Impact of COVID 19 on Global Economy- A study on Econometrics Model using R software

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Abstract

Human health is the backbone for healthy nations and healthy economy of nations. But the new and emerging diseases like COVID-19 a global pandemic, posed health as well as economic challenges exposing the vulnerability of healthcare systems of all countries irrespective of their development status. Livelihood is affected because of inability to procure

basic amenities impacting the national economy in terms of decrease in GDP.

This study is an attempt to map the distribution of the COVID-19 cases across nations and its impact on the national GDP when compared to 2019 and the predicted GDP for 2020 using R software. 159 countries were considered for the study and a total of 190409 COVID-19 positive cases (19th March 2020). The GDP of each of the country in 2019 and 2020 are considered and the effect on economy in terms of GDP is displayed as maps in the software. (source: The World Bank). The overall effect is obtained as the difference in predicted GDP to actual post COVID reflecting the challenges before the system.

Introduction

COVID 19 is a global pandemic (WHO) and has affected nations world over[1]. The mortality and morbidity rates of the disease have exposed the vulnerability of healthcare system of nations irrespective of their development status putting the lives of people at risk. Nations are forced to lockdown as a drastic measure to prevent its spread.

COVID 19 outbreak in Wuhan city in China in December 2019 has spread across nations today and several epicenters have been identified across the globe forcing WHO to declare it as a global pandemic which was earlier thought to be a public health emergency of international concern. Mortality and morbidity rates of the disease have been escalating every day with more countries being affected with the passage of time. China forced a lockdown on Wuhan but by then, the disease had already spread and today many nations have declared lockdown irrespective of their development status. This national lockdown has not only caused disruption in the production, supply, maintenance of essential services and commodities but bringing economic slowdown. Restrictions across borders have impacted the supply of raw materials on dependent nations and thereby affecting production[2]. China's growing importance in the global economy is as a manufacturer and exporter of consumer products and also as the main supplier of intermediate inputs for manufacturing companies abroad.

Today, about 20 percent of global trade in manufacturing intermediate products originates in China (up from 4 percent in 2002). The OECD notes that "production declines in China have

spillover effects around the world given China's role in producing computers, electronics, pharmaceuticals, and transport equipment, and as a primary source of demand for many commodities"[3].
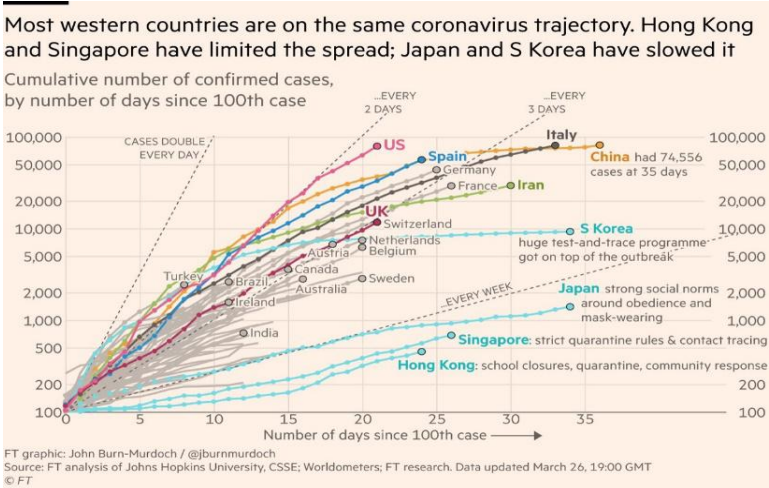

Figure 1: Corona virus trajectory

The pandemic has brought a drastic shift in demand and supply of goods, unusual consumption patterns and panic buying leading to exhaustion of many of the items. Global financial markets have been affected causing the stock indices to plunge and negatively impacting global economic growth.

