MONASH University

MONASH BUSINESS SCHOOL

Forecast Covid-19 Daily Cases

Ruiqi Tang

October 27, 2022

Outline

1. Background and Introduction
2. Methodology
3. Conclusion and Finding

Outline

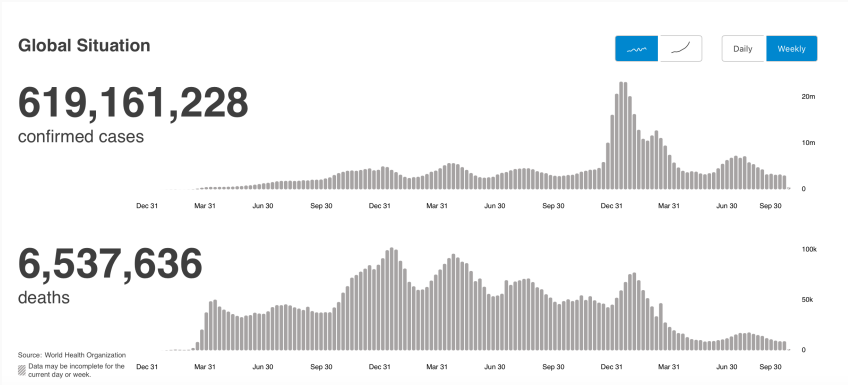
1 Background and Introduction

2 Methodology

3 Conclusion and Finding

WHO

- The total number of confirmed cases exceeds **600 million**
- The total number of deaths cases exceeds **6 million**



Many researchers illustrate that early intervention will efficiently reduce a large number of confirmed cases and deaths

Epidemiological Model

We have many mathematics models to determine the virus spreading, such as SI, SIR, SIRE.

R is one of key parameters in models, my model will mainly focus on it.

what is R

R is a potential measure of the transmission of infectious disease and represents the mean number of secondary infections generated by a typical infected individual in a population with all susceptible

Research Questions

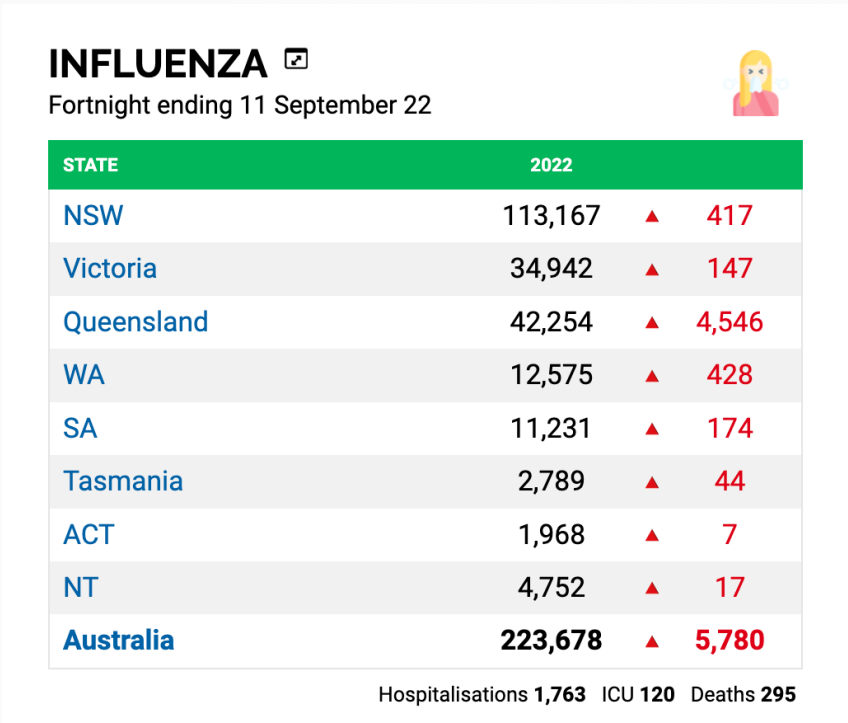
- Estimate *R*, and choose a appropriate window to estimate *R*
- Forecast daily new cases

