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Abstract:
Coronavirus has had a significant impact on the global economy, with spiraling unemployment and deficits. However, a far more diverse impact has been observed in developing nations which, to some extent, are constrained in methods to overcome the sharp economic decline. The research incorporates the use of deep-learning and econometric models to observe the impact of coronavirus on the Indian economy. The models are trained and tested on reliably-sourced data and their accuracy is recorded. In lieu, the models are inputted with recent data pertaining to economic activity in India and the outputs are evaluated. Furthermore, in light of the results from the models, the paper assesses the steps taken by the central government in order to promote upturns based on the impact they have had on the economy. Finally, possible measures and policy changes are laid out which may aid subvert the looming recession.

I. INTRODUCTION

What is COVID 19?
Coronavirus disease 2019 (COVID-19) is an infectious disease, which is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus was first identified in December 2019 in Wuhan, Hubei, China, and has resulted in an ongoing pandemic. The first confirmed case has been followed back to 17 November 2019 in Hubei [1]. As of 4 July 2020, more than 11 million cases have been reported across 188 countries and territories, resulting in more than 523,000 deaths. More than 5.83 million people have recuperated [2]. Respiratory symptoms, fever, cough, shortness of breath and breathing difficulties are the common symptoms of the virus. In more severe cases, the virus can cause pneumonia, severe acute respiratory syndrome, kidney failure and even death. Recommended suggestions to forestall infection spread incorporate regular hand washing, covering mouth and nose when coughing and sneezing, thoroughly cooking meat and eggs. Evade close contact with anybody demonstrating indications of respiratory illness such as coughing and sneezing.

Globalization and Covid-19
With the rise of globalization, the world has now become like a small neighborhood where individuals can easily collaborate with one another without confronting any genuine obstructions. This has become both advantageous and adverse to the social, political, and monetary sphere as far as the welfare of the people is concerned. Meaning despite the free movement of people, goods, and services led by globalisation being the stimulus to social-economic development, it has additionally become a wellspring of spreading infections. Accordingly, because of the technological advancement factor of globalization, a flare-up, for example, COVID-19 has transformed into a significant pandemic infection that has affected more than million individuals around the globe regardless of their topographical area differences. This is essentially in light of the fact that mechanical progression which is one of the fundamental powers for globalization, made it simpler for individuals to travel via land, ocean and even air from one place to the next without confronting any deterrents. In that case, if these people have contracted the disease such as COVID-19 in the city or country (A), they can easily transmit it to the city or country (B) which had no infections if proper healthcare measures are not in place to forestall the spread to the overall population.

Current Economic Impact
The monetary effect of the 2020 coronavirus pandemic in India has been to a great extent problematic. India's development in the final quarter of the monetary year 2020 went down to 3.1% according to the Ministry of Statistics. The Chief Economic Adviser to the Government of India said this drop is principally due to the coronavirus pandemic impact on the Indian economy. Remarkably India had additionally been seeing a pre-pandemic log jam, and as indicated by the World Bank, the current pandemic has "amplified prior dangers to India's financial standpoint. The World Bank and rating organizations had at first updated India's development for FY2021 with the least figures India has found in three decades since India's economic liberalization in the 1990s. However, after the announcement of the economic package in mid-May, India's Gross domestic product gauges were minimized significantly more to negative figures, flagging a profound downturn. (The evaluations of more than 30 nations have been minimized during this period.) On 26, May, CRISIL reported that this will maybe be India's most exceedingly terrible downturn since autonomy. State Bank of India research gauges a constriction of over 40% in the Gross domestic product in Q1 FY21. The contraction won't be uniform, rather it will contrast as per different boundaries, for example, state and sector. Within a month, unemployment rose from 6.7% to 26% (between 15 March and 19 April). During the lockdown, an estimated 14 crore (140 million) individuals lost their livelihood while many received pay cuts. More than 45% of households across the country have reported a drop in their remuneration as compared to the previous year. The Indian economy was expected to lose over ₹32,000 crore (US$4.5 billion) every
day during the first 21-days of complete lockdown, which was declared following the coronavirus outbreak. During complete lockdown, less than a quarter of India's $2.8 trillion economic movement was functional. Up to 53% of businesses in the country were projected to be significantly affected. Supply chains have been put under stress with the lockdown restrictions in place; initially, there was a lack of clarity in streamlining what an "essential" is and what is not. Those employed in the informal sectors along with the daily wage workers have been at the most risk. Various farmers around the country who produce perishables also faced uncertainty.

