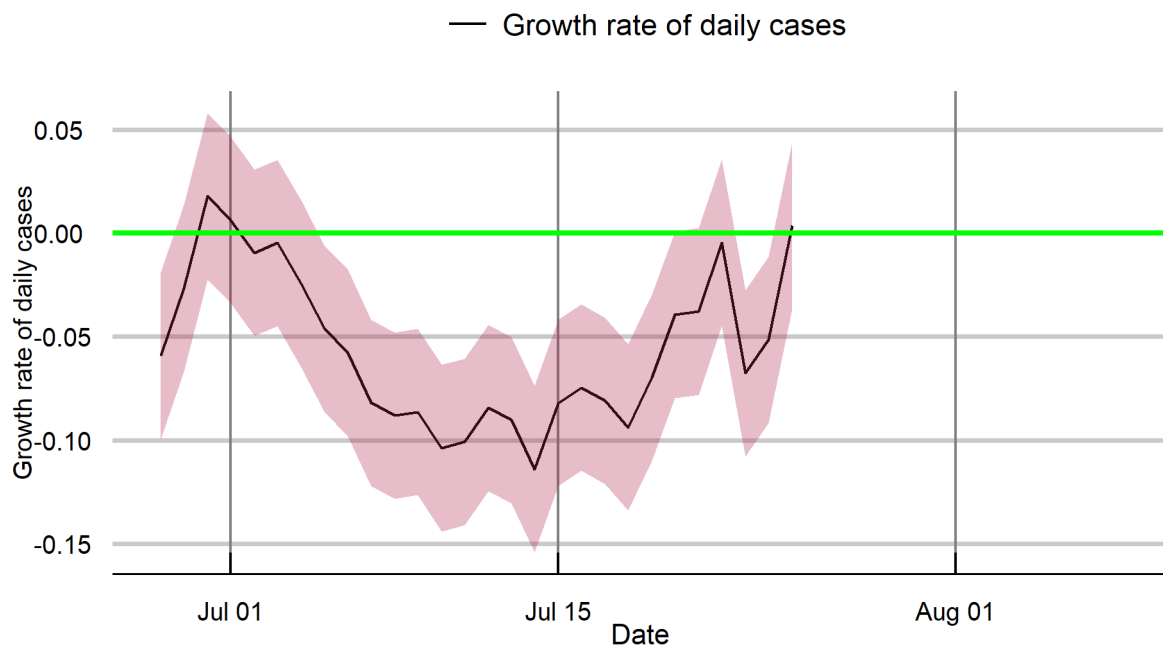
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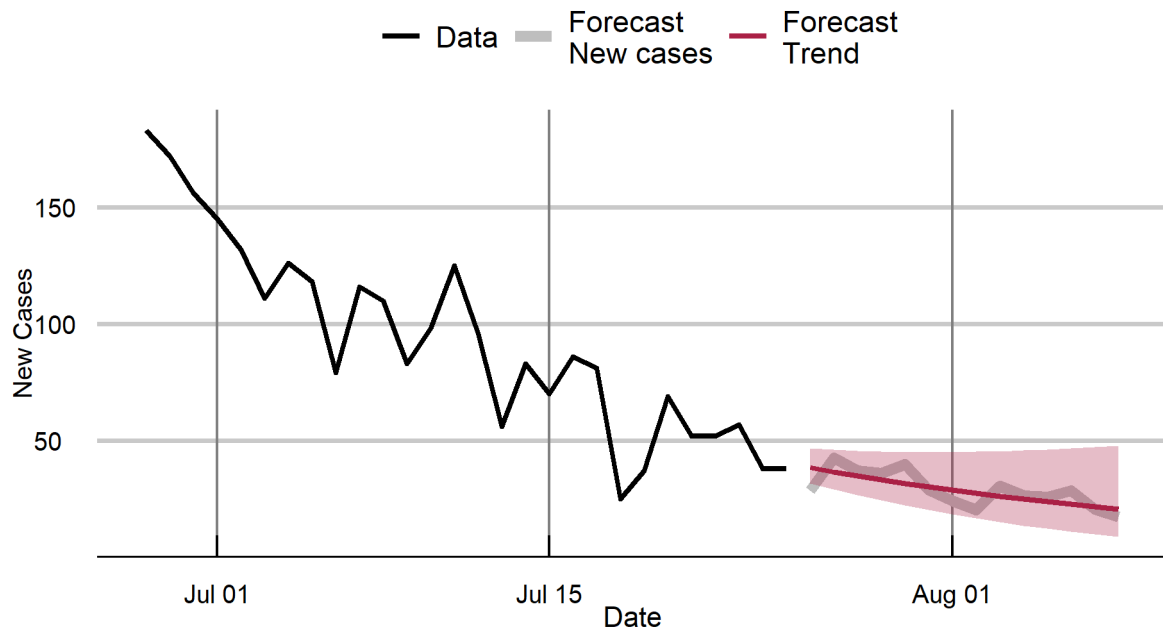
Uttarakhand