Outline

Data Source

The data comes from Coronavirus Case in Australian

This website provides the new daily cases for each state



INFLUENZA

Fortnight ending 11 September 22

STATE	2022		
NSW	113,167	▲	417
Victoria	34,942	▲	147
Queensland	42,254	▲	4,546
WA	12,575	▲	428
SA	11,231	▲	174
Tasmania	2,789	▲	44
ACT	1,968	▲	7
NT	4,752	▲	17
Australia	**223,678**	▲	**5,780**

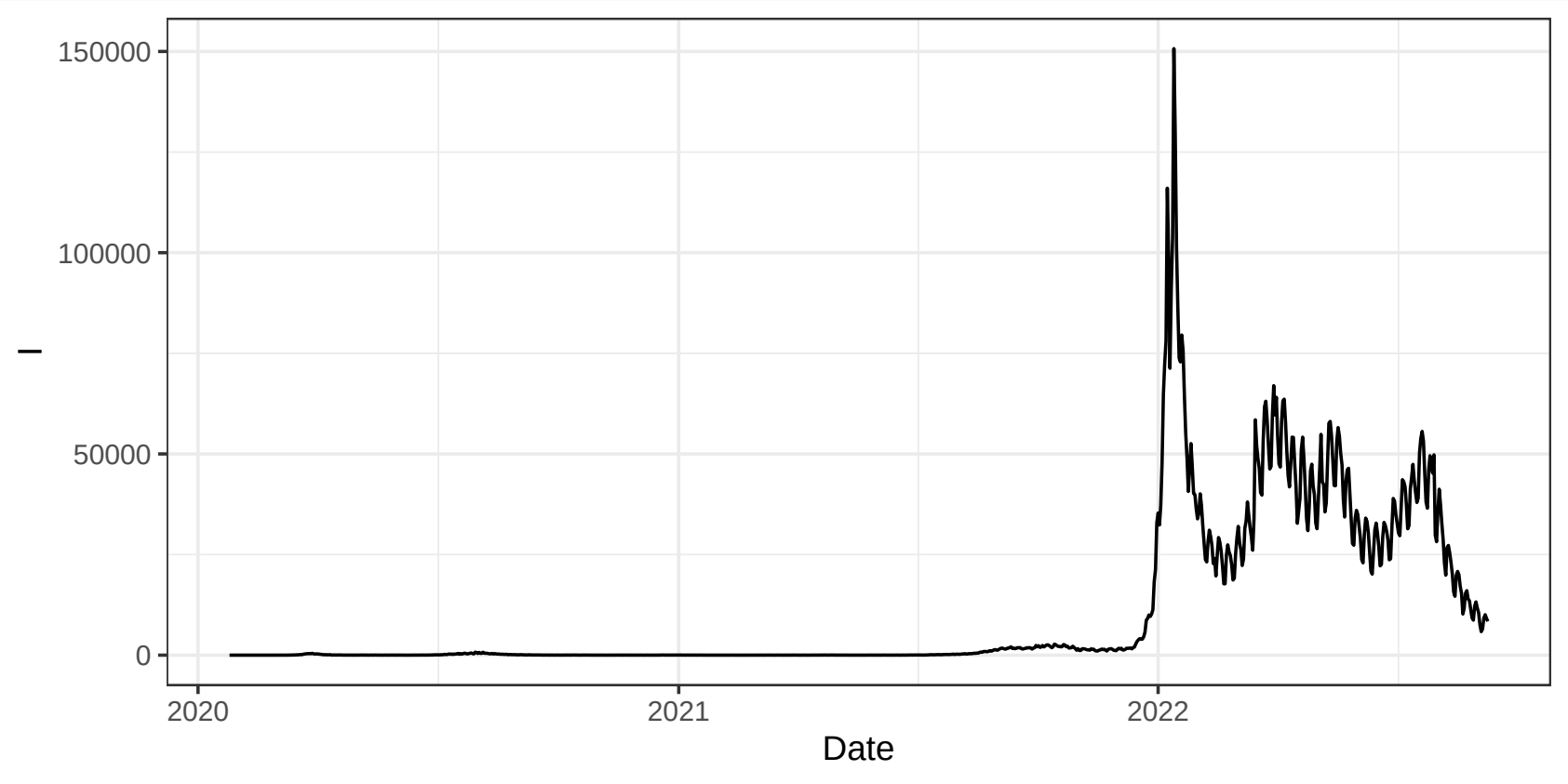
Hospitalisations **1,763** ICU **120** Deaths **295**