Models for Forecasting Growth

Sequence to Sequence Neural Networks

Deep learning has become one of the premier techniques employed in the face of vast data resources. Herein, we use neural networks in order to appropriately weigh the GDP data of India. The research utilizes Long Short Term Memory cells and Time-Distributed nodes due to their ability to mitigate the vanishing gradient problem which is encountered by the majority of Recurrent Neural Networks — this makes them optimum for use in sequence to sequence predictions. Primarily, the data was converted into single-time step input and output arrays for the training of the model. Since the data consists of GDP growth rates for each year, the model was devised as a univariate, multi-time step model which would take in the past n years of data and output the coming 5 years. The model utilized an encoding-decoding sequence within the LSTM to ensure the maximum accuracy of the model.

![Figure 1. Depiction of the final, hyper-tuned sequence to sequence learning model.](image)

Figure N depicts the default construction of the model used to forecast the Indian GDP for the coming 5 years. The model input was then hyper tuned using 200 epochs and a sequential search method to obtain the best input length sequence for the model: 16. Therefore, the model took in 16 timesteps of data or 16 years worth of data and outputted the next 5. The final layer construction included an input with 16 nodes and output of a 5-length single time distributed densely. Furthermore, the model was hyper tuned using a random search method in order to obtain the most accurate model parameters. The tuner was run for 5 trials with 5 epochs each and the final, hyper-parameterized model was obtained. The R2 value for the test set, which amounted to ¼ of the complete data, resulted in 0.9934, depicting the high reliability and accuracy of the model.

![Figure 2. Illustrating the probability of negative growth for the Indian economy over the coming 4 years.](image)

ARIMA Modelling

Arima models offer a different approach to time series estimation. Exponential smoothing and Arima models are two widely used approaches to time series estimation that provide complementary approaches to the problem. Although Exponential Smoothing Models are based on descriptions of trends and timelines in data, Arima models aim to illustrate automated relationships in data Arima's Acronym Auto-Regressive Integrated Moving Average. The fixed sequence logs in the prediction equation are called the "autoregressive" terms, and the delay of the estimated errors are called the "moving average" terms, and the time limit for being constant is "integrated". The seasonal Arima model is subdivided into the "Arima (P, D, Q)" model, where: p is the number of automatic words, d is the number of periodic variations required for stability, and Q is the number of delay estimation errors in the estimation equation. The estimation equation is constructed as follows. First, specify the dth difference of Y, i.e.:

$$\begin{align*}
\text{If } D &= 0; y_t &= Y_t \\
\text{If } D &= 1; y_t &= Y_t - Y_{t-1} \\
\text{If } D &= 2; y_t &= (Y_t - Y_{t-1}) - (Y_t - Y_{t-2}) \\
&= Y_t - 2Y_{t-1} + Y_{t-2}
\end{align*}$$

Equation 1: Illustrating the estimation equation of the auto-correlation model.

Here we have used the Arima model to estimate India's GDP based on data from the last n years. The Arima model only works for stationary data, but it does not freeze a country's GDP data because it depends on a myriad of variations and we used differentiation to make the data consistent. We have guided GDP for the next five years using the built-in Arima functions to suit our needs.
does go into a recession, it can lead to many economic problems. People will lose their houses, businesses will go bankrupt, unemployment rates will skyrocket, and consumer purchases will fall off. While most young people will face problems finding jobs post school. Since these problems will be deep rooted and enduring, the government would need to tackle them carefully with appropriate policies and schemes. Hence, the pace of recovery, if any, will be determined by the economic policy choices taken to ensure that the significant secondary impacts (job losses, reduced earnings, rising NPLs (non-performing loans), corporate defaults, rating downgrade, etc.) can be contained.

