

Cambridge Judge Business School  
Cambridge Centre for Health Leadership & Enterprise

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# COVID-19 TRACKER: INDIA

26 September 2021



Centre for  
**Health Leadership  
& Enterprise**



This tracker<sup>1</sup> was 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 has edged down to 0.96 as of 26 September (from 0.98 a week ago). The filtered daily growth rate has dropped to -1.1% currently (from -0.6% a week ago). The trend value of reported cases in India is expected to be around 23,600 per day in two weeks, by 10 October.*

*The positive prognosis, nationally, is substantially driven by Kerala, where new cases are in steady decline – the daily number is likely to be around 12,500 in the state by 10 October.*

*Also propitious is the fact that the growth rate of cases has declined substantially over the week in Maharashtra, though it remains positive as of date. Mizoram, Tamil Nadu, and West Bengal are the other states with high incidences combined with positive growth rates.*

*Cases also appear to be growing in a number of states that have low reported incidences: Gujarat, Haryana, Nagaland, Uttar Pradesh, Uttarakhand, Jharkhand and Madhya Pradesh -- the last two states, at elevated rates.*

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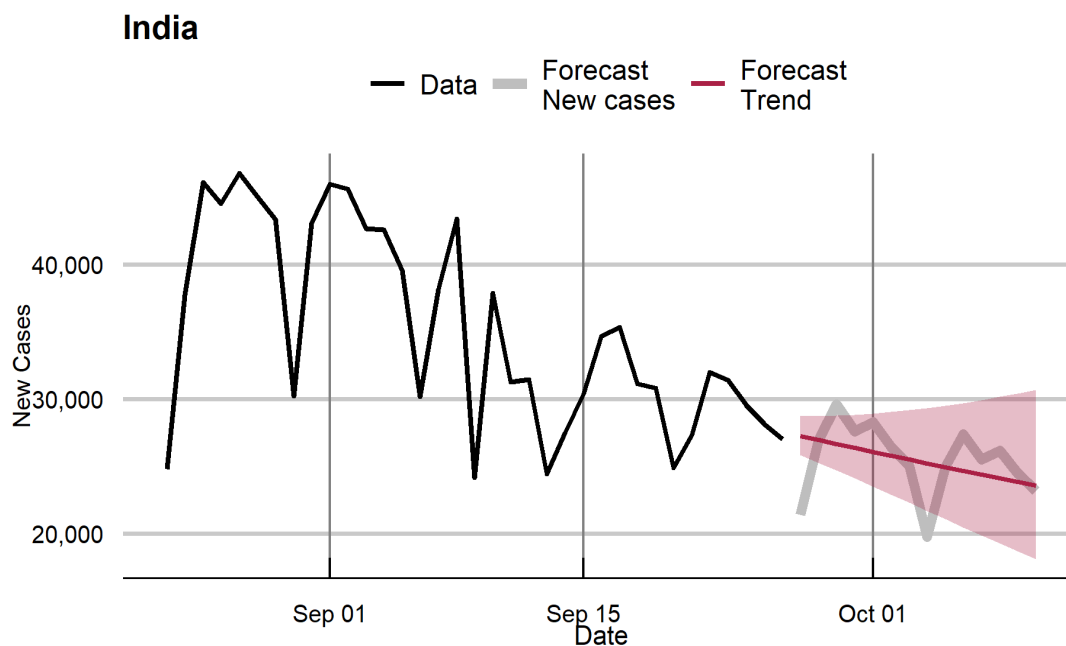
<sup>1</sup> CJBs COVID-19 Tracker for India can be accessed at: [www.jbs.cam.ac.uk/covid-india](http://www.jbs.cam.ac.uk/covid-india)

The companion spreadsheet contains all the estimates and forecasts. A UK [tracker](#) based on the same forecasting method is published by the [National Institute of Economic and Social Research](#).

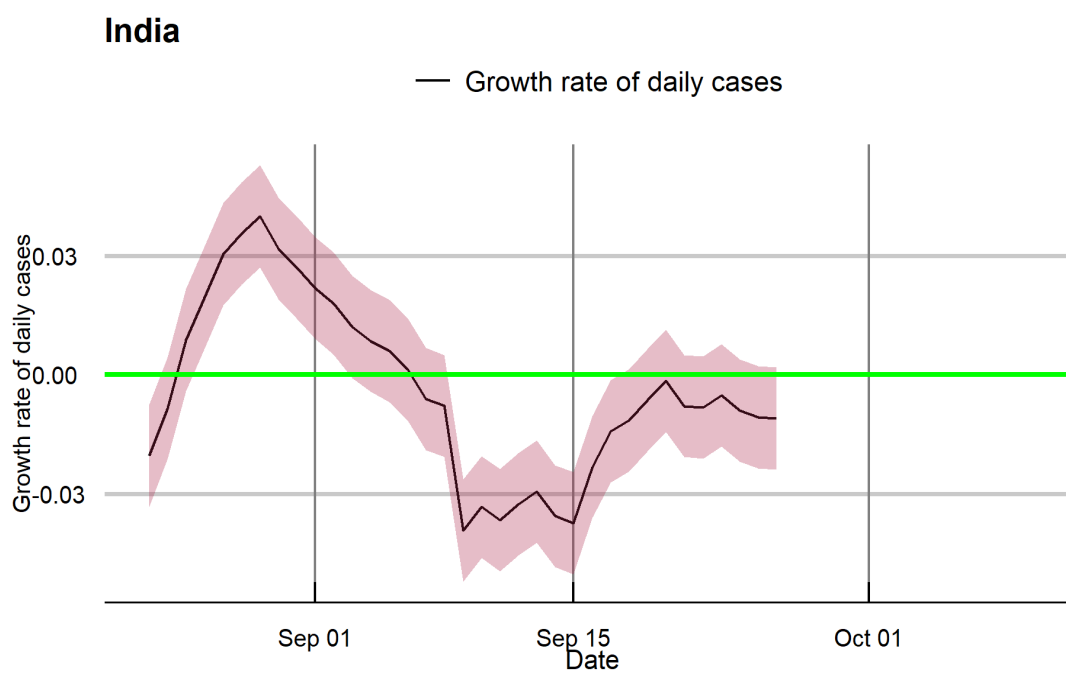
Contact: [Paul Kattuman](#)

## Daily Covid-19 cases in India: Forecast

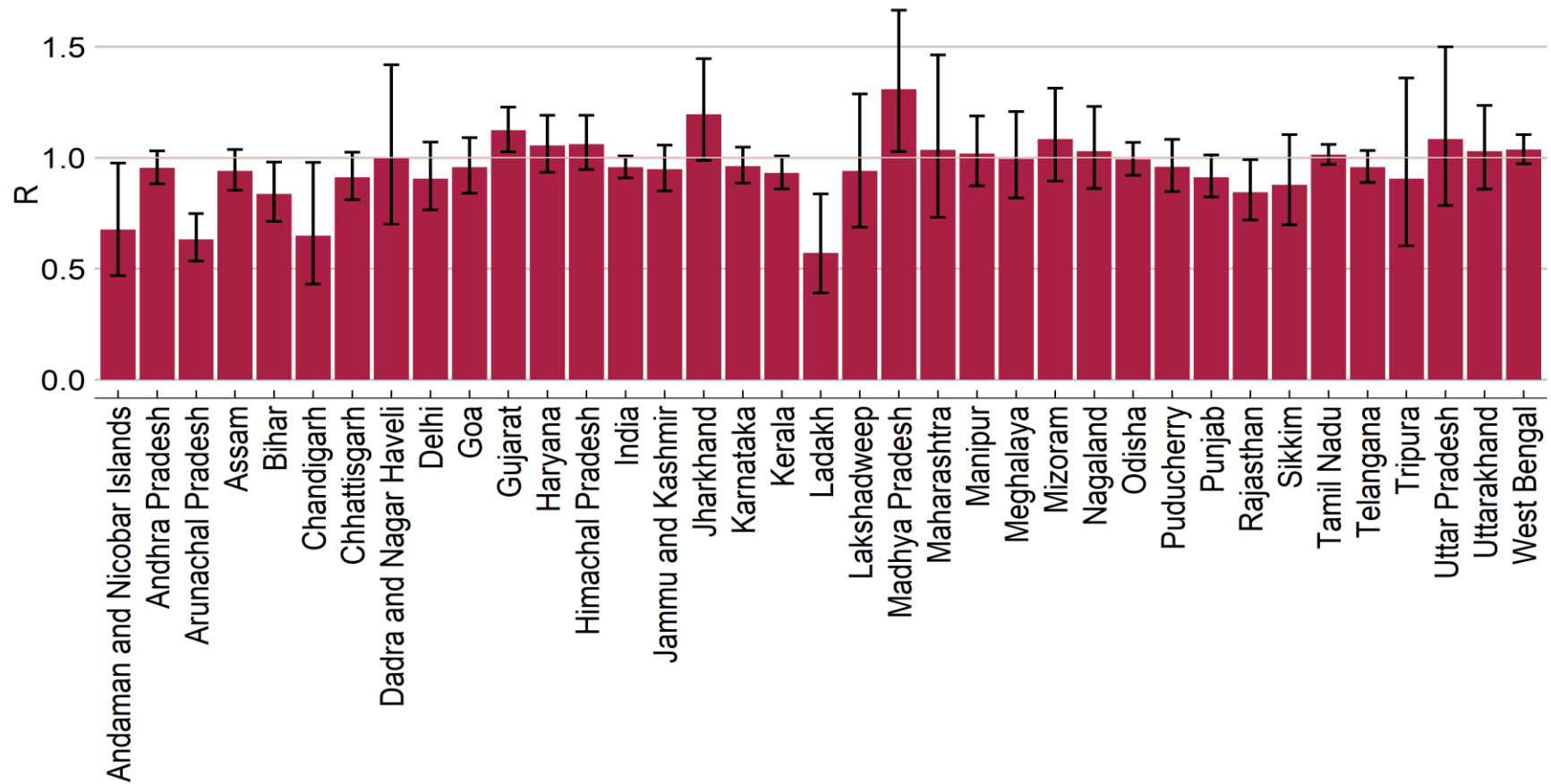
Forecasts of daily new cases for the period 27 September to 10 October 2021, based on data till 26 September 2021. The trend value of new COVID-19 cases is likely be around 23,600 per day by 10 October.



The filtered growth rate of daily new cases was -0.011 (-1.1 %) as on 26 September 2021.



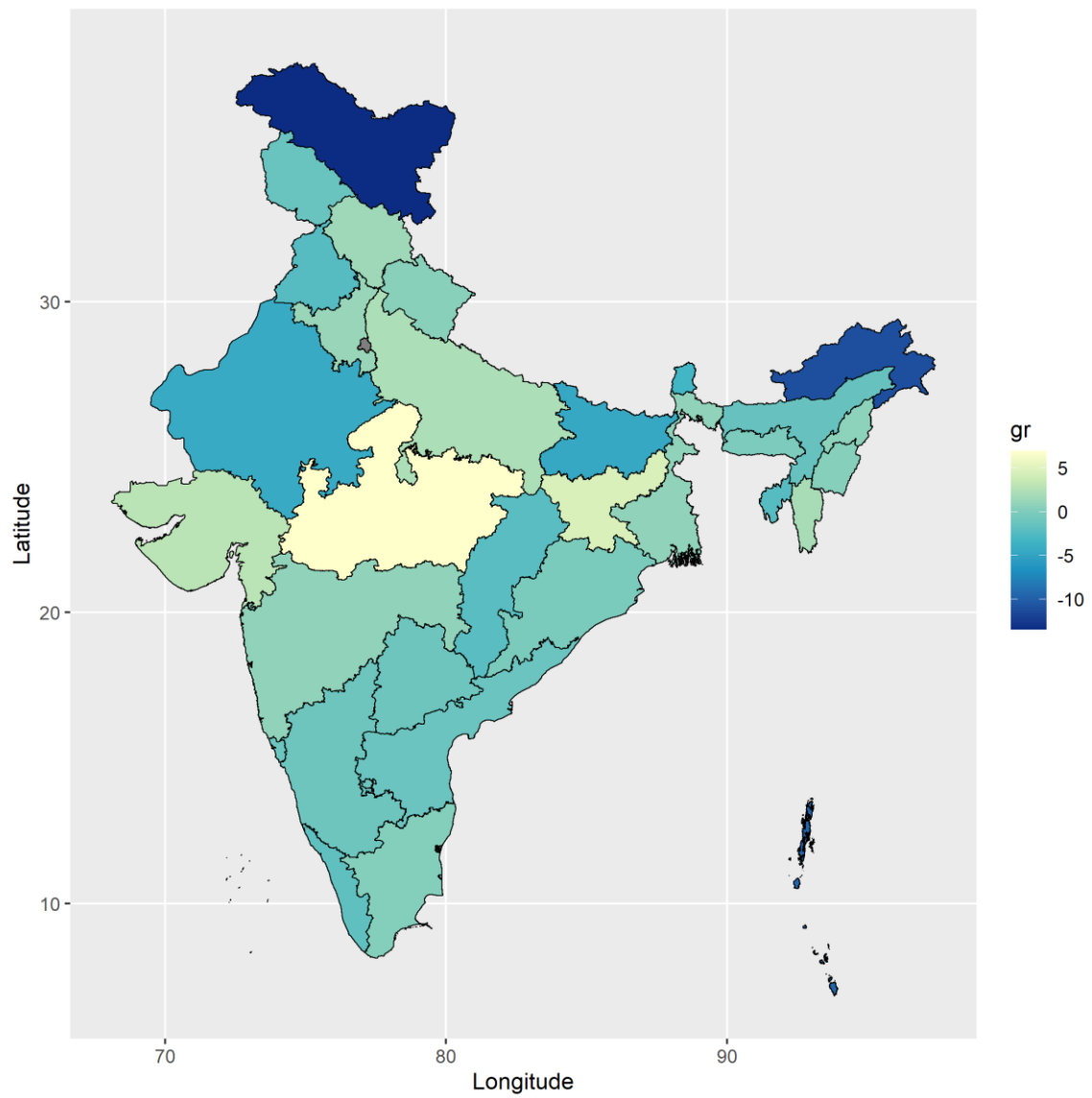
**R<sub>t</sub>: 26 September 2021**



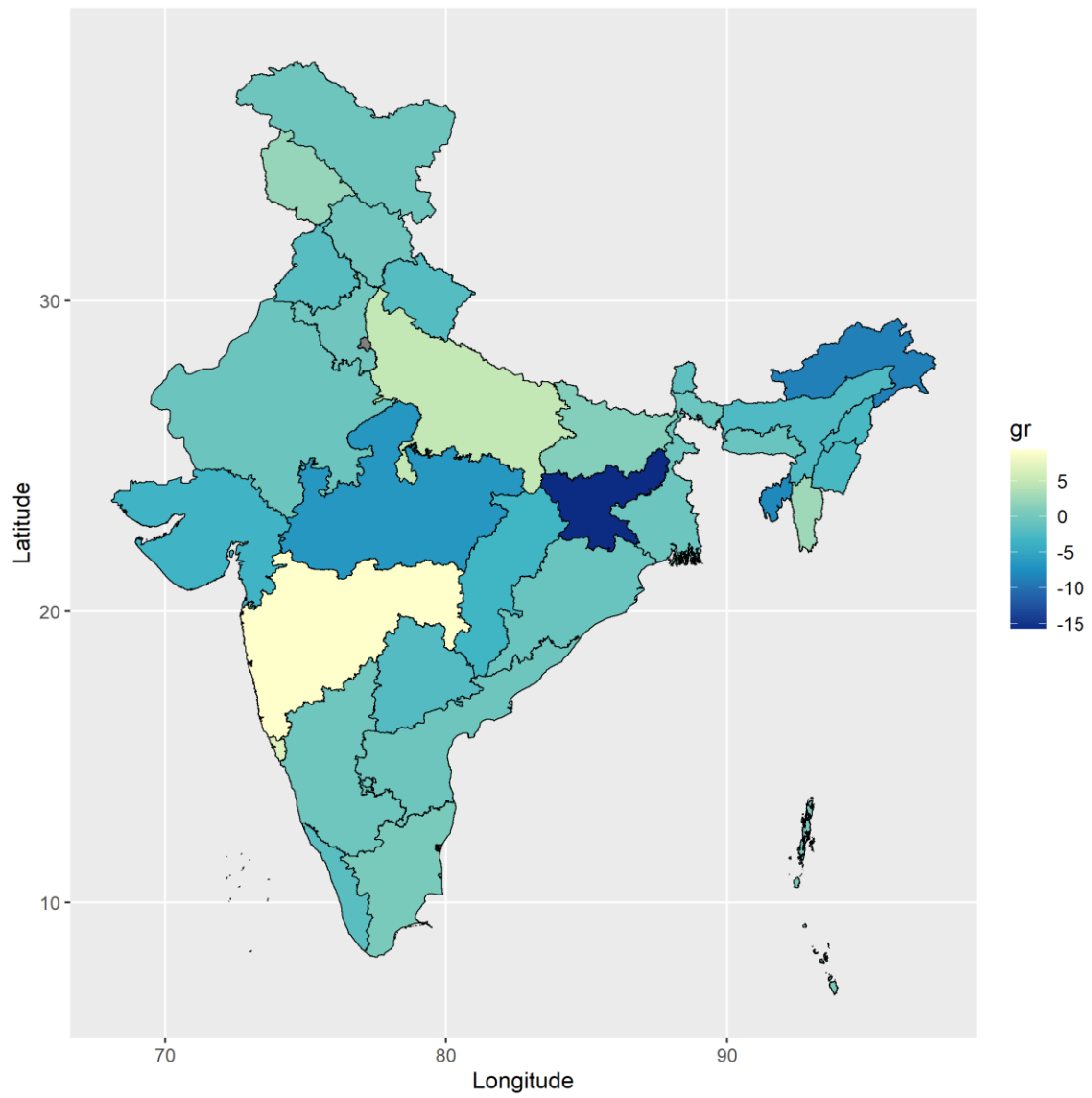
Bar chart shows point estimates of R and the  $\pm 1$  standard deviation confidence intervals

Note: Small daily numbers (less than 25) currently seen in Andaman and Nicobar Islands, Arunachal Pradesh, Bihar, Chandigarh, Chhattisgarh, Dadra and Nagar Haveli, Gujarat, Haryana, Jharkhand, Ladakh, Lakshadweep, Madhya Pradesh, Rajasthan, Tripura, Uttar Pradesh and Uttarakhand make their estimates and forecasts less precise.

