

An analysis of economy plunge during a pandemic and assumed reactivation policies

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ABSTRACT

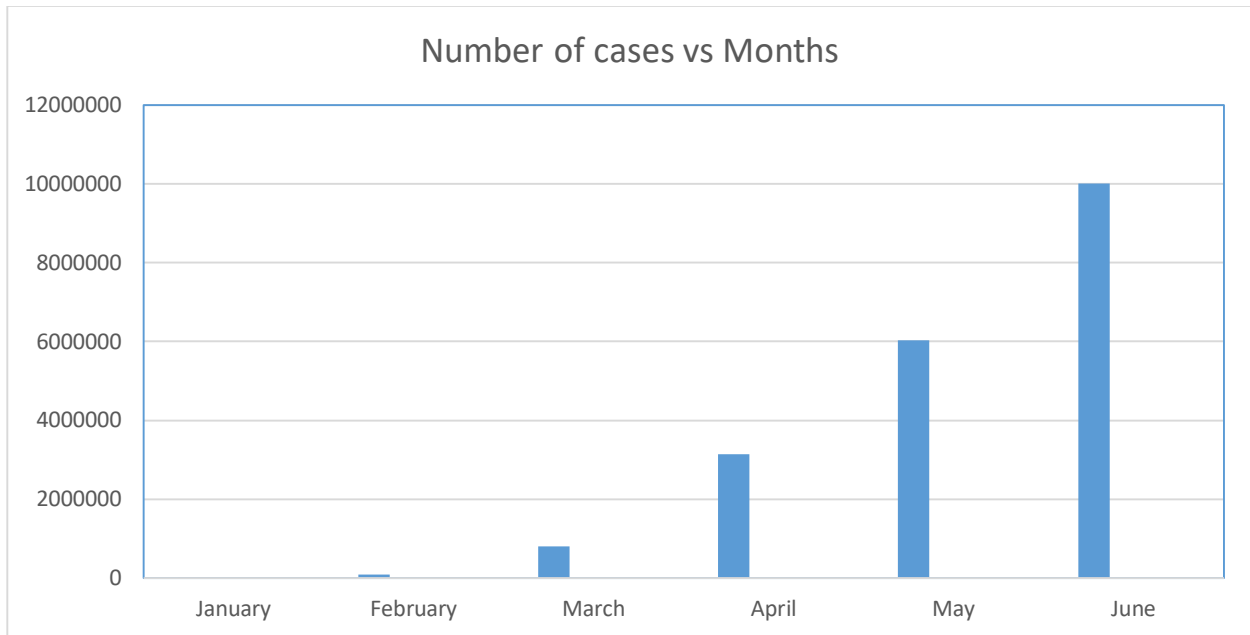
Corona virus outbreak has put the world on hold and this has got the economies down to alarming levels. And this is the time when policies should be framed according to the downfall trends to re-strengthen the economy. Corona virus has swiftly transformed from a health care danger to a financial crisis. In this paper, first we see how the number of cases are rising and how the world's GDP is falling down with respect to time. In this paper we have predicted the Public debt to GDP Ratio of India in 2021 using Machine Learning algorithm. This paper also shows the trends in the unemployment rate in India and a heat map of cases around the world. This paper also presents some policies to improve the current financial situation. The 5 policies include: Economic framework, Public health policy framework, Gradual opening of the lockdown, Educational Transformations, and the Public private partnership.

Keywords: Data Analysis, Economy, Pandemic.

