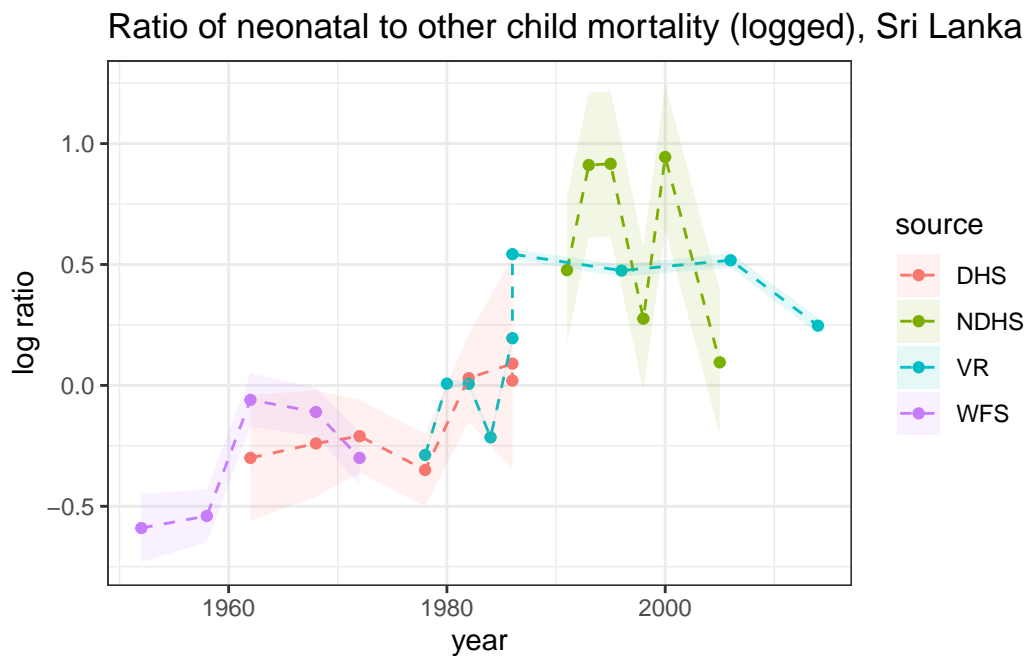# Week 10: Temporal data

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27/03/23

Child mortality in Sri Lanka

In this lab you will be fitting a couple of different models to the data about child mortality in Sri Lanka, which was used in the lecture. Here's the data and the plot from the lecture:

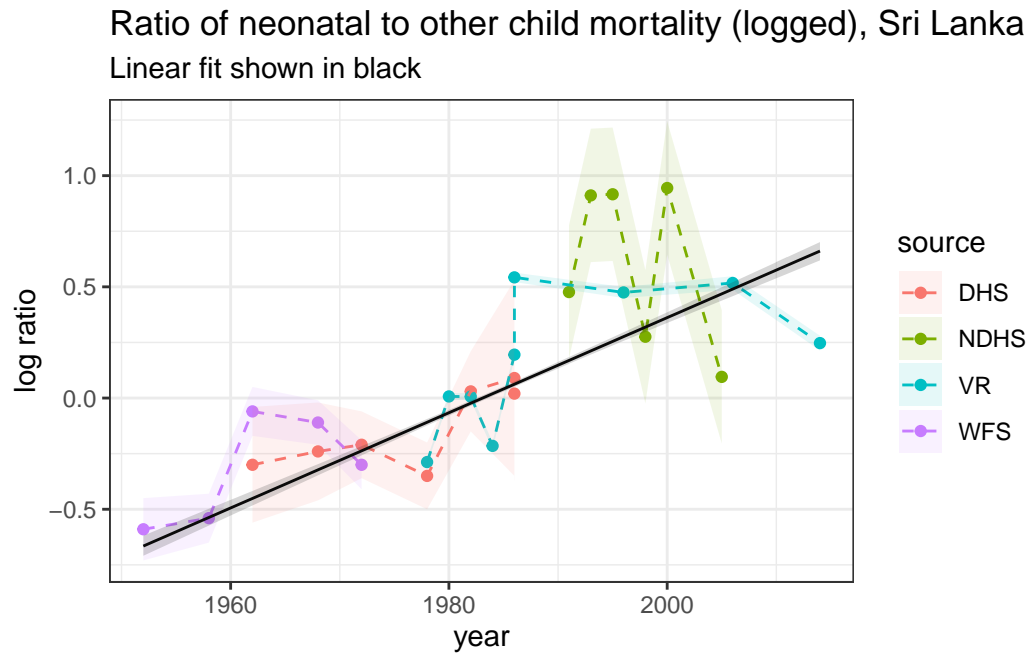**Ratio of neonatal to other child mortality (logged), Sri Lanka**