Daily growth rates of cases (%)  
Trend values as on 26 September 2021

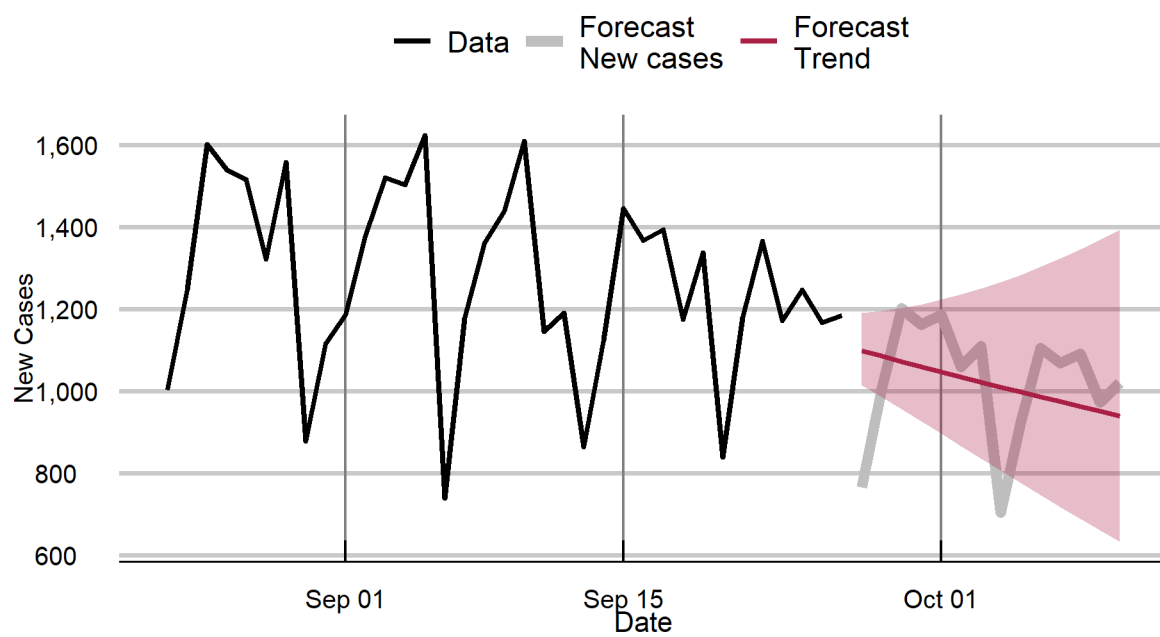


Daily growth rates of cases (%)  
Trend values as on 19 September 2021

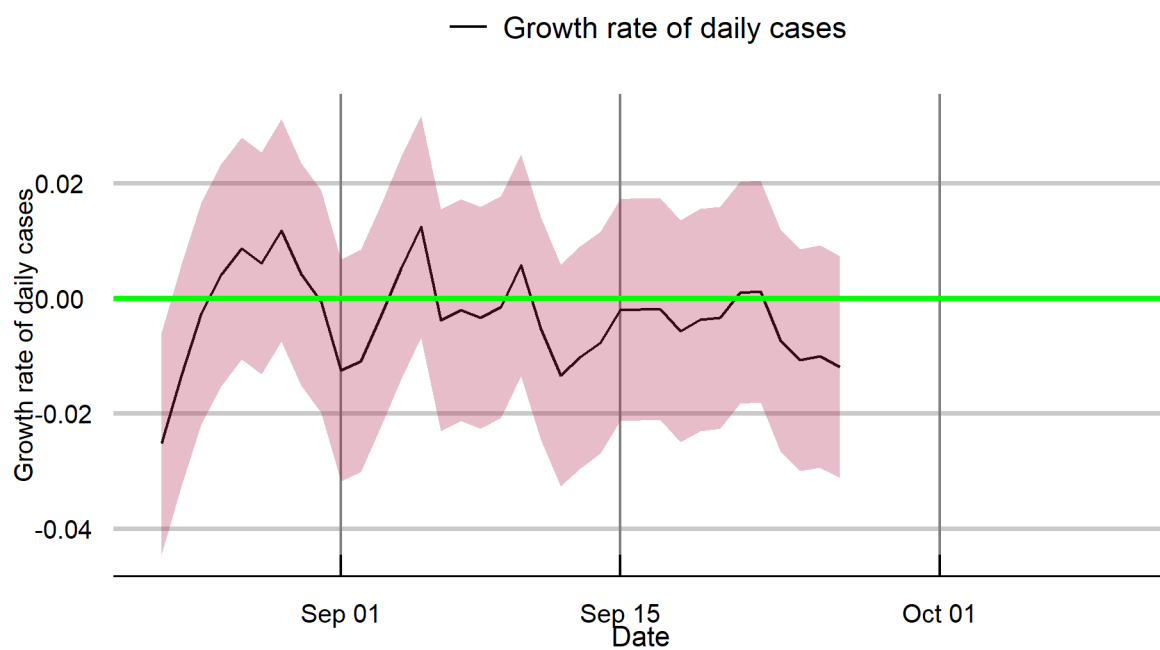


## Case forecasts and growth rates: States and Union territories

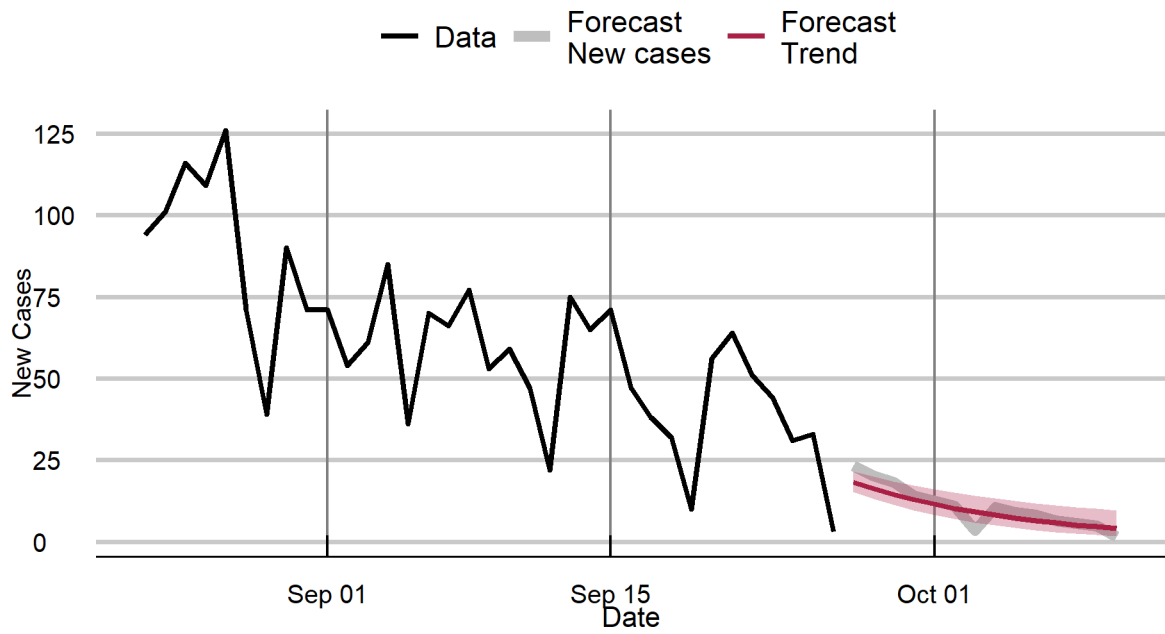
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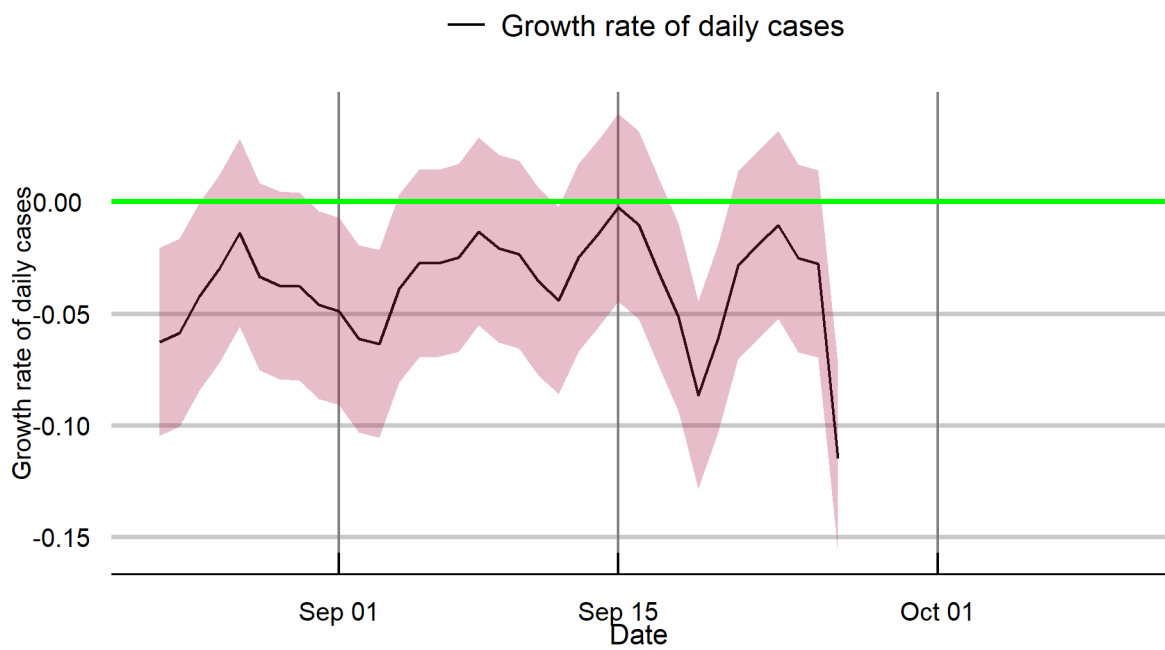
### Andhra Pradesh



## Arunachal Pradesh

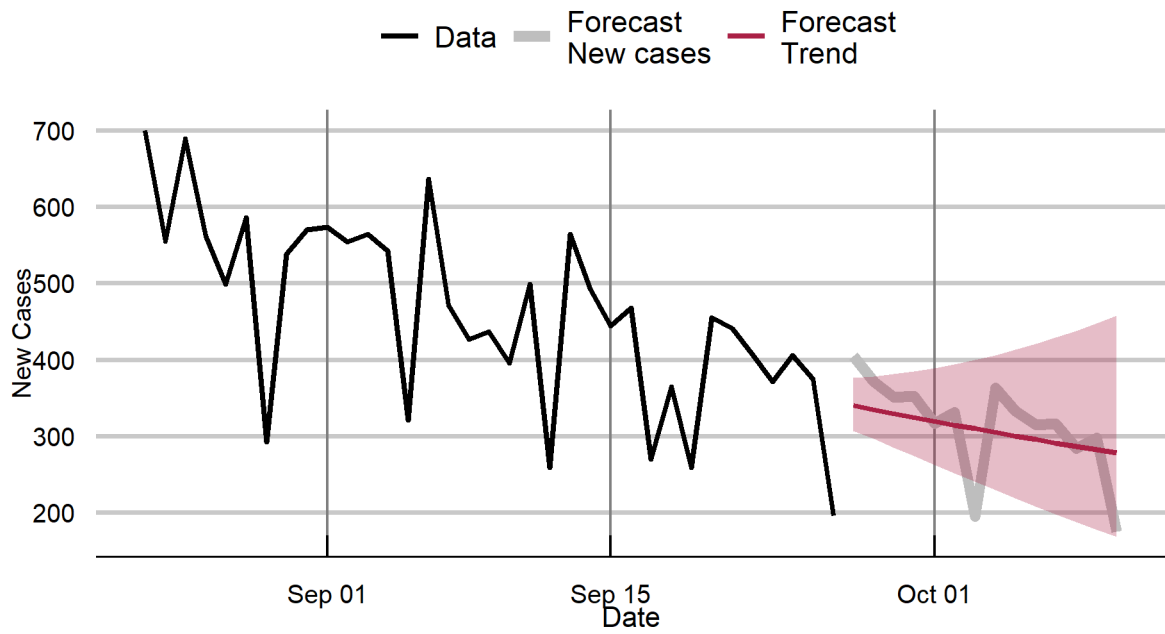


## Arunachal Pradesh

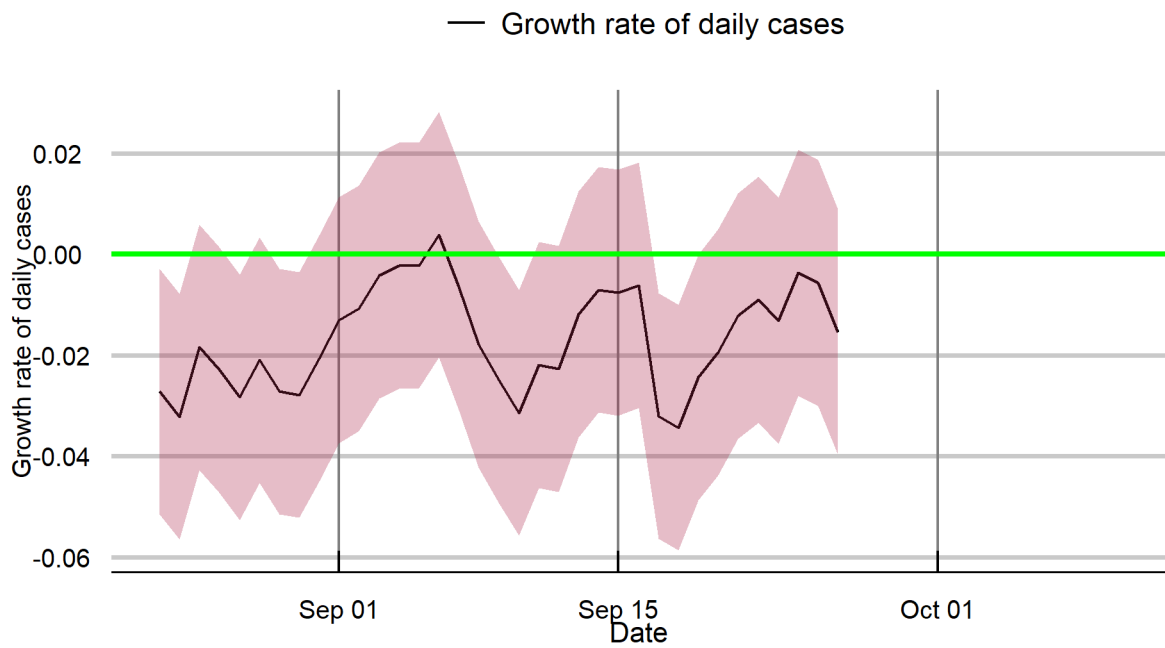




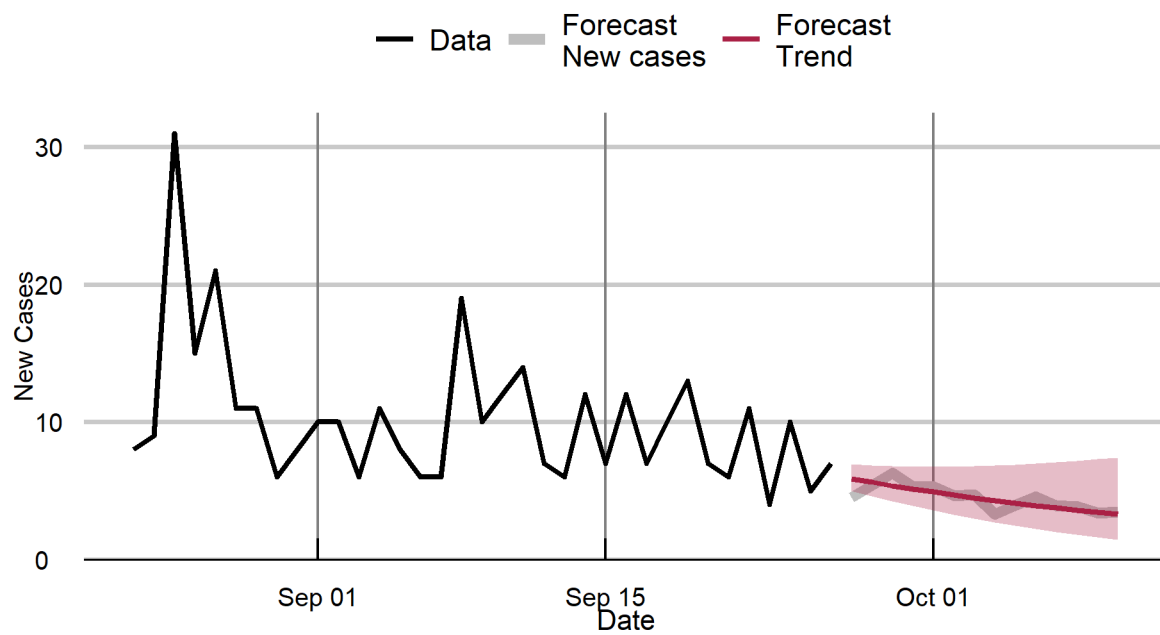
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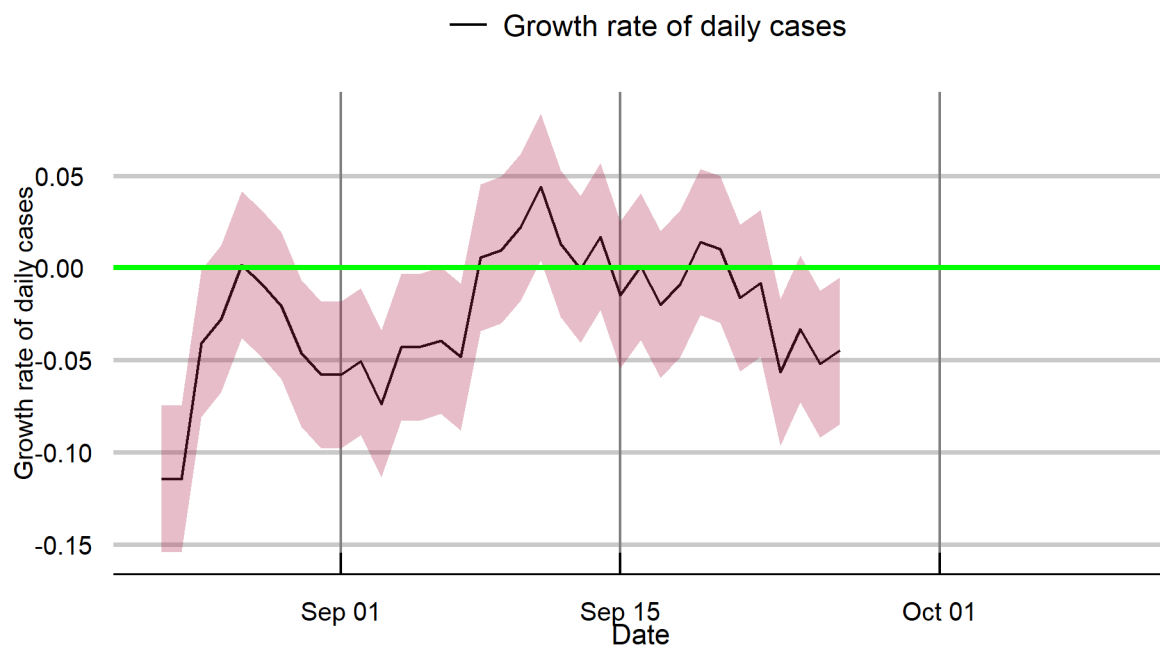
## Assam



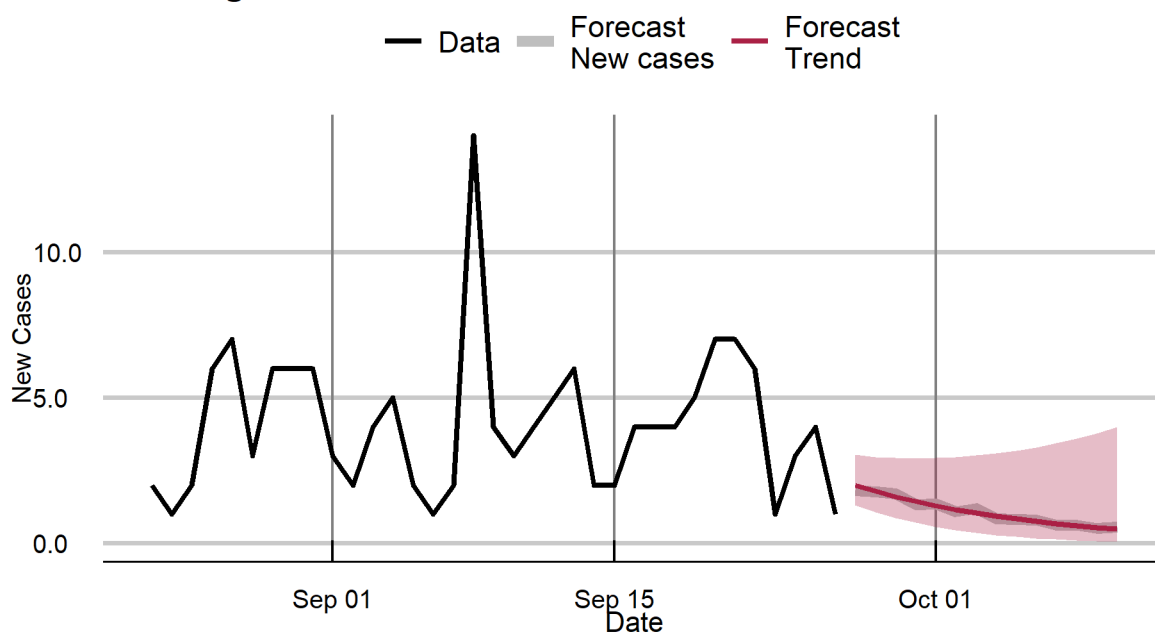
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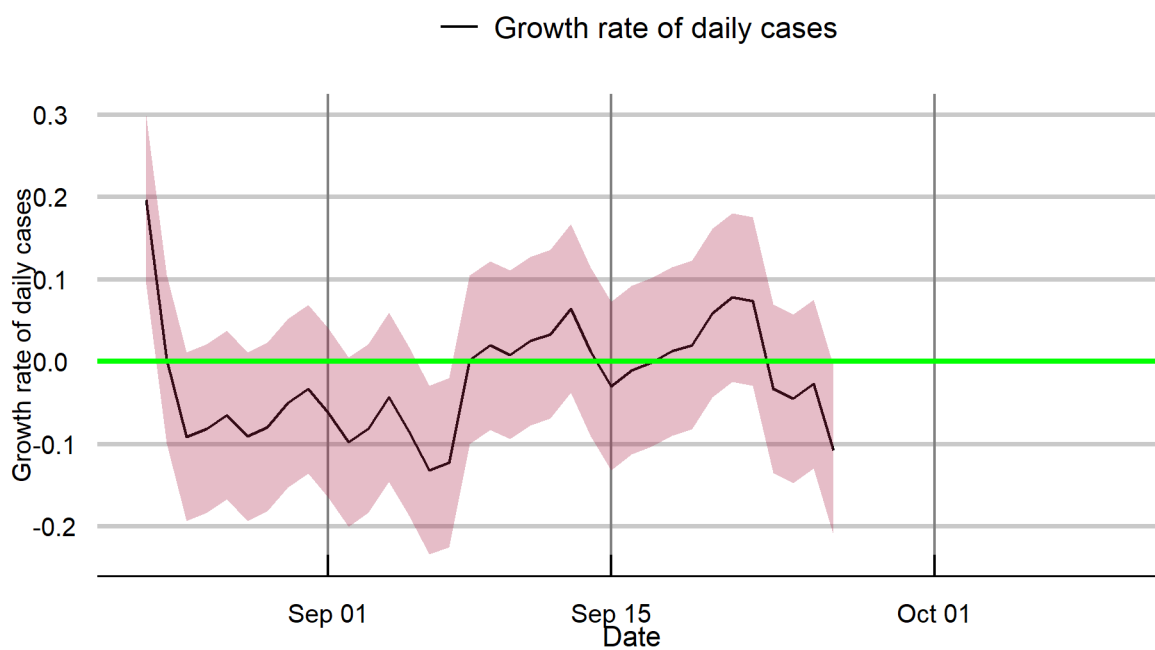
## Bihar



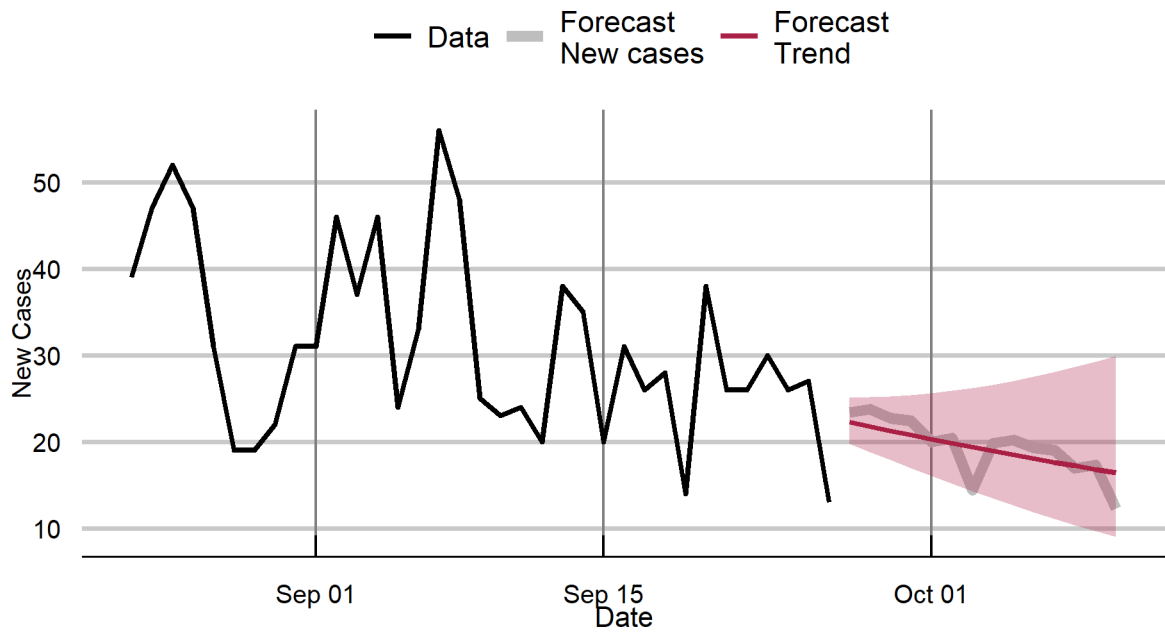
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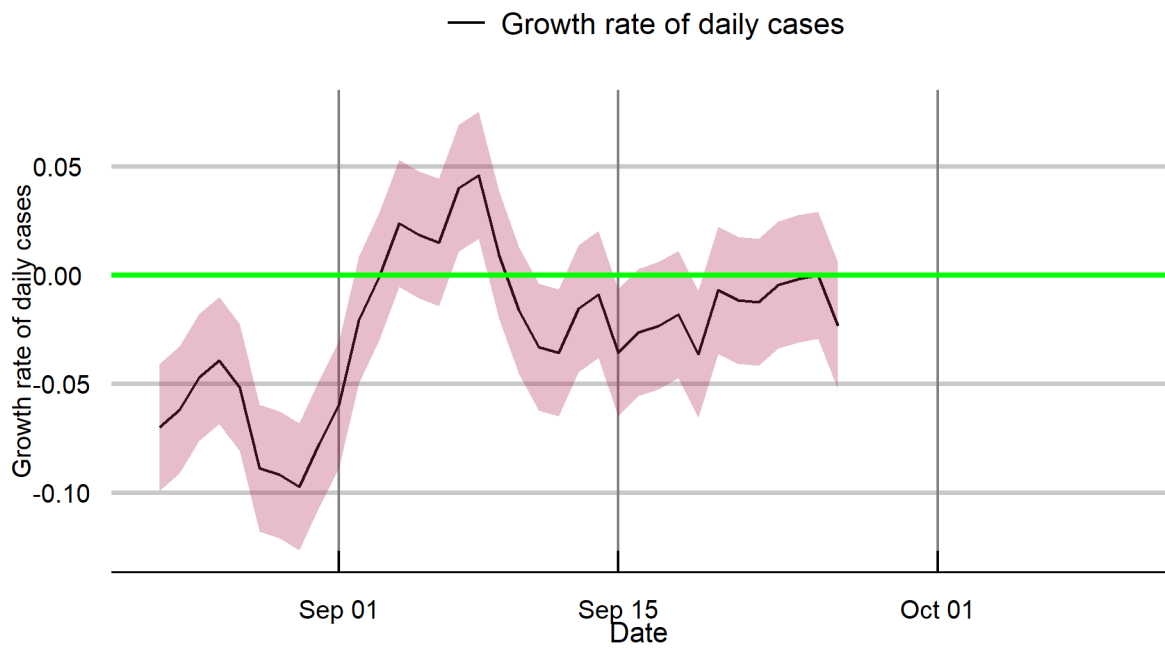
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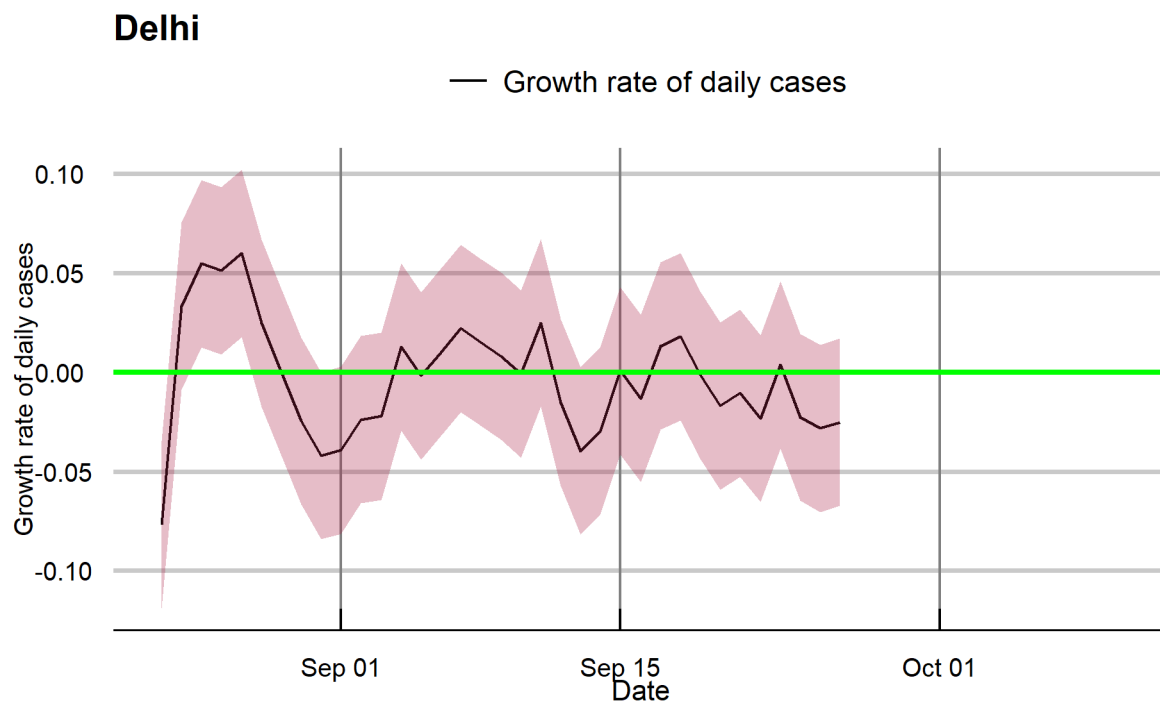
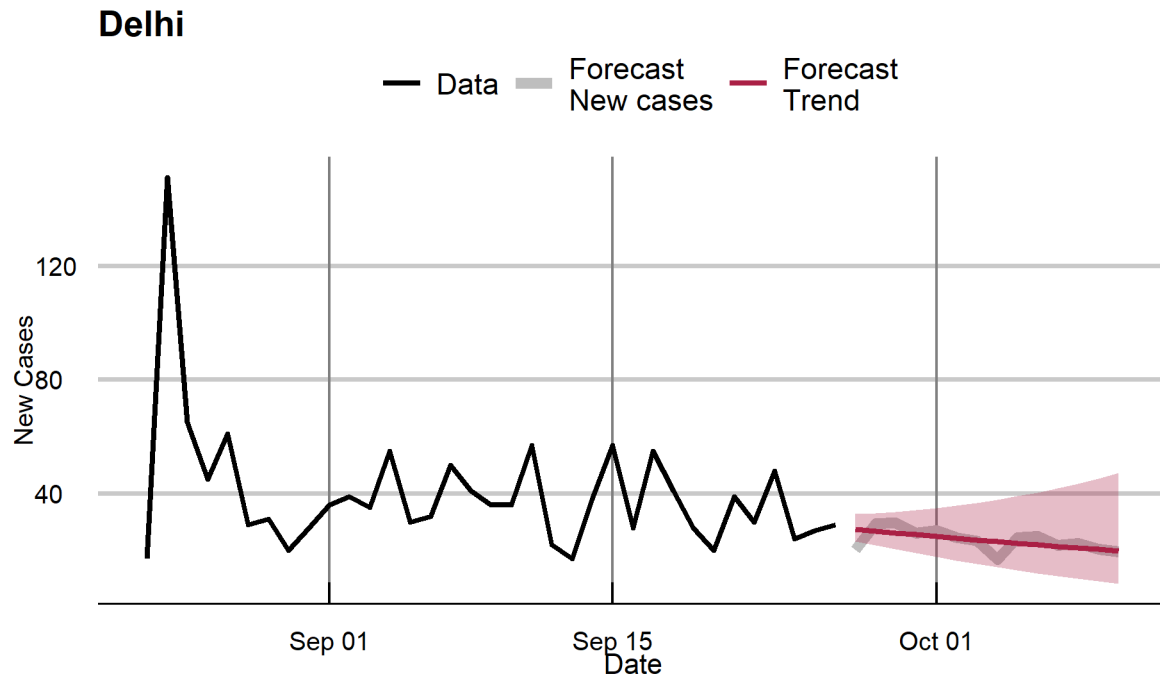