INTRODUCTION

Corona virus Disease (COVID-19) is a respiratory disorder which is caused due to the novel corona virus named SARS-CoV-2. This Disease was discovered in China

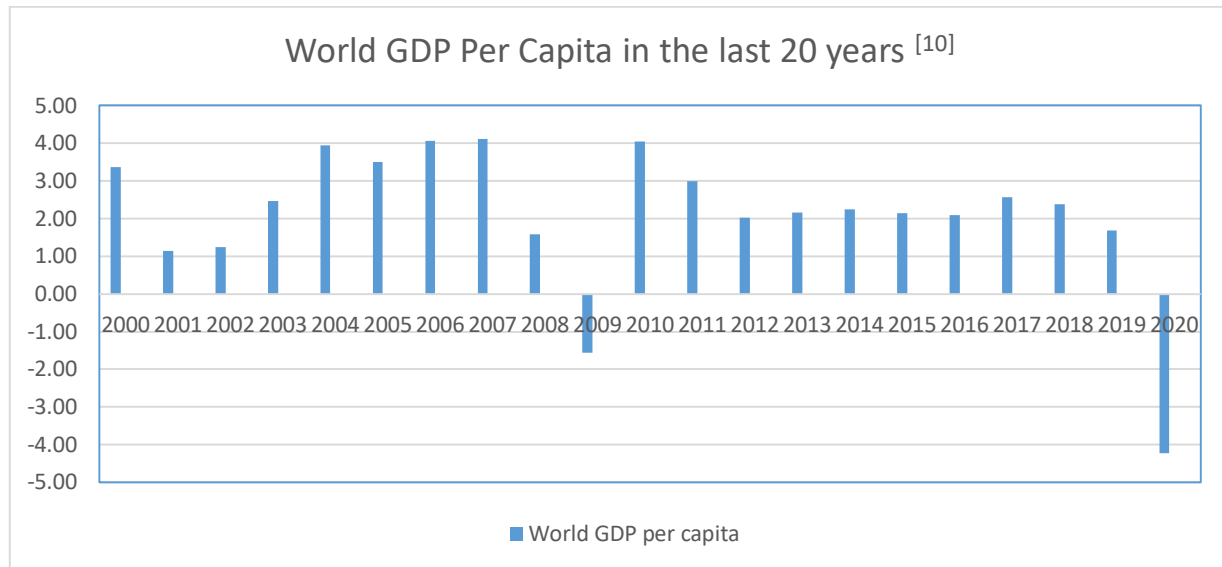
approximately around December, 2019.^[8] By June'2020, corona virus cases raised to 10 million and number of deaths crossed 5 Lakhs.^[9]



Graph 1 : Number of Cases vs. Months

As the disease is spreading with a tremendous speed and yet no vaccines are invented. The reason why half of the world has come to a standstill is that, the only way of not getting infected by this virus is to practice social distancing. Be it Production, Manufacturing, Service sector, Education industry, leisure and travel, all these industries have come to a halt. And due to this halt, our economies are facing these issues.

CONCEPTUAL BACKGROUND



Graph 2 : World GDP per Capita in the last 20 years^[10]

As you can see in the graph, the world GDP per capita has dropped to -4.23 per ca. This is the drop which the world has not seen since many decades. But, because social distancing is the only way to break the chain of this infection, the world has to suffer this drop.

As you can observe from the graph that last drop was seen during “The great recession” in 2009, it rebounded very quickly in 2010. 2020, is also seeing a decrease which is more than double from the recession of 2009.

We will be studying the trend in Public Debt to GDP Ratio of India and predicting its value in 2021 further in this paper.

REVIEW OF LITERATURE

- The Coronavirus and financial stability: Boot, Arnoud W. A. et al. have drawn our attention towards the importance of laying some important policies and strategies for the upliftment of the economic. They have an opinion to provide liquidity to influenced firms to avoid any kind of financial emergency.^[1]
- Regulating in pandemic: evaluating economic and financial policy responses to the coronavirus crisis: Hafiz et al. explain the consequences of three interrelated however conceivably clashing needs which are required to be controlled during the COVID-19 emergency: (1) providing social as well as financial support to families affected due to

the virus (2) overseeing fundamental monetary and financial crisis; and (3) urging basic spatial practices to help control the number of infected patients.^[2]