Fitting a linear model

Let's firstly fit a linear model in time to these data. Here's the code to do this:

Extract the results:

Plot the results:

Ratio of neonatal to other child mortality (logged), Sri Lanka
Linear fit shown in black
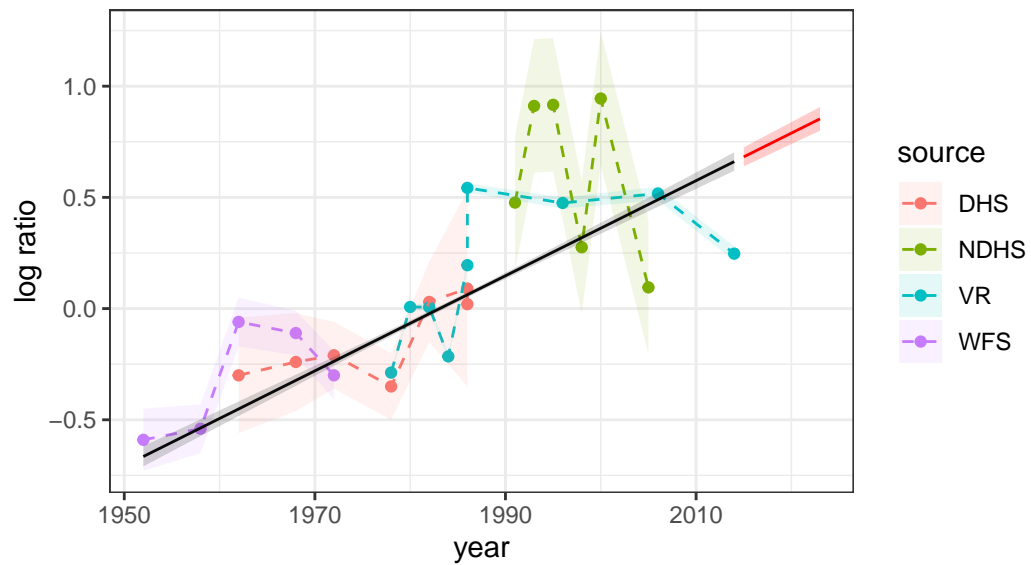

Question 1

Project the linear model above out to 2023 by adding a `generated quantities` block in Stan (do the projections based on the expected value μ). Plot the resulting projections on a graph similar to that above.

Ratio of neonatal to other child mortality (logged), Sri Lanka
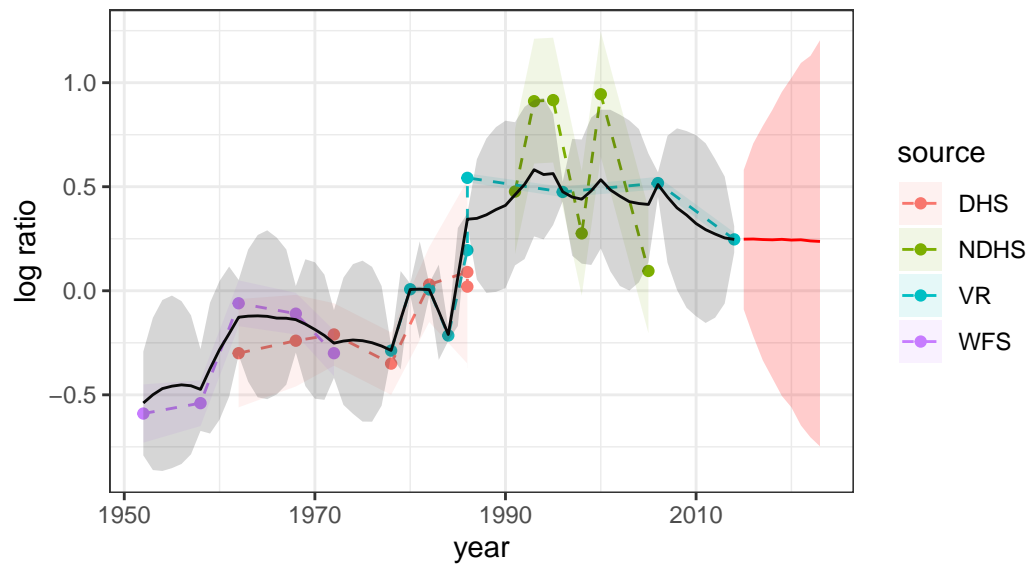Linear fit shown in black
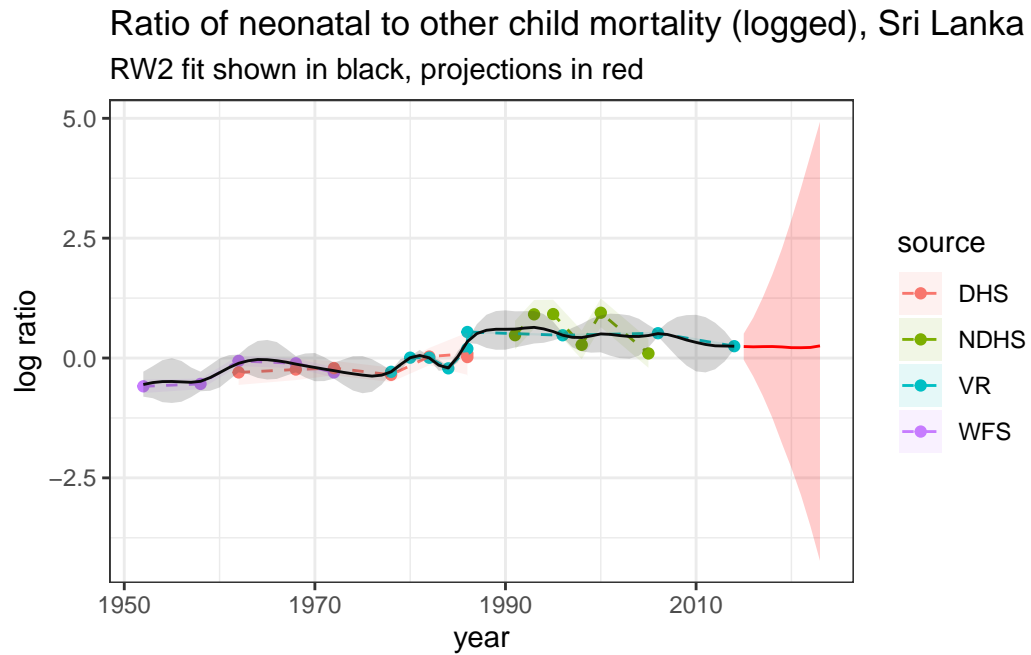