Financial markets are volatile in United States to Asia and Europe as virus is creating a global economic and financial crisis much to the panic of investors amidst few metrics to indicate how prolonged and expansive the economic effects maybe[4]. The pandemic is also affecting global politics as world leaders are cancelling international meetings[5] and some nations reportedly are stoking conspiracy theories that shift blame to other countries[6]. With the economic effects of the pandemic growing, policymakers will be forced to give weightage to policies that address the immediate economic effects instead of longer-term considerations. In this highly fluid economic condition, the magnitude of health crisis related economic effects are speculating risk and volatility of financial markets and corporate financial decisions.

Economic policies are being affected by multiple factors such as reduced economic activity, supply chain disruptions and reduced trade across borders. Liquidity and credit market issues posing a different challenge to policy makers. The response and action by leaders of nations including the G-7 nations have been through- lowering interest rates, increasing liquidity in their financial systems, making payments directly to household, deferring tax payments,

continuing unemployment insurance, increasing guarantees and loans to businesses. The IMF has announced availability of about $50 billion for the global crisis response[7].

The economic crisis effect of COVID 19 in addition could trigger a wave of defaults around the world[8]. In Q3 2019—before the outbreak of Covid-19—global debt levels reached an all-time high of nearly $253 trillion, about 320% of global GDP[9]. About 70% of global debt is held by advanced economies and about 30% is held by emerging markets. With Households facing an increase in unemployment in many developing countries, a decline in remittances is observed. The pandemic has led to many emerging market currencies to depreciate raising the value of their debts in terms of local currency. Though most governments have signaled a commitment to or already implemented policies to support those economically impacted by the pandemic, they face challenges with decisions about the type of assistance (loans versus direct payments), the amount of assistance, how to allocate rescue funds, and what conditions if any to attach to funds. Decline in industry activity has reduced demand for energy products such as crude oil, causing prices to drop sharply and decrease in business and tourist travel has led to a sharp drop in scheduled airline flights by as much as 10%.

Gross Domestic Product (GDP) is one of the most widely used measures of an economy's output or production. According to the report in November 2012 by the Organization for Economic Cooperation and Development (OECD), there would be major shifts in global GDP by the year 2060. Based on 2005 purchasing power parity (PPP) values, China would have GDP of $15.26 trillion by 2016, exceeding the United States' GDP of $15.24 trillion for the first time to become the world's largest economy. The Chinese economy is forecast to be 1.5 times larger than the U.S. by 2030 and 1.7 times bigger by 2060. In addition, India is expected to overtake the U.S. economy to become the second biggest in 2051. The combined GDP of China and India will exceed that of the combined G-7 nations (the world's richest economies) by 2025, and be 1.5 times larger by 2060.
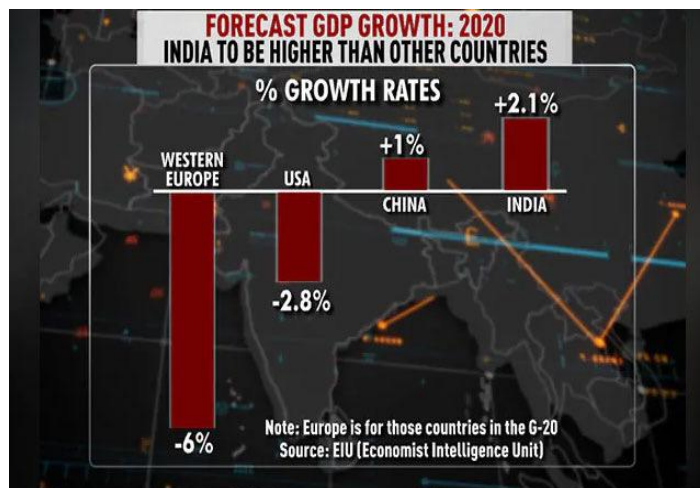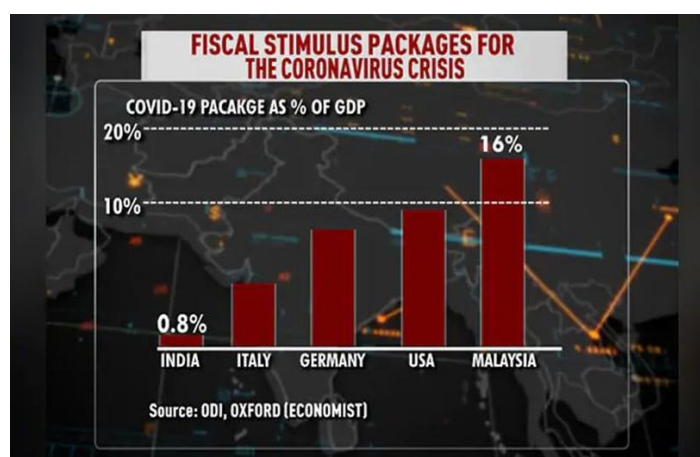
Figure 2: Forecast GDP growth rate 2020 of countries