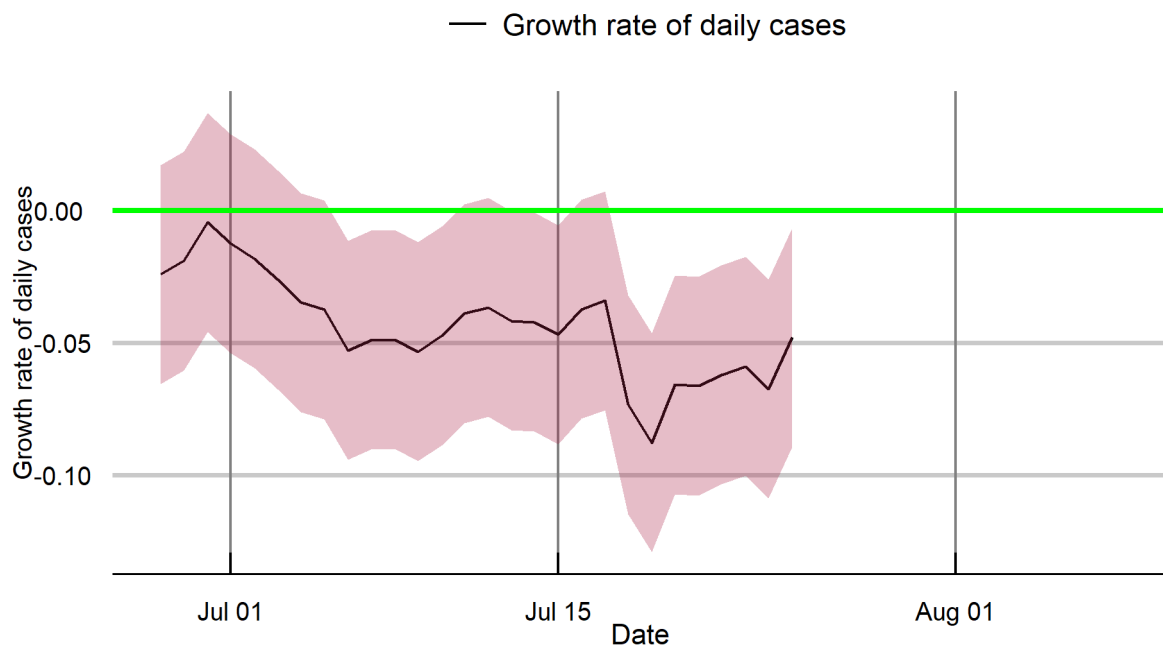
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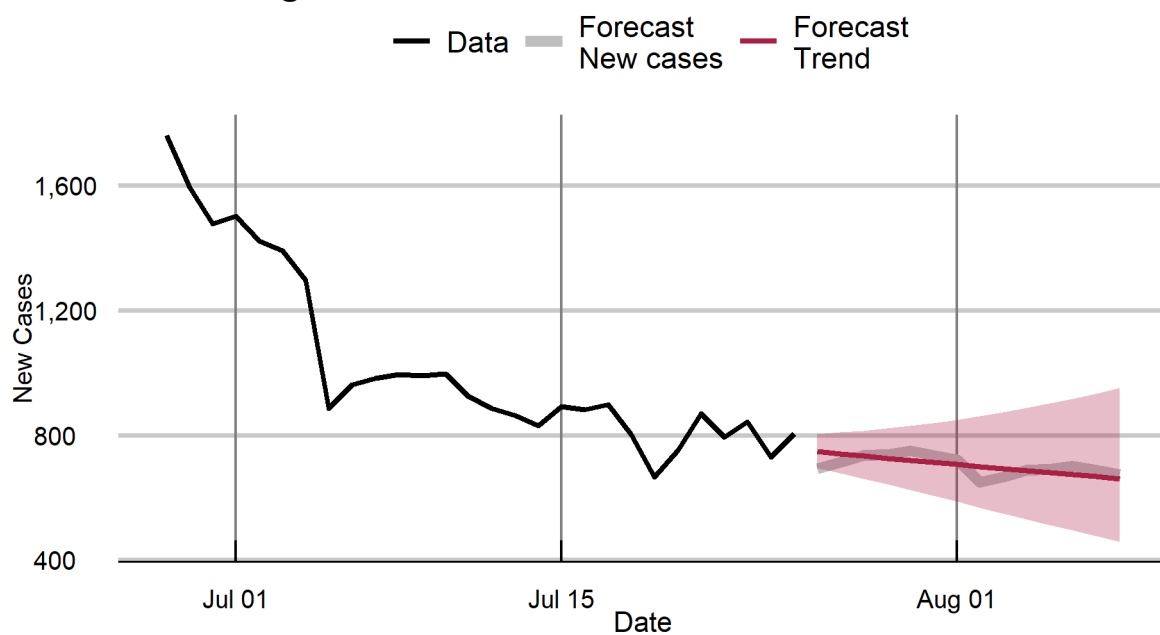
Uttar Pradesh