Policy Changes & Steps for a Positive Outlook
Covid-19 has almost hit every other sector and no sector was saved from its wrath. The difference is that some were hit really hard like the travel industry and the aerospace sector, and other industries just took a hit like the pharmaceutical industry and the communication industry. Millions got laid off and lost their livelihood or had to take a salary cut thus reducing the income of the household. Which led to a chain reaction and reduced the credit creation and money supply of the economy and thus reducing the income of the economy. The Government of India also accessed the problem and was quite active to stop the economic downfall. The government took a series of actions to save millions from losing even the basic necessities of life to survive.

Evaluating Current Actions
On 19 March, the formation of the COVID-19 Economic Response Task Force was announced by Prime Minister of India Narendra Modi. On 21 March, The Union cabinet of India approved incentives for electronic manufacturing worth ₹40,995 crore (US$5.7 billion) and many state government announced to prove ₹1000 (US$14) to daily wage worker. On 24 March, ₹15000cr (US$21 billion) for the healthcare sector was approved by the prime minister of India. On 25 March, World’s largest food security scheme to provide ration to 800 million people was initiated. On 27 March, RBI reduced Repo Rates and told other measure would introduce 3,74,000cr (US$52 billion) to the financial system of India [3]. On 1 April, Measures were taken to increase liquidity in the country by RBI [4]. On 2 April, US$1 billion emergency fund for India was approved by the World Bank. On 8 April, Various states and Union territories gave 20 million workers engaged in manual work were given ₹3000 crore (US$420 million) of funds under the PM Garib Kaylan Yojana. The government decided to release ₹18,000 crore (US$2.5 billion) for the tax payer [5]. On 10 April, The Asian Development Bank (ADB) granted India ₹15,800 crore (US$2.2 billion) assistance [6]. On 17 April, RBI announced more measures to counter the economic impact of the pandemic including ₹50,000 crore (US$7.0 billion) [7]. On 18 April, FDI policies were changed. Likewise, on 28 April, ADB approved ₹10,500 crore (US$1.5 billion) loan to India. Silmarily, by 12 May, An overall economic package worth ₹20 lakh crore (US$280 billion) was approved by the prime minister of India. On 27 March, ₹10,500 crore (US$1.5 billion) loan to India. Similarly, by 12 May, An overall economic package worth ₹20 lakh crore (US$280 billion) was approved by the prime minister of India.

Economic & Social Implications of Findings
According to the model that we have prepared, the result of the pandemic can be quite drastic. Since the quarterly GDP has been predicted to fall more, India’s economy can face a recession, a period of temporary economic decline during which trade and industrial activity are reduced, generally recognised by a fall in GDP in two successive quarters. During a recession, the economy struggles, people get unemployed, companies make fewer sales and the country’s overall production declines. This messes up the entire economy. During this period, economies generally react by loosening their economic policies by introducing more money into the system, i.e., by increasing the money supply. This is done by reducing the loan rates. Increased spending by the legislature and diminished tax assessment are additionally viewed as smart responses for this issue. The great recession of 2008 is the most recent example of a recession. India has seen a recession only thrice after gaining independence from British - as per available data - in fiscal year 1958, 1966 and 1980. The reason was the same each time a recession hit India: a monsoon shock that hit agriculture, then a sizable part of the economy. However, CRISIL said the recession in the current fiscal (April 2020 to March 2021) is different as agriculture could soften the blow this time by growing near its trend rate, assuming a normal monsoon. If India’s economy was approved by the World Bank. On 25 March, World’s largest food security scheme to provide ration to 800 million people was initiated. On 27 March, RBI reduced Repo Rates and told other measure would introduce 3,74,000cr (US$52 billion) to the financial system of India [3]. On 1 April, Measures were taken to increase liquidity in the country by RBI [4]. On 2 April, US$1 billion emergency fund for India was approved by the World Bank. On 8 April, Various states and Union territories gave 20 million workers engaged in manual work were given ₹3000 crore (US$420 million) of funds under the PM Garib Kaylan Yojana. The government decided to release ₹18,000 crore (US$2.5 billion) for the tax payer [5]. On 10 April, The Asian Development Bank (ADB) granted India ₹15,800 crore (US$2.2 billion) assistance [6]. On 17 April, RBI announced more measures to counter the economic impact of the pandemic including ₹50,000 crore (US$7.0 billion) [7]. On 18 April, FDI policies were changed. Likewise, on 28 April, ADB approved ₹10,500 crore (US$1.5 billion) loan to India. Silmarily, by 12 May, An overall economic package worth ₹20 lakh crore (US$280 billion) was introduced. This ₹ 20 lakh crore includes the previous government packages (₹ 1.7 lakh crore) as well as the RBI decisions (₹ 5-6 lakh crore) [8]. On 13 May, the definition of MSMEs was revised, which allows more companies to avail the benefits of MSME schemes. Collateral free loans and bank guarantees that would allow resumption of work for many MSMEs. For non-bank lenders a liquidity scheme and partial credit guarantee scheme. Tax deadlines were extended. On 16 May, A fund for farm-gate infrastructure was announced, amendments to the Essential Commodities Act, as well as the