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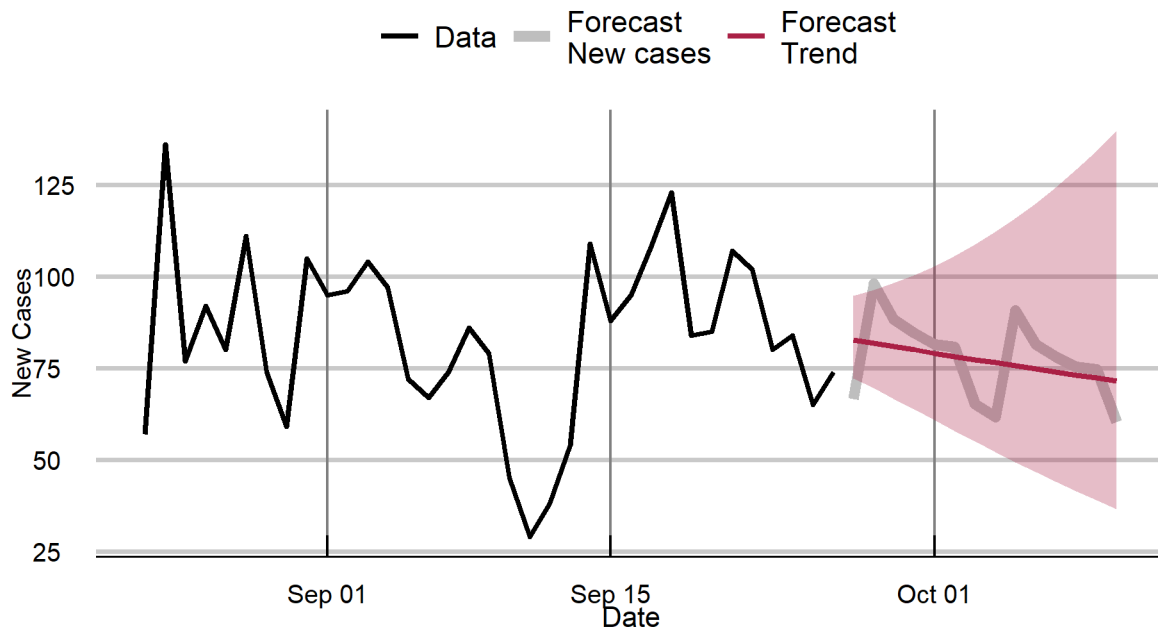


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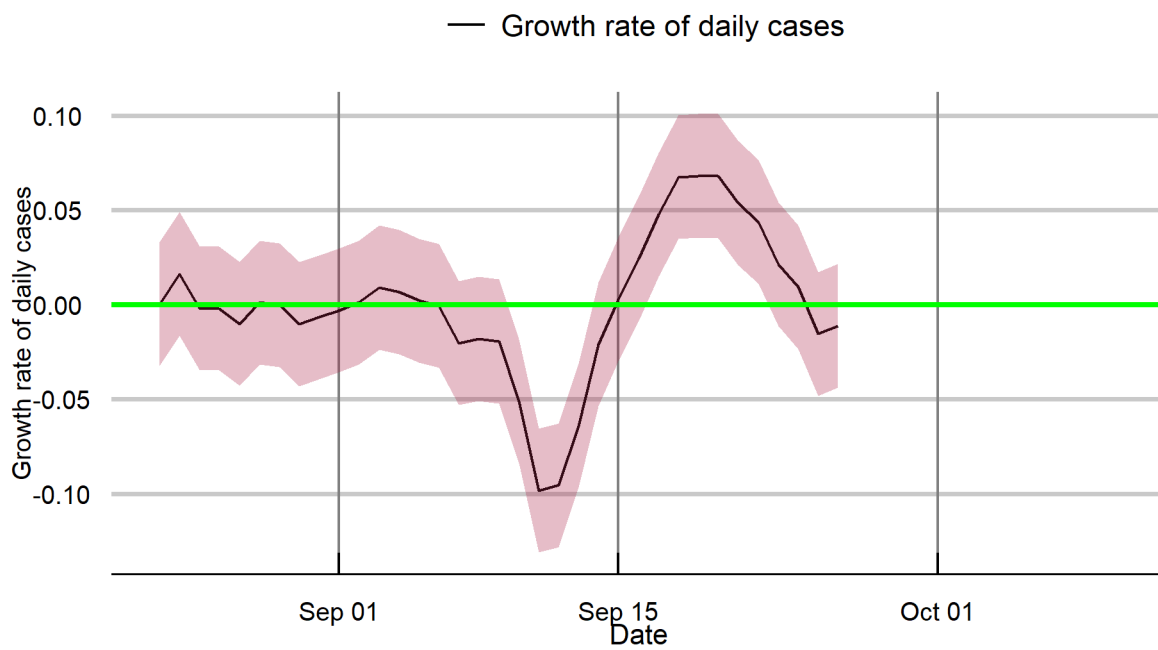




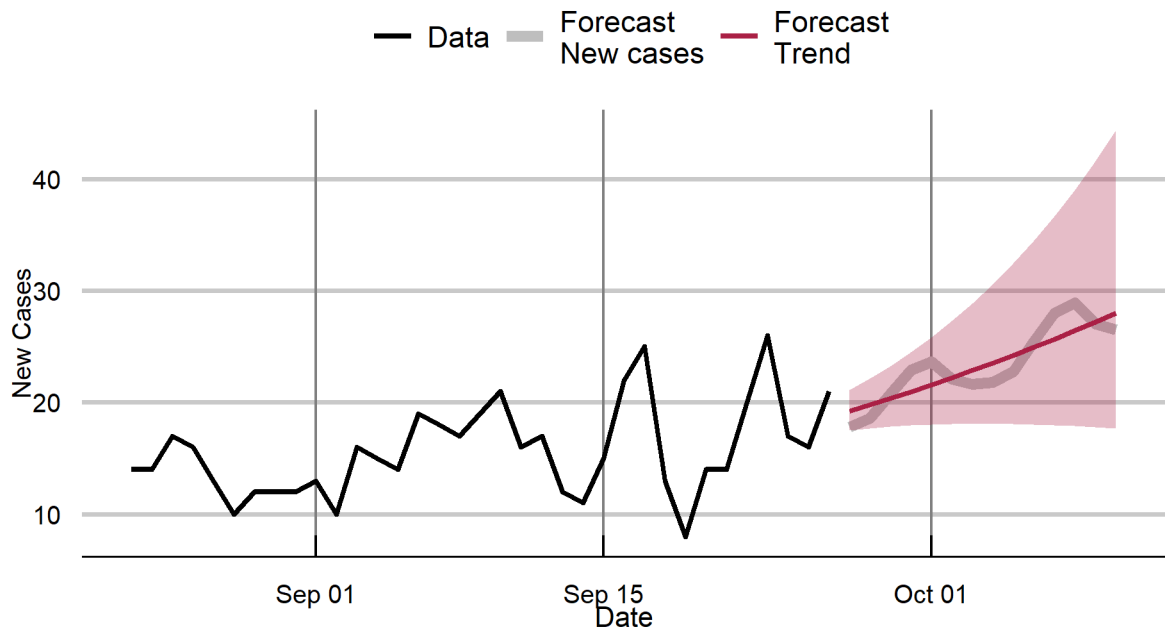
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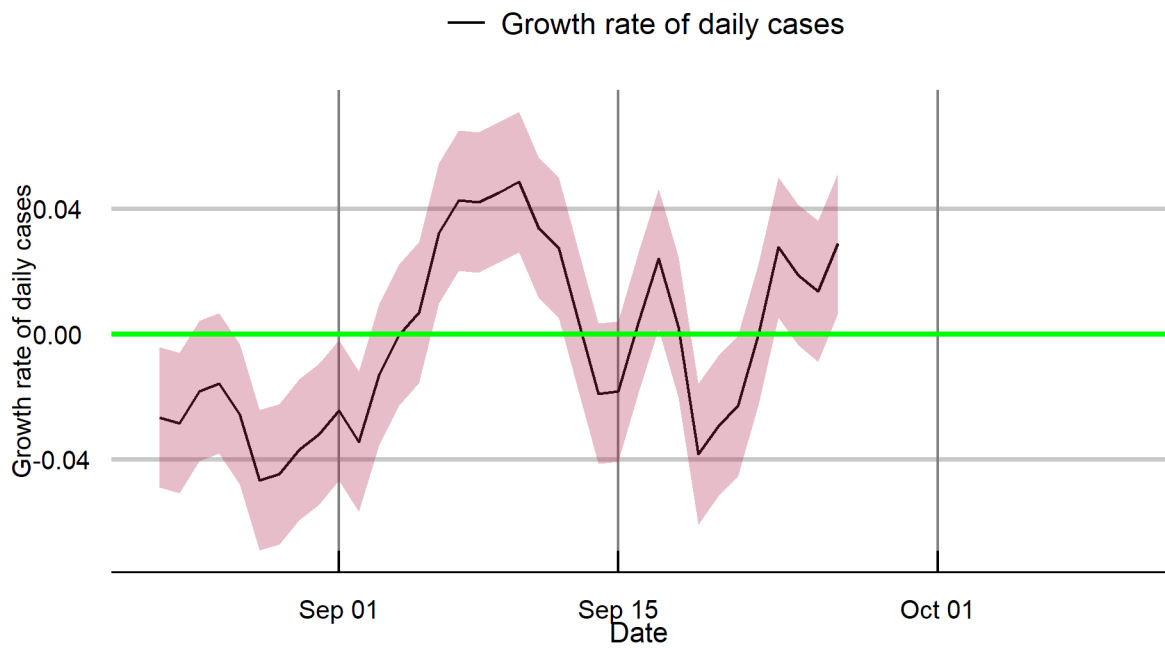
## Goa



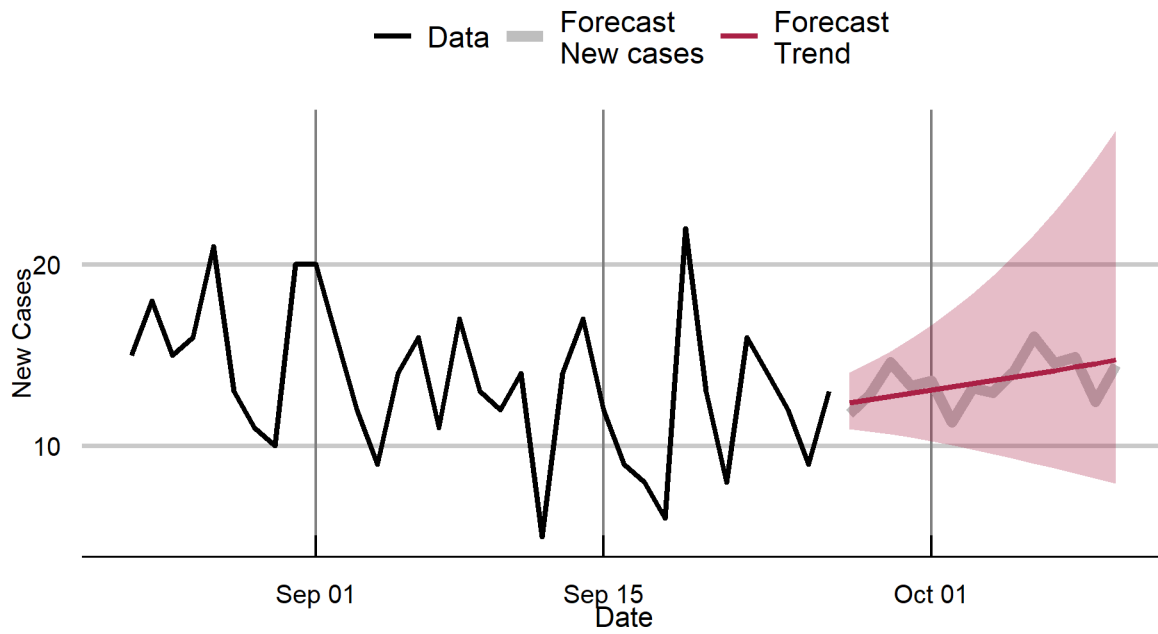
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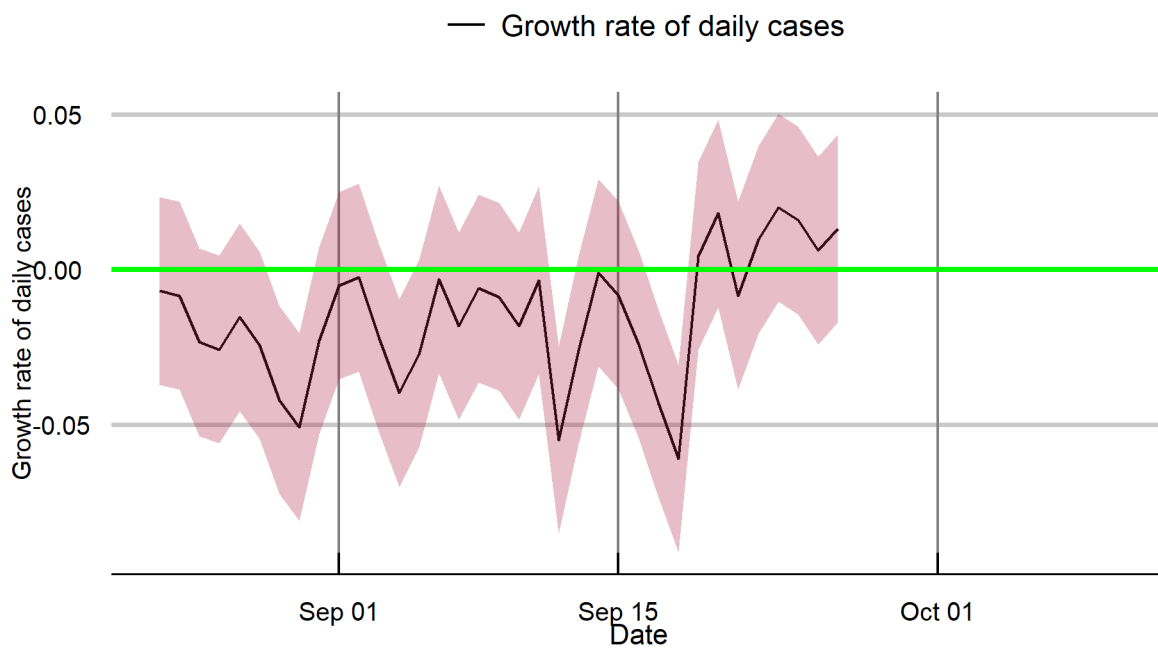
## Gujarat