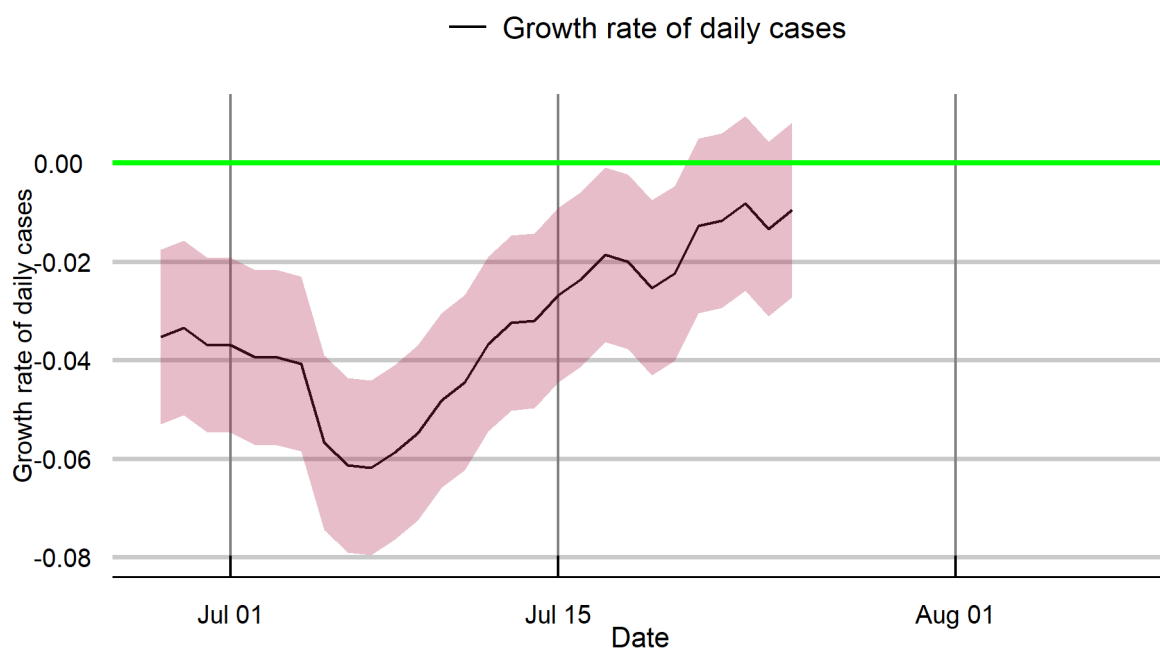
Uttar Pradesh



West Bengal



West Bengal

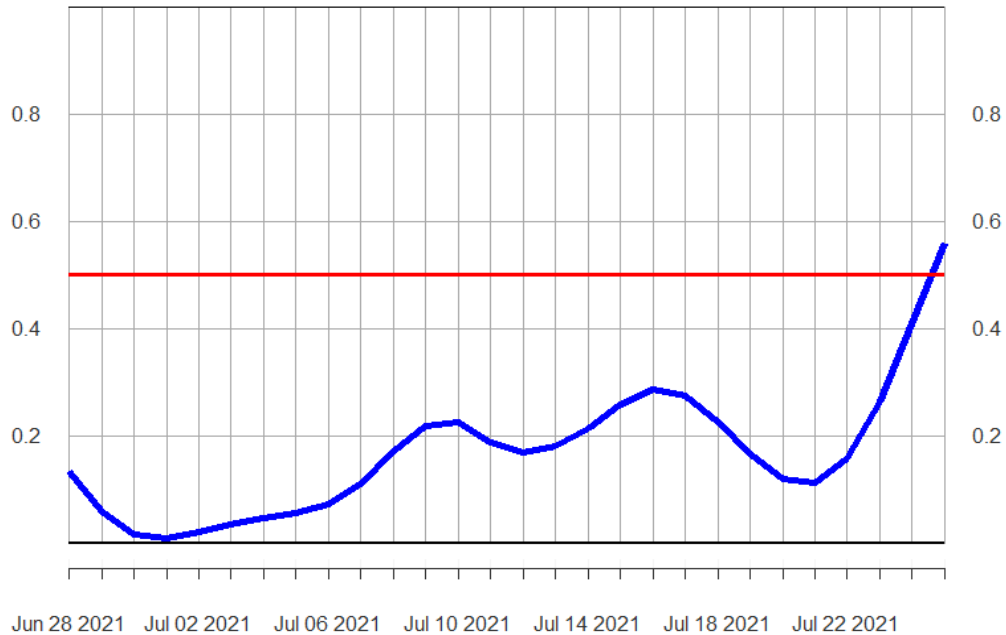


The nature of growth in new cases:

States with positive daily growth rates which are likely to be accelerating

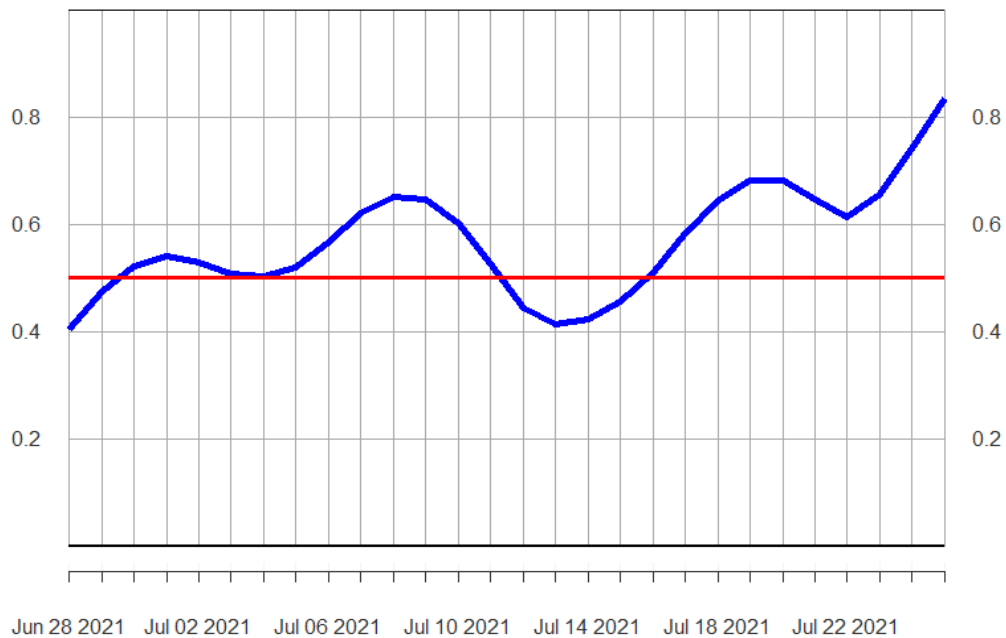
**Delhi: Probability that
the case growth rate is accelerating
as on 2021-07-25 : 0.56**