Figure.2-3. Prediction and Differentiation of the autocorrelation model.

Figure.3. The predicted valuation of the Indian economy over the coming months. The blue line shows the original Red line portrays the state that would have occurred due to lack of COVID-19.
opening up of the defence sector, power sector and space sector for privatization [9]. On 20 May, A free food grain package and collateral free credit for MSMEs were some proposals of the economic package that the Cabinet of India cleared. Furthermore, on 22 May, The RBI extended the moratorium on loans and cut repo and reverse repo rates among other things. RBI also allocated funds for Exim Banks and an extension to SIDBI [10]. On 2 June, Mobile manufacturing incentives to mobile manufacturers were offered by the government. This included a ₹50,000 crore (US$7.0 billion) production-linked incentive on goods made locally in India. On 20 June, The Garib Kalyan Rojgar Abhiyaan was launched to tackle the impact of COVID-19 on migrant workers in India. It is a rural public works scheme with an initial funding of ₹50,000 crore (US$7.0 billion) [11]. However, this was all not enough to stop the fastest growing country to fall in an economic downturn. One knows the fact that opening up the economy after lockdown won't bring back the safe level of economic opportunities as earlier expected, as seen in the case of China where after months of lockdown the economy was only able to reach 90% of their old capacity. To maximize and fast track the growth of the economy and minimize the duration and impact of the downturn. The Indian government also have considered the strategy taken by other developing countries to shrink the overall effect of downturn and wealth drain in the country. The key aspect of all policies was to increase credit creation and money supply by manifolds which the Government of India was not able to achieve the level they were expecting. Like in the case of Germany, where the Government measures were most appropriate to increase the money supply and credit creation. One more priority that the government had before the introduction of these policies were to save micro, small and medium enterprises from closing down forever as they had the least cash flow and liquidity to sail through the rough time. Therefore, while the government is doing its best to improve demand, supply and restart business, this uncertainty has become the new normal. The risks to the well-being of every citizen, small enterprises and businesses will not disappear quickly. As long as there is no vaccine or treatment. We all live in an era of uncertainty. When there is uncertainty, the government must be very cautious and wise in how to spend money and where to spend it. To utilize it with utmost care and least wastage. The government cannot and should not immediately exhaust all its financial capabilities. At times of crisis and unprecedented, when countries and the world sail, the government should not take any action in a rush but it should be ready to take action when necessary, is one of the most responsible things to do.

II. REFERENCES


[2]. The earliest record of GDP of India is available for the year 1961 https://www.google.com/publicdata/explore?ds=d5bncppjof8i9h&met_y=ny_gdp_mktp_kd_zg&dim=countr yatry:IND:USA:PAK&hl=en&dl=en