## Haryana

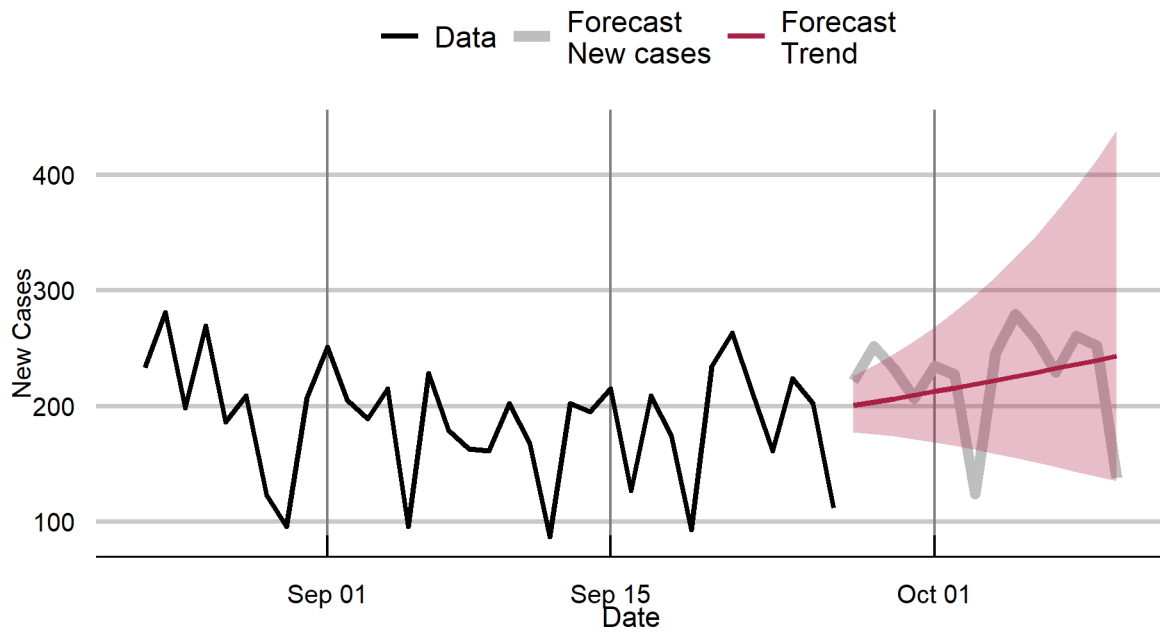


## Haryana

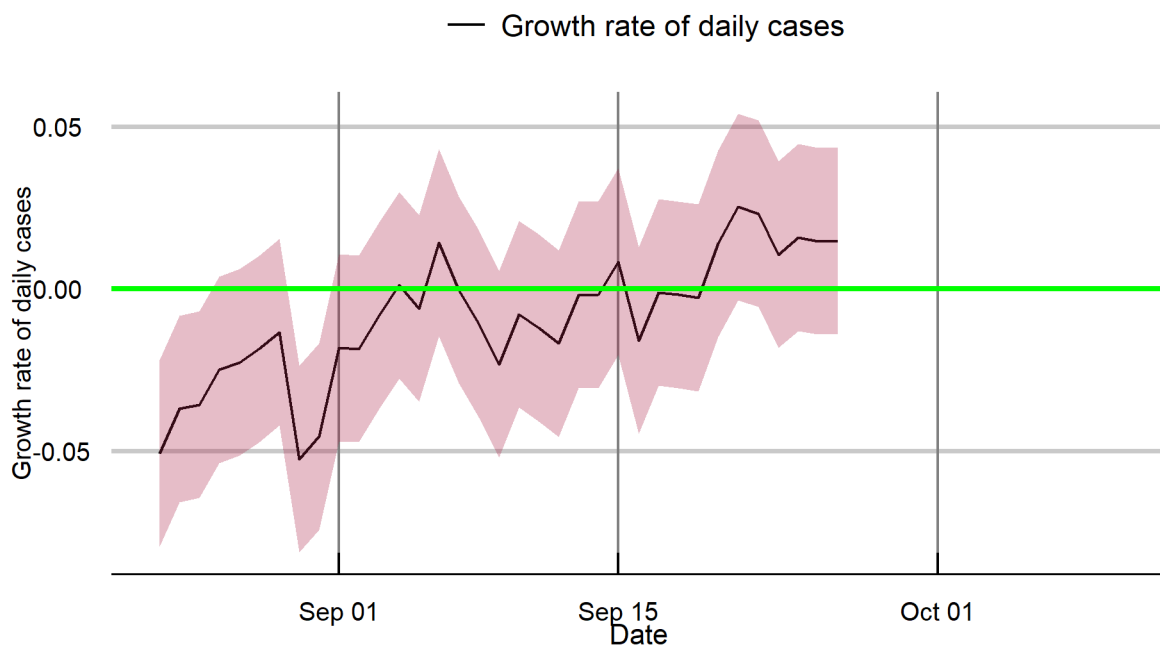




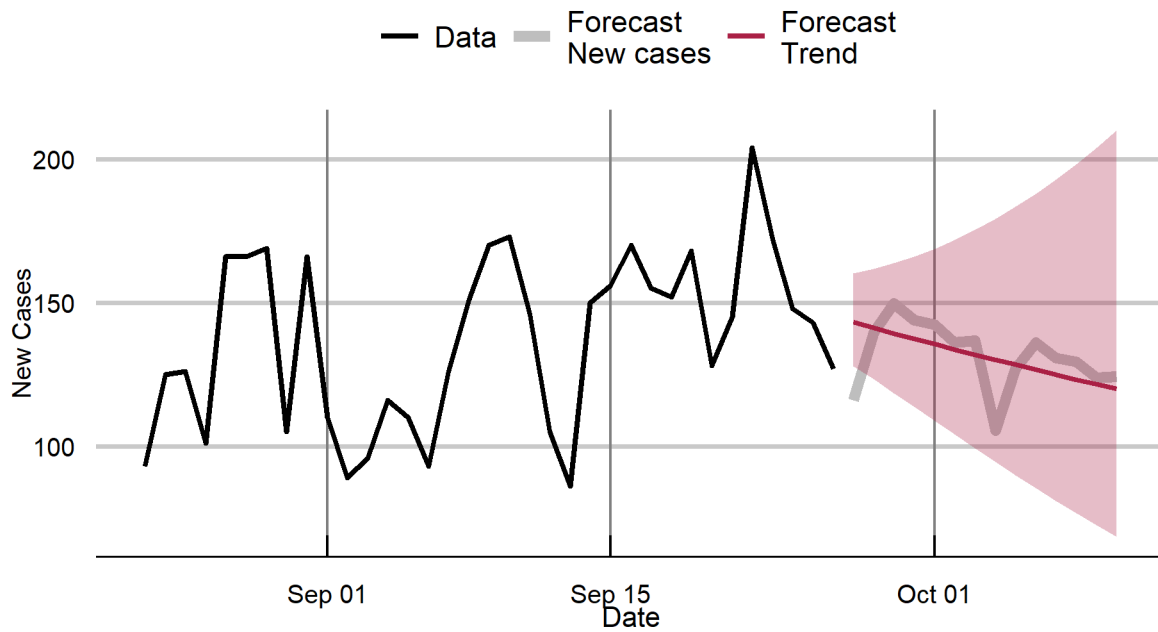
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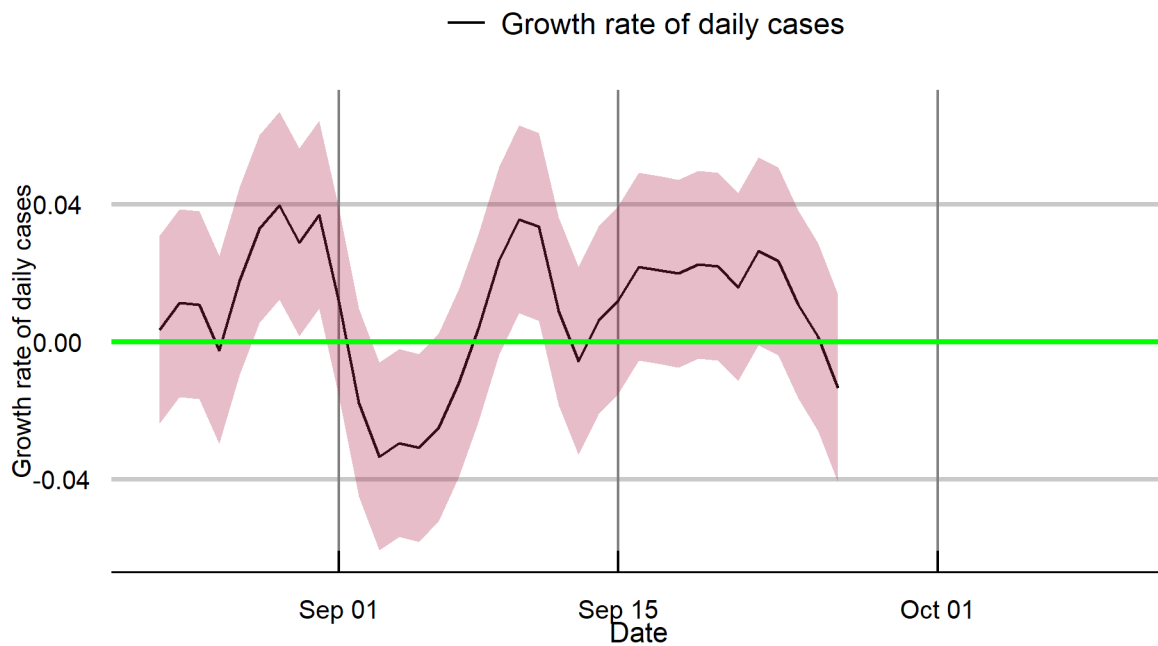
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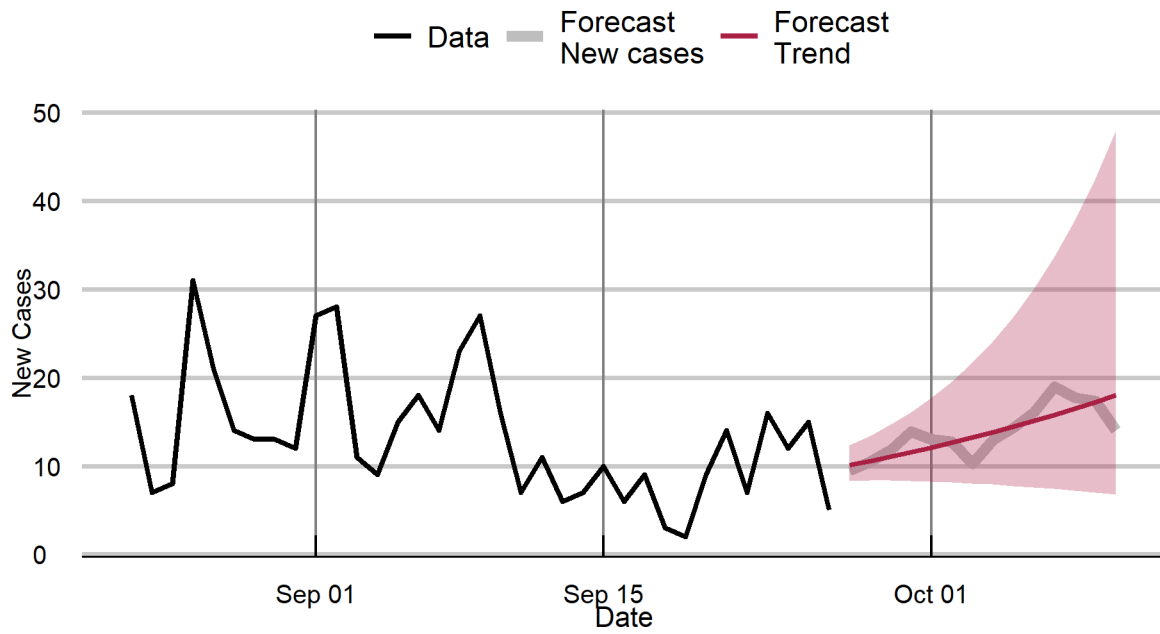
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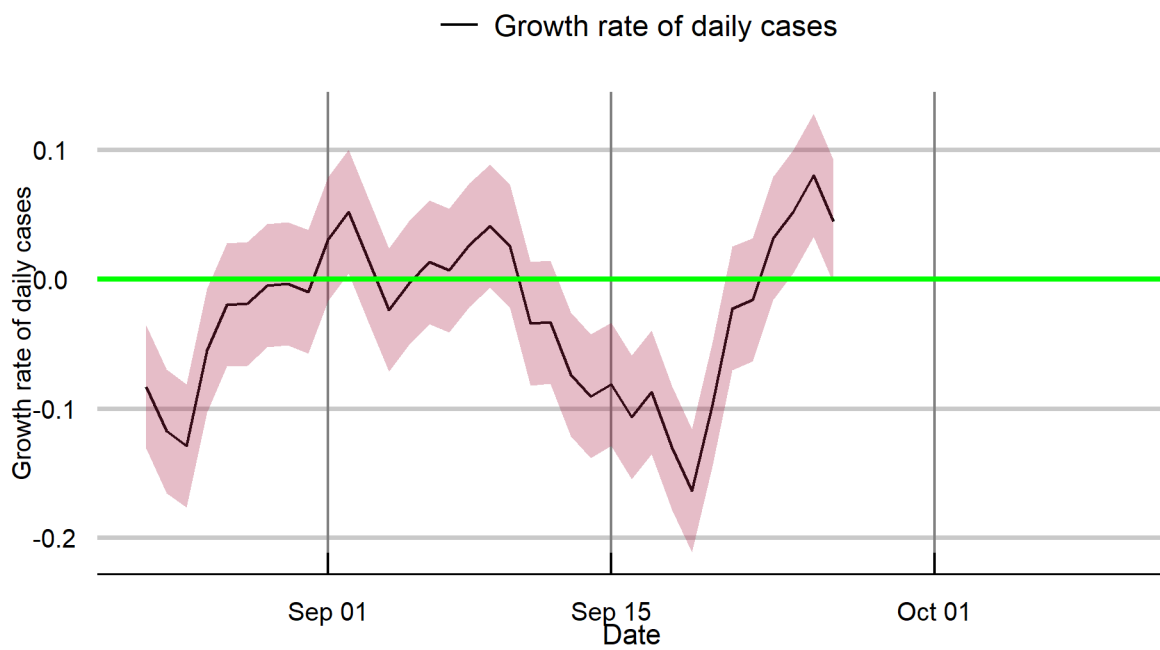
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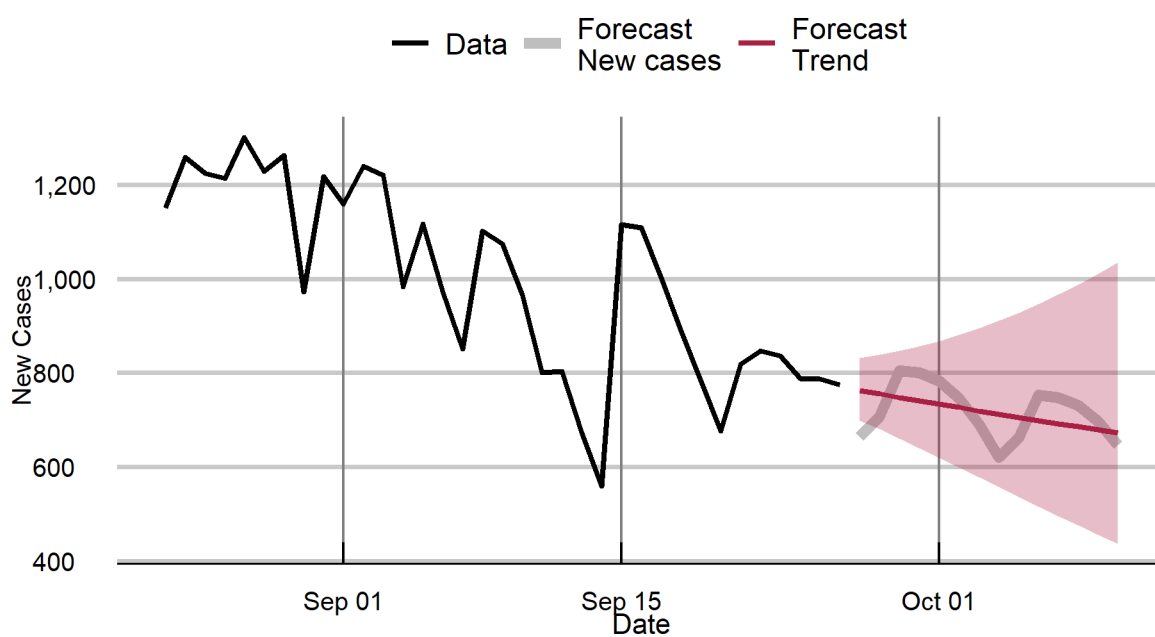
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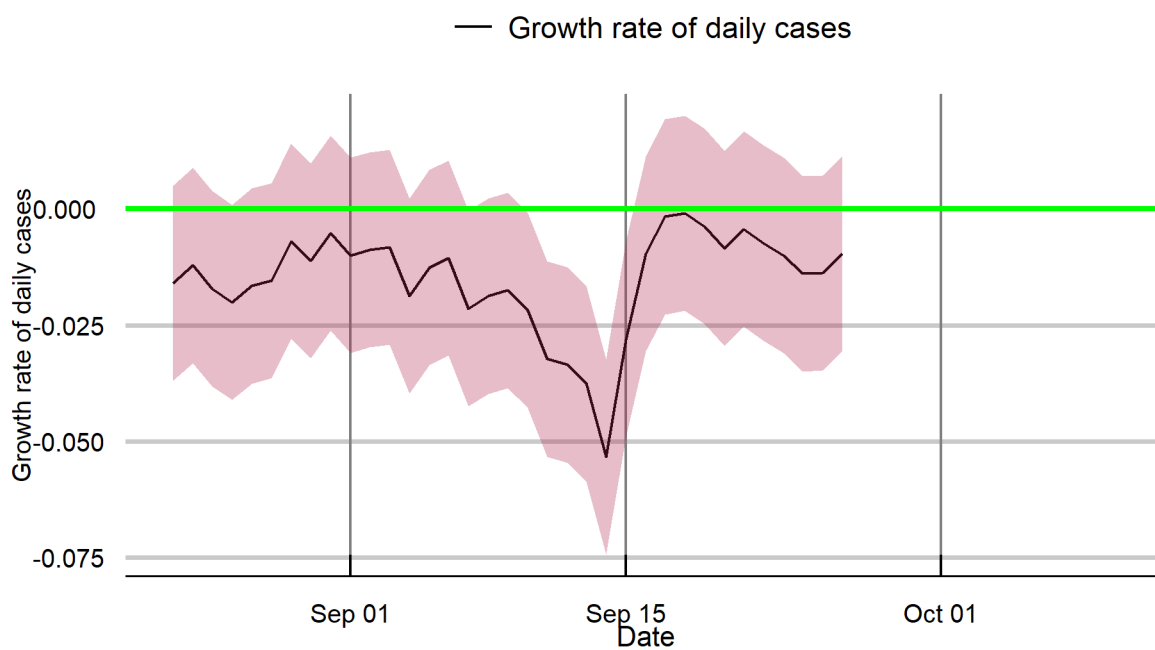
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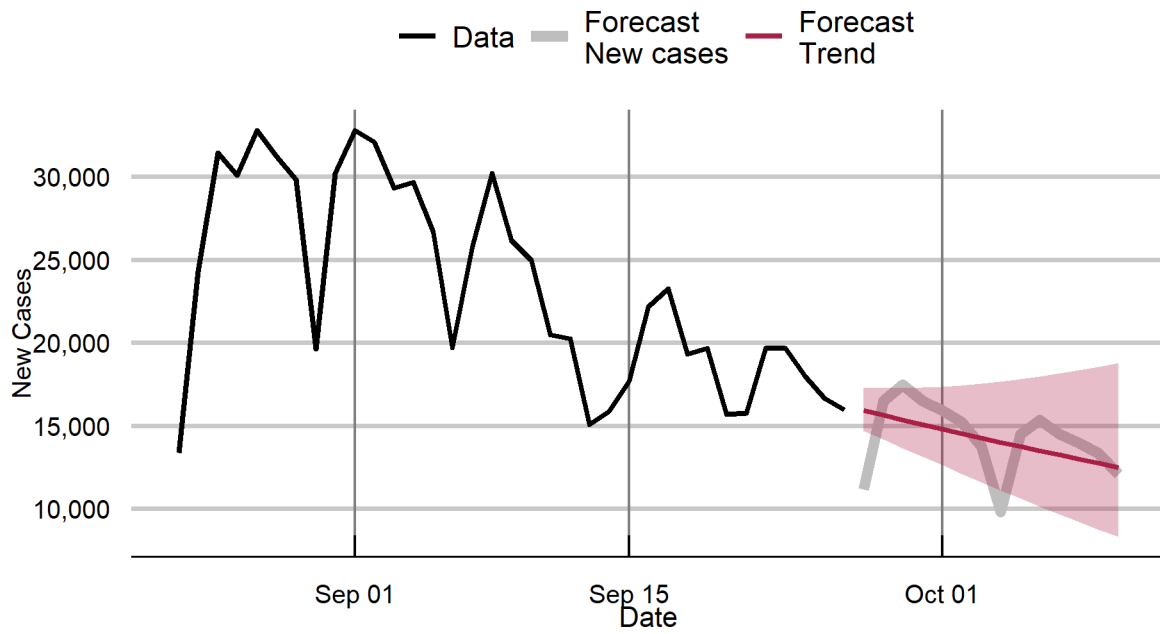
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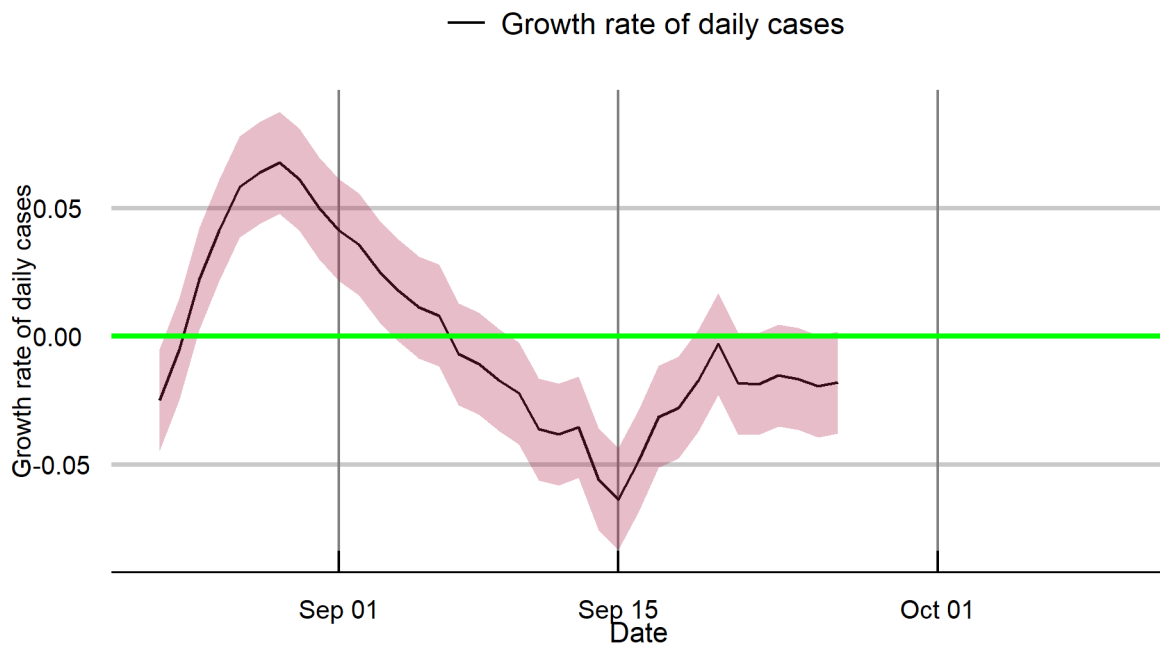
## Karnataka



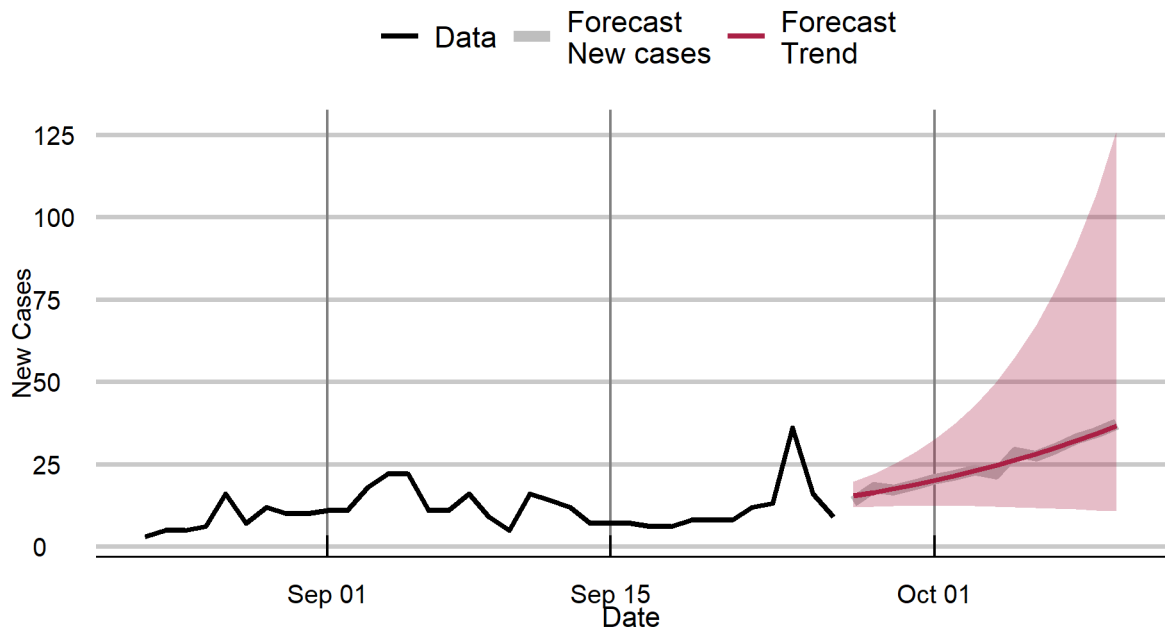
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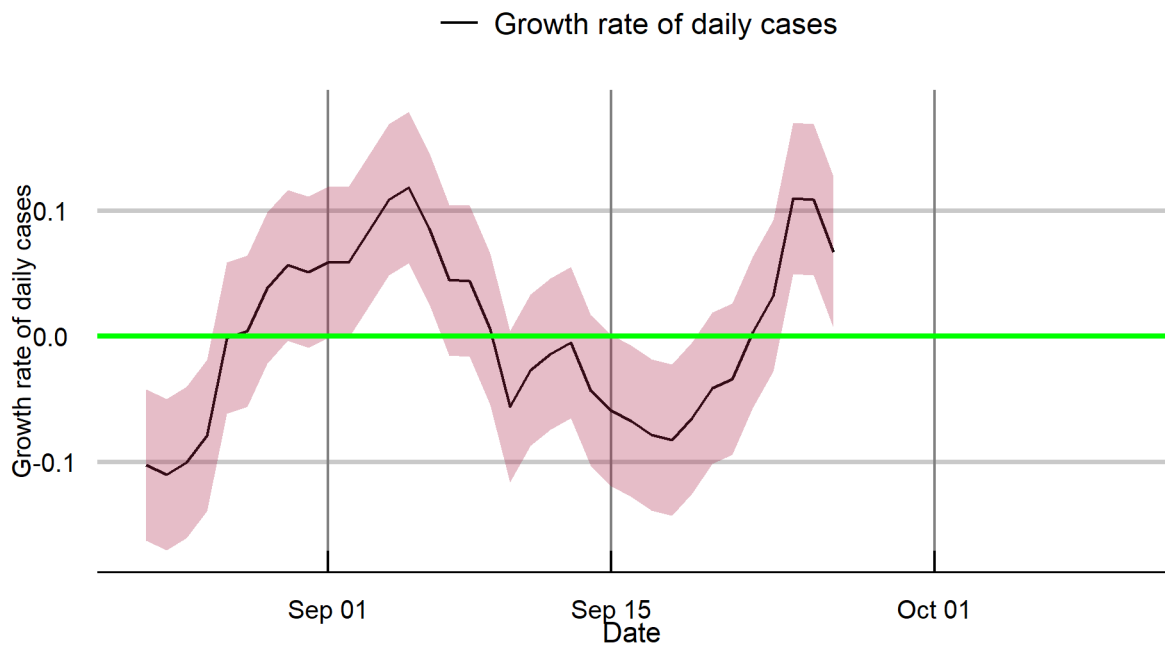
## Kerala