Random walks

Question 2

Code up and estimate a first order random walk model to fit to the Sri Lankan data, taking into account measurement error, and project out to 2023.

Ratio of neonatal to other child mortality (logged), Sri Lanka

RW1 fit shown in black, projections in red

Question 3

Now alter your model above to estimate and project a second-order random walk model (RW2).

Ratio of neonatal to other child mortality (logged), Sri Lanka
RW2 fit shown in black, projections in red

Question 4

Run the first order and second order random walk models, including projections out to 2023. Compare these estimates with the linear fit by plotting everything on the same graph.

Ratio of neonatal to other child mortality (logged), Sri Lanka
RW2 fit shown in red, RW1 shown in blue, Linear is in green
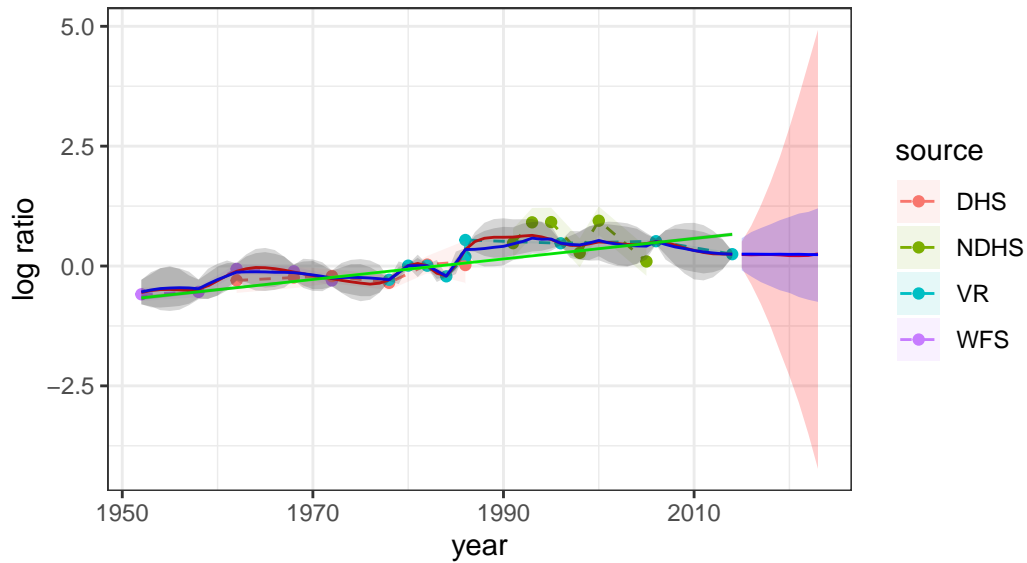
- The fit for linear model is off completely.
- RW models predict the data better as compared to linear model. RW2 has more uncertainity around prediction values, however the within data fit is smoother for RW2.

Question 5

Rerun the RW2 model excluding the VR data. Briefly comment on the differences between the two data situations.