- Financial markets under the global pandemic of COVID-19: Zhang et al. focuses on general patterns of the systematic and specific risks which the global economic markets will be facing due to the sudden breakdown of COVID-19. They also discuss the extent of improvement which will occur due to the policies and strategies getting developed.^[3]
- Coronavirus (COVID-19) – An epidemic or pandemic for financial markets: Ali et al. focuses on the unexpected and uncertain rise in the number of cases due to Corona virus and how will that affect the global economic market. They also suggested that even safest commodities like return like the gold market is reflecting a negative turn.^[4]
- Financial Markets and News about the Coronavirus: Mamaysky, through a very detailed analysis of many different models,, proposes that the hypersensitive market is state is really unstable now and is directly connected to the price overreaction news. His analysis shows that these markets are linked to high risk premium and comparatively lower prices.^[5]
- Socio-economic impacts of novel coronavirus: The policy solutions: Evans has analyzed the statistics and literature of the past pandemics and provided some policy solutions like National and International Shift in Investments, Public and Private Partnerships to reduce the impact of the pandemic on the global market. The paper puts forward the point that this is the time for the government to take strict action and lay strong policies.^[6]
- Finance in the times of coronavirus: Beck has explained that, the most unfavorable situation, COVID-19 can have very significant repercussions for the economies. Quick consideration ought to be taken around the general wellbeing and protection of the citizens. Economic will no doubt not be quick, so proper reactions can be readied. But any financial emergency can arrive any time so we have to be ready with some policies and short term solutions.^[7]

ANALYSIS AND RESULTS

1. Public debt to GDP Ratio

GDP is the total monetary value of the produced goods and services in a country. And Public debt is the total amount any country's Government has borrowed for public welfare.

The ratio is calculated as:

$$\text{Public Debt to GDP Ratio} = \frac{\text{Total Public Debt}}{\text{GDP of the country}}$$

Equation 1 : Public Debt to GDP Ratio^[11]

The ratio not only helps to contemplate a country's economic status but also signifies if a country will be able to pay back the Public debt or not.

A low Public debt to GDP Ratio means that country is totally able to pay the Public debt without hindering the overall development of the country. Whereas, any country with a higher ratio will have to pay higher interest on their borrowings.

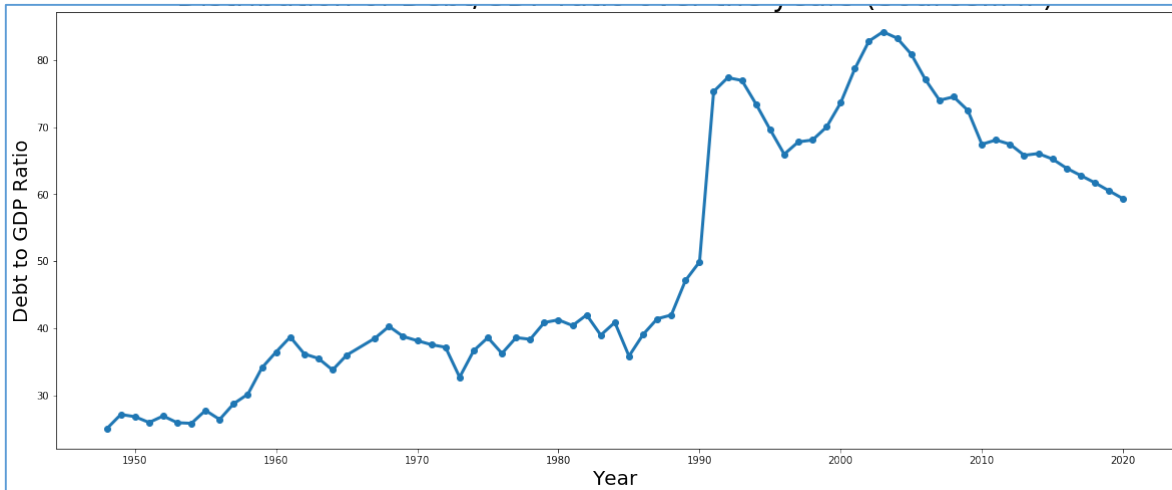
In the times of corona, we had to go in a state of lockdown because of which, government revenue went down massively. We have piled up Public debt to balance the requirement. But this will affect the Ratio and the increase the gap between the Public debt and the GDP.