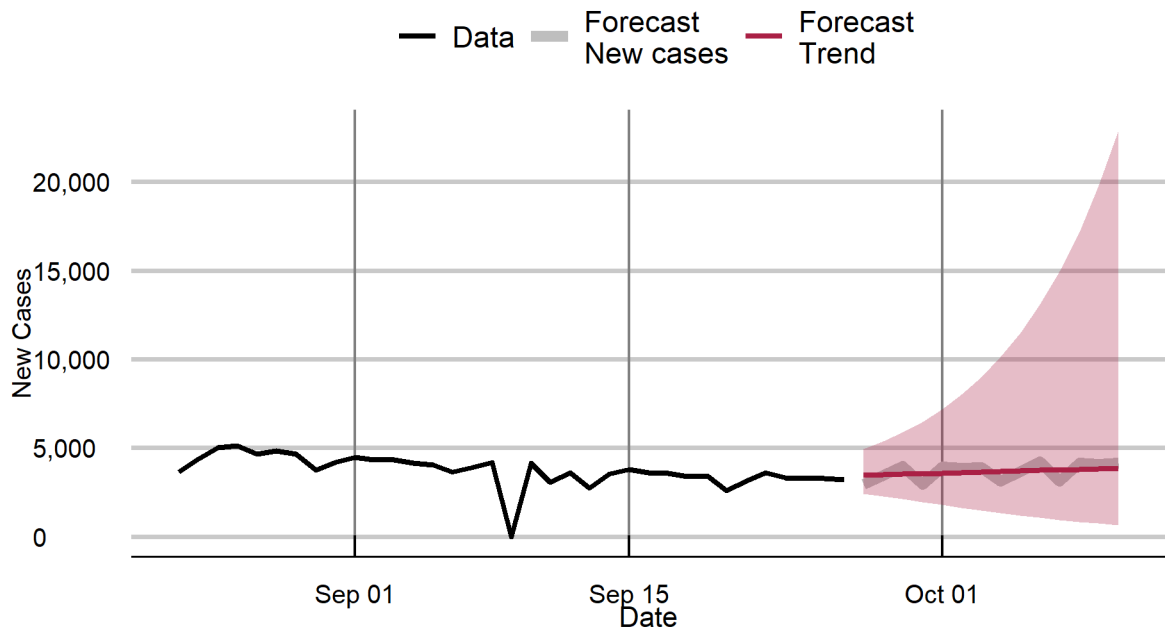
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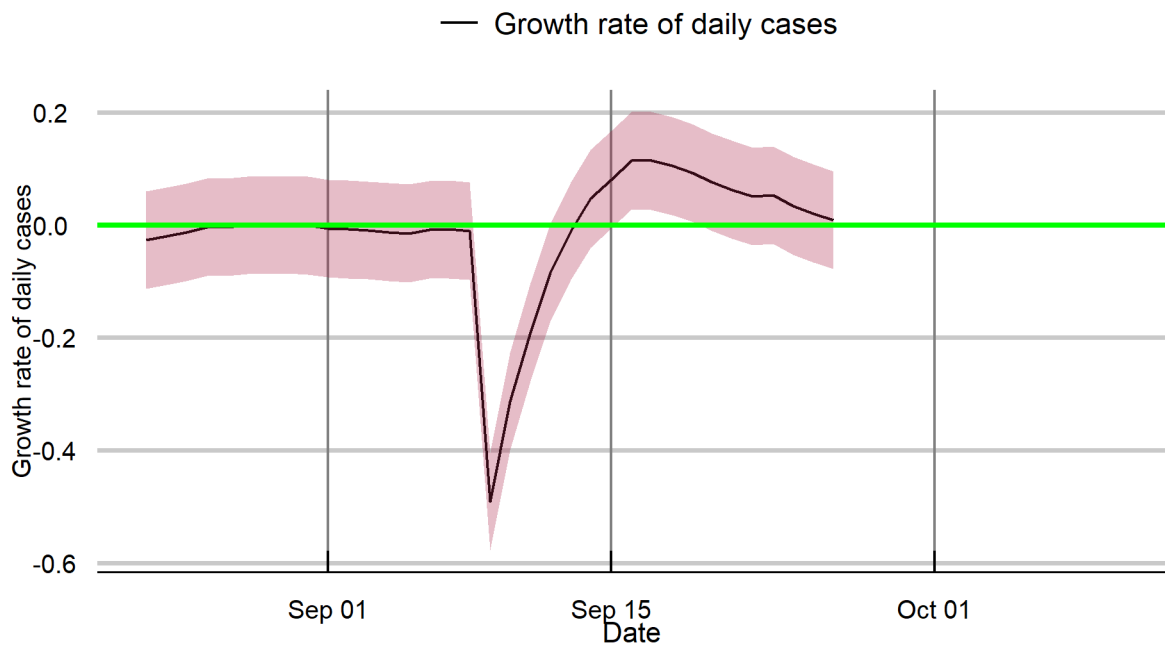
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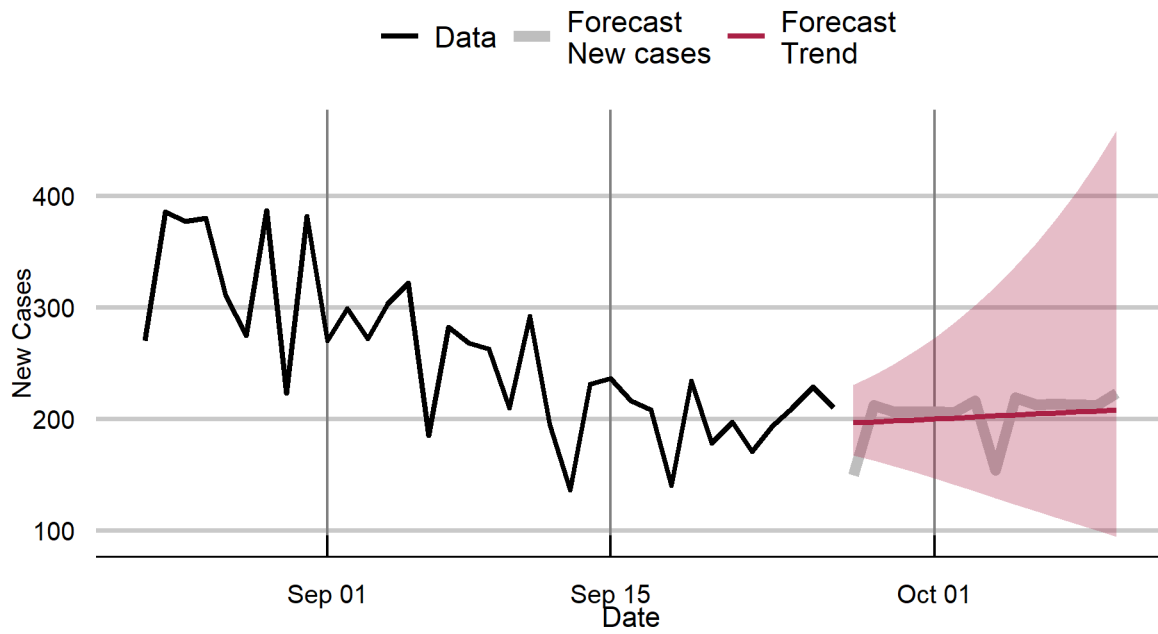
## Maharashtra



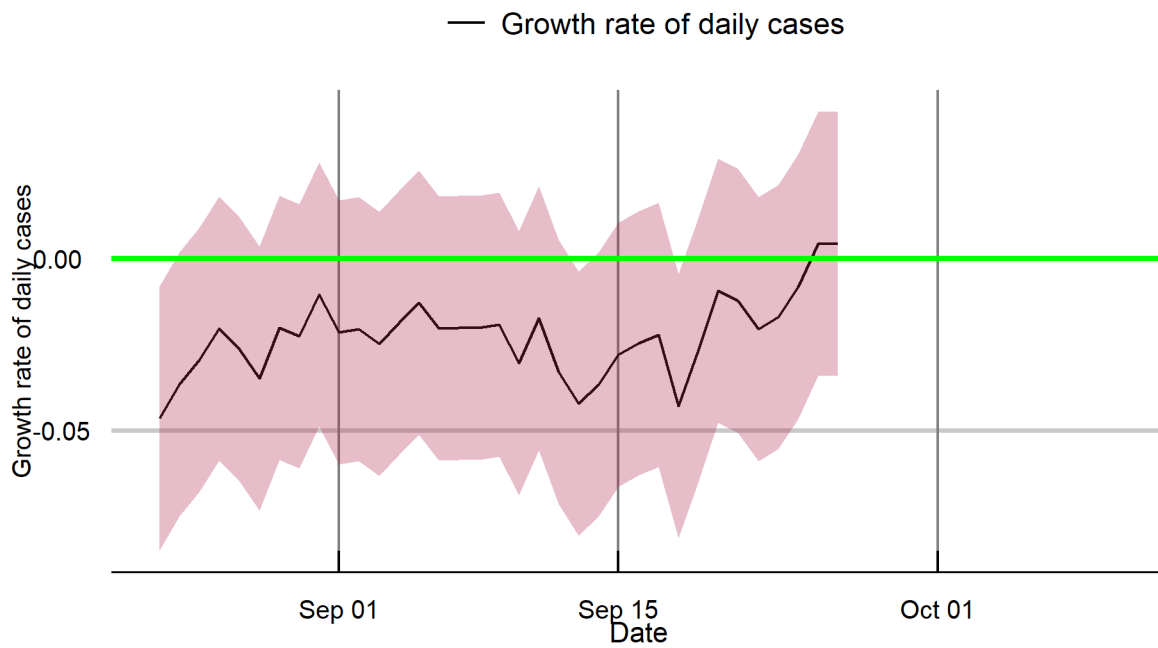
## Maharashtra



## Manipur

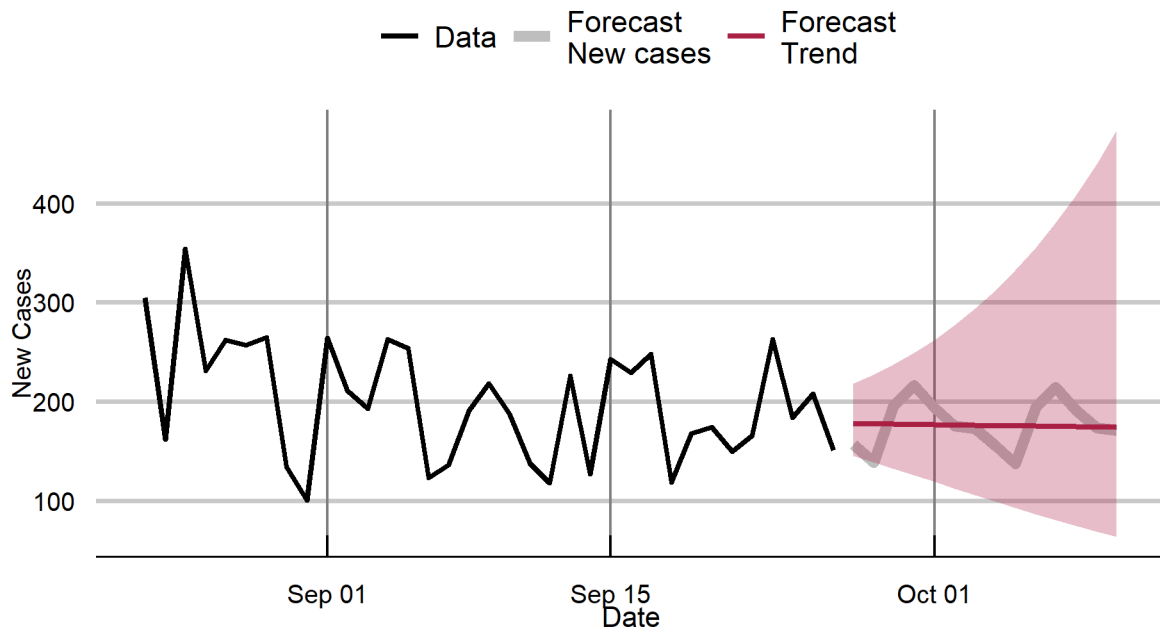


## Manipur

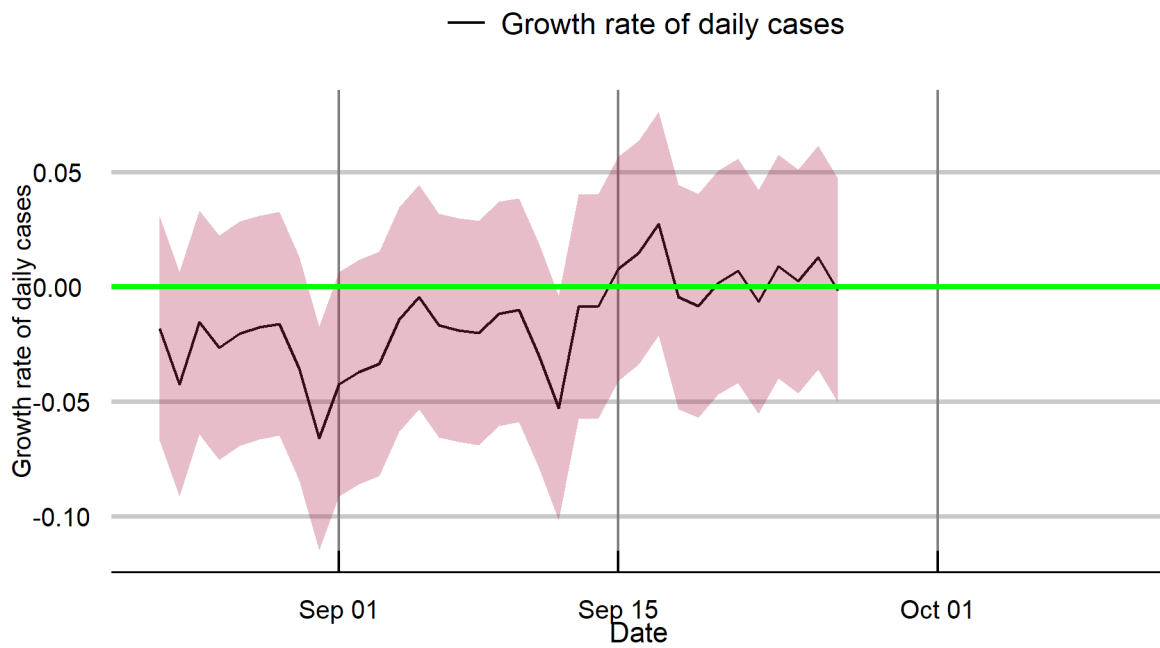




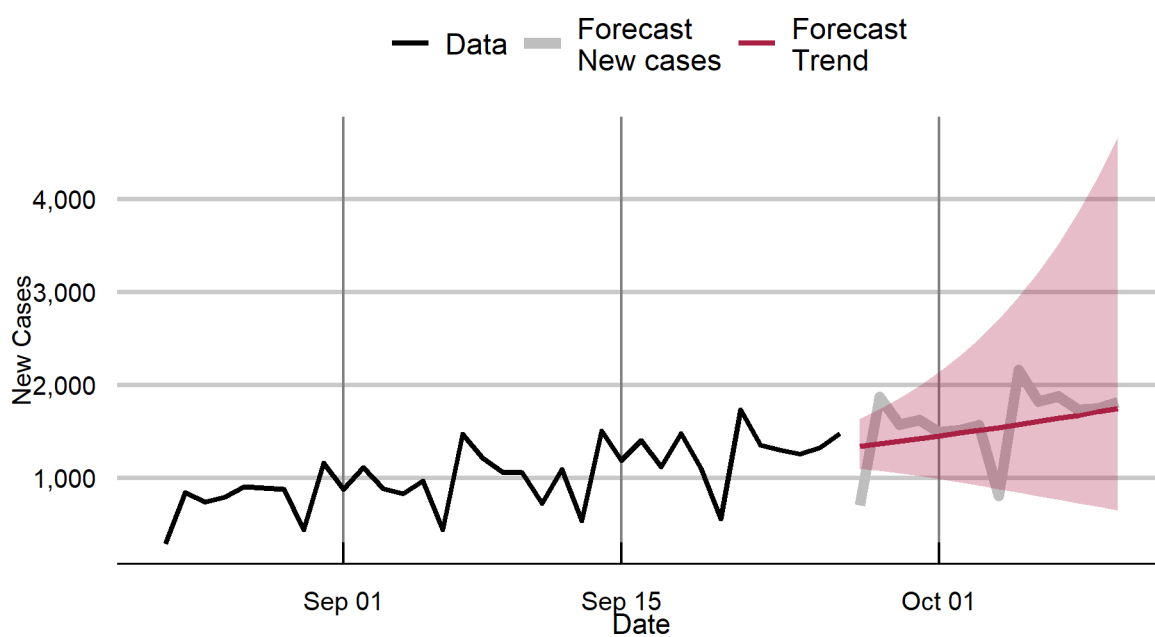
## Meghalaya



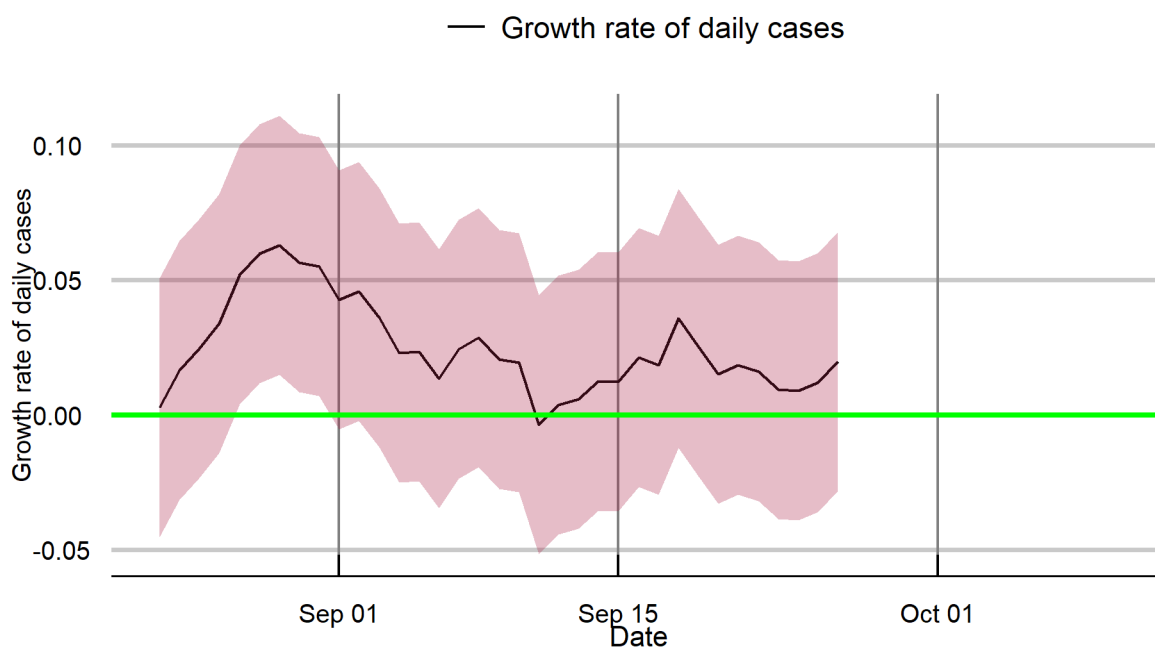
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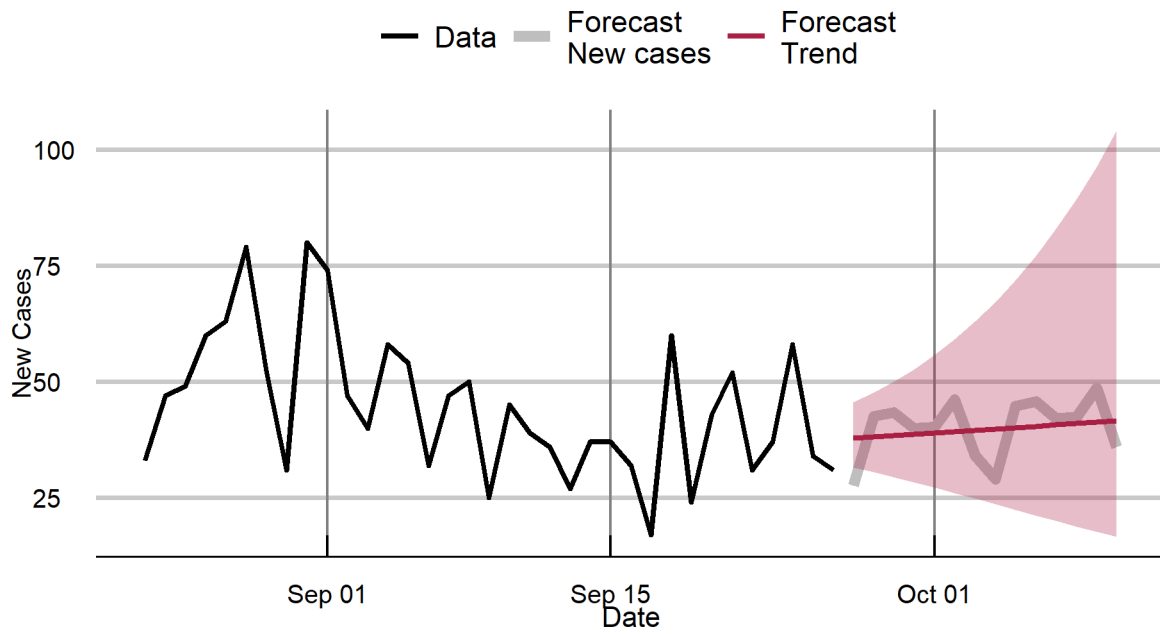
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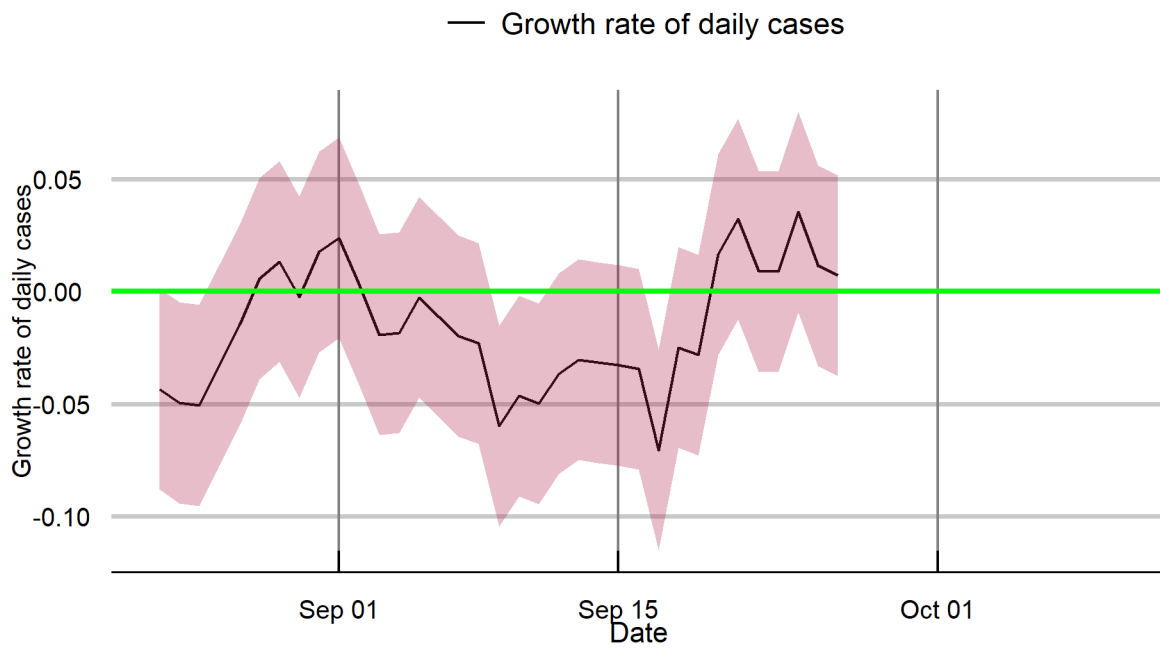
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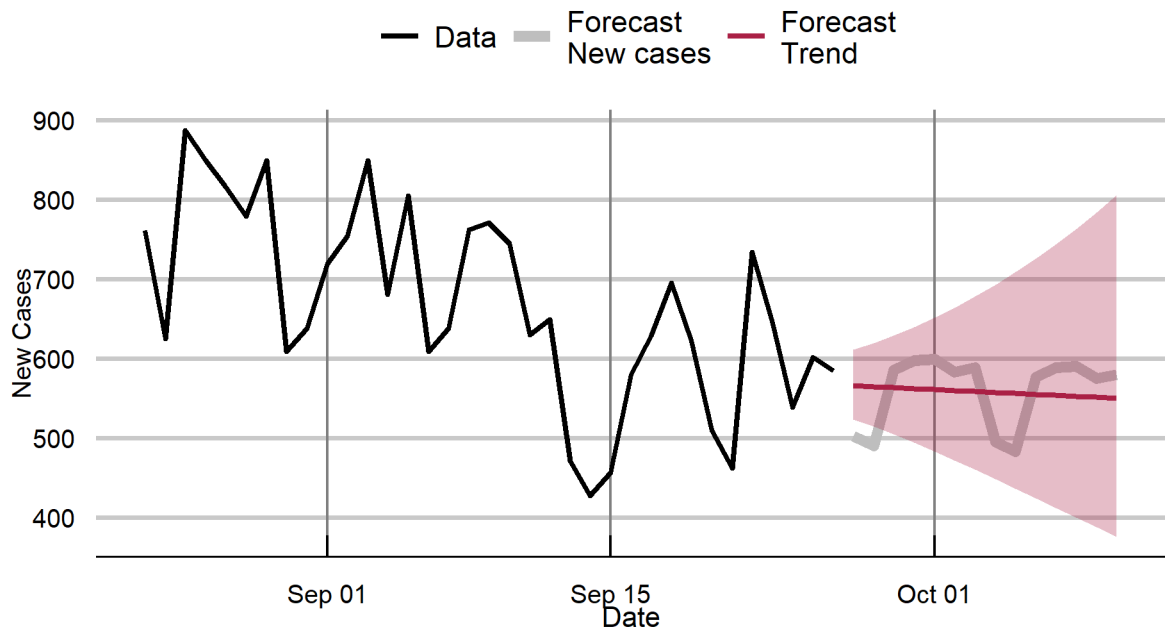
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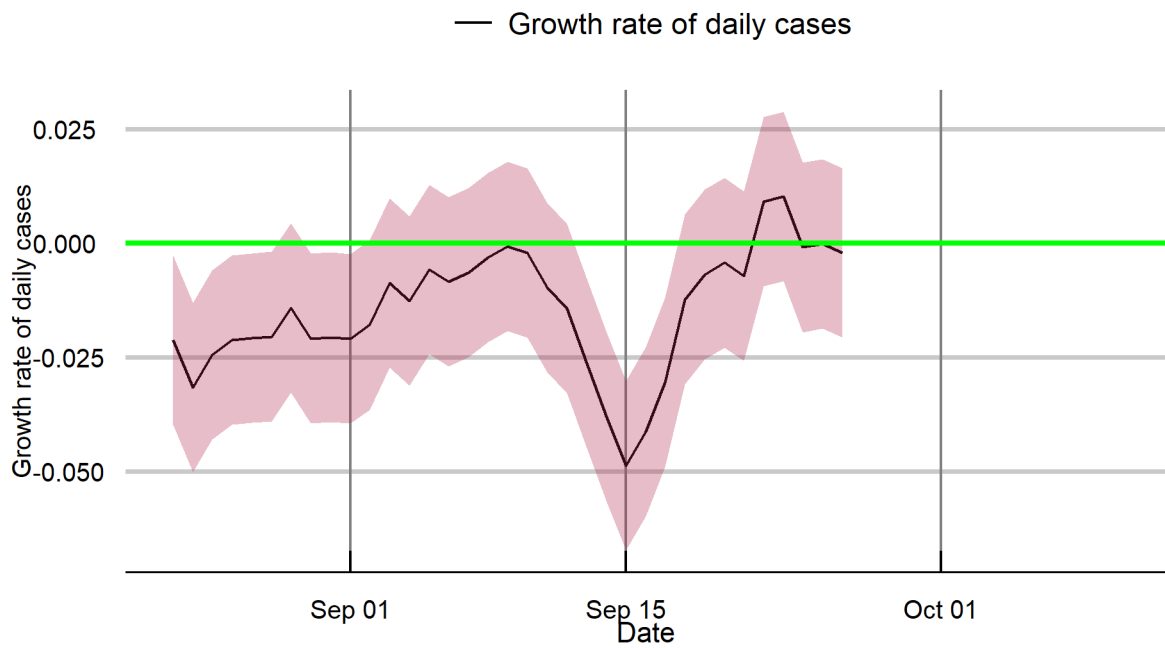
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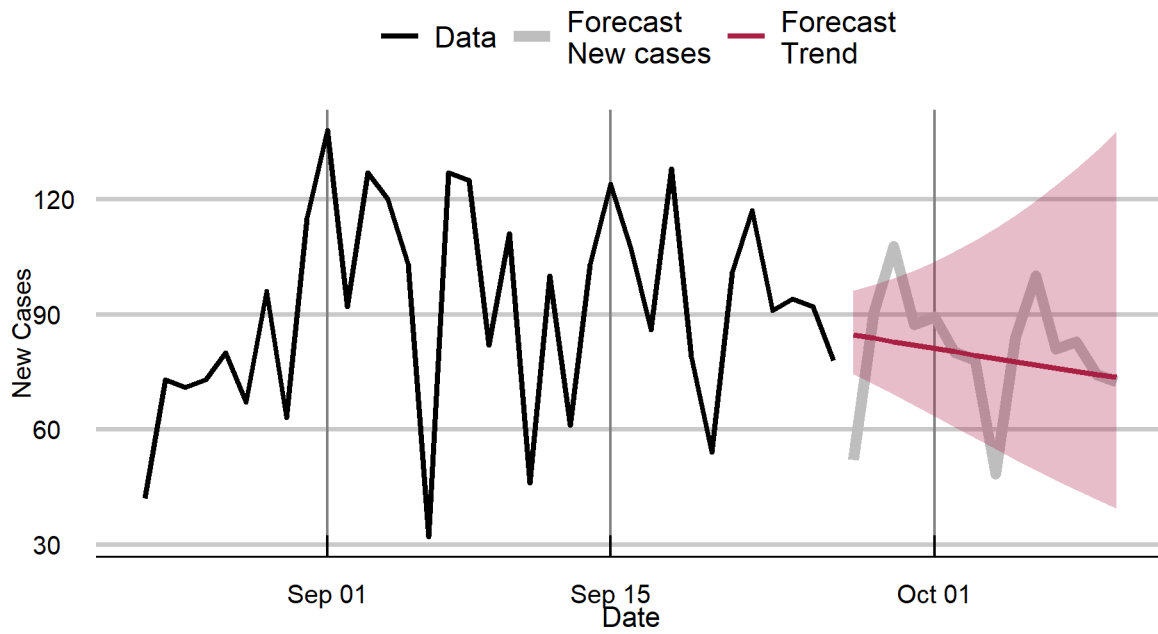
## Odisha



