COVID-19 Pandemic: Trends, Possible Causes, Impacts and Remedies, with Special Reference to India

Ramesh Chandra Das
Associate Professor of Economics, Department of Economics
Vidyasagar University, Midnapore, West Bengal

Abstract

The devastating performance of the COVID-19 all around the world has nodded down the valour of the so called powerful global leaders in terms of their helplessness to defend themselves from its ramifications and fatality. The biological scientists have some answers to its growth and spread and possible health damages. But social scientists have a little to offer in this respect. They can just search for the responsible factors behind its spread and fatality and assess its possible impacts. The present study, thus, attempts to analyse the trends in highly affected countries, finding possible factors for incidence and death, making impact studies for selected countries and growth impacts for special attempts to India. It observes that the factors like net immigration, health expenditure, international flights movements, old age population are responsible for incidence and death rates. The growth impact of India is around loss of INR16 lacs crore if the pre tariff war growth rate is to be ensured and hence 7-8% stimulus packages are recommended through direct demand boosting projects for recovering Indian economy from the stalemate.

Keywords: *COVID-19; developed and developing countries; incidence; death; socio-economic factors; demographic factors; environmental factors; growth; stimulus*

Introduction

Starting its devastating journey from Wuhan Province of China on January 21st, 2020, Novel Corona Virus, now named COVID-19, spread to world's so-called developed countries of the west and the rest of the world in a very short span like wildfire which led to the present pandemic. We saw how the self-proclaimed almighty human civilization surrendered, and still has been surrendering to this small micro-organism which is several thousand parts of the shape and area of the top of a needle. It infected lacs and lacs of people and claimed thousands and thousands of lives globally till date. The lengthy ramifications primarily had threats to lives and now it is threatening livelihoods of the countries of all the regions in different magnitudes.As we have now nothing to do with it, we can just try to find some possible causes behind its outbreak, to search for economic impacts and to offer possible remedies.

Being COVID-19 a very new topic to social scientists there is not plenty of research outcomes till date. Most of the studies have concentrated on basic issues like finding possible factors for the outbreak and spread, economic impacts, etc. but nothing was uncovered from its root. There have been some works by biological scientists on immunological aspects of the COVID like viruses, impact of BCG vaccinations on

immunity, impact of hunger upon fighting against bacteria, impacts of the genetical structures of white and black people upon the spread and death of different virus borne diseases.

To focus our study for finding out possible factors for number of incidences and deaths due to COVID-19 we have reviewed some of the works of biological scientists and social scientists.

According to Raja (2008), Indians have some genetic advantage in fighting against viruses and bacteria. The Indians have evolved to gain more genes that protect against viral infections. These genes enable natural killer (NK) cells, a type of white blood cells that provide a first line of defense against viral infections. Two families of genes, KIR genes and HLA genes, play a part in this protective function. According to him, Indians have more KIR genes than the China and economically developed zones of the world which could make Indians more immune to the virus.Hoch (2010), in his work on immune mechanism activated by hunger and stress, finds that hunger or stress cause the production of peptides which protect against bacteria. If the energy level decreases due to hunger, the metabolic system gets activated and several peptides are produced which destroy bad bacteria and increase immunity level. Science Daily (Oct 20, 2016) reveals that Africans have high immunity than Europeans which make capable the former to combat infectious diseases.In another study Barreiro (2016) has demonstrated that Americans of African descent have a stronger immune response to infection compared to Americans of European descent. The study establishes for the first time this difference in immune responses and shows that it is mostly genetic, inherited from their ancestors and influenced by a relatively recent natural selection.In a different study with similar flavourRathore et al (2018), has observed that umbilical cord blood of children in the US and India have differences. They interpreted that Indian babies could be more susceptible to early-life infections if they had lower frequencies of certain immune cells and he agreed exposure to pathogens could equip the immune system better to fight new assaults like Zika or coronavirus, to some extent. Besides, the applications of different vaccines may improve the immunity of the children to defend themselves from pathogens. In this context, Curtis et al (2020) assert that BCG Vaccination against tuberculosis in the weak regions of the world, Asia and Africa, could have increased the immunity level to fight against viruses. The essence of the above studies from biological science exhibits that the poor countries, having relatively high values in hunger index and low level of health care facilities have high immunity levels and hence low magnitudes of attack from Corona Virus.

Studies related to demographic significance have been worth mentioning. One of such valuable studies has been through the work of Rook et al (2014). The study argues that people living in urban centers who have less access to green spaces may be more apposite to have chronic inflammation, a condition caused by immune system dysfunction.

The studies related to the role of socio-economic factors behind the spread of COVID-19 have also been highly relevant to be reviewed for the present study. One such study is of Lau et al (2020) which opines that many countries are facing increasing numbers of COVID-19 cases because they are mostly attributed to regular international flight connections with China. The study indicates a strong linear correlation between domestic and international COVID-19 cases and air traffic volume for regions within and outside

China.In a detailed study Banik et al (2020) analyse the factors that determine the fatality rates across 29 economies spread across both the developing and developed world. The study reveals that factors such as public health system, population age structure, poverty level and BCG vaccination are powerful contributory factors in determining fatality rates. In a study related to counties of United States, Mukherji (2020) unveils the socioeconomic and health factors that can explain the differential impact of the coronavirus pandemic. Using dynamic panel model the study develops vulnerability index of the counties depending on their economic, demographic, and health factors. It observes that counties with high per capita personal income have a high incidence of both reported cases and deaths. The unemployment rate is negative for deaths implying that places with low unemployment rates or higher economic activity have higher reported deaths. Counties with higher income inequality experienced more deaths and reported more cases. The results are striking in the sense that developed countries in USA in particular or regions of the world in general may not be safe from the outbreak, rather they are highly vulnerable than the less developed or developing countries.

