IMPACT OF MEASURES TAKEN BY GOVERNMENTS ON SPREAD OF CORONA

REFERENZEN

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https://github.com/WanjohiWanjohi/corona-measures.git

OUR ANALYSIS

- For the purpose of this analysis we make use of the well established SIR(Susceptible-Infected-Recovered) differential equations to infer the input parameters of the spreading rate. With this model and the sample parameters from a Monte Carlo importance sampling, we go a step further to forecast future scenarios of the spread of COVID 19 in Senegal.

- The Senegal government has put in place several measures to curb the spreading rate that will have an impact on the observed data. These include schools closure , a nationwide state of emergency as well as a nation wide curfew.

Exponential growth $x_t = x_o(1 + r)^t$

- An exponential growth refers to the way a quantity increases over time when the instantaneous rate of change of a quantity (aka a quantity's derivative) is proportional to the quantity itself where ***r*** is the growth rate and time ***t*** goes in discrete intervals . If the proportionality is reversed i.e as the derivative increases , the quantity decreases , this is referred to as an exponentional decay. In the case of a specifed region of quantities(*n*) with equal intervals then the growth is termed a geometric progression

OUR MODEL

An exponential function defines a graph that crosses the y-axis at (0,1) with the form $y = b^x$ whose domain is all real numbers , made of all positive real numbers. The graph is asymptotic to the x-axis i.e it goes close to the x-axis but never touches it . When b >1 , the graph increases .

The SIR model differs from the SEIR model in that the latter includes the exposed as part of the output parameters. For the purpose of evaluating the John Hopkins data set found here , the SIR model is favorable because it uses an exponential equation to predict the infectious period which follows an exponential growth, a characteristics of a bilogical epidemic . However , this same reason makes it quite unrealistic as discussed by Fowler and Hollingworth(2015) because people's behaviors change during a pandemic as well as that as a pandemic progresses, the infected population decreases contrary to the subject in an ideal exponential growth function.

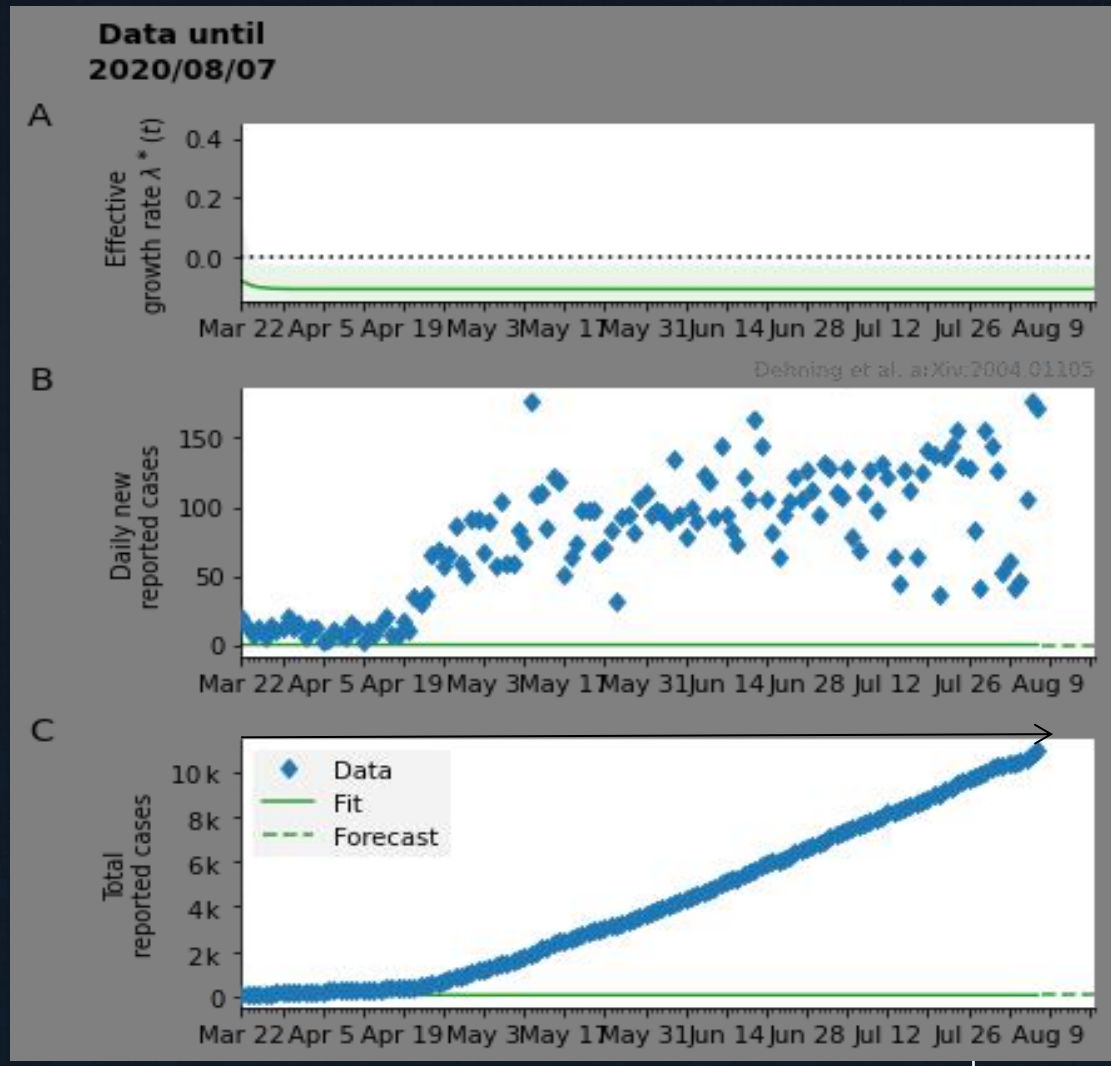
For the sake of this analysis , we consider the dates March 10th , March 16th and March 31st. of 2020 where schools were closed , travel ban and airspace closed as well as a national state of emergency declared respectively.