Raw Data

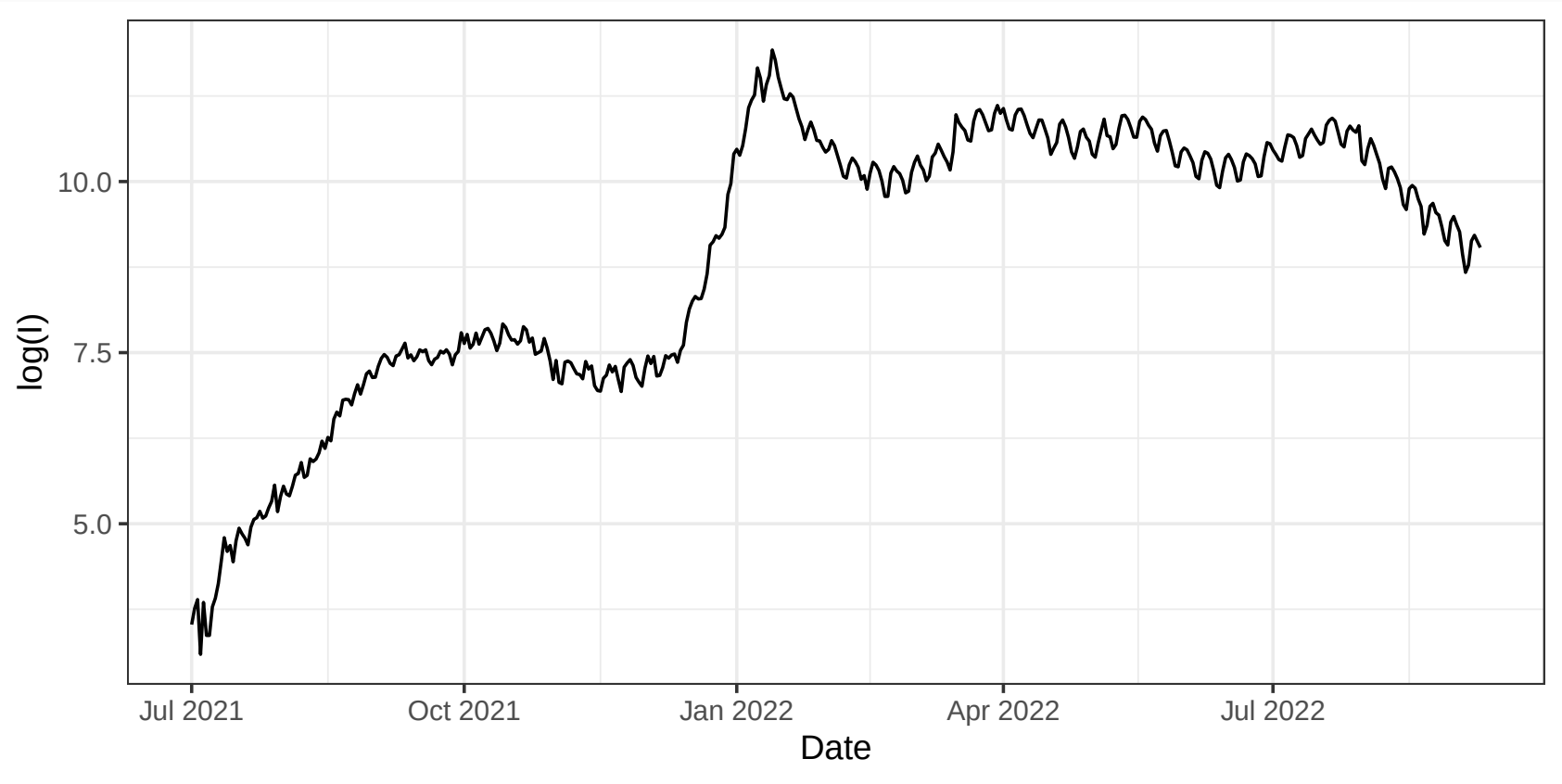
Date	I
2020-01-25	0
2020-01-26	0
2020-01-27	1
2020-01-28	0
2020-01-29	4
2020-01-30	0