Figure 3: Country-wise fiscal stimulus package for the Corona virus crisis

(https://www.investopedia.com/articles/investing/121213/gdp-and-its-importance.asp)

This recent marked deterioration in global financial conditions and heightened uncertainty, will depress global GDP growth in the early part of the year, even below zero in the first quarter of 2020. As assumed, even if the COVID-19 effects fade gradually through 2020, illustrative simulations suggest that global growth could be lowered by up to ½ percentage point this year. On this basis, global GDP growth is projected to slow from 2.9% in 2019 to 2.4% this year, before picking up to around 3¼ per cent in 2021 with the effect fading and output gradually recovering. If outbreaks spread more widely in the Asia-Pacific region or the major advanced economies in the northern hemisphere, the adverse effects on global growth and trade will be much worse and more widespread. Illustrative simulations of this downside risk scenario suggest that global GDP could possibly be reduced by 1½ per cent in 2020, rather than by ½ per cent as in the base-case scenario[10].

With this background, the challenges from the outbreak necessitates not just for policy actions to contain the spread of the virus and strengthen health care systems, but also to boost confidence and demand, and limit adverse supply effects. Multipronged approach in policy making is essential for containment of the disease and policy measures to restrict the spread of the coronavirus and limit its economic costs. This requires coordinated policy action within and across all the major economies and would provide the most effective and timely counterweight.

The public and private health system is one of the first sectors impacted by the outbreak with a drastic surge in hospital admissions leading to sudden peaks in administrative and operational expenditure. Epidemics caused by diseases can also create the need for long-term treatment – sometimes, for the rest of patients' lives. In that sense, they appear both 'as a crisis and a systemic condition'. A report from the United Nations Development Programme in 2017 estimated that the Zika virus epidemic would cost about US$7–18 billion in Latin Economic impact of epidemics and pandemics. America and the Caribbean for 2015–2017, with the poorest countries (e.g. Haiti) facing the highest costs as a share of gross domestic product (GDP). The report also noted that, while in the short term, the biggest impact would be felt in the tourism sector, in the long-term, the most substantial impact would relate to treatment and care for children[11].

The outbreak has mandated country's authorities to take actions and measures to contain it: closing schools or reducing transportation and other public services. Population proactively are taking precautionary measures, including people staying at home to avoid getting the disease or to care for a sick family member. In this context, a paper examined the impact of the 2009 H1N1 pandemic on missed days of work in Chile[11]. The researchers estimated that the pandemic increased the mean days missed significantly, resulting in at least US$16 million in labour productivity loss. They then extrapolated this finding to the United States and – with caveats – estimated that the pandemic led to approximately US$2 billion in lost labour productivity. Shops and companies might suspend their operations temporarily to avoid their workforce being affected by the disease which impacts consumer spending.

With around 60% of emerging infectious diseases reported globally being zoonoses, virus outbreaks may result in significant costs to a country's agricultural sector and trade which are the backbone of a country's economy. Travel and tourism also may be affected as travel to regions affected by outbreaks are likely to decline.

The labour market outcomes also will be affected by COVID-19. In addition to the concerns about the health of workers and their families, the virus and the subsequent economic shocks will impact the world of work across three key dimensions: 1) The quantity of jobs (both unemployment and underemployment); 2) The quality of work (e.g. wages and access to social protection); and 3) Effects on specific groups who are more vulnerable to adverse labour market outcomes. The ILO actively maintains a series of econometric models that are used to produce estimates of labour market indicators in the countries and years for which country-reported data are unavailable.