2021-06-28 / 2021-07-25



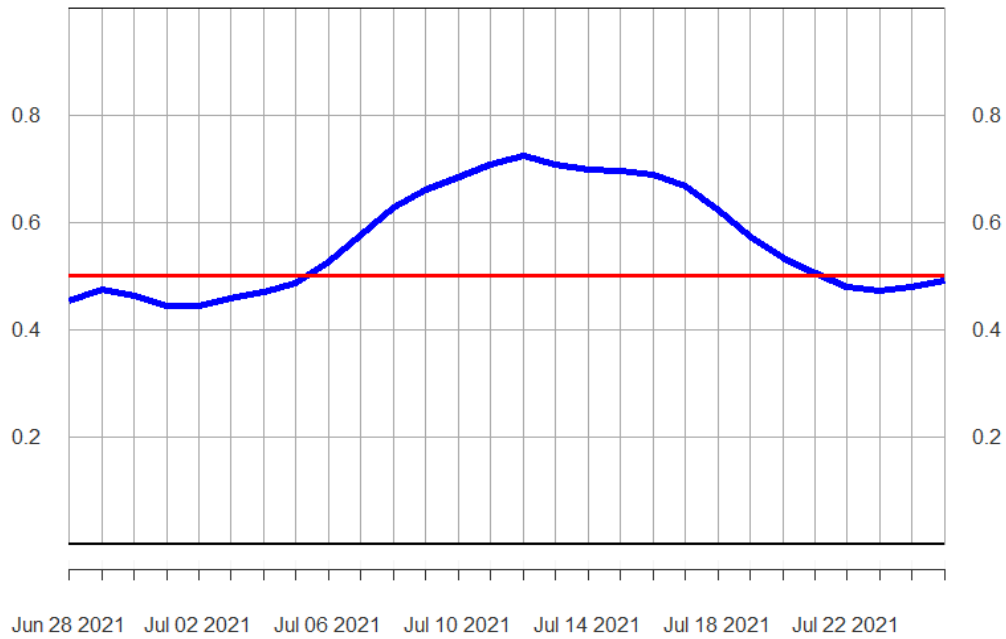
**Kerala: Probability that
the case growth rate is accelerating
as on 2021-07-25 : 0.84**

2021-06-28 / 2021-07-25



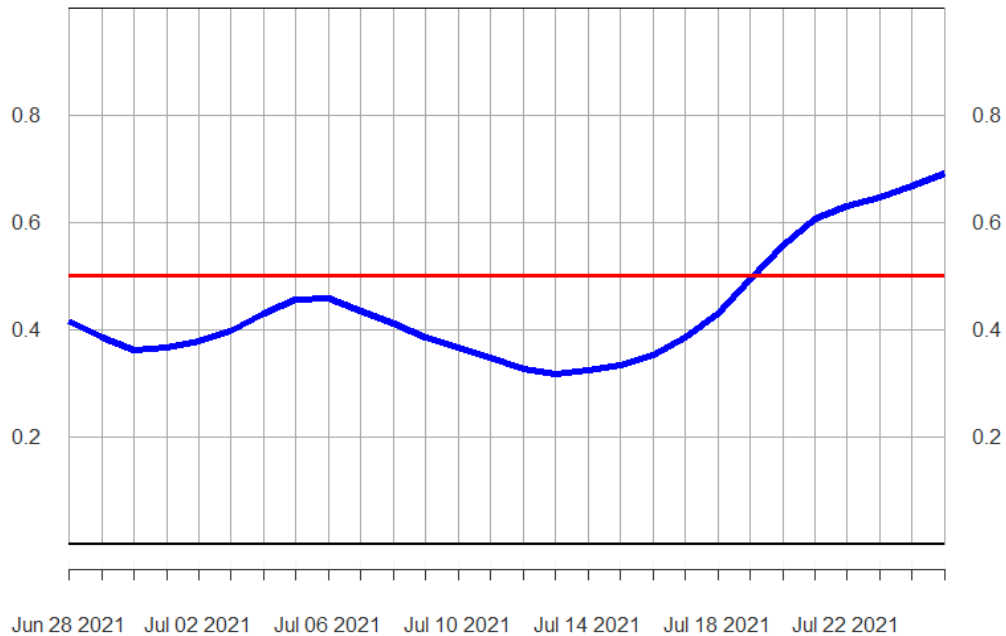
**Manipur: Probability that
the case growth rate is accelerating
as on 2021-07-25 : 0.49**