Rationale of the Present Study

The studies so far available have not considered the highly affected countries' scenario of the outbreak, not considered broad spectrum of responsible factors from socio-economic, demographic and environmental fronts and not making any impact assessment for any particular country. The present study strives to cover all these lacunae of the available literature and opens the way for further developments of the literature.

Objectives of the Study

The present study has three-fold objectives-first to study the trends across regions and highly affected countries, second to relate possible factors to its outbreak and spread, and third to measure impacts and offering solutions to save livelihoods, not to fight against COVID-19 with special reference to India.

The study is organised by the following sections-data and methodology, analysis of results, and conclusions and policy recommendations.

Data and Methodology

In carrying out the study we have used the World Health Organization's (WHO) data on number of COVID incidences and deaths. The possible factors responsible for the incidence and death have been considered from the domains of economics, society, demography and environment. The data on all of these domains are brought from the World Banks' latest publications on the selected variables (www.worldbank.org). The economic variables are extent of globalization, international air traffic flow and net immigration; social variables are per capita health expenditure and degree of hunger; demographic indicators are percentage of old age population and percentage of urban population; and environmental factor is the per capita CO2 emission. More globalization means more flow of goods and services and more people are attached to these activities which may allow more spread of the virus. Similarly, large number of international traffic flow and immigration means more people flow to the concerned countries leading to increase the chances of spread of the infection. Again, high magnitude of health expenditure, low magnitude of hunger and large number of old age population mean low

immunity level, and so high chances of infection. Empirical support on these claims have been given in the literature and discussion part. Besides, the countries with high level of pollution (measured in terms of CO2), a common phenomenon to the urban areas, become susceptible to high chances of diseases and so low immunity to combat any virus infection like COVID 19.

The list of countries selected for the study are USA, UK, Italy, Spain, France, China and India. The data off WHO are considered from the very first day of outbreak of COVID-19 up to last day of Lock Down in major countries, that is, from January 21st to May 31st of 2020. The time of study for impact analysis for India is its all phases of Lock Down, i.e. from March 25, 2020 to May 31st, 2020, a total of 68 days.

At first, we have shown the trends of COVID incidences (interchangeably used as number of cases) and deaths across different regions of the world which is followed by the country specific trends. Second, using descriptive statistics on the selected variables, we have computed the degrees of associations by Pearson's correlation coefficient across the selected countries and tested their significance by 't' test.

The correlation coefficient is formulated by the following expression-

$$r_{x,y} = \text{cov}(x, y) / \sigma_x.\sigma_y = (n\sum xy - \sum x.\sum y) / \sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]} \quad \ldots. (1)$$

The 't' statistic for the $r_{x,y}$ is the following-

$$t = (r_{x,y} * \sqrt{n-2}) / \sqrt{1 - r_{x,y}^{\ 2}} \quad \ldots\ldots\ldots (2)$$

Where (n-2) is the degrees of freedom.

Third, we relate the impact of this pandemic upon income, employment and trade variables and then we make assessments of the impact of this pandemic upon India's GDP under different conditions on expected real growth of income and inflation rates.For this purpose of assessment in Indian context we use the basic income (GNP = Y) identity as follows-

$$Y = Consumption\ (C) + Investment\ (I) + Government\ (G) + Export\ (X) - Import\ (M)$$
$$Or,\ Y = C + I + G + (X - M)$$
$$Or,\ Y = C + I + G + Net\ Export$$
$$Or,\ Y = C + I + G + NX$$
$$Or,\ 1 = C/Y + I/Y + G/Y + NX/Y$$
$$Or,\ 100 = (C/Y)*100 + (I/Y)*100 + (G/Y)*100 + (NX/Y)*100$$
$$\ldots\ldots\ldots (3)$$

This shows how 100 unit of income gets distributed among all the four heads of aggregate demand. The impact of increase in government expenditure upon Y, which is known as government expenditure multiplier, can be given by the following expression-

$$dY / dG = 1/(1-MPC) > 1$$
$$or, dY = dG * [1/(1-MPC)] \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

where MPC is the marginal propensity of consumption, 0 < MPC < 1.

One unit of increase in government expenditure (in the absence of additional income tax which a common phenomenon in the pandemic) leads to more than one unit of income and vice-versa. There is a question of the way in which the multiplier will work in the pandemic. Hence, lot of assumptions on the working of the economy in the pandemic are taken and as a result, there will have several possible impacts on income. Sequel to these calculations the recommendations regarding stimulus packages are provided.

Empirical Analysis

In the following sections we discuss on the analysis of the results obtained against each of the objectives.

Region-wise Data on Total Incidence and Death as on May 31st (132 days of Outbreak)

Till May 31st, there are 5934936 (about 60 lacs) cases and 367167 (about 3.7 lacs) of death at global level. With respect to different regions, the highest number of incidences is observed for Americas (about 27.5 lacs) followed by Europe with about 21.5 lacs. The lowest degree of incidences is observed for Africa followed by South East Asia(Figure 1).

With respect to the number of deaths, Europe leads the group with 1.8 lacs followed by Americas with 1.58 lacs. Africa has the lowest mortality case with only 2554 followed by South East Asia and Western Pacific (Figure 1).

