COVID-19 INFECTION RATE SIMULATIONS

DISCLAIMER

This white paper is internal and confidential to HAPPY and is prepared based on the primary research conducted by HAPPY. This is the third paper in the series of white papers that HAPPY is going to publish.

EXECUTIVE SUMMARY

COVID-19 has led to huge disruptions in almost all business over the country. Small businesses are the one's bearing the most brunt as lockdown has brought unprecedented hardships from maintaining labour to cash flow cycle and are in dire need of financial assistance. The Governments 20 lac crore package along with some new amendments especially for the MSME sector have ensured that the cost of funds have reduced. The RBI too has reduced the Reverse repo rate so that banks are more than willing to lend their funds.

While these measures would help the economy fight back the COVID, measures to prevent the spread of the virus via the lockdown seems to be achieving the desired results as our model has shown a decrease in the infection rate.

Mumbai has been the epicentre of the COVID-19 pandemic in India, accounting for over 55,500 cases alone, followed by Delhi with over 35,000 cases. India reported its 100th case on 15th March 2020. It took us 65 days to reach 100,000 cases and only 14 days to add another 100,000 to the tally.

METHODOLOGY

FB Prophet API was used for forecasting infection rates along with some additional regressors. Prophet is optimized for trends that are non-linear growth curves, where a trend hits a natural limit or saturates, this is precisely how COVID-19 infection curves have behaved in other countries. For this paper, models for cities/countries similar to Mumbai and Delhi, e.g. New York, Brazil, Italy, China, South Korea were studied.

An ARIMA model with multivariate regression model was used with a logistic growth curve and Lockdown Intensity as additional regressors. The model was tested over multiple simulations of weekly Lockdown Intensities (High, Moderate, Low, Very Low). Parameters were estimated using Prophet's built in Hamiltonian Monte Carlo (HMC) algorithm. HMC is a Markov chain Monte Carlo (MCMC) method that uses the derivatives of the density function being sampled to generate efficient transitions spanning the posterior.

ASSUMPTIONS

1) India's trajectory is similar to that of its foreign counterparts, USA, South Korea, China.

2) Lockdown Intensity:

High: schools, religious places, malls, movie theatres and local markets remain closed and no inter-district travel.

Moderate: schools, religious places remain closed. Malls, inter-district travel is allowed.

Low: schools, religious places remain closed (except for examinations). Inter-city travel is allowed.

Very Low: All restrictions lifted except in containment zones.

3) Migration of laborer was not considered since for running simulations for the two cities (Mumbai & Delhi)

4) Growth of COVID rate is exponential which will damp after some time

5) 42 percent of infected in India are in the age 21-40

6) Present rate is taken with respect to whole India since testing has spread across

7) Trajectory of India will follow a logistic pattern.

INFERENCES

The result of the equation gives us infection Rate of 0.45 percent by the 180th day after day 0 provided 10 crore tests are done. This assumes that tests will spread across India
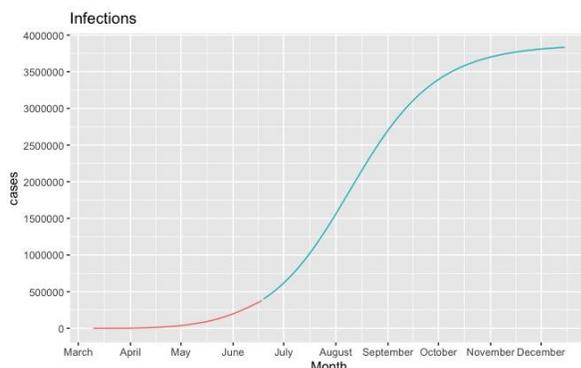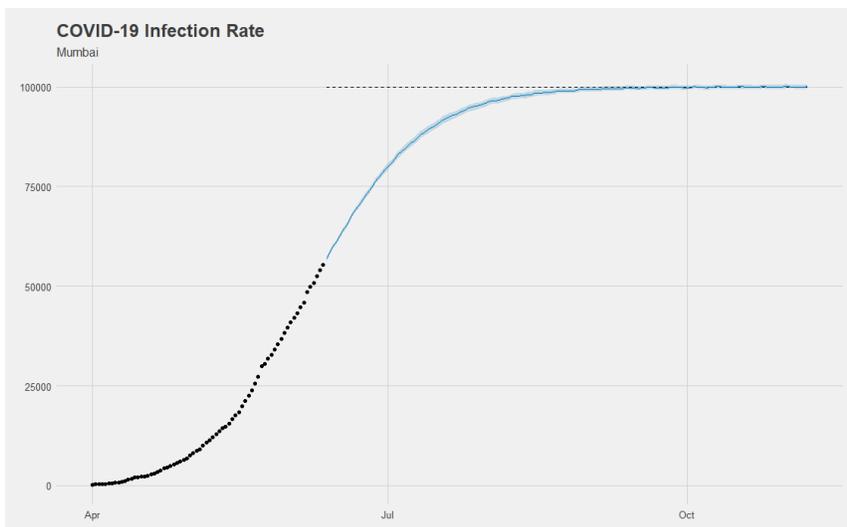