2021-06-28 / 2021-07-25



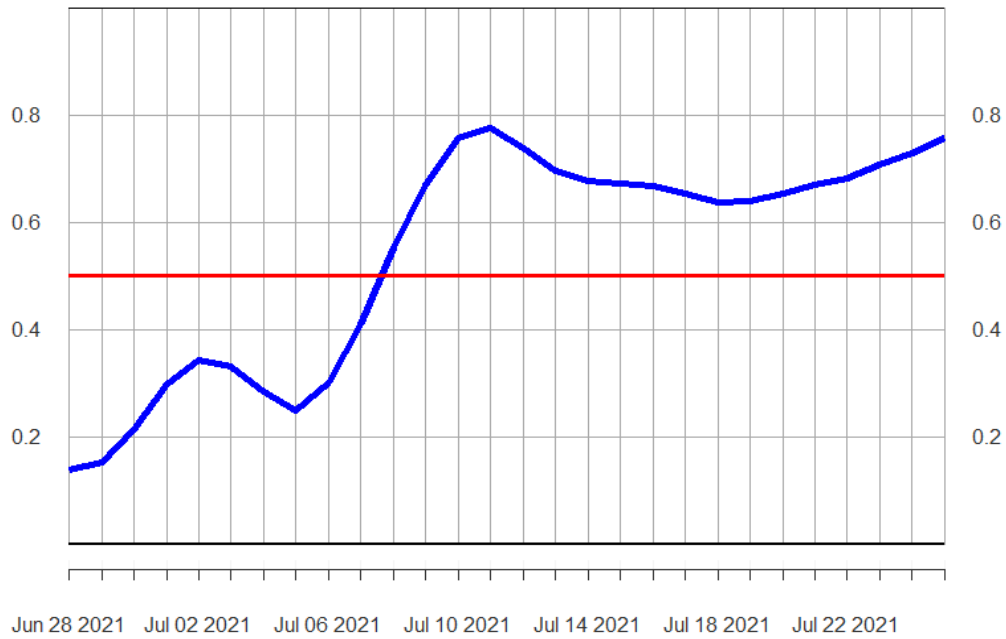
**Meghalaya: Probability that
the case growth rate is accelerating
as on 2021-07-25 : 0.69**

2021-06-28 / 2021-07-25



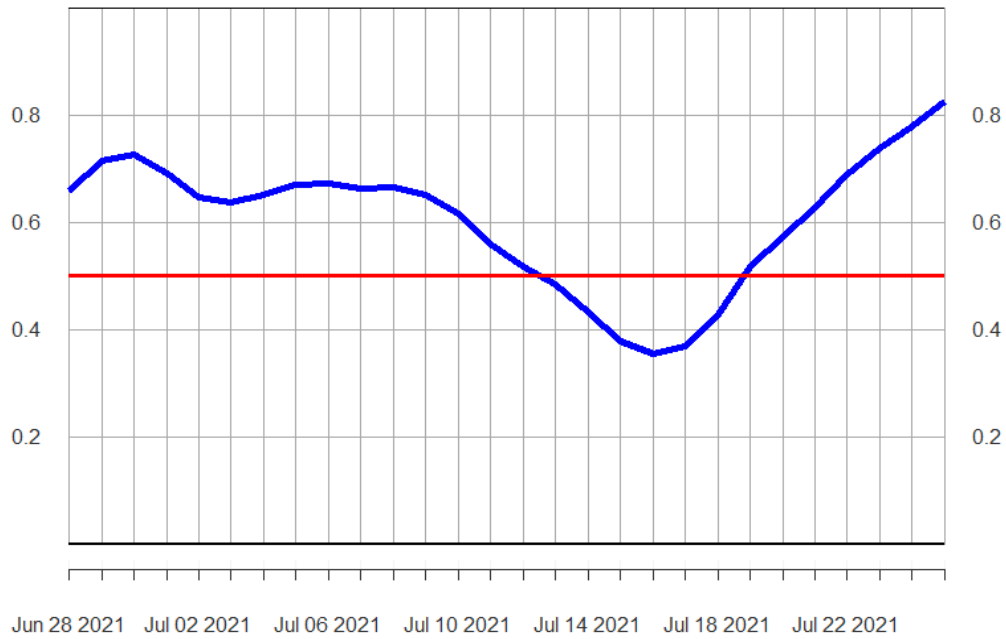
**Mizoram: Probability that
the case growth rate is accelerating
as on 2021-07-25 : 0.76**