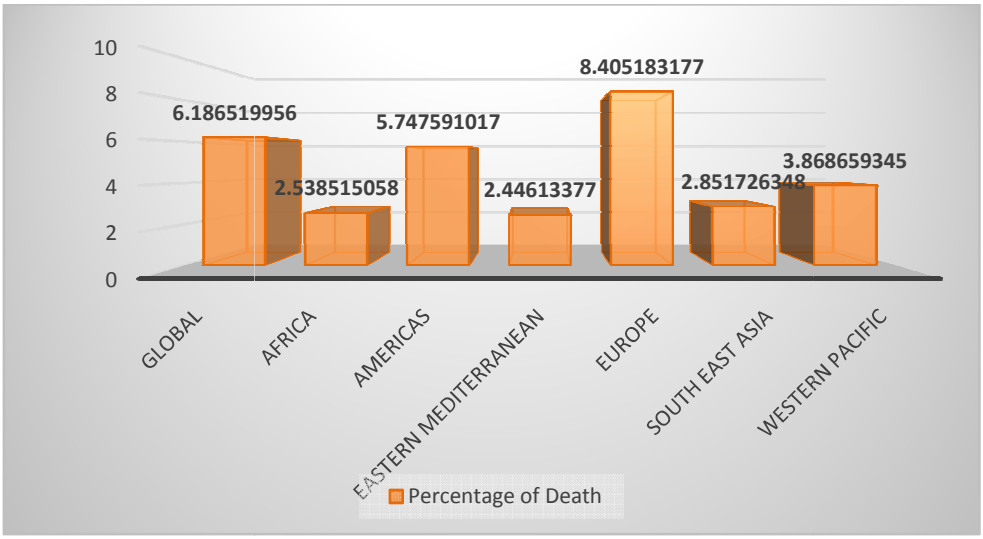
Figure 1: Region-wise Data on Total Incidence and Death as on May 31st (132 days)

Source: Sketched by the author

Percentage of Deaths out of Number of Incidences across regions

The effective impact of the incidence depends on the rate of death out of the incidence. Figure 2 shows that Europe has highest mortality rates of around 9% (which is higher than global rate of 6.2%) followed by Americas with around 6%. As usual, Africa and South East Asia remain at the bottom line in this respect.

Figure 2: Percentage of death across regions



Source: Sketched by the author

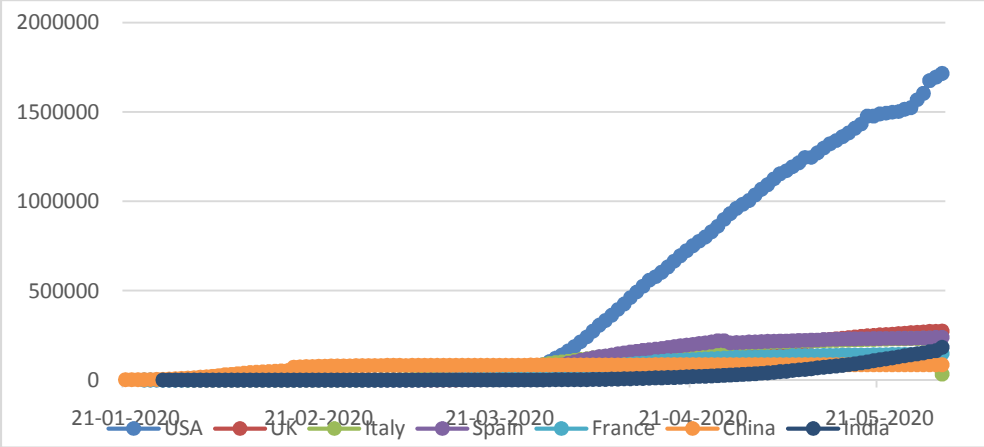
Trends of Incidences of Highly Affected Countries (Jan 21st - May 31st)

We now come to the trends of incidences of the highly affected countries for the 132 days of COVID-19 outbreak. We have seven selected countries as mentioned, USA, UK, Italy, Spain, France, China and India. The first 5 are from the so-called developed zones of the world with high death rates. China and India are the highly emerging nations with the former as the initiator of the outbreak and India is our nation with special emphasis.

Figure 3 shows that all the selected countries have rising trends of number of cases starting with China on January 21st, 2020 at Wuhan Province. On March 28, USA and Italy surpassed China in number of cases and deaths. After that the trend for USA has been exponential reaching 1716078 on May 31st. UK and Spain have retained second position on May 31st. USA crossed Italy on March 29 and become the leader till the last date of the study. Spain over takes Italy on April 5 but UK over takes Spain on May 14. But in the late, Russia has been there with a greater number of cases than UK, Italy, Spain and France but its death rate was very low compared to the formers. India is now

taking the rising trends. Presently, China has been sterilised in terms of number of cases. India over takes China on May 16.

Figure 3: Trends of Incidence of Highly Affected Countries (Jan 21st - May 31st)

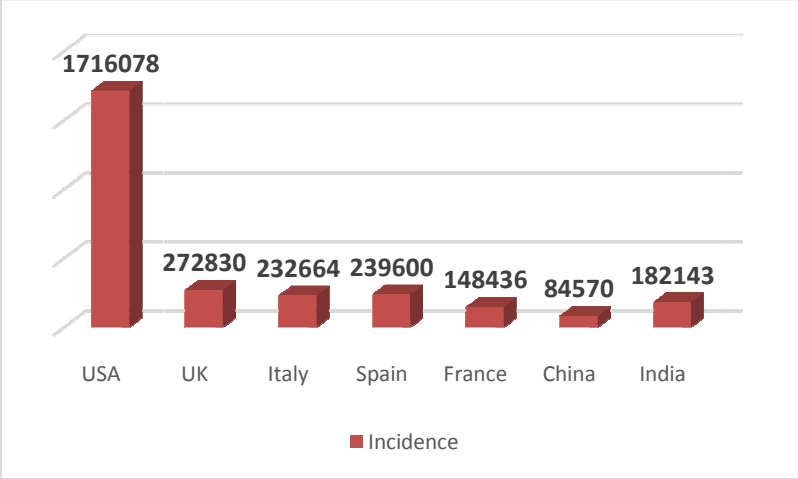


Source: Sketched by the author

Number of Incidences and Deaths on May 31st

Figure 4 shows that USA is the leading country with number of cases of around 17 lacs which is far away from its followers. It has 7.5 times a greater number of cases compared to its nearest follower UK. India has reached the figure of 1.82 lacs. China is in the trough with a figure of 84500 cases.