* In order to adapt the model to data on corruption tweet , a different modelling approach that does include the suceptible but instead categorizes oon infected and uninfected (as applicable to social media frenzies). In this way then the inputs of time from february to August , and a projection of future infections, rather interest in the topic

OUR RESULTS

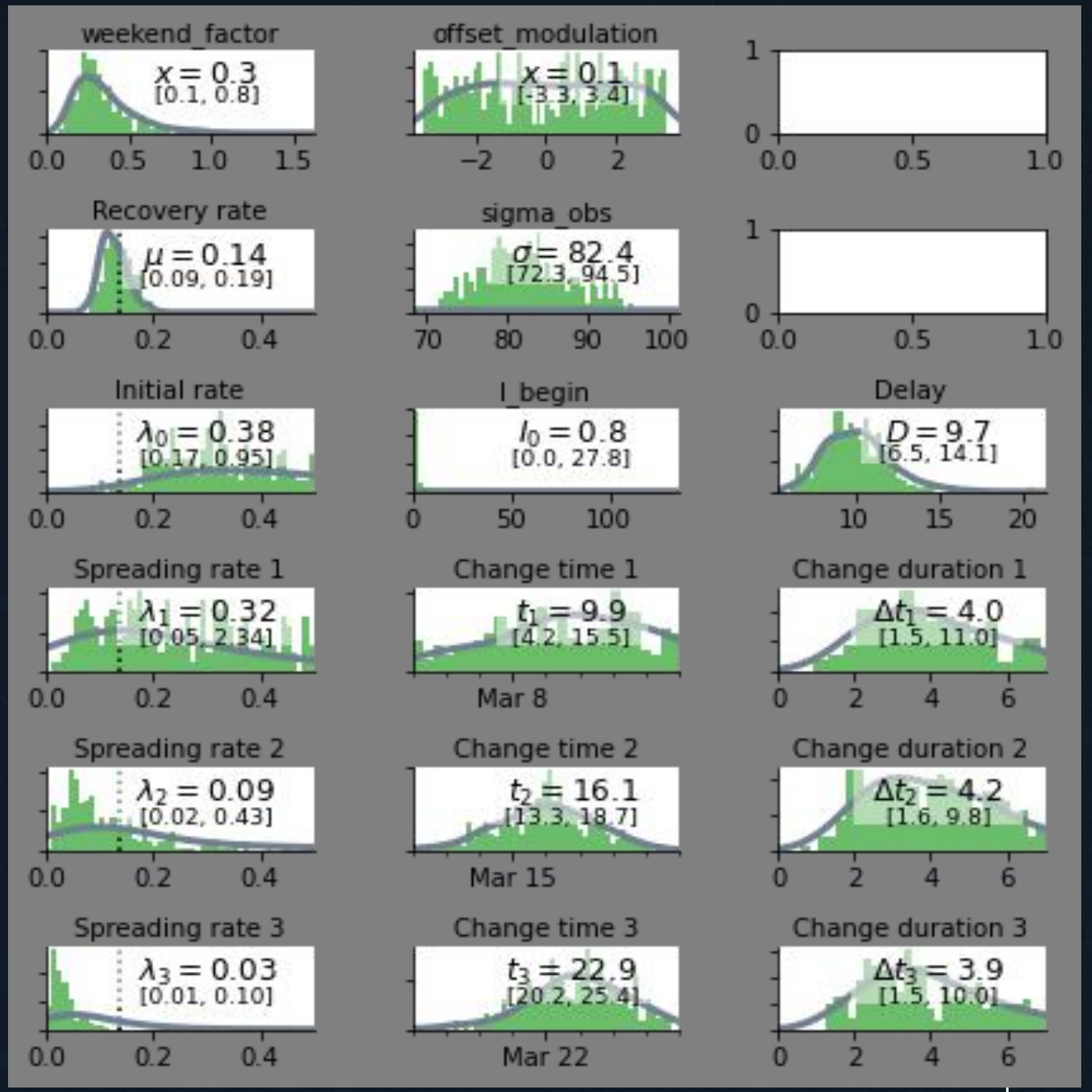
From our inquiry into the dataset ,we realize the following plots , of our given considered dates , the nationwide state of emergency seems to be the most effective of the measures implemented towards social distancing. Additionally, schools being re-opened on 25th June marked **a rapid decrease** in cases reported followed by an increase in general cases reported.