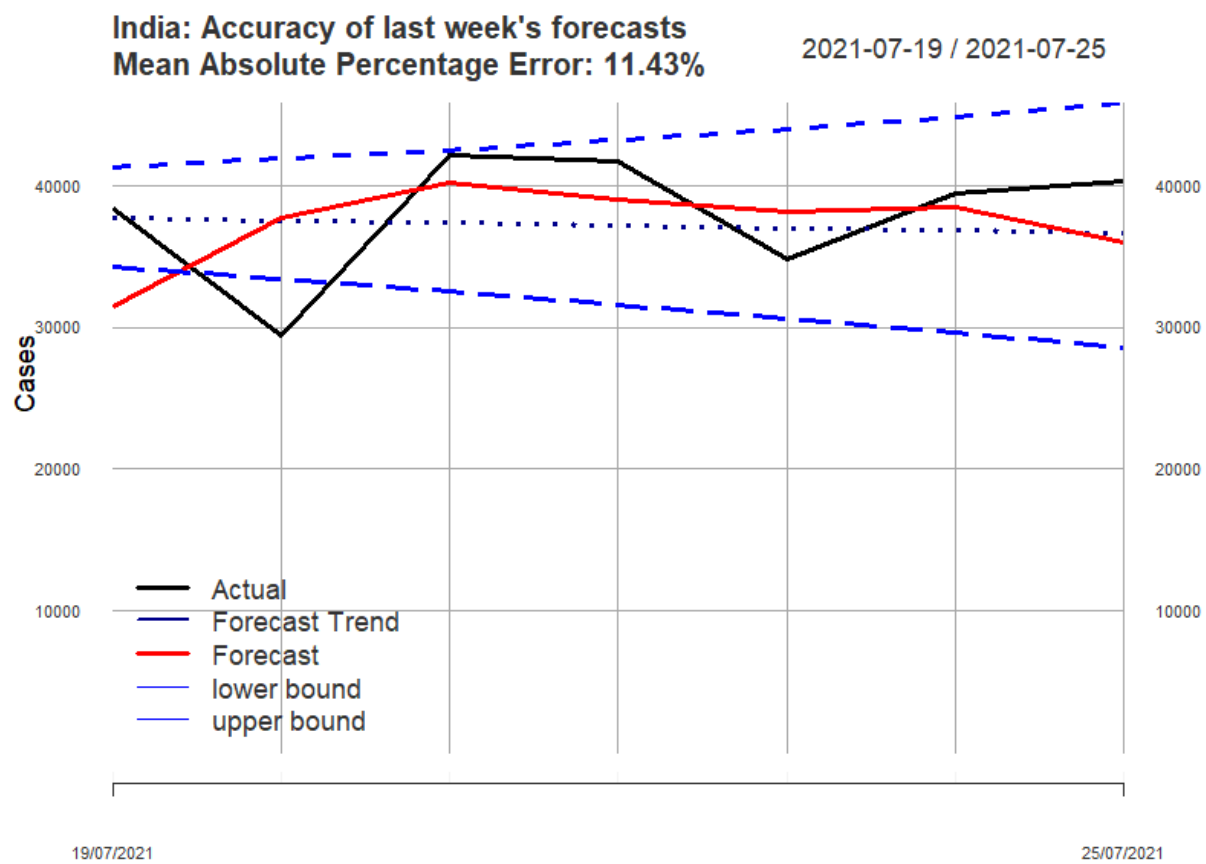
2021-06-28 / 2021-07-25



**Sikkim: Probability that
the case growth rate is accelerating
as on 2021-07-25 : 0.83**

2021-06-28 / 2021-07-25





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/ozgix0yn/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.

Andrew Harvey*, Paul Kattuman*, Rajeev Sadanandan#, Stefan Scholtes*, Craig Thamotheram+

*University of Cambridge.

#Health Systems Transformation Platform.

+National Institute of Economic and Social Research

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