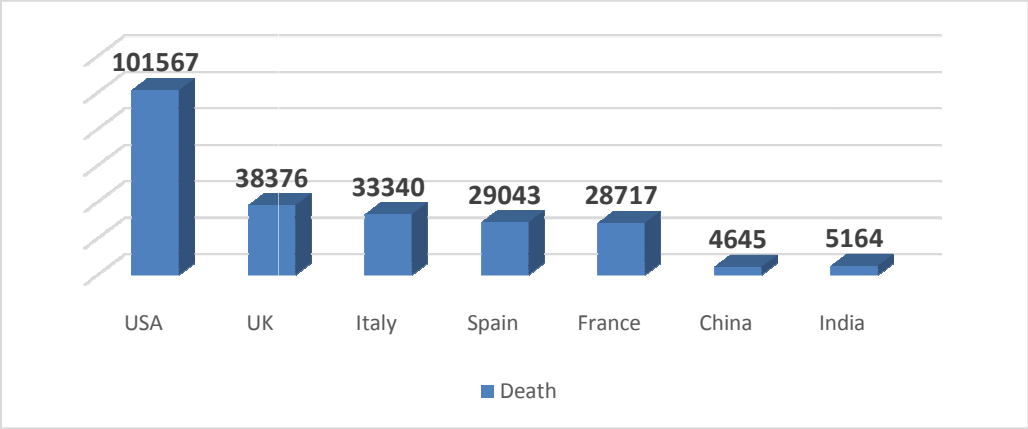
Figure 4: Number of Incidences on May 31st



Source: Sketched by the author

USA is again at the top of the list in number of deaths. It has more than one lac death cases on May 31st and it is increasing day by day.China is at the bottom level with 4645 deaths followed by India with 5164 people died in the pandemic (Figure 5).

Figure 5: Total Number of Deaths as on May 31st

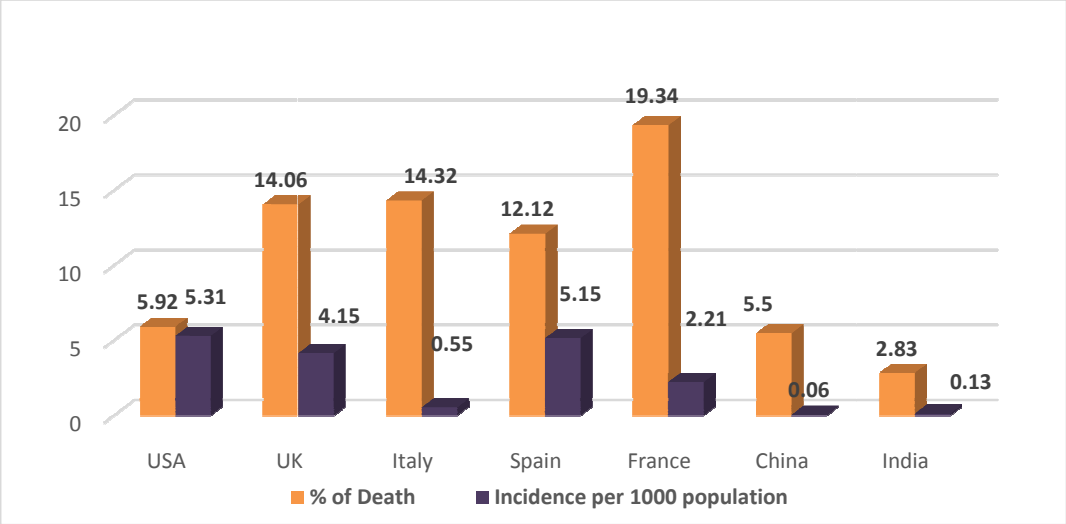


Source: Sketched by the author

Per cent of Deaths out of Incidences and Rate of Incidence per 1000 population

Comparison of the total number of incidences and deaths across the nations with different structures may be misleading as it may not reflect the true picture in absolute sense. The percentage of death (or the death rate) and rate of incidence out of total population rather reflects the true one. The present study thus considers the rate of incidence and deaths for clarity and comparison across the selected nations. Figure 6 shows that France has highest rate of mortality (19.3%) compared to UK and Italy (14%), Spain (12%), USA (6%), China (5.5%) and India with 3%.

Figure 6: Per cent of Deaths out of Incidences and Rate of Incidence per 1000 population



Source: Sketched by the author

But with respect to the rate of incidence of per 1000 population, USA leads the group with 5.3 people followed by Spain (around 5.1 people) and UK (more than 4 people). India is having better situation with 0.13 people per 1000 population which means 13 people affected per one lac population. China is at the bottom level with only 0.06 people per 1000 or 6 out of one lac population.

Possible Socio-economic, Demographic and Environmental Factors

We have tried to pull some possible factors behind the pandemic from Socio-economic, Demographic and Environmental fronts to relate with number of incidences and deaths of the selected 7 countries. The economic factors are Globalization Index, International Flights (%), Net Immigration (Inflow minus Outflow), the social factors are Per Capita Health Expenditure and Hunger Index, demographic factor is percentage of Old Age Population and Urban Population (%), and environmental factor is Per Capita CO2 Emission. Table 1 presents the respective data for the selected countries.