In the budget, Government of India mentioned that they will be borrowing 7 Lakh Crores which they have now increased to 12 Lakh crores to fight the economic sink this year. ^[12]

These are the values of the ratio of the last 20 years for Government of India.^[13]

Year	Ratio	Year	Ratio
2001	78.72847	2011	68.09642
2002	82.84997	2012	67.4512
2003	84.24304	2013	65.81296
2004	83.2886	2014	66.07321
2005	80.89368	2015	65.26009
2006	77.10831	2016	63.88952
2007	74.02652	2017	62.80133
2008	74.53614	2018	61.72202
2009	72.52661	2019	60.52567
2010	67.45763	2020	59.33666

Table 1 : Values of the Public Debt to GDP Ratio



Graph 3 : Distribution of Public Debt to GDP ratio of India over the years^[13]

Now according to the trend, and various other factors we would predict the Public debt to GDP ratio of India for the Year 2021.

For Prediction, I have divided the data set into training set and testing set. The training set comprises of data from 2001 to 2016. And the further is the testing set.

Now, we predict using 2 models and judge the prediction based on the accuracy by comparison of the testing dataset.

1. Autoregressive (AR) Model

The autoregressive model forecasts the future value according to the past values. It is basically a Linear Regression which predicts the future value when there is some correlation between values in a time series data and the values that succeeds and precedes it.

The AR(p) model is defined by the equation^[14]

$$y_t = \delta + \phi_1 y_{t-1} + \phi_2 y_{t-2} + \dots + \phi_p y_{t-p} + A_t$$

Equation 2 : AR(p) model equation^[14]

Where:

- $y_{t-1}, y_{t-2} \dots y_{t-p}$ are the past series values (lags),
- A_t is white noise (i.e. randomness),
- and δ is defined by the following equation:

$$\delta = \left(1 - \sum_{i=1}^p \phi_i \right) \mu,$$

Equation 3 : Equation for Delta^[14]

where μ is the process mean

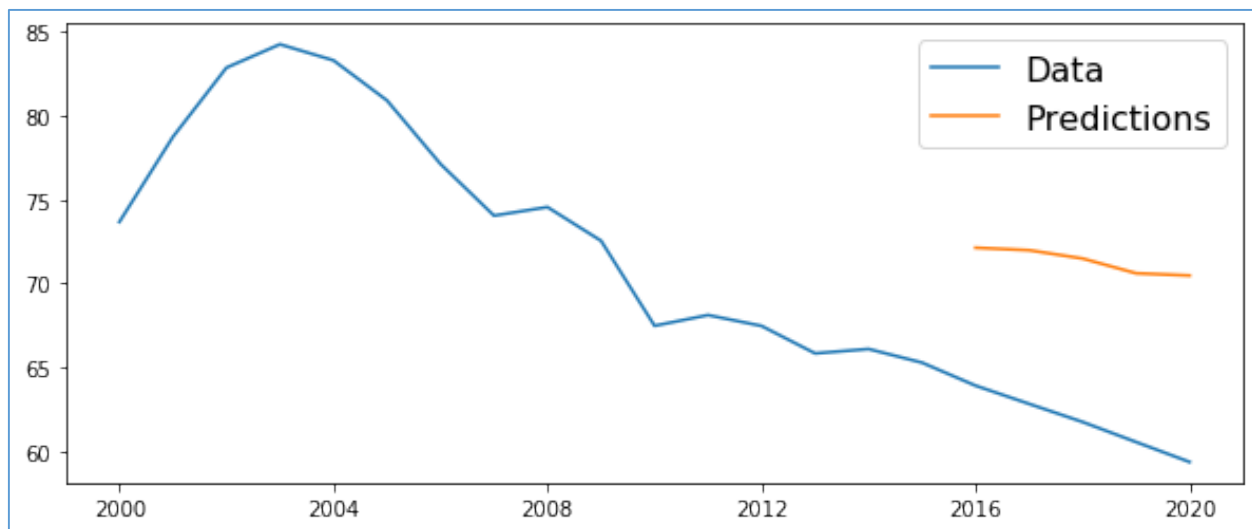
We predict the values of the testing set using the training set using the equation.