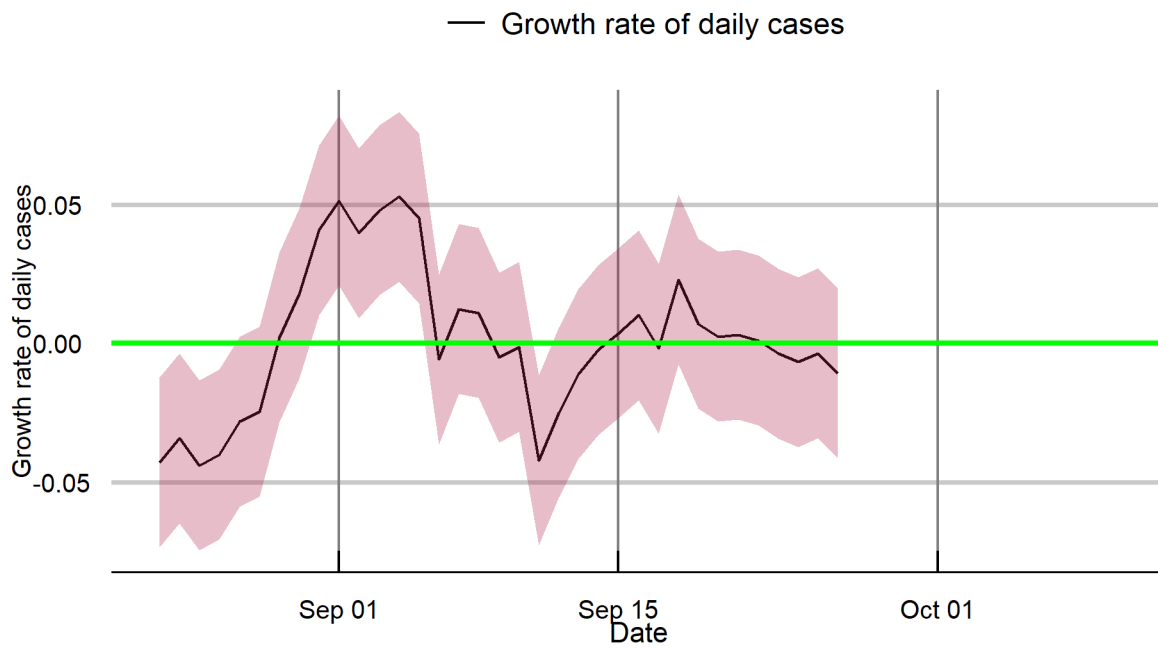
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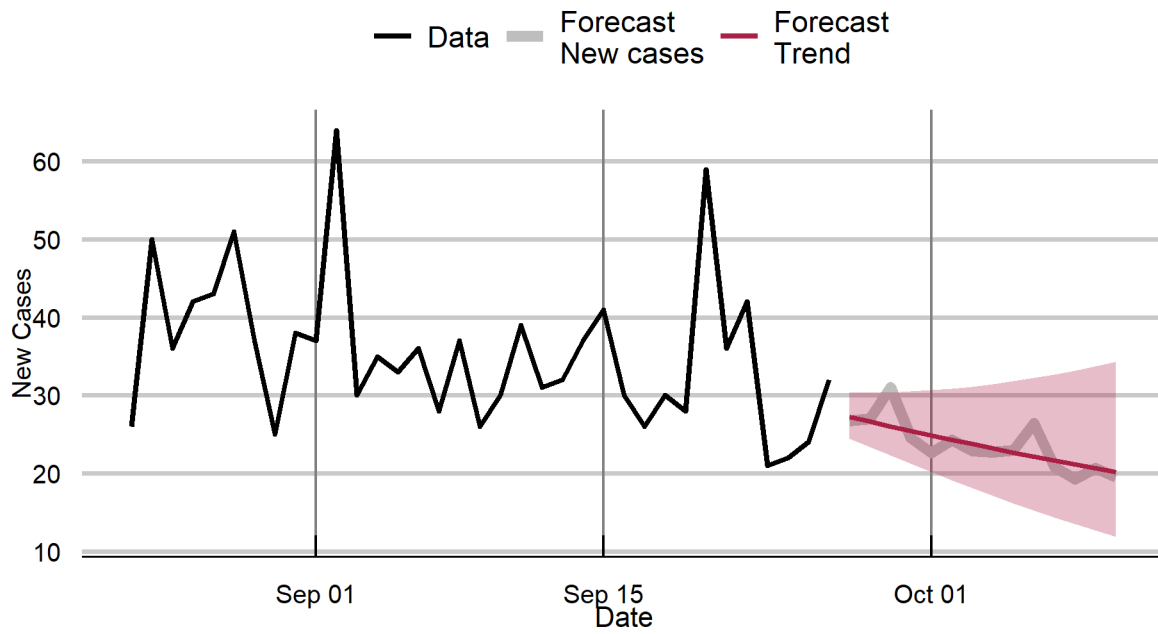
## Puducherry



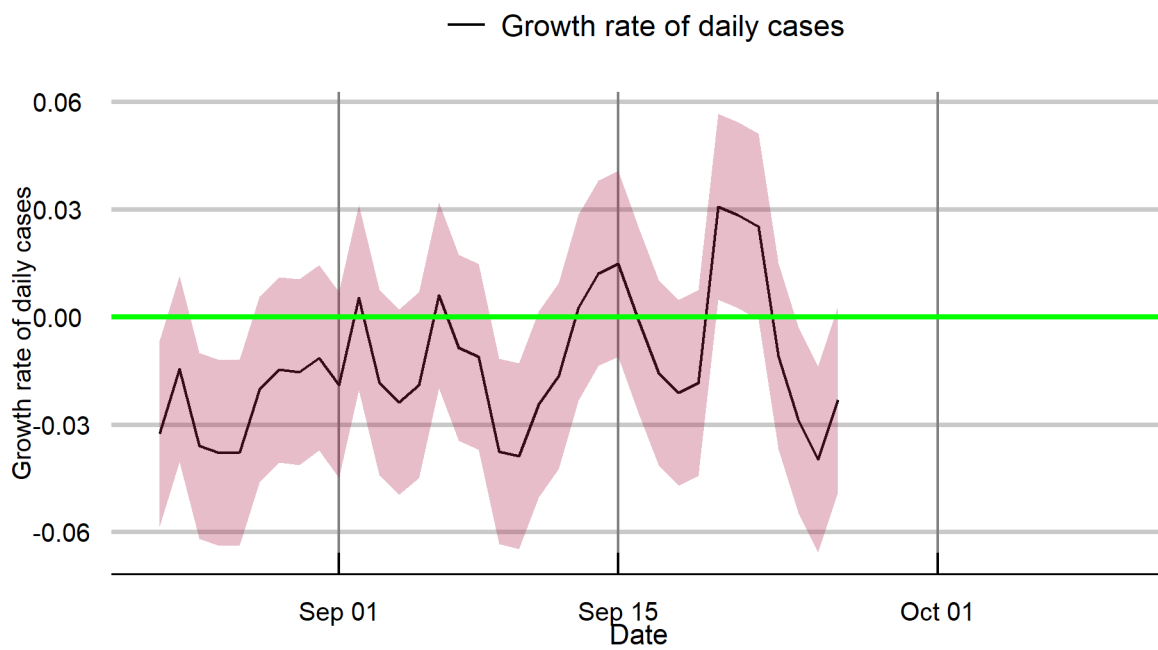
## Puducherry



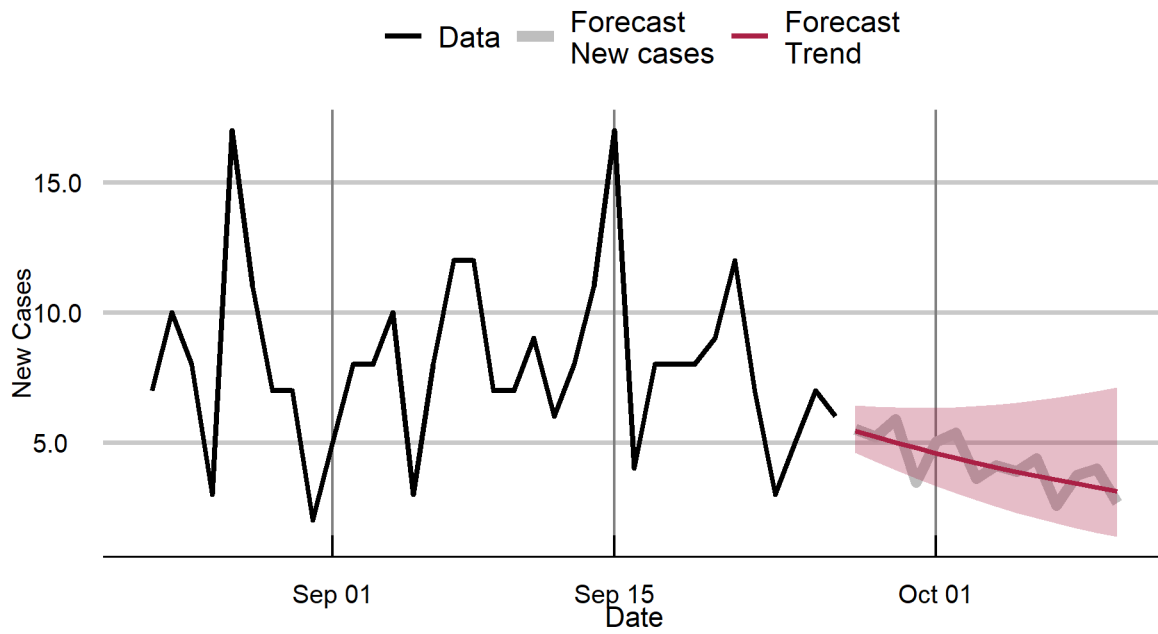
## Punjab



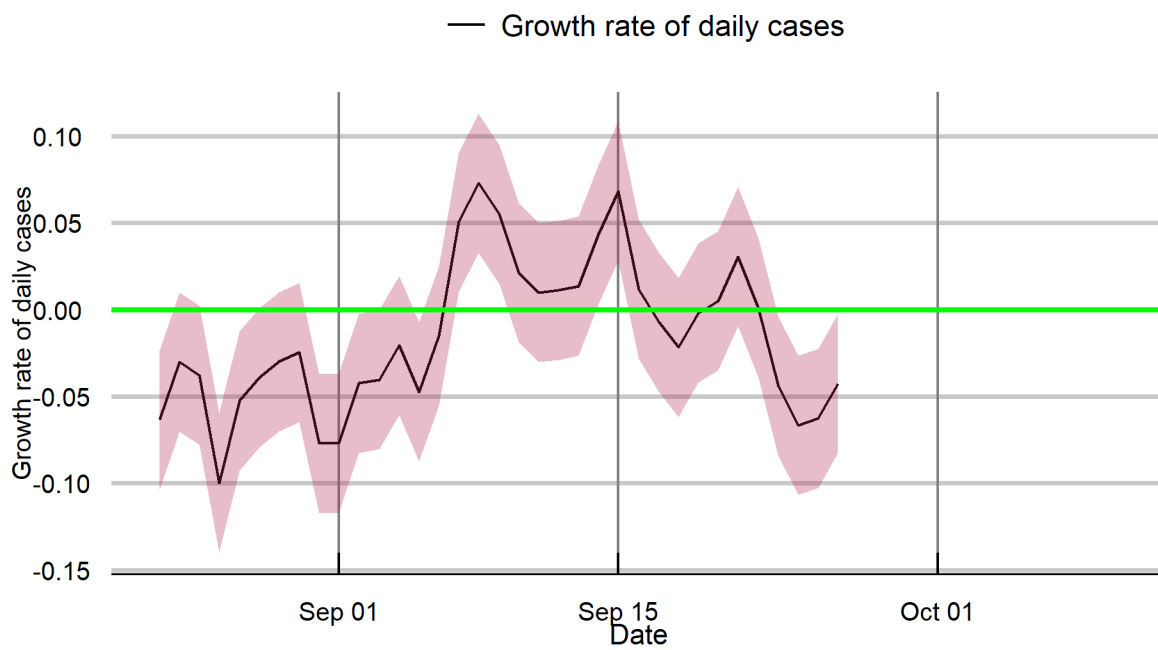
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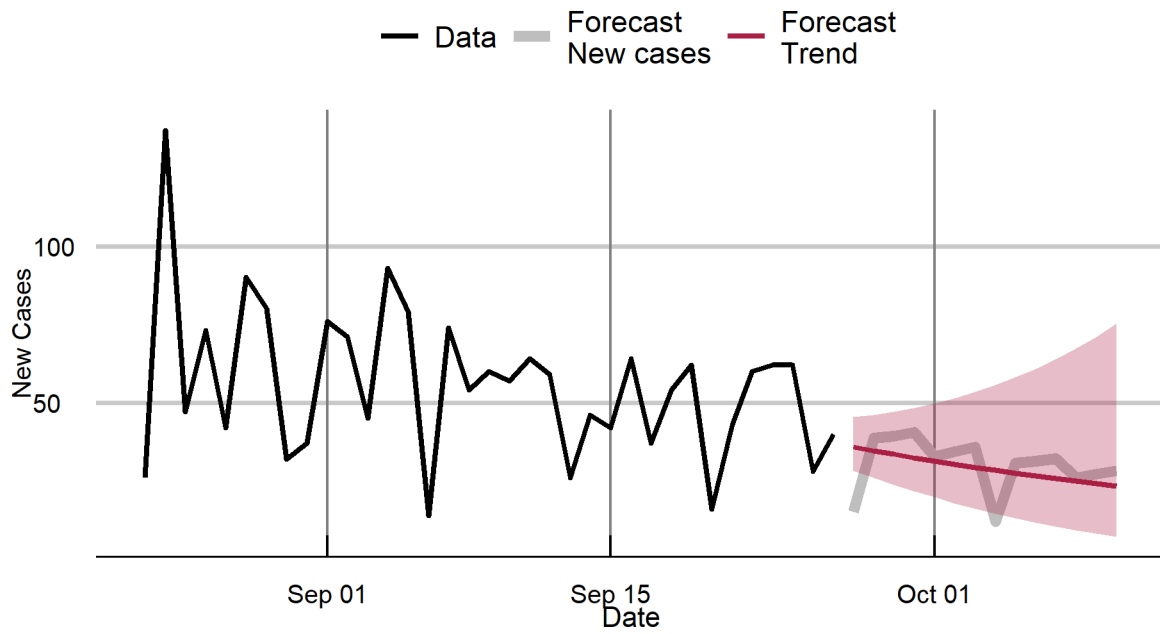
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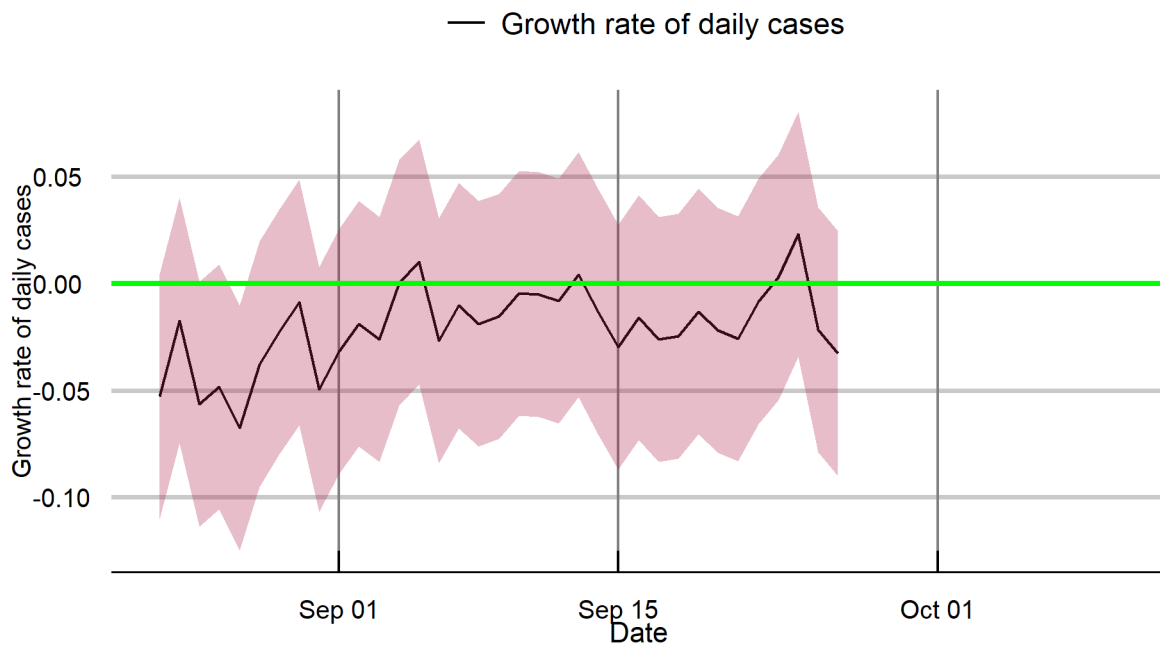
## Rajasthan