ILO estimates indicate a rise in global unemployment of between 5.3 million ("low" scenario) and 24.7 million ("high" scenario) from a base level of 188 million in 2019 based on different scenarios for the impact of COVID-19 on global GDP growth. The "mid" scenario suggests an increase of 13 million (7.4 million in high-income countries).

Similarly, based on the available analysis of the impact of COVID-19 on economic growth (GDP), several scenarios can be investigated to obtain a plausible range for the (un)employment impact of the virus.

McKibbin and Fernando (2020)[12] implemented a range of supply and demand shocks in a global hybrid DSGE/CGE model on the effect on the labour market with the assumption that during the course of the year all countries will suffer from the pandemic[13]. They proposed three potential scenarios based on the strength of the effects of the virus (low, mid and high) resulting in three sets of unemployment estimates:

• "Low" scenario where GDP growth drops by around 2 per cent: Global unemployment would increase by 5.3 million, with an uncertainty of 3.5 to 7 million[14].

• "Mid" scenario where GDP growth drop by 4 per cent: Global unemployment would increase by 13 million (7.4 million in high-income countries), with an uncertainty of 7.7 to 18.3 million.

• "High" scenario where COVID-19 has serious disruptive effects, reducing GDP growth by around 8 per cent: Global unemployment would increase by 24.7 million, with an uncertainty ranging from 13 million to 36 million.

According to International Labour Organization (ILO) three key pillars to sustain during COVID 19 crisis is: Protecting workers in the workplace, stimulating the economy and labour

demand, supporting employment and incomes. Many countries have implemented decisive measures to control the spread of the disease while ameliorating its pernicious effect on the economy and labour market across these three policy pillars.

REVIEW OF LITERATURE

Studies related to epidemic diseases have found that population   health, as measured by life expectancy, infant and child mortality and maternal mortality, is positively related to economic welfare and growth (Pritchett and Summers, 1996; Bloom and Sachs, 1998; Bhargava and et al., 2001; Cuddington et al., 1994; Cuddington and Hancock, 1994; Robalino et al., 2002a; Robalino et al., 2002b; WHO Commission on Macroeconomics and Health, 2001; Haacker, 2004)[15-22].

Several studies focusing on this aspect of the impact of epidemics and pandemics have found that the effects across the economy can be significant. A recent article estimates that the total value of losses (including lost income3 – through reductions in the size of the labour force and productivity, increases in absenteeism and, importantly, as the result of individual and social measures that interrupt transmission, but disrupt economic activity – and the intrinsic cost of elevated mortality) incurred by a severe global influenza pandemic (such as the 1918 pandemic), could reach about US$500 billion per year, i.e. about 0.6 % of global income.

There are only a few studies of economic costs of large-scale outbreaks of infectious diseases to date: Schoenbaum (1987) is an example of an early analysis of the economic impact of influenza[23]. Meltzer et al. (1999) examine the likely economic effects of the influenza pandemic in the US and evaluate several vaccine-based interventions. At a gross attack rate (i.e. the number of people contracting the virus out of the total population) of 15-35%, the number of influenza deaths is 89 – 207 thousand, and an estimated mean total economic impact for the US economy is $73.1- $166.5 billion[24].

Bloom et al. (2005) use the Oxford economic forecasting model to estimate the potential economic impact of a pandemic resulting from the mutation of avian influenza strain. They assume a mild pandemic with a 20% attack rate and a 0.5 percent case-fatality rate, and a consumption shock of 3%. Scenarios include two-quarters of demand contraction only in Asia (combined effect 2.6% Asian GDP or US$113.2 billion); a longer-term shock with a longer outbreak and larger shock to consumption and export yields a loss of 6.5% of GDP (US$282.7 billion). Global GDP is reduced by 0.6%, global trade of goods and services contracts by $2.5

trillion (14%). Open economies are more vulnerable to international shocks[25].