I reprsents incidence number

Raw Data



Data Transformation



- using **log transformation**.
- Using data after **2021-07-01**, because all positive number and they are very stable.

Time Decomposition

Decomposition

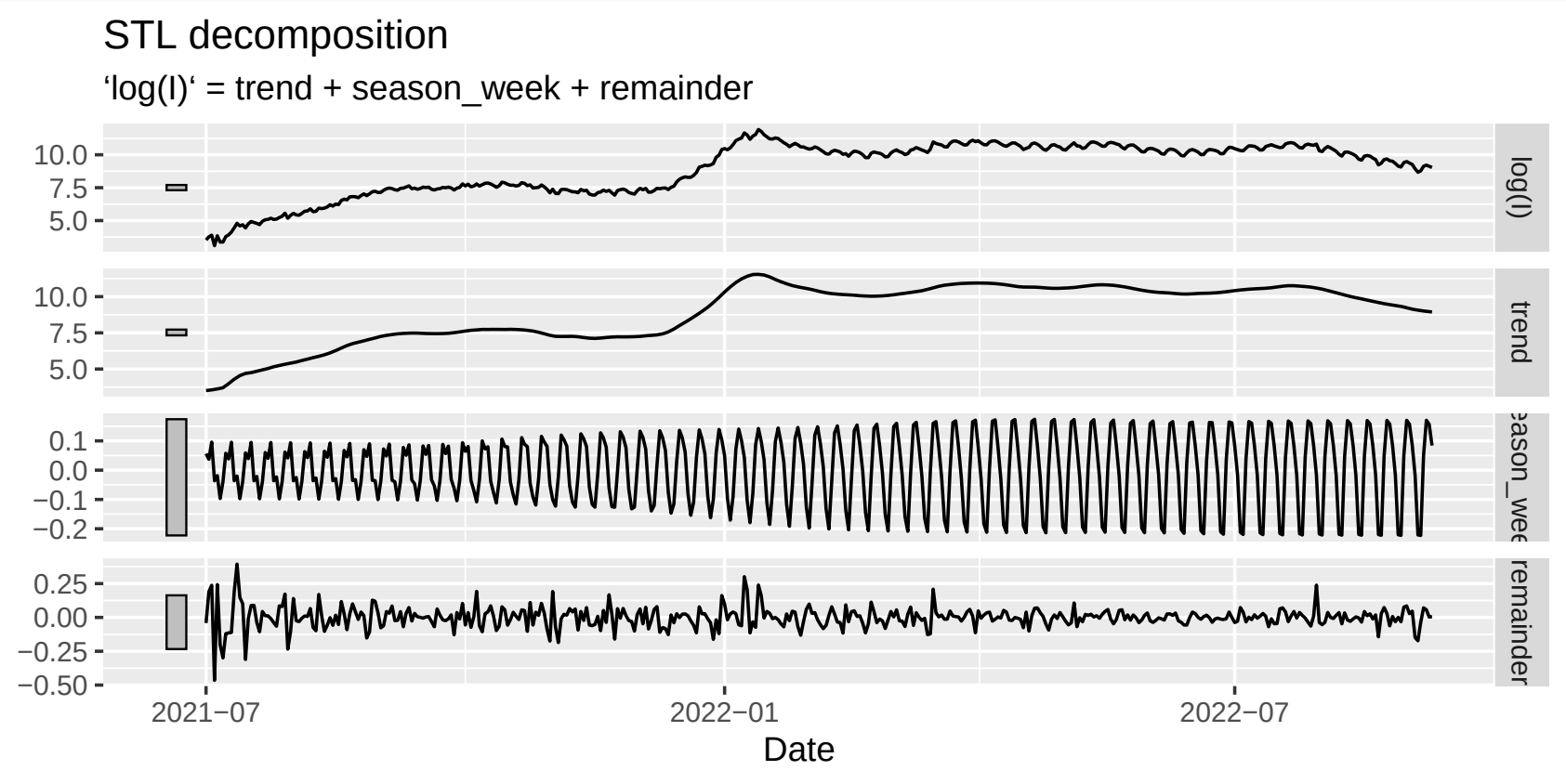