Table 1: Socio-economic, Demographic and Environmental Factors

Countries	USA	UK	Italy	Spain	France	China	India
Incidence	1477459	248822	226699	232037	140959	84505	106750
Death	101567	38376	232664	29043	28717	4645	5164
Globalization Index	82.5	90.0	83.4	85.8	87.4	65.1	62.3
International Flight (%)	60	62	70	55	58	25	20
Net Immigration	5637183	1083985	825326	1018659	382478	-1433524	-1797986
Per Capita Health Expd	10246.14	3858.674	2840.131	2506.465	4379.727	440.8256	69.2931
Hunger Index	1	2	1	2	2	10	28
Per capita CO2 emission	13.83	8.06	6.02	0.01	6.09	1.31	0.29
% of Old Age	20	18.39587	22.75168	18.5	18	7.12	5.23
Urban Population (%)	82.2	83.4	80	80.3	80.4	50	34.03

Source: World Bank, UN and ILO

The developed countries are relatively in higher positions in respect of globalization, percentage of international flights, net immigration, per capita health expenditure, providing food security (which means low hunger index), per capita pollution, old age population and urbanization, compared to the two developing countries China and India. The figures of net immigration for China and India are negative indicating more outflow than inflow. It is observed that the countries with high magnitudes of incidence and death are also with high values of all the determinants except hunger index. That means there may be some degrees of associations between number of incidences and deaths with the selected indicators from different domains. We, thus, compute the correlation coefficients for all the countries in terms of incidence and death with all the indicators and tested the significance by the help of 't' statistic as given in equation 1 and 2. The results are given in Table 2.

Correlations of the Factors with total number of Incidence and Death

It is observed from Table 2 that the signs of correlation coefficient of all the indicators with number of incidence and death are positive except the hunger index. The results are a natural outcome. The countries with high globalization, high international air traffic movements, net immigration, high pollution, share of old age population and urbanization have experienced relatively large numbers of incidences and deaths. The results for international flights admit the observation of Lau et (2020). The correlations with hunger index are found to be negative with respect to both incidence and death since more the number of hungry people (like in India and China) are less the cases of incidence and death will be there. The developed countries with very low scores in hunger index (or they are more food secured) experience high COVID incidence and death. The reason may be that high hunger means low food security and high immunity and vice versa. The results support the observations of Raja (2008) and Hoch (2010).Besides, increase in old age population has positive correlation with both incidence and deaths. Increase in the magnitudes of urbanization makes people susceptible to less greener spaces and high life risk which supports the work of Graham et al (2014).

Table 2: Correlations of the Factors with total number of Incidence and Death

	Correlation with Incidences	Correlation with Deaths		
			t(Incidence)	t(Death)
Globalization Index	0.226518	0.343008	0.520028	0.816526
International Flight (%)	0.332929	0.656232	0.789491	**1.944686****
Net Immigration	0.925128	0.396106	**5.44875***	0.964623
Per Capita Health Expd	0.912895	0.313188	**5.000801***	0.737409
Hunger Index	-0.32834	-0.44581	-0.77729	-1.11364
Per capita CO2 emission	0.803979	0.43191	**3.02317****	1.070809
% of Old Age	0.384387	0.676056	0.931046	**2.051581****
Urban Population (%)	0.370886	0.453139	0.893018	1.136643

Notes: * Marks for 1% level of significance, ** marks at 5%

Source: Computed by the author

The correlation results with relatively large in absolute values have been tested to be statistically significant. Last two columns of Table 2 give the calculated t values for incidence and deaths. It is observed that Immigration and Per Capita Health Expenditure are the two highly significant factors in making positive associations with number of incidences of the countries. This means, the countries with net inflow of outside people have high incidence rates under COVID-19. Again, the countries with regular health expenses like check-up, frequent doctors' consultations, etc. have high rate of incidence since these behaviours actually exhibit the cases of low immunity and high susceptibility to diseases. The old age population has high health expenditure. Mainly the developed countries have such phenomenon.

Again, the countries with high magnitude of environmental pollution (CO2 emission) have high incidence rates. Mainly the developed countries again have such phenomenon since they are mainly the largest emitters of CO2.

With respect to the number of deaths, international traffic flow and percentage of old age population are highly significant. Mainly the developed countries suffer a lot from these two factors and high death rates in these countries may be largely due to these two factors. Other remaining factors are found to be weakly significant with usual signs in respect of both the cases of incidence and death. Hunger index has negative correlation which means the countries with food insecurity such as in India and China have low magnitudes of deaths since hunger makes people more immune against viruses and bacteria. The high proportion of old age people in the developed countries has claimed more deaths from COVID. Again, high urban population means low green spaces for them, low immunity and high death rates. The same is true when we speak of Indian cities and big towns.

Impacts on Growth Rates, Unemployment Rates and Merchandise Trade

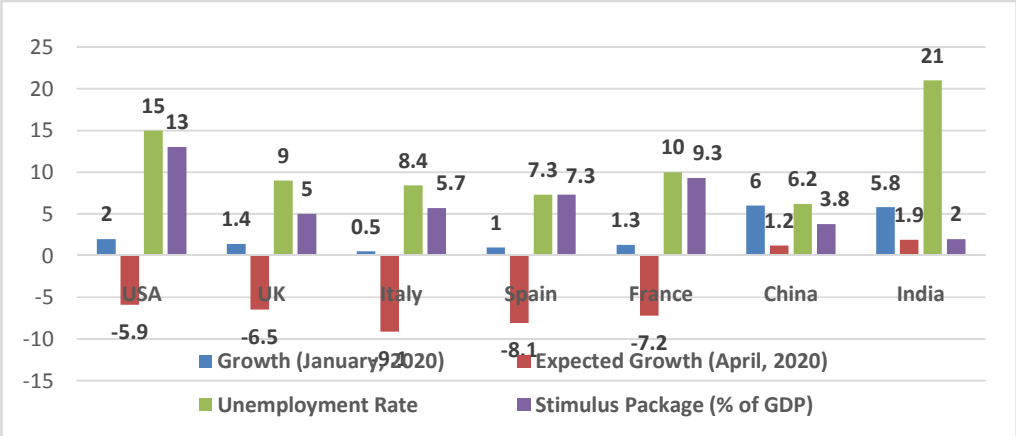
GDP Growth

According to IMF there will be drastic fall in the growth rate of real GDP of the countries. Figure 7 shows that, in January 2020, the developed countries have growth rates of 0.5 to 2%, and for China 6% and for India 5.8%. But in April, the projected growth rate will slash down to negative figures for the developed countries with Italy to worst hit to -9%. But for China it is 1.2% and for India 1.9. In May, the figures for China and India may take negative growth values.