On August 7, the Government of Senegal announced stricter enforcement of existing measures to prevent the spread of COVID-19, including: the prohibition of gatherings in public spaces, including beaches; a prohibition on all demonstrations on public highways; mandatory use of facial coverings; and social distancing requirements on public transport. Violators may be subject to fines and potentially one month of jail time.* In lieu of this move , it is expected then that a **rapid decrease** in reported cases is to be expected for the next 5-8 days and then the reported cases to stabilize at around 100 and a . Overall , the measures implemented so far have staggered the speed of infection within Senegal and the additional measure continues to do the same and for the week of 10th August , the cases are projected to reach a total of 11,200 cases , a growth by 400 cases to account for the surge in cases after an implemented measure and the resultant plateau.



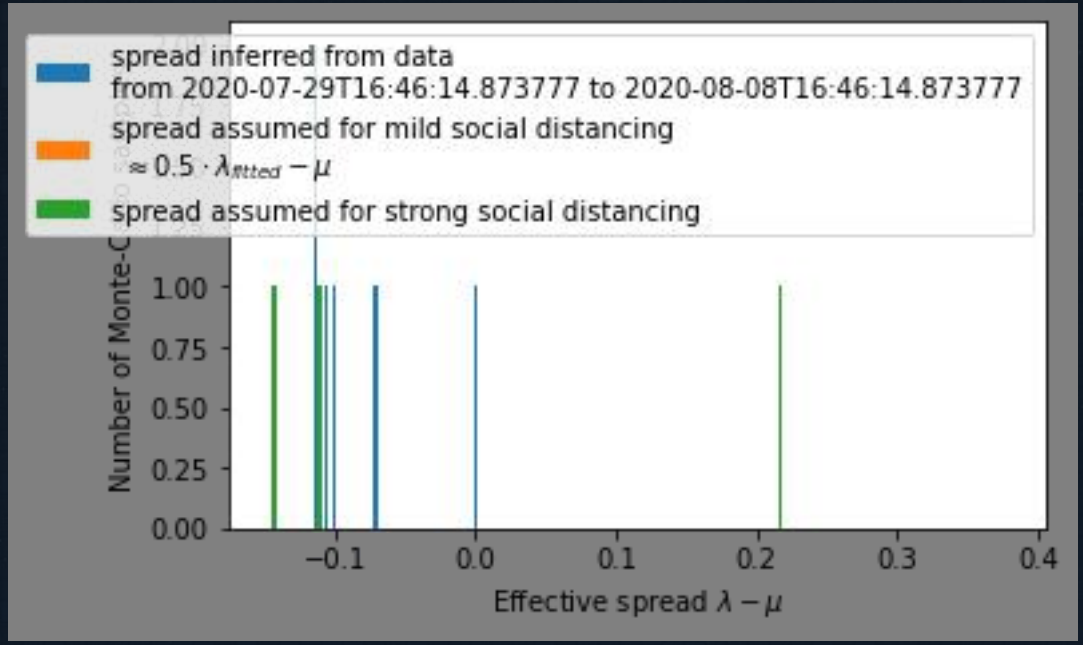
OUR RESULTS

- The initial spreading rate depicted as ʎ in the graphs , is intially at 0.38 , after the first implemented measure where schools were closed reduced it to 0.32 .
- It declined further to 0.09 following the travel ban and further to 0.03 after the declaration of a national state of emergency.
- The largest change time (*t*) is 22.9 following the implementation of the same state of emergency with the largest lasting change beign observed after the implementation of the travel ban
- According to J Dehning et al (2002) , for the infection to be contained , the recovery rate μ has to be greater than the spreading rate.



OUR FORECAST AND CONCLUSION

From our model, given stron social distancing measures implemented, it is possible to limit the spreading rate to 0.2 therefore the projected spread for the week of 10th August is at 11,254 cases in the best case scenario



CITATIONS

1. Fowler, A.C., Déirdre Hollingsworth, T. Simple Approximations for Epidemics with Exponential and Fixed Infectious Periods. Bull Math Biol 77, 1539–1555 (2015). https://doi.org/10.1007/s11538-015-0095-3
2. https://sn.usembassy.gov/event-enforcement-of-covid-19-prevention-measures-in-senegal/
3. J. Dehning et al., Science 369, eabb9789 (2020). DOI: 10.1126/science.abb9789