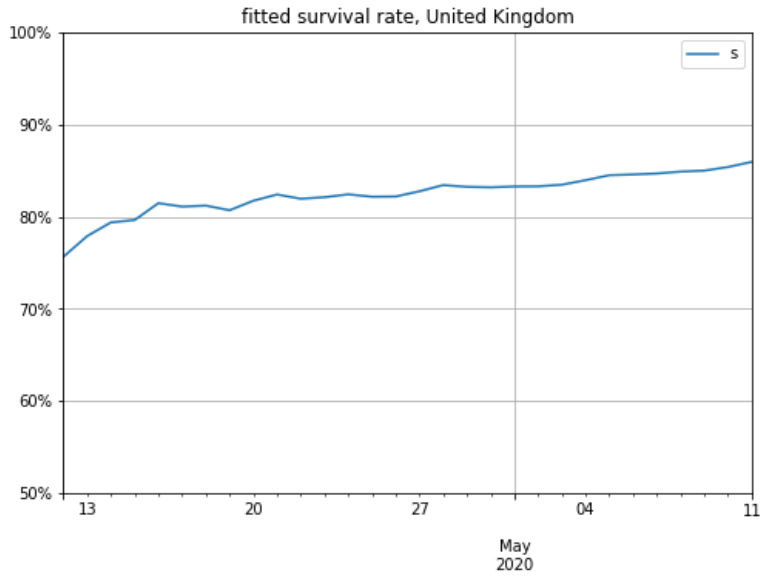
12 May 2020

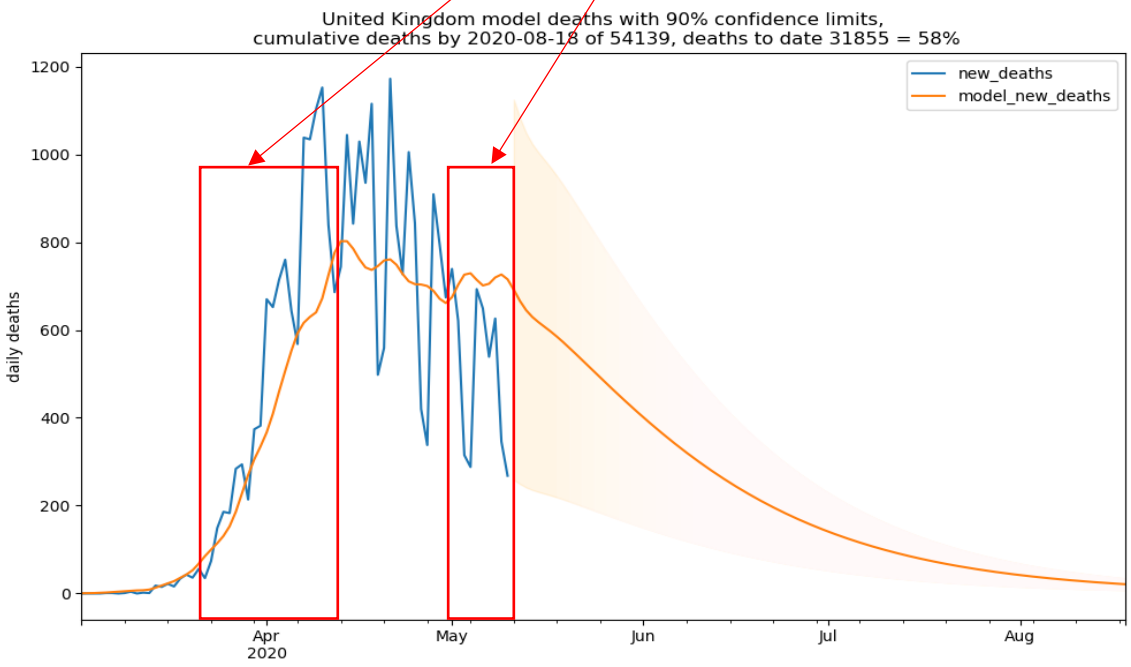
Using a time varying survival rate in the COVID-19 deaths projection

It is clear from the fitting results that the fitted survival rate, ***s***, is trending up:



For most countries we see an increasing average survival rate, ***s***, where this average is based on a model is fitted with exponential weights and a halflife of 20 days.