Unemployment Rate

According to ILO, the unemployment rate will be highest for India with 21% followed by USA 15%, France 10%, UK 9% (Figure 7). Considering the small informal sectors, India's unemployment figure will jump to some multiples of 21%.

Figure 7: Growth and Unemployment impact, and Announced Stimulus Package (all in %)

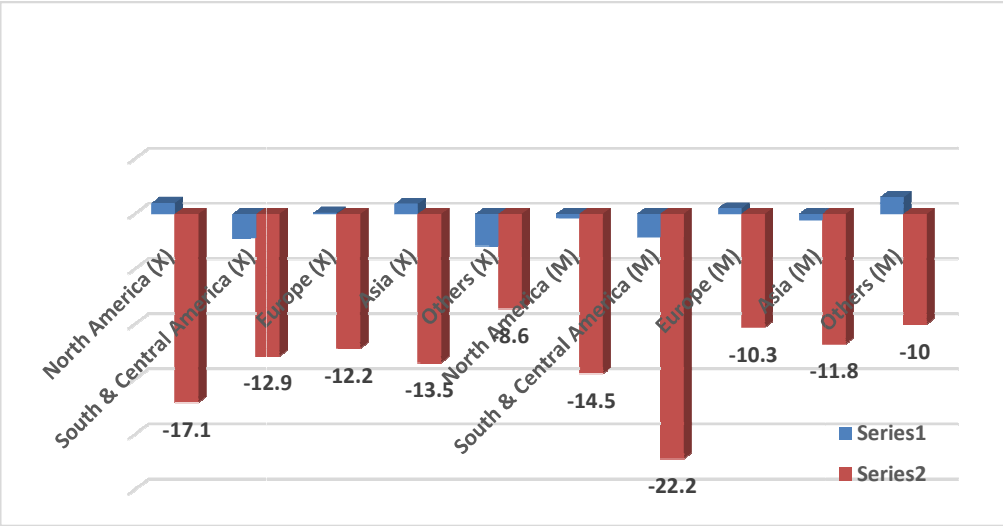


Source: Sketched by the author

Region-wise Volume of Merchandise Trade (% change from 2019-2020)

According to the WTO data, world trade is expected to fall by between 13% and 32% in 2020 as the COVID 19 pandemic disrupts normal economic activity and life around the world. Having no country specific data on this head right now, WTO has published region-wise data on exports and imports and their changes from 2019 to 2020. Figure 8 depicts that there will be around 17 % reduction in export in North America, 13.5% in Asia, 12.2% in Europe.

Figure 8: Region-wise Volume of Merchandise Trade (% change from 2019 to 2020)



Note: Series 1 for 2019 and Series 2 for 2020

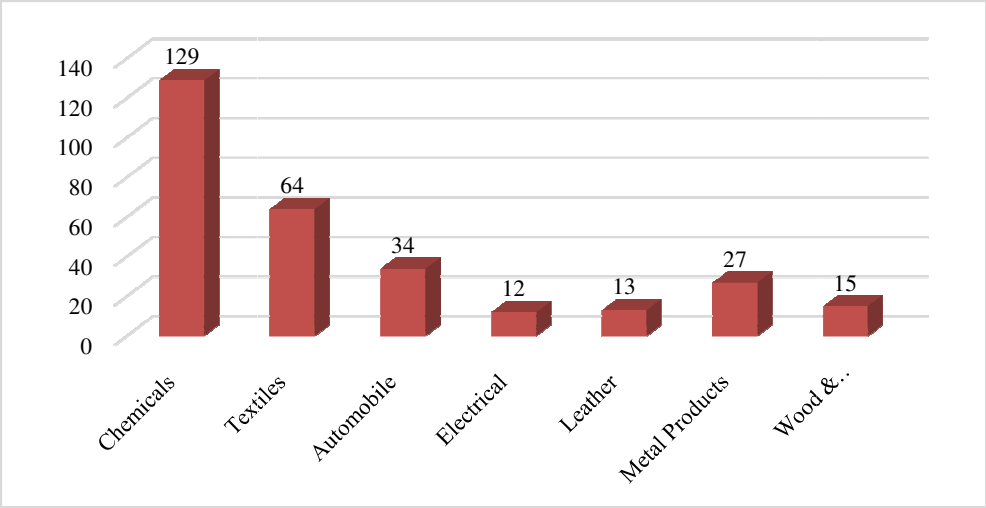
Source: Sketched by the author

But with respect to change in import from 2019 to 2020, there will be 22% reduction in South & Central America, 14.5% in North America, 12% in Asia and 10% in Europe. Hence, in overall sense, there will be steep reductions in trade volume all around the globe. COVID-19 forces the international flows of goods and services and making backward movements of the countries from open trade to restricted trade; the volume of supply of the goods will mainly be directed for the indigenous demands of the countries during the pandemic phase.

India's Trade Effect

India's major sectors in international transactions are chemicals, textiles, automobiles, metal products, leather, electricals, and wood & furniture. With respect to India, the UN report says that there will be around $348 million shrinkage of total trade. Figure 9 gives major sectoral decomposition of the total trade effect of $348 million.It is seen that Chemicals Industry will the worst hit sector due to the pandemic followed by textiles and automobiles.

Figure 9: India's Trade Effect-Total Reduction of $348 Million



Source: Sketched by the author

Growth Impact and Remedies for India-Active Government's Intervention with Stimulus Package

We now want to measure the loss of GDP in India under different conditions on the economic activities during the 68 days' lock down from March 25 to May 31st and accordingly suggest for possible remedies. We compute and analyse the growth impact in India associating equation (3) and (4).