Predictions made:

Year	Actual Value	Predicted Value	Accuracy
2016-01-01	63.88952	72.111364	0.8859
2017-01-01	62.80133	71.963535	0.8726
2018-01-01	61.72202	71.468614	0.8636
2019-01-01	60.52567	70.588753	0.8574
2020-01-01	59.33666	70.455733	0.8421

Table 2 : Predictions by AR Model

Prediction of Public Debt to GDP ratio of India using AR Model



Graph 4: Graph of the predictions made using AR Model

Accuracy: 86.43%

As we can see in the graph, the predictions are not accurate on the testing set of the data. Now, we will use another model for prediction.

2. Rolling Forecast model

Rolling origin is a prediction technique according to which the forecasting origin is updated successively and the forecasts are produced from each origin. This technique allows obtaining several forecast errors for time series, which gives a better understanding of how the models perform.

Basically the Idea is to predict $X(t+1)$, next value in a time series. So, we feed not only $X(t)$, but $X(t-1)$, $X(t-2)$ etc. to the model.

We again predict the values of the testing set using the training set.

Predictions made:

Year	Actual Value	Predicted Value	Accuracy
2016-01-01	63.88952	65.717543	0.9721
2017-01-01	62.80133	64.963535	0.9667
2018-01-01	61.72202	63.168614	0.9770
2019-01-01	60.52567	61.688753	0.9811
2020-01-01	59.33666	60.455733	0.9814

Table 3: Predictions made by Rolling Forecast Origin Approach

Prediction of Public Debt to GDP ratio of India using Rolling Forecast Origin Approach



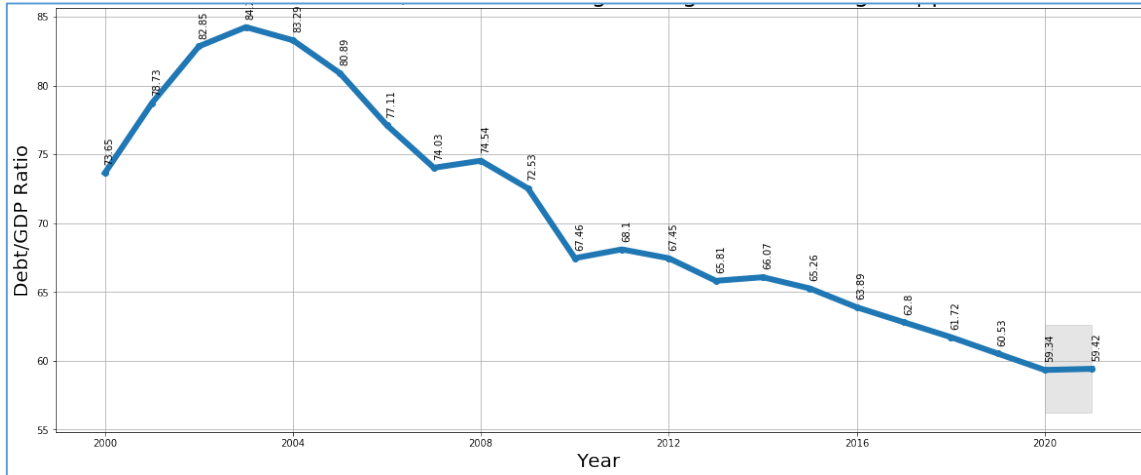
Graph 5: Graph of predictions made by Rolling Forecast Origin Approach