$$Y = Trend + Season + Remainder$$

seasonally adjusted series

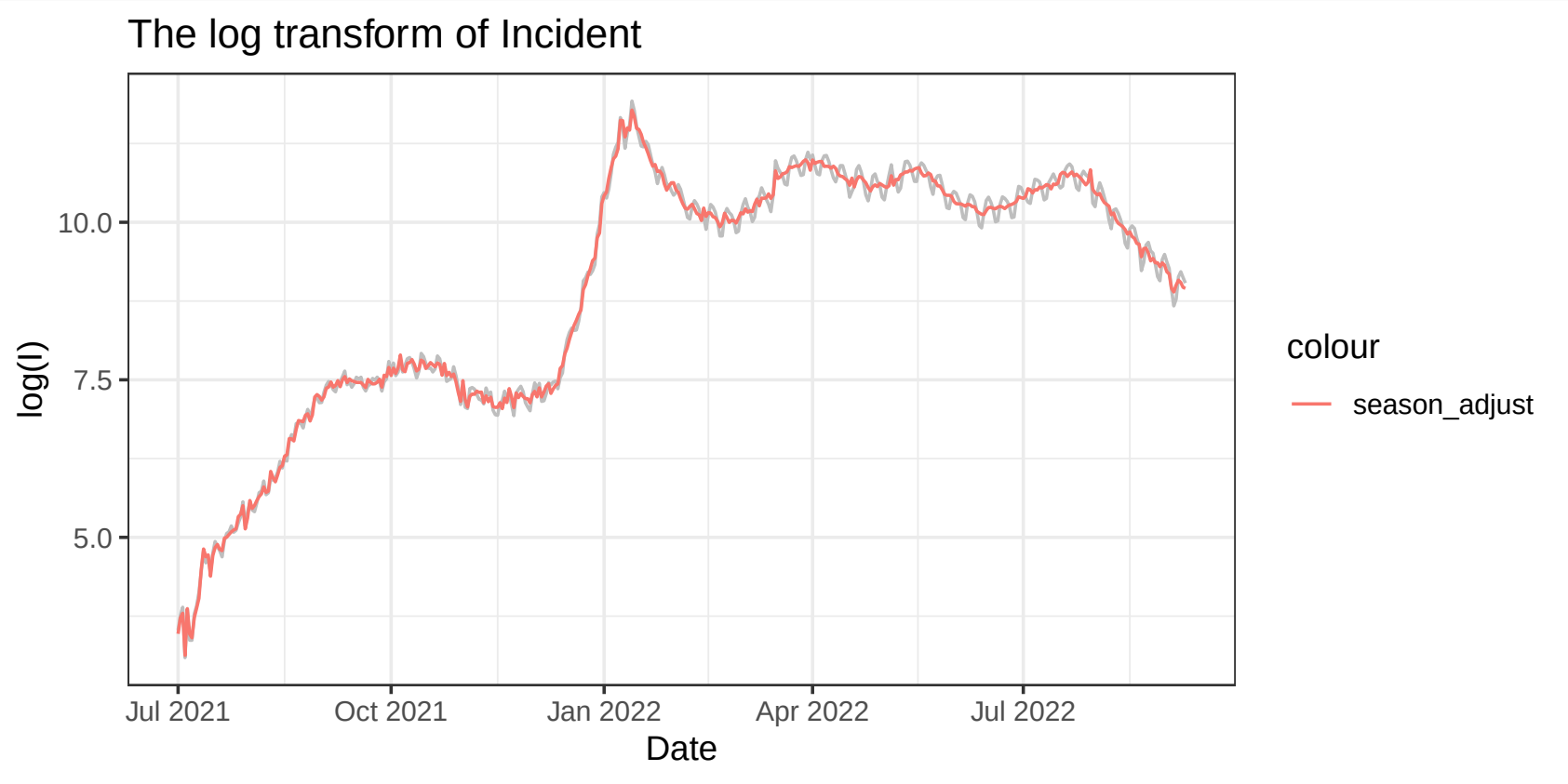
$$Y_{adj} = Trend + Remainder$$

Time decomposition

STL time series decomposition is used here



seasonally adjusted series



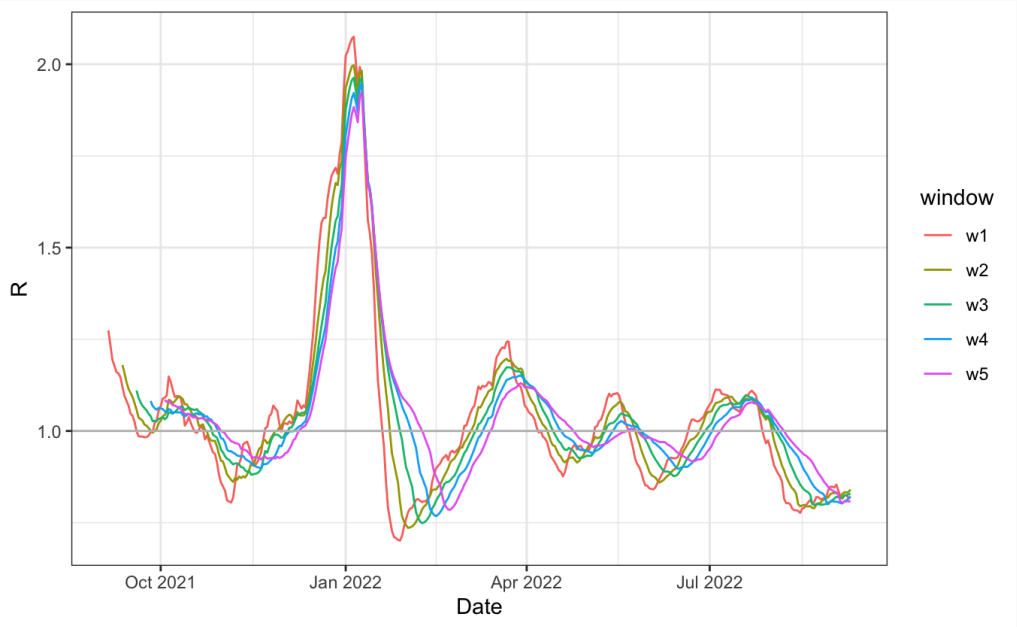
Windows

Window

1. Small values of window lead to more rapid detection of changes in transmission but also more statistical noise.
2. large values of window lead to more smoothing, and reductions in statistical noise. It will lose some detail