Consequently, the fitted daily deaths are too low in early April (since the fitted average survival rate is too high) and too high in recent weeks.

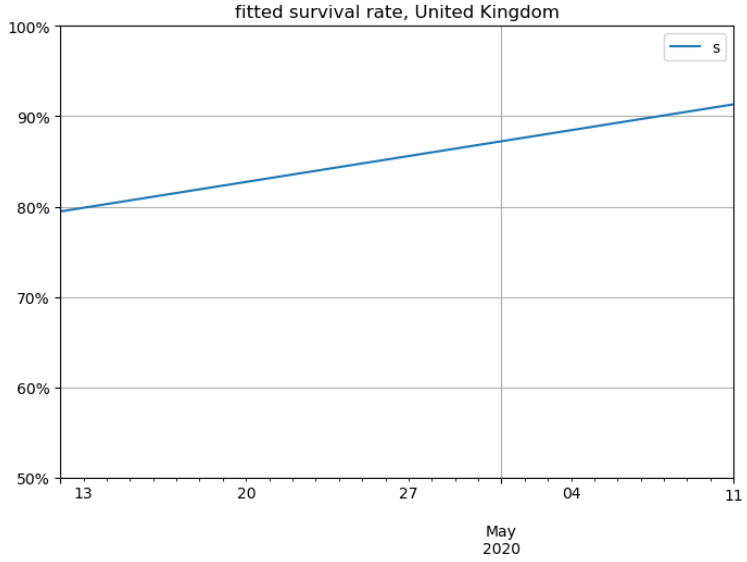


The survival rate at each date *t* prior to the current date *T* is assumed to follow the following simple linear function:

$$s(t) = a+b.(t-T)$$

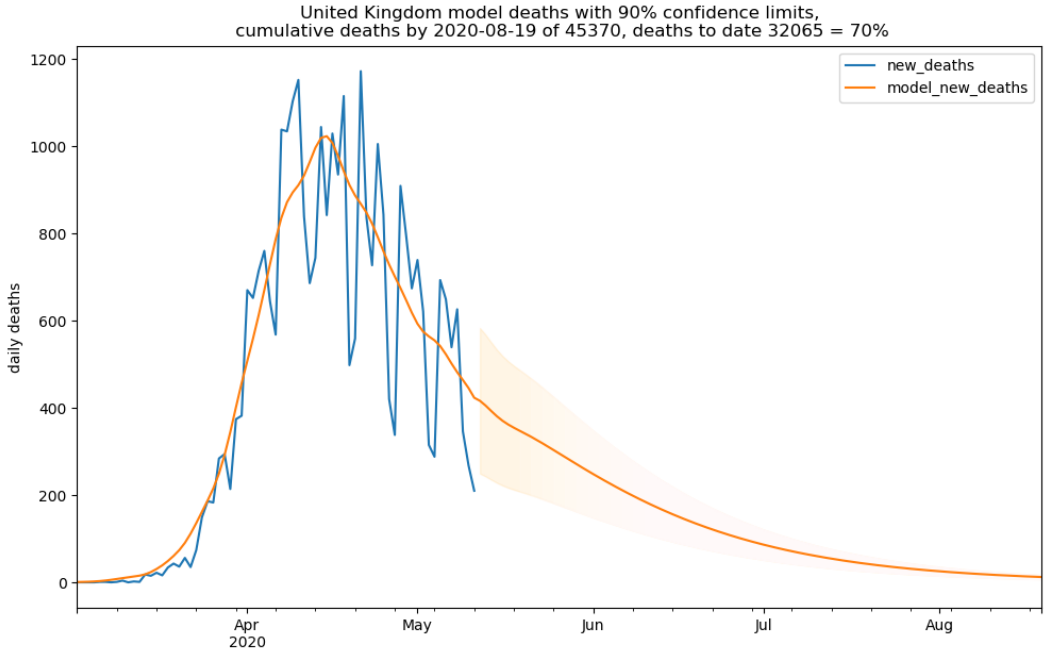
where $0>a>1, b>0$, $s(t)>0$. As *T* is the current fit date, $(t-T)$ is always negative and survival rates in the past are below the current rate. For projecting into the future, i.e. $t>T$, we keep the survival rate constant at the current survival rate $s(T)$.