Ratio of neonatal to other child mortality (logged) excluding VF

RW2 fit shown in black, projections in red
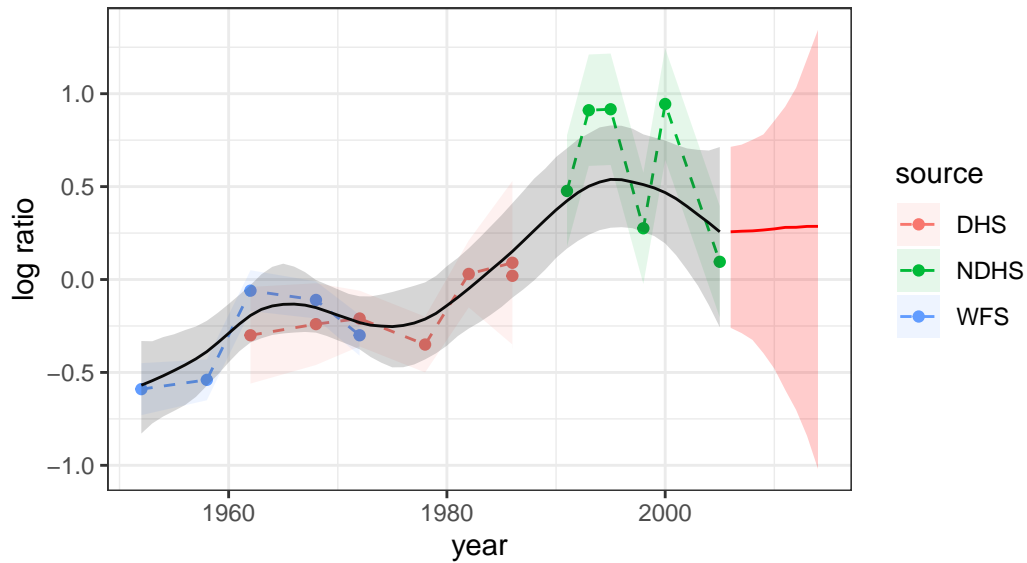
- For the context when VR data source is not included, the uncertainity in estimates produced by RW2 model are lesser than the case when RW2 is trained with VR data included. The model fit is also smoother when VR data is excluded. So, the model trained w/o VR data is better.

Question 6

Briefly comment on which model you think is most appropriate, or an alternative model that would be more appropriate in this context.

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Ratio of neonatal to other child mortality (logged) excluding VF
RW1 fit shown in black, projections in red
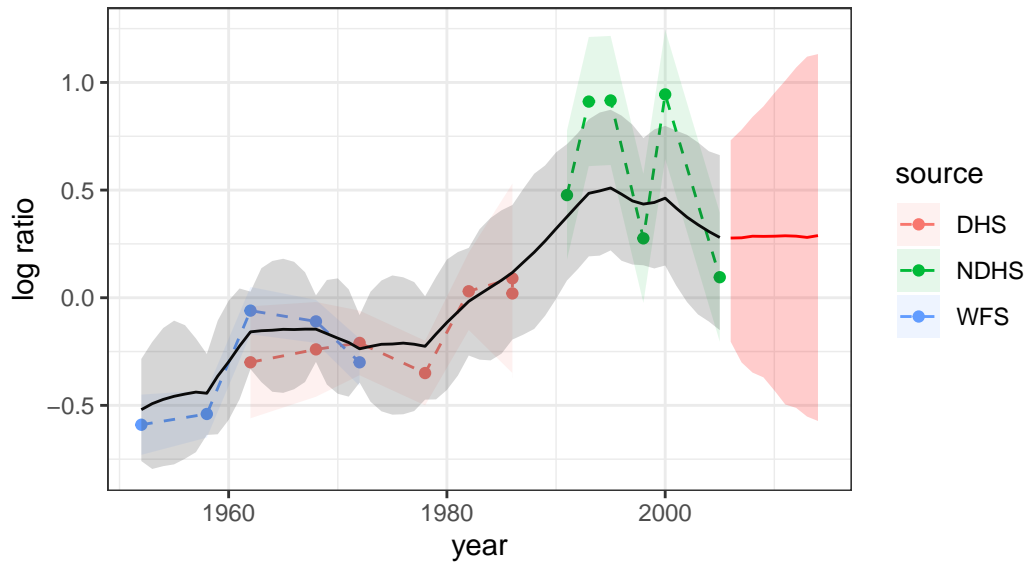
- From comparing the plot of RW2 and RW1, we can see that the predictions of RW2 are more appropriate. The uncertainity in estimates produced by RW2 model are lesser than the case when RW2 is trained with VR data included. The model fit is also smoother when VR data is excluded. So, the model trained w/o VR data is better.

- Lastly, there are multiple observations in the data for the year 1986, so it might be a good idea to manually choose the data for that year to reduce the uncertainities around that point during model fitting.