Estimate R

I use Bayesian-based method to estimate R by package `EpiEstim`



R

If $R > 1$, The number of infectious cases increases

If $R < 1$, The number of infectious cases decline

Renewal equation

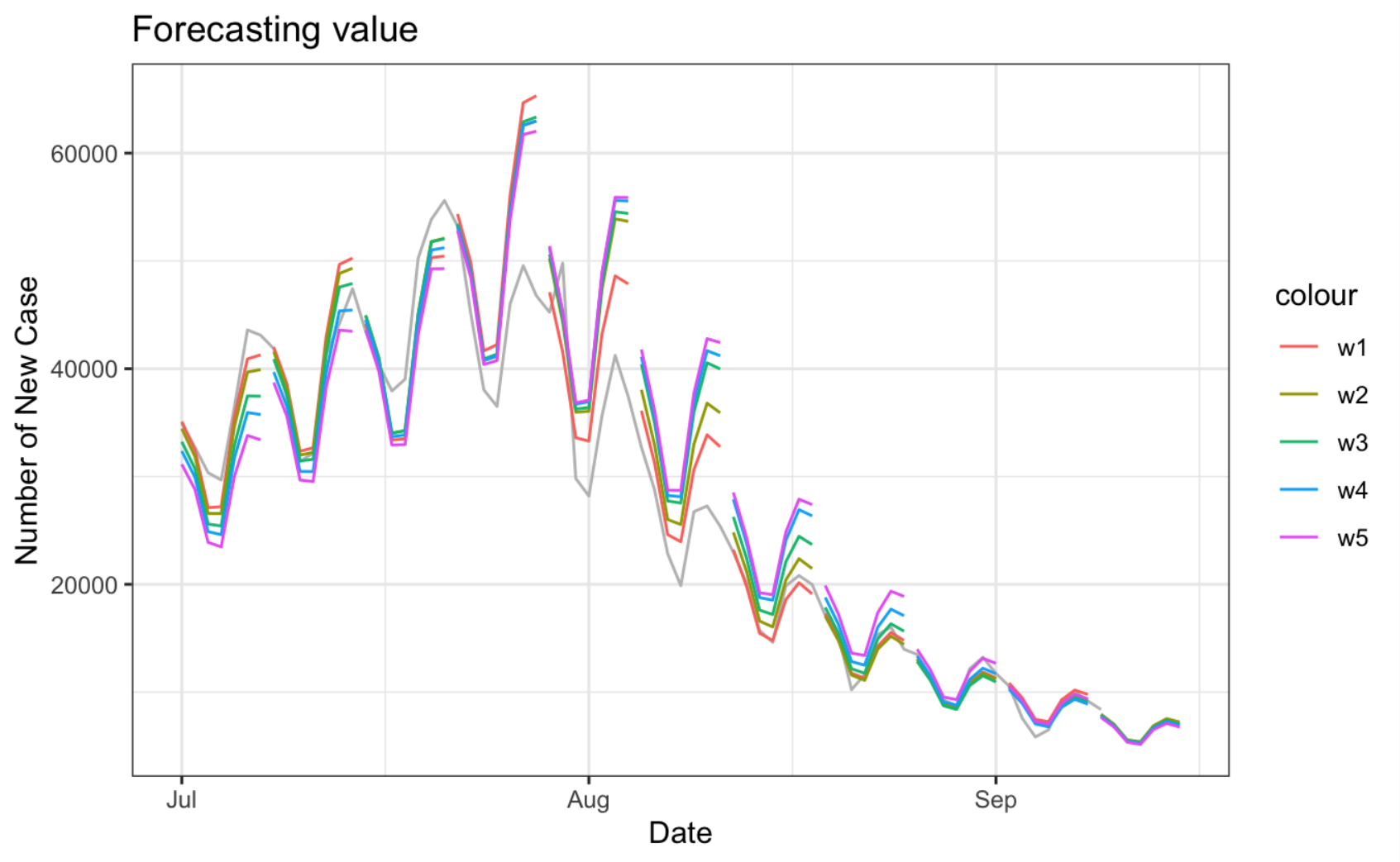
$$I_t \sim Pois\left(R_t \sum_{s=0}^{t} I_{t-s} w_s\right)$$

w is a serial interval distribution.

serial interval is time from the infection of a primary case to infection of the cases the individual generates.

Based on many studies, w follows gamma distribution.

Forecasting



Evaluation

Windows	MAE	RMSE
One	2841	4516
Two	3238	5012
Three	3845	5712
Four	4390	6199
Five	4956	6654

Model with one-week window is more suitable

Outline

1 Background and Introduction

2 Methodology

3 Conclusion and Finding

Conclusion and Finding

Conclusion

1. The model performance is very good, except ending of July, because our model cannot react quickly for a large increase.
2. One-week windows is better

Q & A

THANK YOU