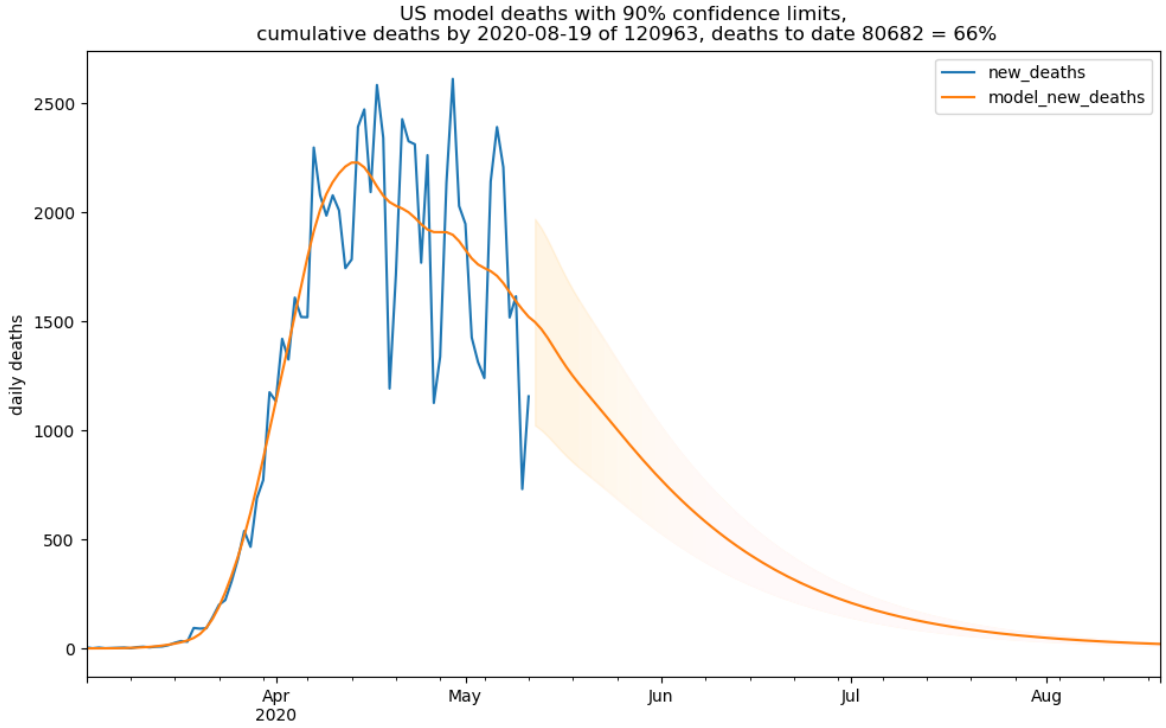
The survival rate, s(t), is shown below for the UK as at *T = 11 May 2020*:



This covid19.py module has been updated to fit this new variable survival rate. This entails updating the functions and replacing the parameter tuple *(s,n,p)* with *(a,b,n,p)*.

The model now shows a better fit to past US and UK data and the confidence intervals are tighter as a result:




US model deaths with 90% confidence limits,
cumulative deaths by 2020-08-19 of 120963, deaths to date 80682 = 66%
new_deaths
model_new_deaths
daily deaths
2500
2000
1500
1000
500
0
Apr
2020
May
Jun
Jul
Aug