A 2019 joint report from the World Health Organization (WHO) and the World Bank estimates the impact of such a pandemic upwards, bringing the total cost to 2.2 %-4.8 % of global GDP (US$3 trillion). The report further notes that, in such an event, South Asia's GDP could potentially fall by 2 % (US$53 billion), and sub-Saharan Africa's GDP by 1.7 % (US$28 billion). Another article from the International Monetary Fund, finds that vulnerable populations, particularly the poor, are likely to suffer disproportionately from an outbreak, as they may have less access to health care and lower savings to protect against financial catastrophe[26,27].

Health economics studies on Burden of disease considers the direct and indirect economic costs of illnesses. Conventionally the mortality and morbidity of diseases is used to predict the future loss of income due to death and disability. But this underestimates the true economic costs of infectious diseases of epidemic proportions and affecting large scale population. The mental stress induced in the affected population can also contribute to lowered productivity even after resuming regular work owing to the fear factor. The anxiety and stress may aggravate preexisting comorbid conditions and complicating the disease pattern.

Studies of the macroeconomic effects of the SARS epidemic in 2003 found significant effects on economies through large reductions in consumption of various goods and services, an increase in business operating costs, and re-evaluation of country risks reflected in increased risk premiums. Shocks to other economies were transmitted according to the degree of the countries' exposure, or susceptibility, to the disease. Despite a relatively small number of cases and deaths, the global costs were significant and not limited to the directly affected countries (Lee and McKibbin, 2003). Other studies of SARS include (Chou et al., 2004) for Taiwan, (Hai et al., 2004) for China and (Sui and Wong, 2004) for Hong Kong[28-31].

Before the Covid-19 outbreak, the global economy was struggling to regain a broad-based recovery as a result of the lingering impact of growing trade protectionism, trade disputes among major trading partners, falling commodity and energy prices, and economic uncertainties in Europe over the impact of the UK withdrawal from the European Union. Individually, each of these issues presented a solvable challenge for the global economy. Collectively, however, the issues weakened the global economy and reduced the available policy flexibility of many national leaders, especially among the leading developed economies. In this environment, Covid-19 could have an outsized impact. While the level of economic effects will eventually become clearer, the response to the pandemic could have a

significant and enduring impact on the way businesses organize their work forces, global supply chains, and how governments respond to a global health crisis[32].

The assessment, prediction and forecasting of pattern and distribution of communicable diseases makes use of statistical tools which use the data collected. An analysis of the data as well as interpretation can be made based on the various models. Health GIS as a tool is used by WHO to assess, predict and forecast the communicable diseases and to understand the pattern of noncommunicable diseases effectively, by the economically advanced countries but developing countries are deprived of this technique due to high cost and dearth of trained manpower.

METHODOLOGY:

Data:

The Country-wise data including total population, gender wise population, number of COVID 19 positive cases, GDP for 2019 and predicted GDP for 2020 were entered into MS excel sheet and then imported to R software to create shape files.

Methods:

R is an integrated suite of software facilities for data manipulation, calculation and graphical display for statistical computing and design. R programming is much preferred for data science and fundamental tool for analytics. It is open source and allows to integrate with other languages.

In this study, we have used R libraries with shape files for working on spatial data. The combination of ArcGIS and R helps solve complex spatial problems. The same is depicted in the following flowchart:
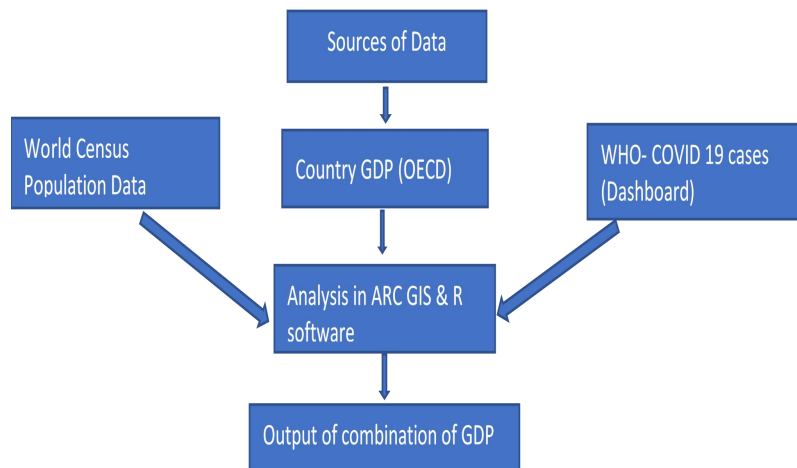
RESULTS AND DISCUSSION