Accuracy: 97.56%

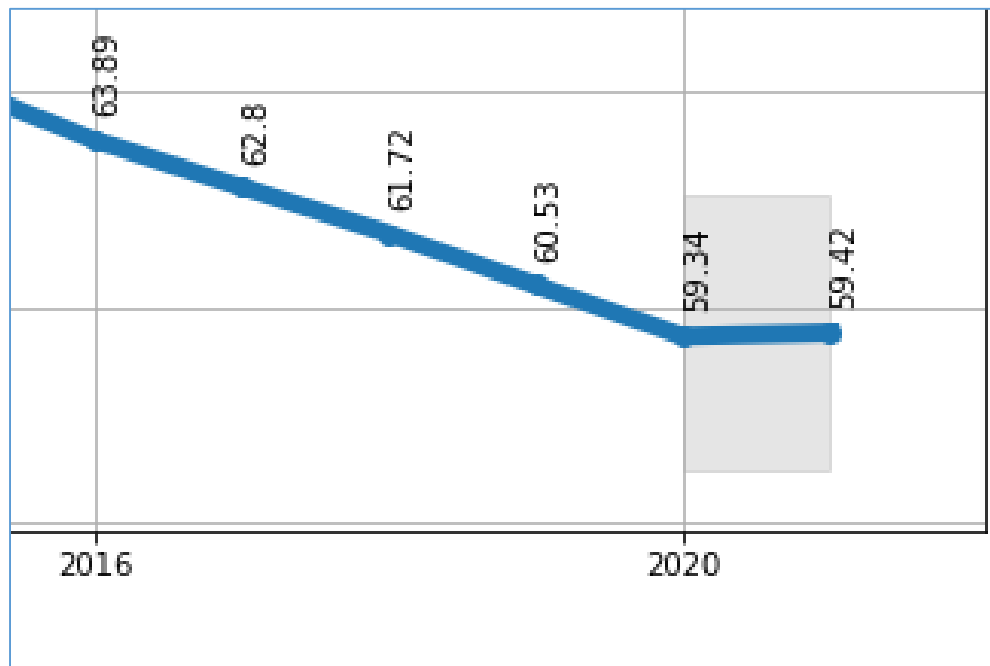
So, we can clearly see that Rolling Forecast is more accurate. So now we use this approach to further predict the Public debt to GDP ratio of India in 2021.

Through this approach we get the predicted value of the Public debt to GDP Ratio as 59.42

We plot it with the confidence interval band:



Graph 6: Prediction of the Public Debt to GDP Ratio of India in the year 2021

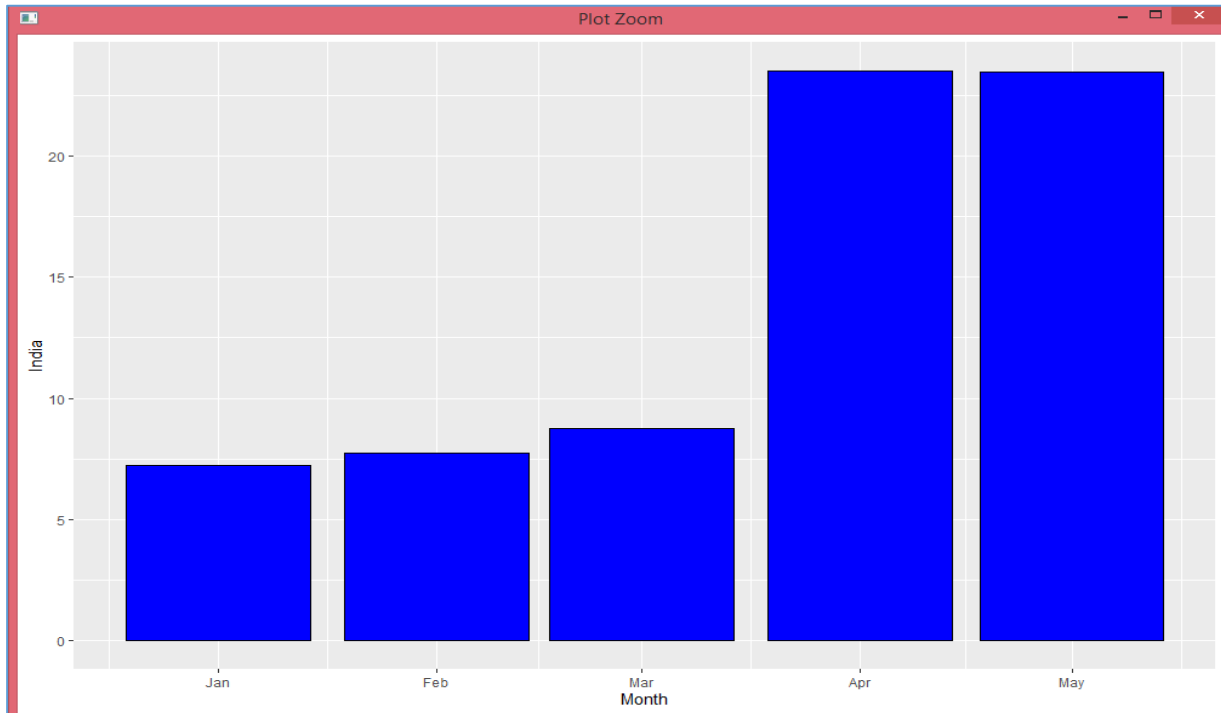


Graph 7 : Prediction of the Public Debt to GDP Ratio of India in the year 2021 with the confidence band

3. Unemployment Rate

<i>Month</i>	<i>India</i>
<i>Jan-20</i>	<i>7.22</i>
<i>Feb-20</i>	<i>7.76</i>
<i>Mar-20</i>	<i>8.75</i>
<i>Apr-20</i>	<i>23.52</i>
<i>May-20</i>	<i>23.48</i>

Table 4: Unemployment Rates of India month-wise^[15]



Graph 8 : Unemployment Rates of India^[15] (Source: CMIE)

Inference: As we can see through the graph, Unemployment rates increased to thrice of itself. The lockdown has created a serious situation for all the daily wage workers as well as companies marked a recession period due to the reduced income source.