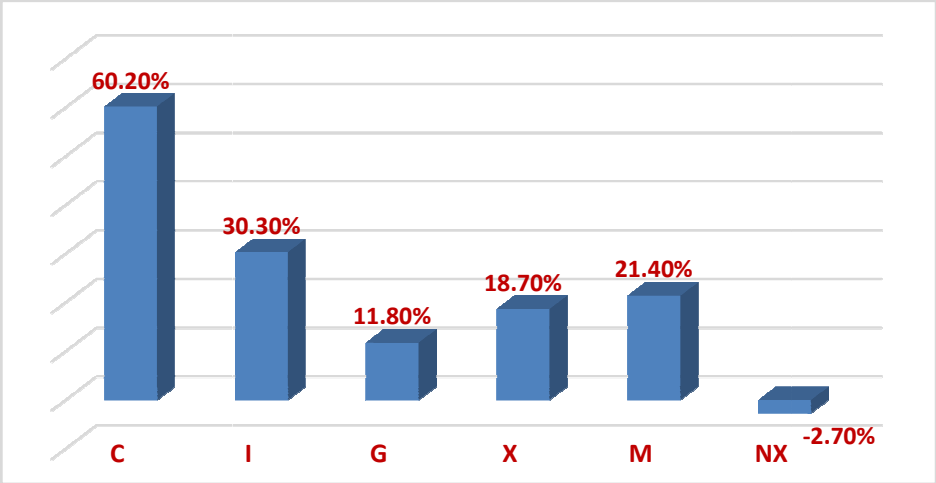
As per Central Statistical Organization (CSO), in 2019-20, second advanced estimate, GDP at current price is 204 lacs crore. Out of the GDP, 60.2% was on Consumption Expenditure, 30.3% on Private Investment Expenditure, 11.8% on Public Investment Expenditure (or government final consumption), 18.7% in Exports, 21.4% in Imports and thus, -2.70% in Net Exports (Table 3 and Figure 10).

Table 3: Distribution of India's GDP (204 lac crore) in different heads as in 2019-20

	GDP	C	I	G	X	M	NX
	204	60.20%	30.30%	11.80 %	18.70%	21.40 %	-2.70%
In 68 day' s Lock Down	38.00548	22.87901	11.515515	4.48459	7.106935	8.13307	-1.02614

Source: Author's calculations

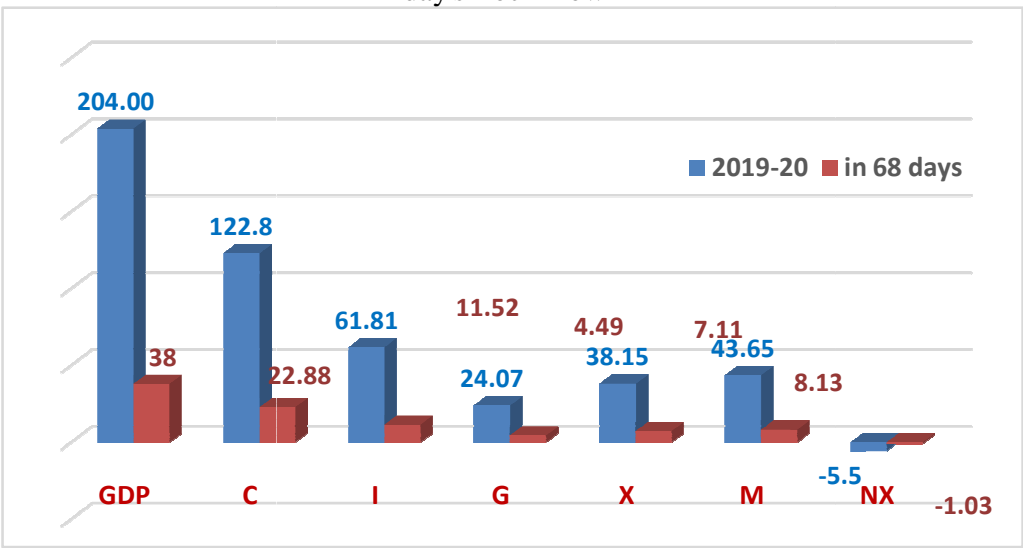
Figure 10: Distribution of GDP (204 lac crore) in different heads as in 2019-20



Source: Sketched by the author

Figure 11 exhibits the GDP in 68 days lock down with proportional distribution among different heads. The GDP in 68 days will be INR38 lac crore (= GDP*68/365) and accordingly, in proportional contribution, 22.88 lac crore will be C, 11.52 lac crore I, 4.49 lac crore of G and -1.03 lac crore of NX.

Figure 11: Distribution of GDP (204 lac crore) in different heads as in 2019-20 and in 68 day's Lock Down



Source: Sketched by the author

Let us consider the possible impacts of the 68 days lock down upon GDP and its components.

Suppose in the lock down phase Consumption falls by 1/3rd, Private Investment falls by 100% (since no private investors will be interested to invest in the lock down phase), G,

X and M, NX remains same and then Loss of GDP in the 68 days will be INR19.15 lac crore which is 9.39% of total GDP of INR204 lac crore (Table 4).

Table 4: Impact on India's GDP in the 68 days

C	I	G	X	M	NX	Fall in GDP	% in 204 Lac cr
7.6263	11.5155	0	0	0	0	19.1418	9.38326

Source: Author's calculations

Now the question is about the recovery of this 19.15 lac cr (9.39% of GDP).

There is no option other than governments strong intervention since private partners, households and trade sectors are unsecured to accept the challenge. India need to boost up aggregate demand, not aggregate supply. Hence, policies should center around demand augmentation, not supply augmentation. More direct cash or direct earning on quick basis is expected to work significantly compared to supply expanding policies like cutting rate of interest, profit tax, loan moratorium, etc.