## Sikkim

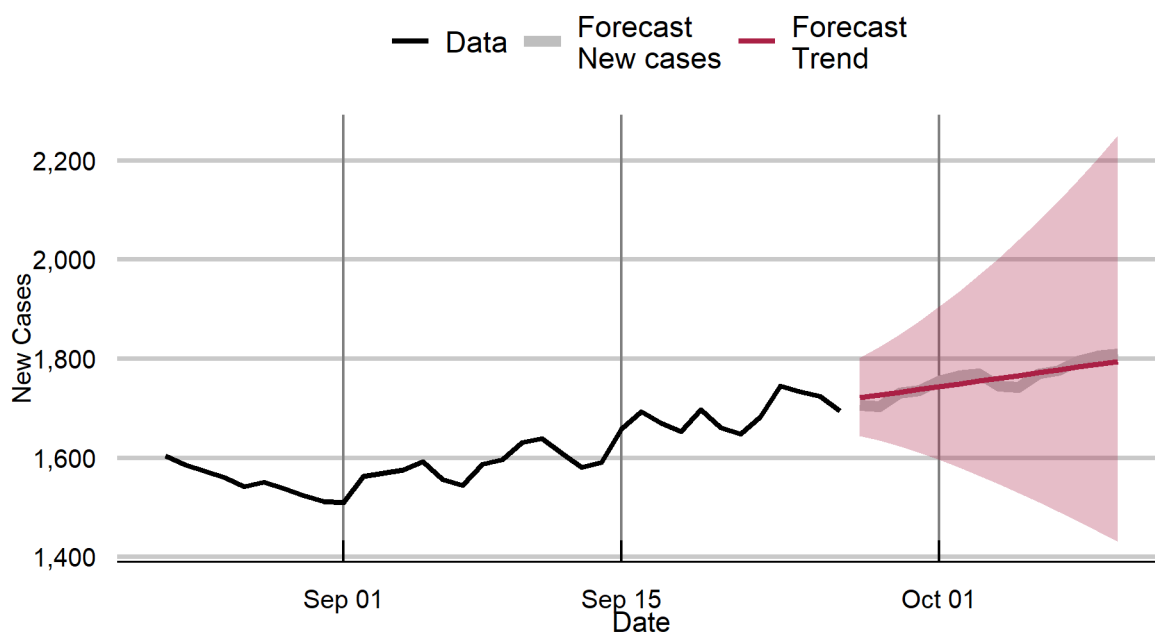


## Sikkim

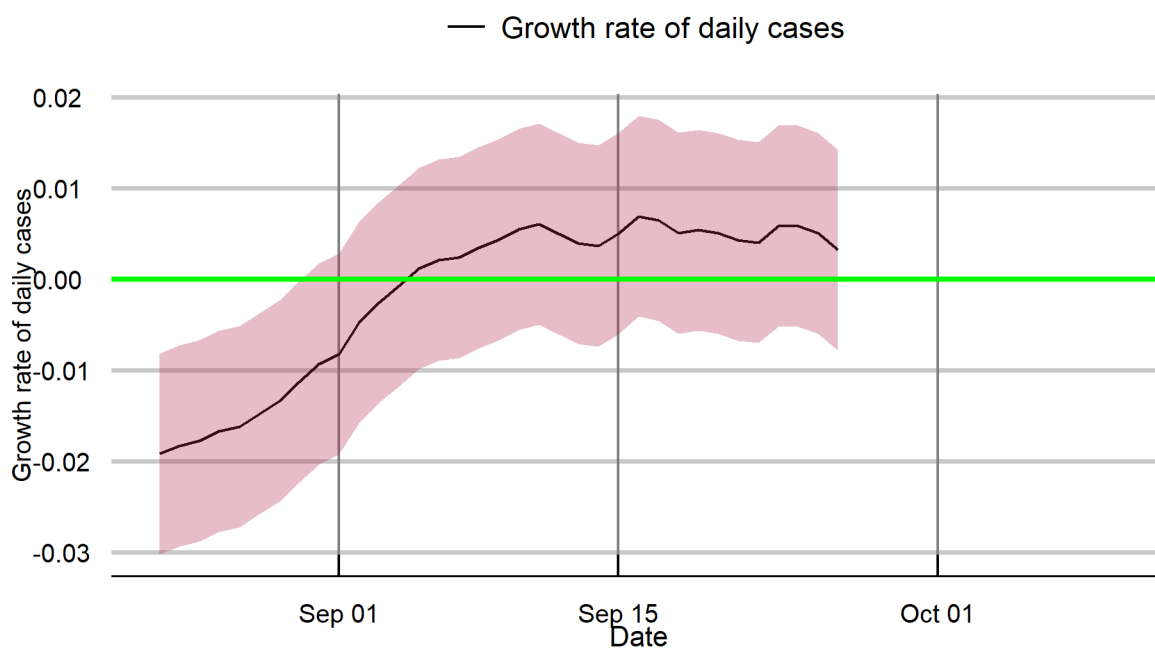




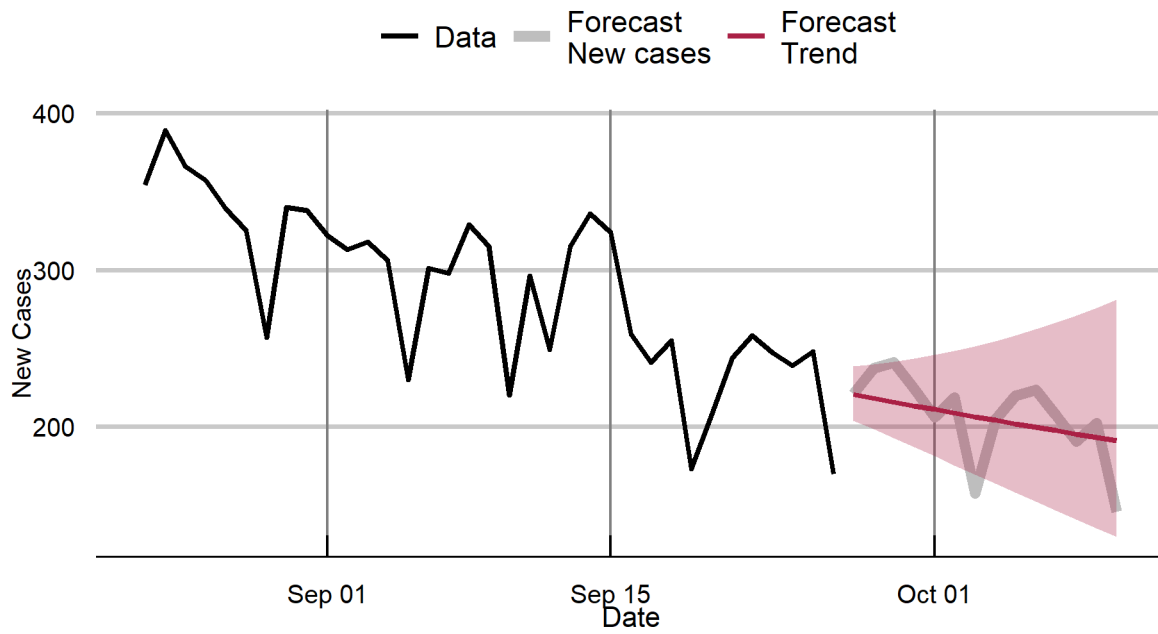
## Tamil Nadu



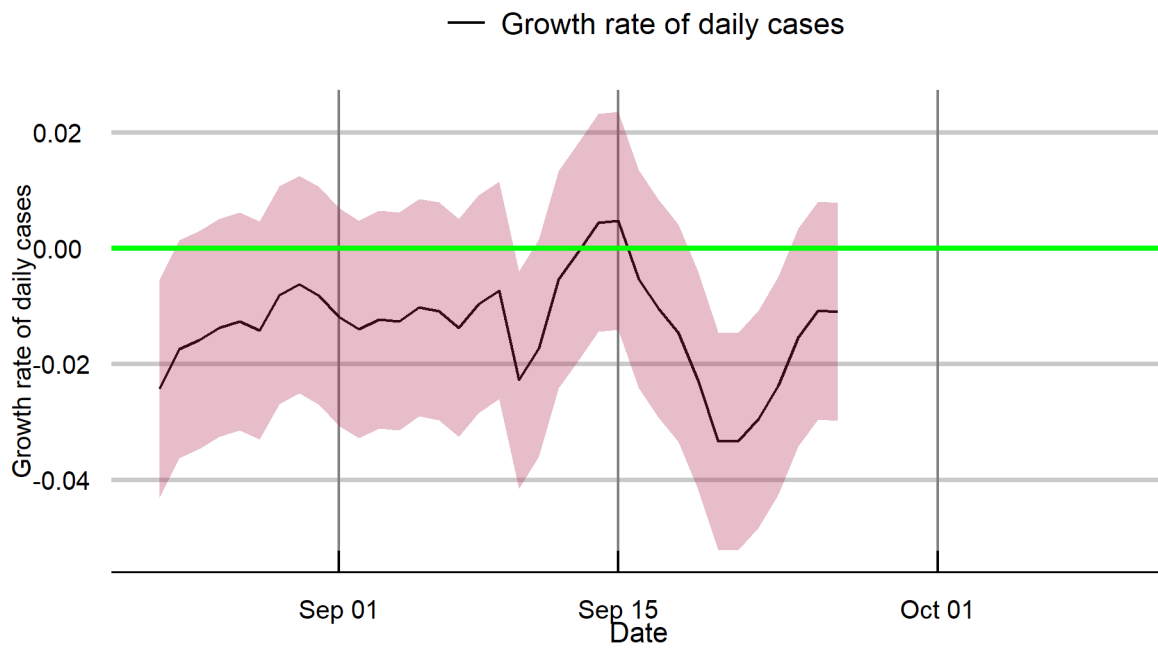
## Tamil Nadu



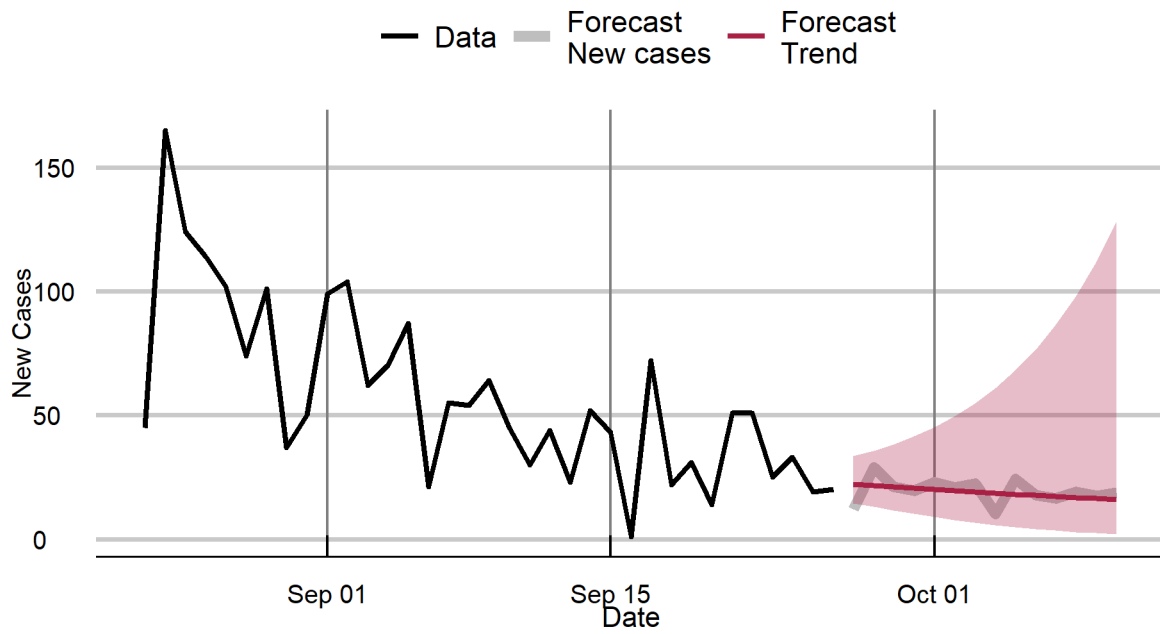
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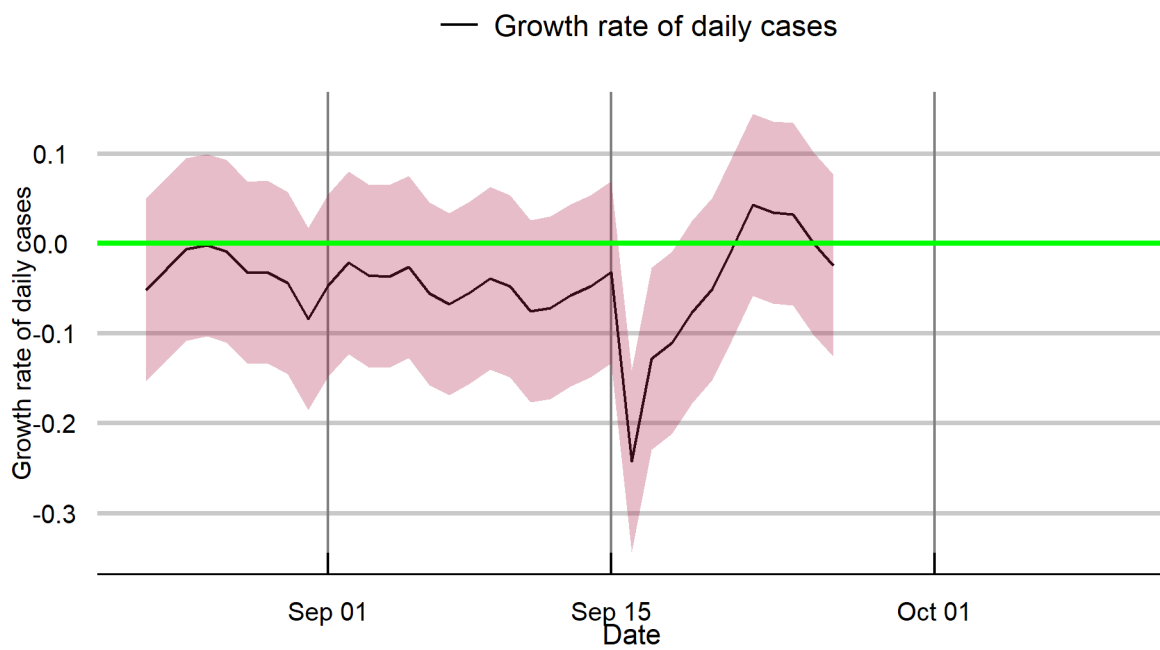
## Telangana



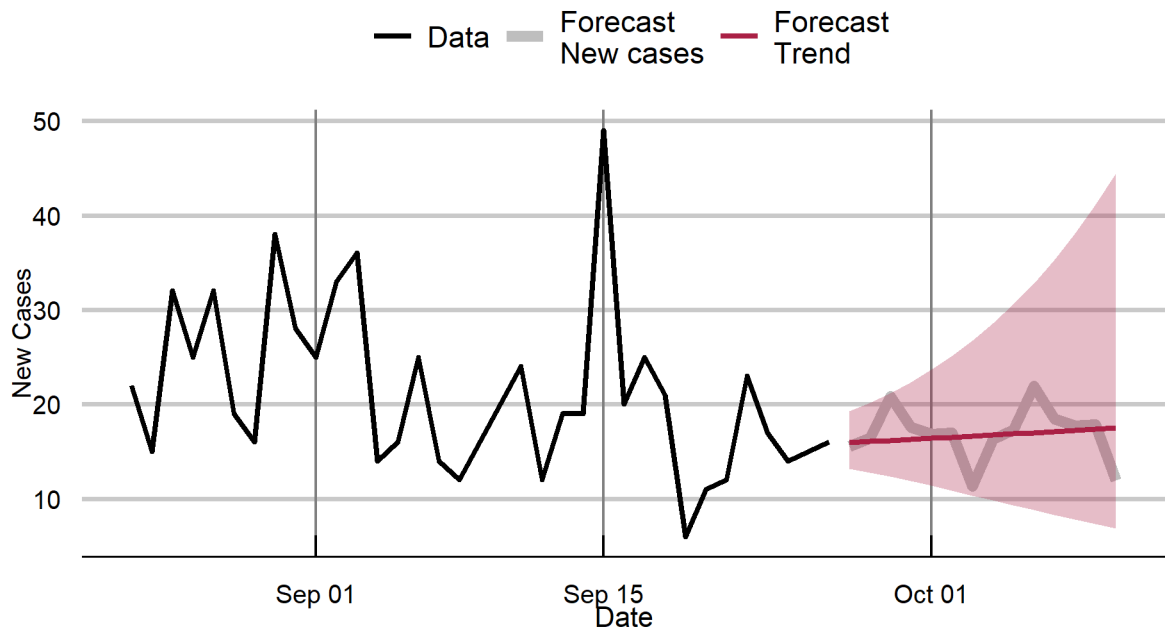
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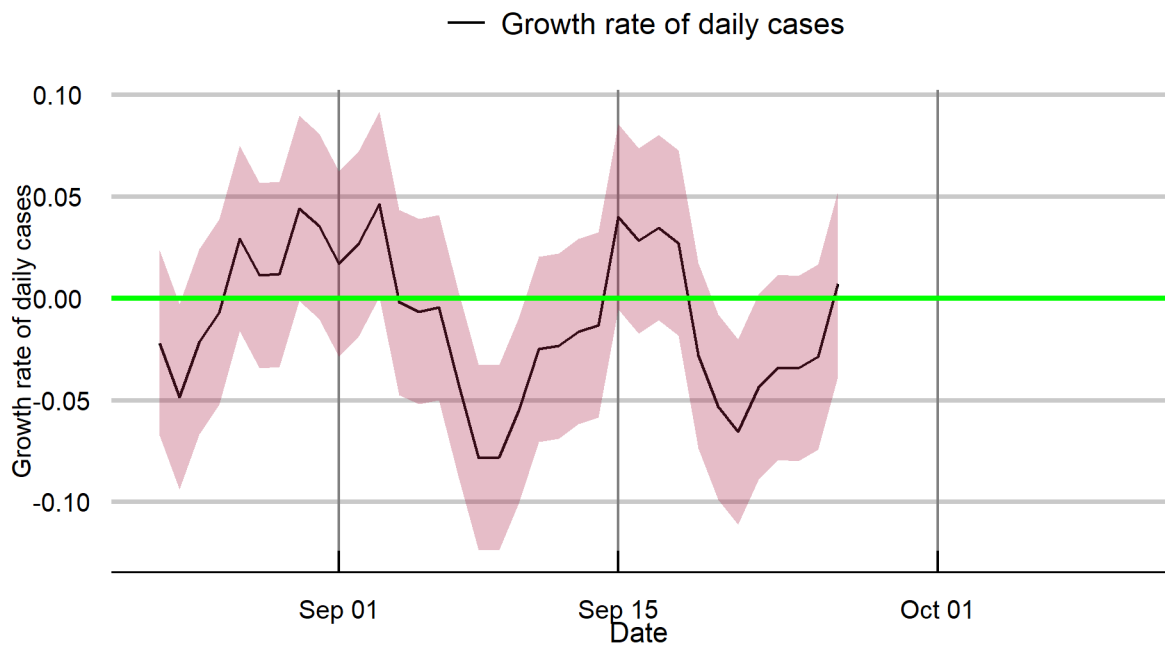
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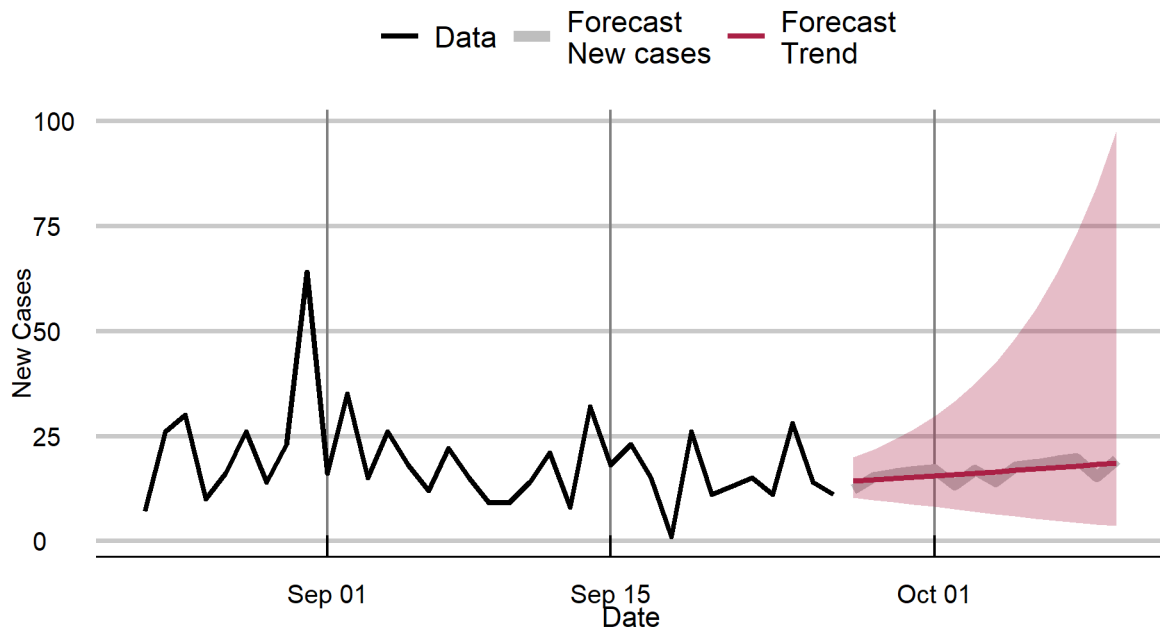
## Uttarakhand