To achieve at the portfolio risk rate, Monte Carlo simulation was done 10,000 times considering that portfolio risk is 5 percent with standard deviation of 2 percent.

The infection rate was randomly distributed to the sample. A portfolio loss of 0.39 percent is predicted after 180 days considering the normal risk distribution is unchanged.

In next 100 days, India will hit cumulative 38 lakh cases which will stabilize afterwards. This is lesser than our previous model predictions.

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Infection rate for Mumbai

At the time of writing, Mumbai had 55,000 cases which grew and eventually flattened to 100,000 cases by September.

Infection rate for Delhi
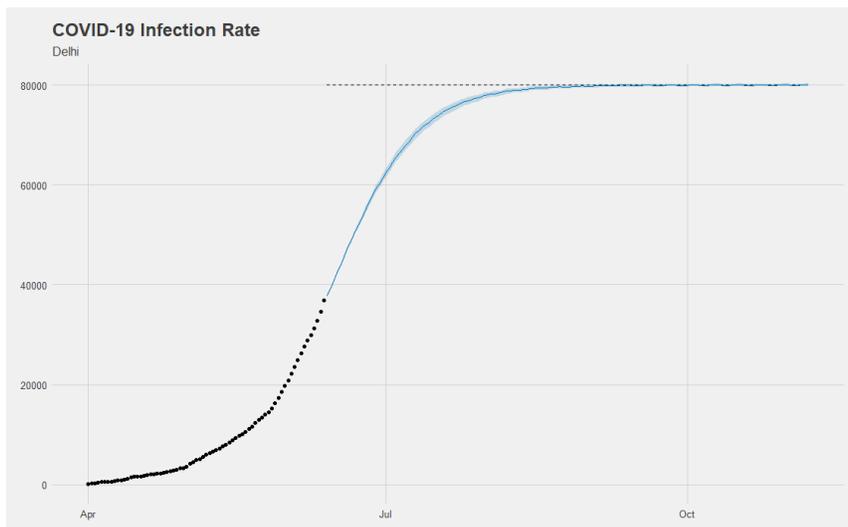
Delhi had 35,000 cases which flattened to 580,000 cases by September.

The pandemic appears to reach its end by September. However, this can move in either direction significantly depending on Government policies, migrants, availability of vaccine. A second wave may very well be possible unless a vaccine or effective treatment is produced.

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WAY FORWARD

The prediction is based on time series taken across India regressed against time , lockdown intensity and testing numbers. A micro analysis is done at district level for Mumbai and Delhi . However with COVID at its peak in first wave , it is slowly spreading towards Tier 2 and Tier 3 districts . Hence a bottom to up approach would be more appropriate to predict the number of infections . Just like Mumbai and Delhi , for each district a model should be created. This would have be regressed against variables like lockdown intensity , testing intensity, medical infrastructure , public awareness surveys, education level etc. Each prediction would then be cumulated at ALL India level .

ABOUT HAPPY

Micro enterprises account for more than 99% of the total number of MSMEs, amounting to 63.05 Mn as per MSME Report 2018-19. 95% of the MSMEs are proprietary in nature[1]. HAPPY is a digital lending fintech targeting a multi-billion-dollar credit gap in India's micro businesses. HAPPY has access to more than 3.5 Mn merchants (micro businesses/entrepreneurs) through 20 plus partners in various categories like payments, telecom, agri-tech and dairy-tech.

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