Before to recommend for the intervention we need to know the extent to which government will intervene. To compute this, we need to derive the government expenditure multiplier with the help of government's spending elasticity (e_g=[dy/dG]*G/Y) and government spending to GDP ratio (G/Y). From the historical data for India (**last twenty years i.e. 1998-2018**), the average value of e_g is calculated which is around 0.96 and for 2018-19 data the G/Y was around 28%. Hence,

$e_g = 0.96$
or, [dy/dG]*(G/Y) = 0.96
or, dY/dG*28 = 0.96
or, dY/dG = 0.96/28*100
or, dY/dG = 3.43

This means one rupeeadditional government expenditure makes 3.43 rupees income (this is the value of the government expendituremultiplier). On the basis of that we aim to calculate the possible extent of government intervention.

Since the exact scenario in different economic fronts is not known we can experiment by taking some considerations on C, I, G, X and M.We have considered three extreme cases for our experiment.

Extreme Case I: Suppose in extremely bad situation (as projected by different agencies) the nominal growth rate is 2%, and inflation is 2% then the real rate of growth is 0%.

In this situation recovery of the deficit of 19.15 lac cr is to be done by government intervention and the amount of government expenditure (keeping in mind the multiplier effect) will be 19.15/3.43 = 5.59 lac cr which is (= 5.59/204*100) 2.74 % of total GDP of 204 lac cr. This means, if zero rate of growth of real GDP is to be maintained then the government should spend 2.74% of its GDP as relief to fight against COVID-19.

Extreme Case II: Suppose the Indian economy was in pre-COVID state with 5% around real GDP growth rate. If the current inflation rate is 3% (April -May, 2020), the nominal rate of growth would be 5+3 = 8%. So new GDP would be 204+204*0.08 = 204+16.32 = 220.32 lac cr. In 68 days', lock down GDP would be 220.32*68/365 = 41.05 lac cr.

Keeping the same 1/3rd reduction of C (on 60.2% of GDP), I as 30.3%, and no effect upon NX, the new tabulated figure would be as presented in Table 5.

Table 5: Extreme Case II

	C	I	G	X	M	NX	Fall in GDP	% in 220.32 Lac cr
Changes in>>	24.63-8.13=16.5 lac cr	41.05*30%=12.31 lac cr	41.05*11.8%=4.84lac cr	0	0	0	20.44	9.277

Source: Author's calculations

So additional government expenditureto restore 5% real rate of growth in the remaining year will be 20.44-4.84 (which was already made in 11.8%, refer to column 4 of Table 5) = 15.6 lac cr which is 7.08% of GDP of 220.32 lac cr. It is to further note that such an increase of government expenditure would not generate multiplier effect within the lock down phase as C and I would be insensitive to such impetus and the multiplier effects would work if unlock phase comes.

Extreme Case III: If the pre tariff war maximum growth rate of 8.27% attained by the Modi Government in 2016-17, is to be attained with current 3% inflation rate then the nominal GDP growth rate would have to be 8.27+3 = 11.27 %. This means, new GDP at current price would be 204+204*11.27% = 227 lac cr. In 68 days lock down this would be 227*68/365 = 42.3 lac crore.

Keeping the same 1/3rd reduction of C (on 60.2% of GDP), I as 30.3%, and no effect upon NX, the new tabulated figure will be as in Table 6.

Table 6: Extreme Case III

	C	I	G	X	M	NX	Fall in GDP	% in 227 Lac cr
Changes in>>	25.38-8.4=17 lac cr	42.3*30%=12.69 lac cr	42.3*11.8%=4.99lac cr	0	0	0	21.09	9.2907

Source: Author's calculations

So additional government expenditure to restore 8.27% real rate of growth in the remaining year will be 21.09-4.99 (which was already made in 11.8%, refer to column 4 of the table) = 16.1 lac cr which is 7.09% of GDP of 227 lac cr. Hence, the amount of additional government expenditure increases with the growth targets. It is to further note that such an increase of government expenditure would not generate multiplier effect within the lock down phase as C and I would be insensitive to such impetus and the multiplier effects would work if unlock phase comes.

Now refer to Figure 7 where we see different stimulus packages offered by the listed countries of the study. USA and France are the two countries offering more than 10% of their GDP as stimulus package whereas India has been with a mere 2% direct stimulus package. There is a clear departure from the possible realities in Indian case and the package offered by the central government of the country. But what the decisions India

government is now taking are mostly for supply boosting through banking channels, disinvestment channels, easy tax for corporates, etc. which may further increase the magnitude of excess supply. In reality, there is a mere INR2-2.5 lac crore of demand boosting package.

Concluding Observations,Recommendations and Future Scope of the Work

The outbreak of COVID-19 has impacted most of the countries in the world in different magnitudes. The so-called developed countries have been worst hit in terms of both number of incidences and death rates. But the irony is that most of the death cases in the world have been centred around the developed countries. The present study thus considered five developed countries and two developing countries for analysing the trends, identifying possible factors behind spread and death and evaluated growth impact under different situations for India. It is observed that the factors like international flight movements, net immigration, CO2 emission, health expenditure and old age population are responsible for high incidence and deaths. With respect to India's growth impact assessment the study observes that there will be loss of GDP of 2-8% out of the targeted GDP of the 2019-2020. Accordingly, to have pre-tariff war and pre-COVID growth rates, Indian government should provide stimulus package of 5-8% of GDP which is INR15-16 lacs crore in total.

What the decisions India government is now taking are mostly for supply boosting through banking channels, disinvestment channels, easy tax for corporates, etc. which may further increase the magnitude of excess supply. It is thus recommended to undertake direct cash transfer for couple of months to the households under destitutions, to the jobless migrant labours, informal workers, etc. with a sizable government spending of 5-8% of GDP. The primary source of such stimulus package should be through borrowing and/or printing new money, not by taxation as it will further narrow the volume of aggregate demand and increase the magnitude of excess supply.

As time goes on more real data would be coming and the results of the impact assessment would change. We are preserving the re-estimation exercise as part of the future research agenda.

Declarations

The author declares that he has no conflict of interest in doing the work and has no funding agency behind the research.

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