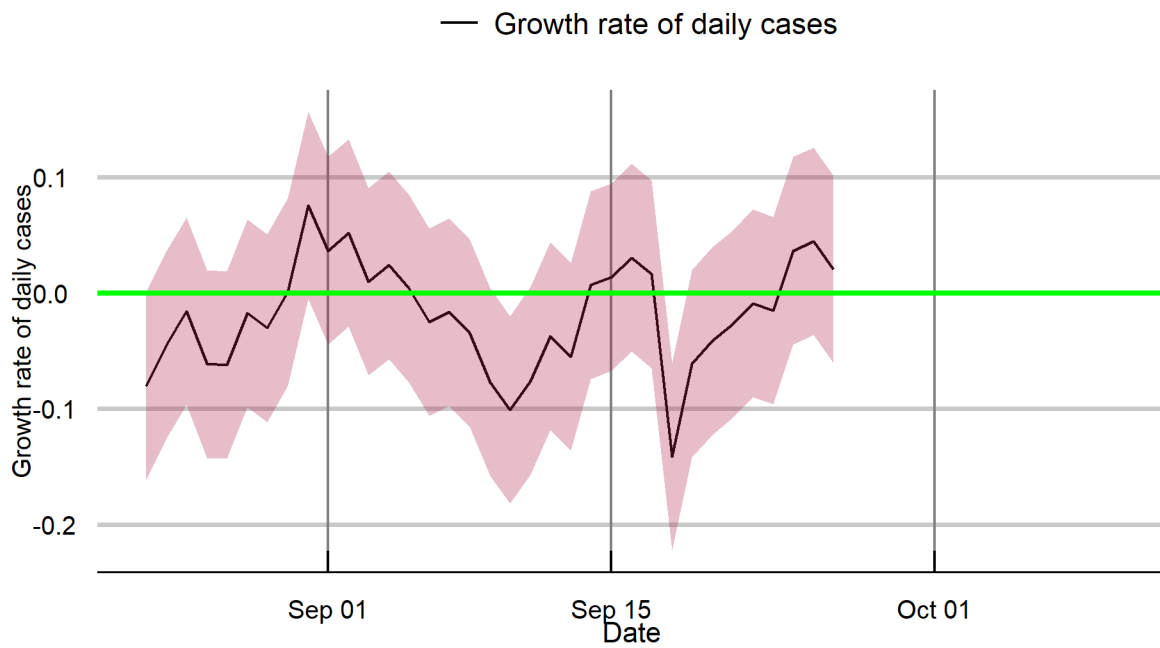
## Uttarakhand



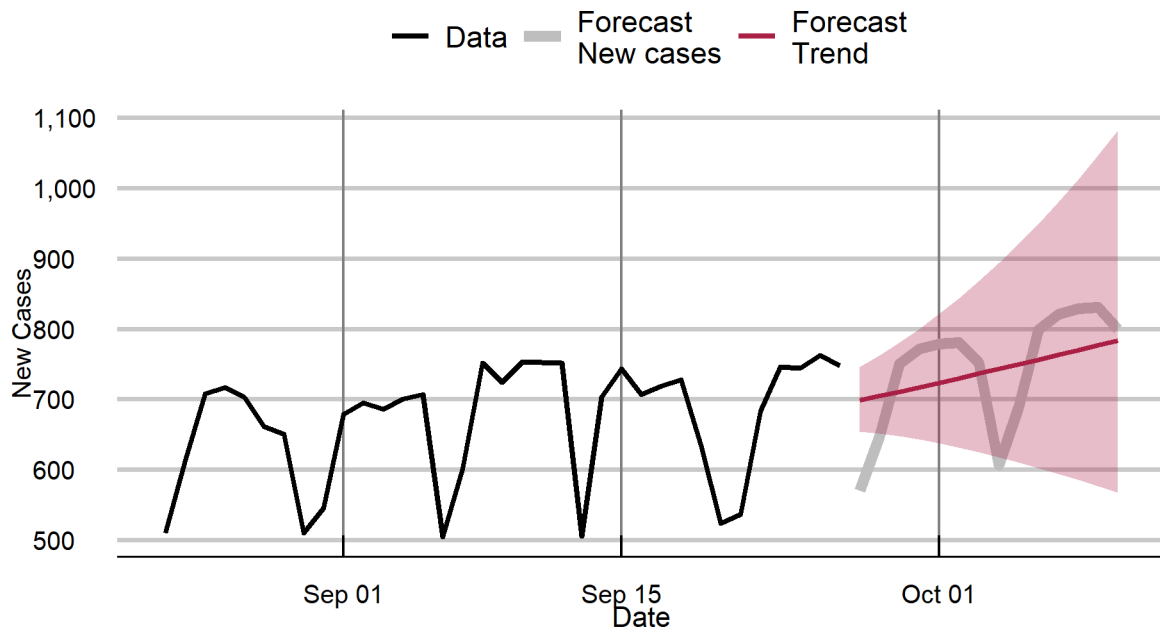
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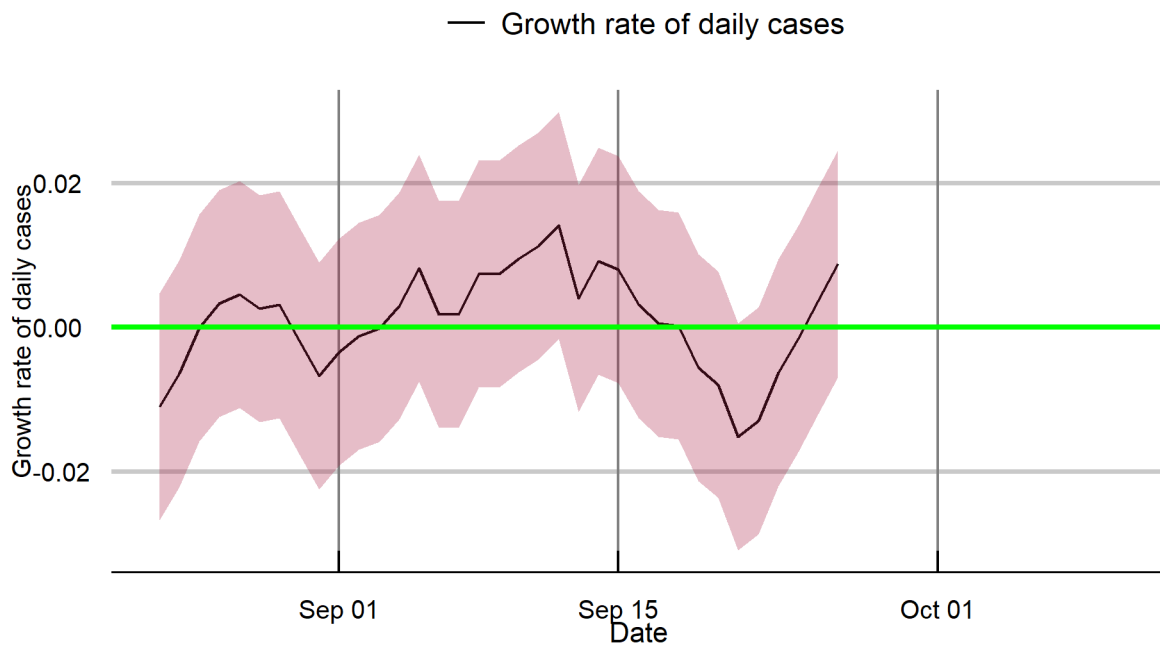
## Uttar Pradesh



## West Bengal



## West Bengal



## Probability that daily cases are accelerating

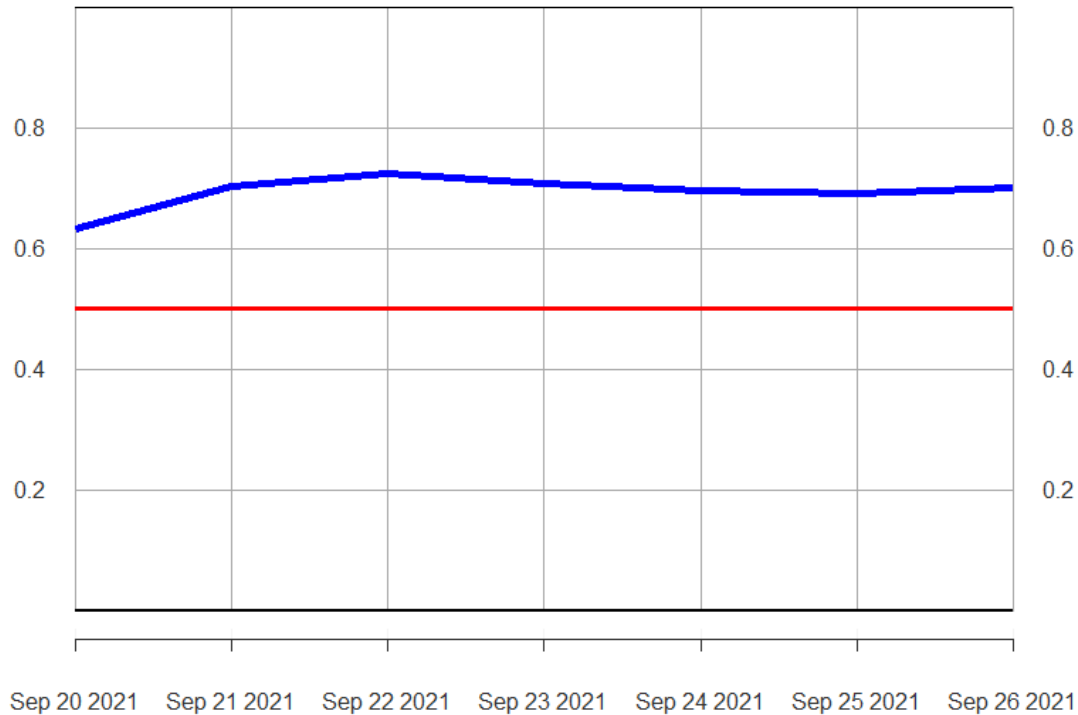
State with cases exceeding 100 and probability of acceleration greater than 0.5

**Himachal Pradesh:**

**Probability that cases are accelerating.**

2021-09-20 / 2021-09-26

**Probability on 2021-09-26 : 0.7**

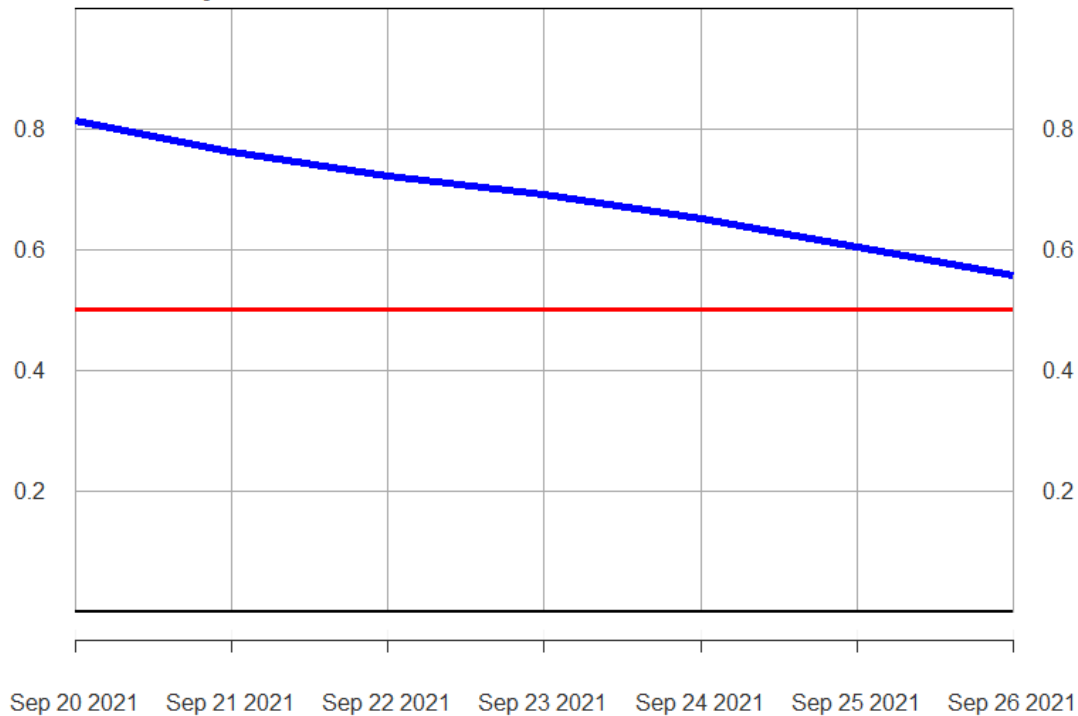


**Maharashtra:**

**Probability that cases are accelerating.**

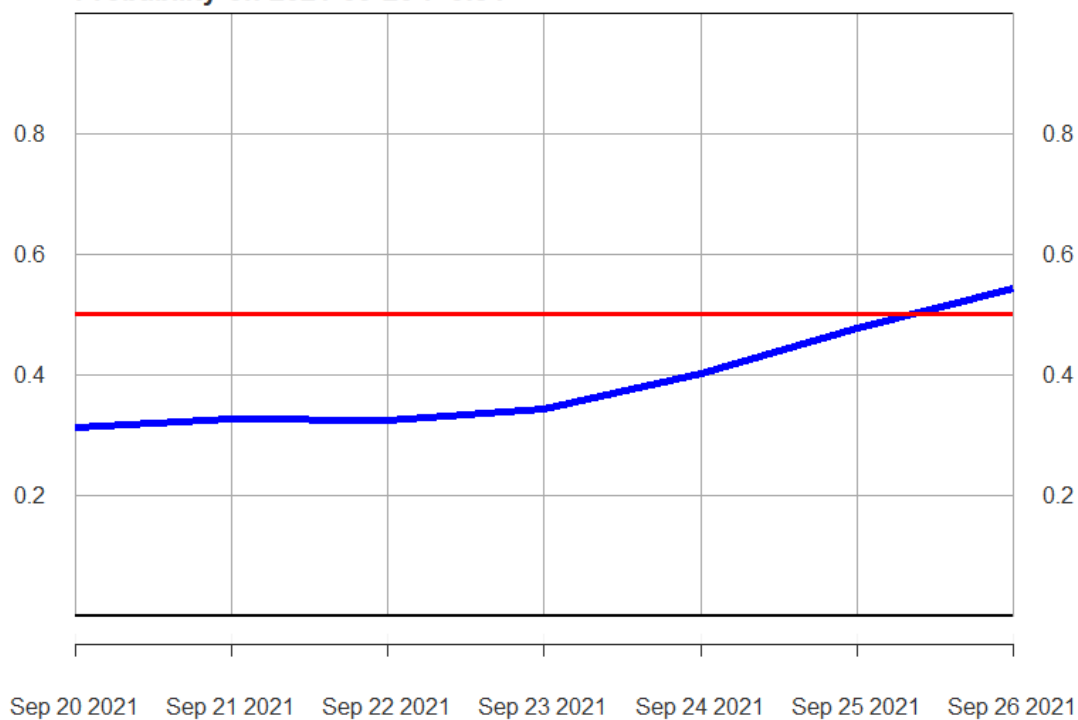
2021-09-20 / 2021-09-26

**Probability on 2021-09-26 : 0.56**



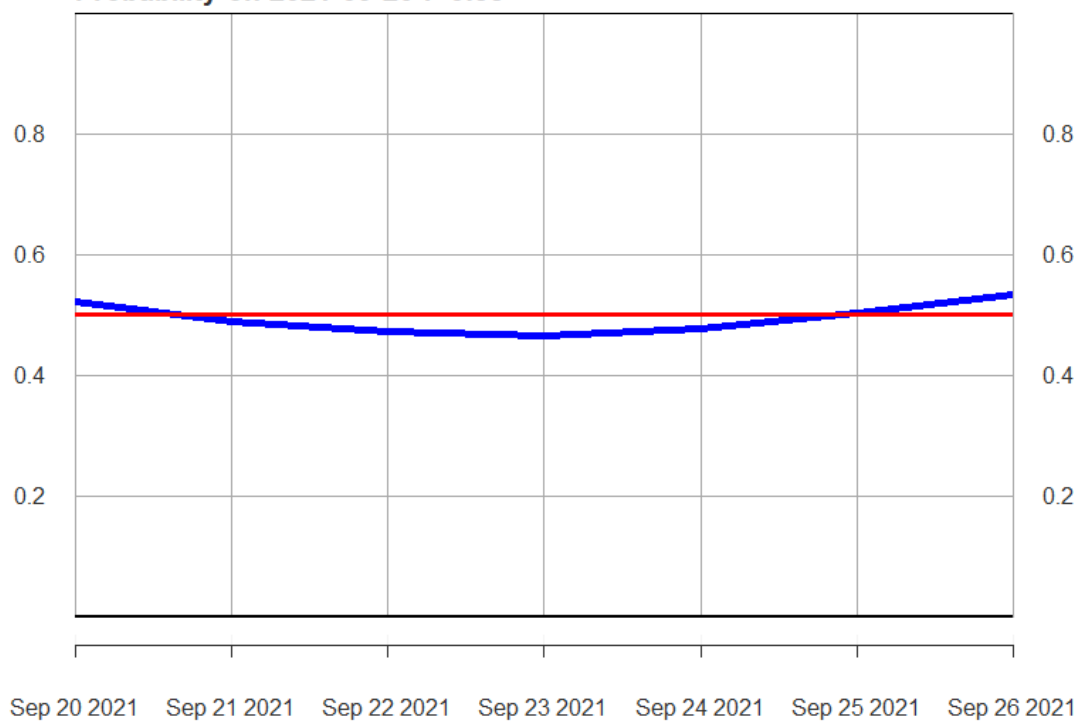
**Manipur:**  
**Probability that cases are accelerating.**  
**Probability on 2021-09-26 : 0.54**

2021-09-20 / 2021-09-26



**Mizoram:**  
**Probability that cases are accelerating.**  
**Probability on 2021-09-26 : 0.53**

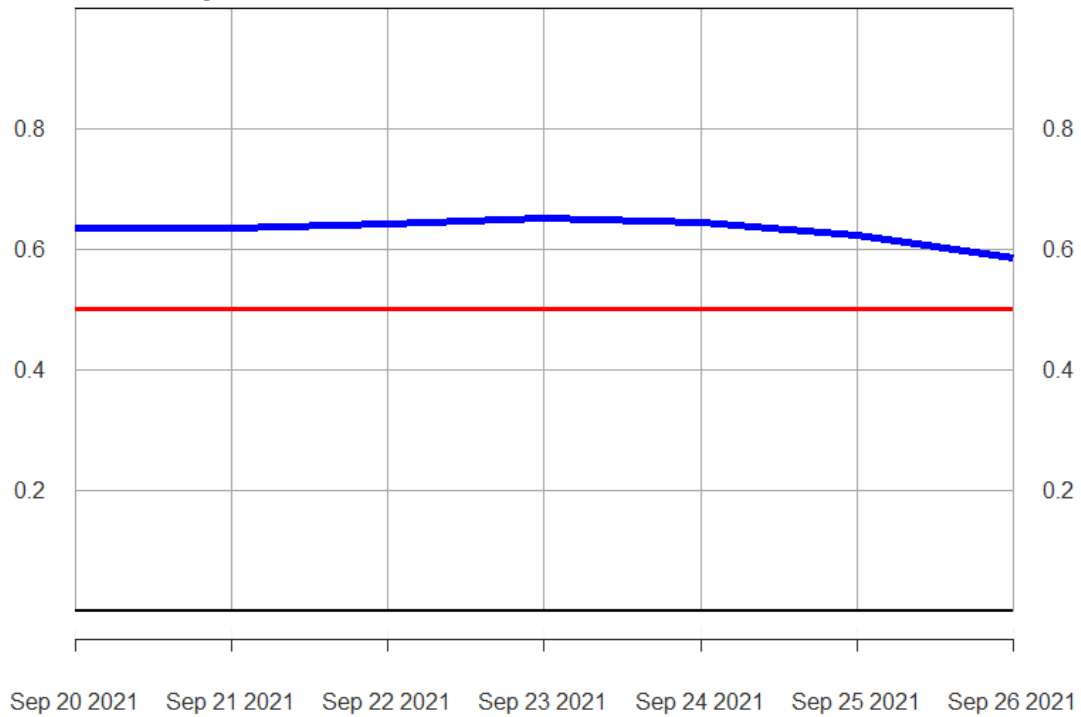
2021-09-20 / 2021-09-26





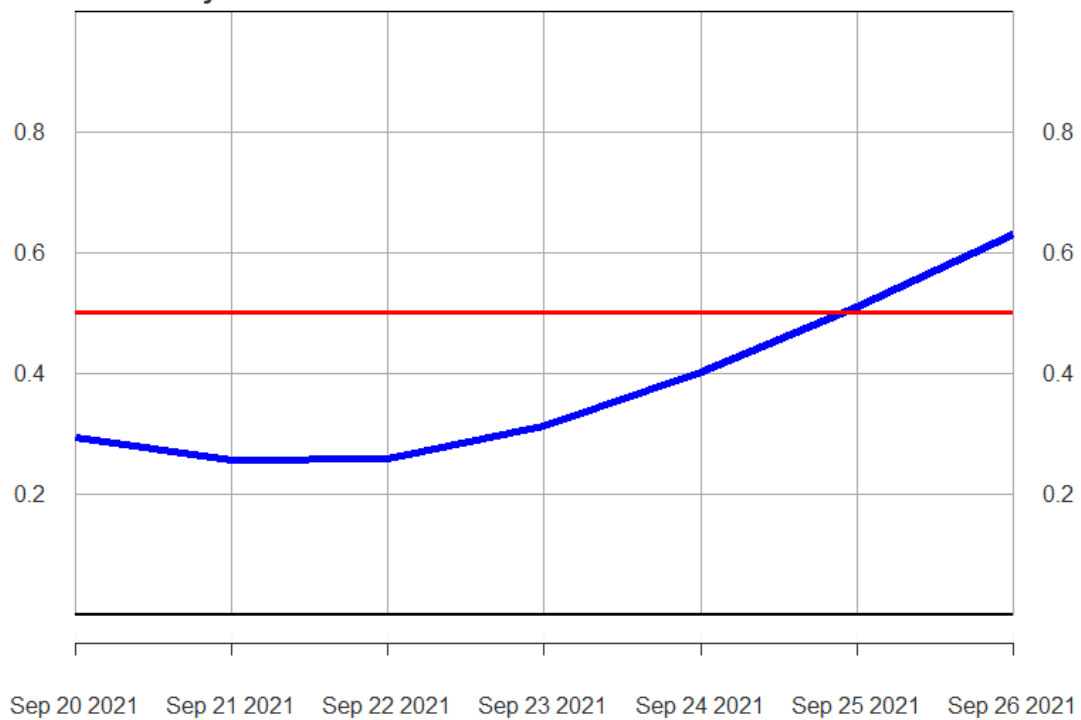
**Tamil Nadu:**  
**Probability that cases are accelerating.**  
**Probability on 2021-09-26 : 0.59**

2021-09-20 / 2021-09-26



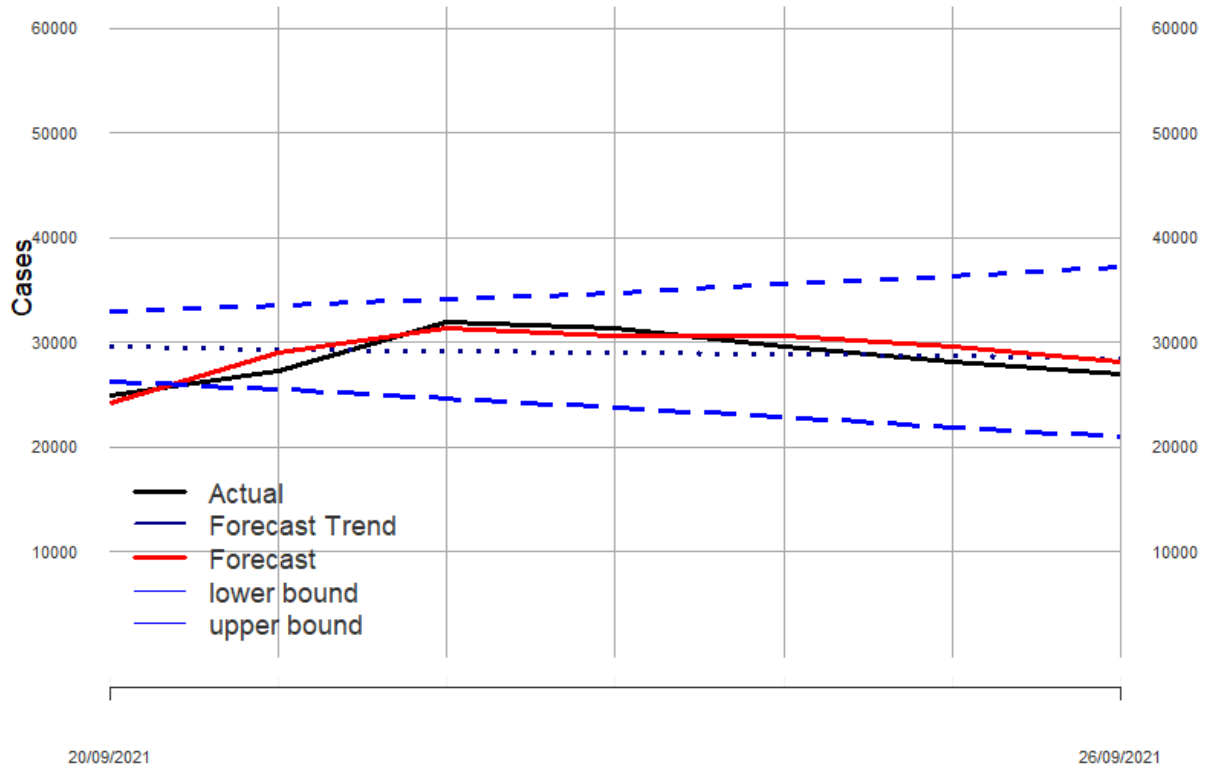
**West Bengal:**  
**Probability that cases are accelerating.**  
**Probability on 2021-09-26 : 0.63**

2021-09-20 / 2021-09-26



**India: Accuracy of last week's forecasts**  
**Mean Absolute Percentage Error: 3.78%**

2021-09-20 / 2021-09-26



## Notes

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**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*. 256, 110-126. doi:10.1017/nie.2021.12.

**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 (2021). A farewell to *R*: Time series models for tracking and forecasting epidemics. *Journal of the Royal Society Interface* (forthcoming). 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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