4. Heat map of no. of cases in the world

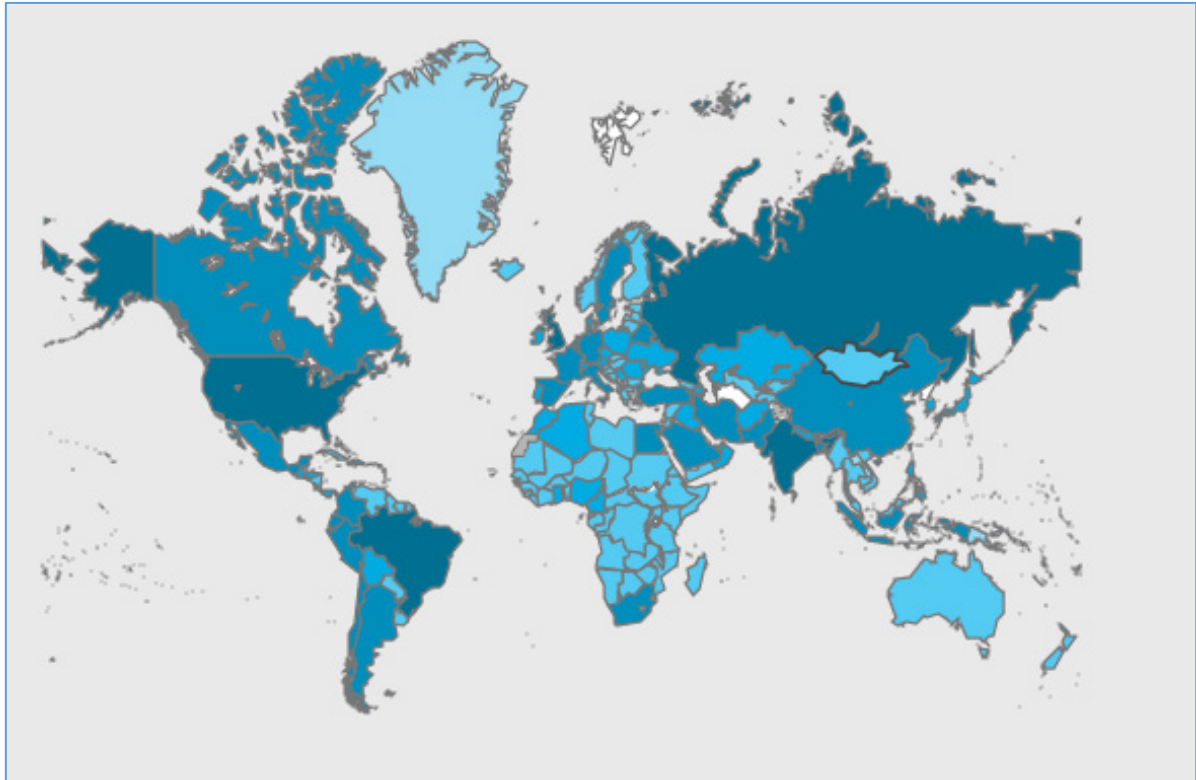


Figure 1 : Heat map of the Corona cases in the world^[16]

Inference: The no. of cases in the world are still rising and have crossed 10 million by June'2020. And this has become an alarming situation for us as, many countries have even started lifting the lockdown. While lifting the lockdown or even moderating the restrictions, we need to keep in mind the area wise situation and then take any step.

FINDINGS AND SUGGESTIONS

The prediction of Public debt to GDP Ratio of India of the year 2021 has shown an increment as compared to the year 2020. The ratio was continuously decreasing from the year 2012. But then also, we saw an increment in the ratio because of the increase in Public debt. We need to formulate some policies which helps us in decreasing the burden of Public debt on the government.

These are some policies that we can adopt to decrease that burden and increase our productivity hence improving the GDP.

1. **Public-Private partnerships:** The time has come to understand the importance of self-dependence. We need to decrease our imports and start manufacturing essential things in our own countries. This will not only decrease the country's Public debt but

also make us able to export goods and earn profits. This will tend to decrease the Public debt also. This will demand a robust Public-Private Partnership. As this would be the initial phase, the stakeholders in both the Public and private platforms should shake hands and make effective cost sharing strategies.

2. **Economic Framework:** Because of this sudden pandemic, unemployment rates have increased drastically and because of the medical urgency, the economic household have got a lot of burden just because of the expense of basic necessities. How will they be able to afford a safe living? So, the system has to adopt a fixed framework of expenses of the basic necessary products. The framework should include all the critical determinants which are necessary to reduce the social costs. A healthy policy framework can easily reduce this burden!
3. **Public Health Policy Framework:** Government has to focus more on getting the number of corona virus affected people stable. And if the government have to reboot their economies, they must be ready with a plan for a huge number of patients, their medication and health requirements. We have to be ready for the worst, which may be yet to come.
4. **Gradual Opening of the lockdown:** The necessary lockdown, which brought such drop in the economy will have to be taken up soon and it would be a great responsibility on the government to control the spread after the upliftment of the lockdown.

According to analysis, there should be 4 stages of opening up the lockdown. And these should have attributes like Transport, Gathering, Services, and Economic Sector. These stages should be implemented according to the region and the amount of virus spread that region has.

5. **Educational transformations:** We are seeing a drastic transformation in the field of education, from offline learning we have moved to e-learning. As education industry is an essential part of the economy as well national growth. This pandemic should not stop us from getting skilled. As organizations have moved to e-learning in the brighter sections of society. The lower sector is still fighting for basic needs and cannot think of online education. Government needs to set up policies for the online education platform and the compulsions or restrictions required to be imposed in that.

CONCLUSION

This paper focused on the impacts of the lockdown due to the transmission of COVID-19 on the world's economic front. We analyzed various statistics like the GDP, Public debt to GDP Ratio, and Unemployment rates to understand the economic drop. We predicted the Public debt to GDP Ratio of 2021. We also suggested some policies and strategies

which has to get adopted for decreasing the burden of Public debt on the government. The strategies majorly focused on how we can increase our productivity and self-dependence.

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