The technique used in the study was to map the GDP of 159 countries across the world and compare the GDP year wise i.e., 2019 and predicted GDP for 2020. The population statistics including gender wise differences in population was also included in the study. With the impact of COVID 19 the economic status of many countries has witnessed a downfall, and this makes it inevitable for them to revise their GDP for the current year against their predicted GDP.

The results obtained are as follows:

Figure 4 shows the population density in different countries across the world:
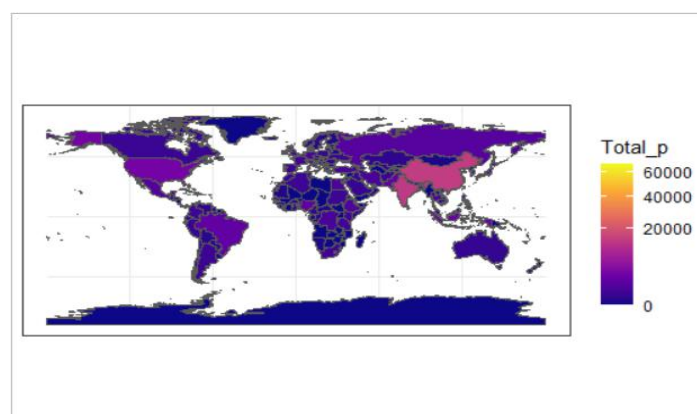
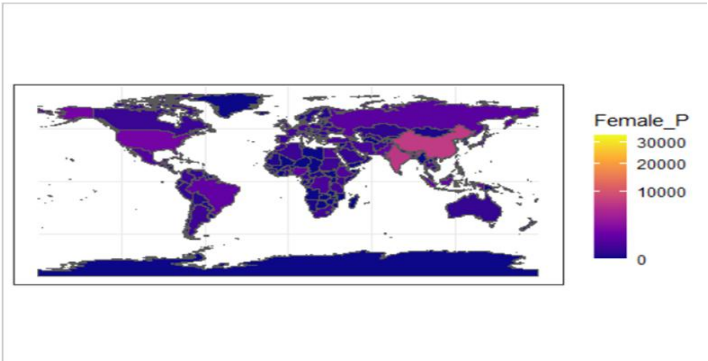**Figure 4: Population Density across the world**

The differences in the density of population as well as distribution may have significant difference in the impact of the COVID 19 disease across nations.

The following maps show the gender wise distribution of population across the world.
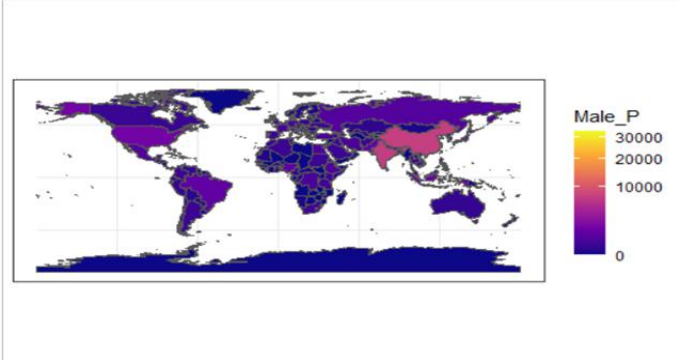

Figure 5: Male Population Density across the world

The differences in the gender wise distribution of the population across different countries may contribute significantly on the economic impact of the disease owing to the per capita income and GDP.

Figure 6: Female Population Density across the world

The total female population in comparison to the total population may affect the economic productivity in different countries considering their contribution to the economy of the country.
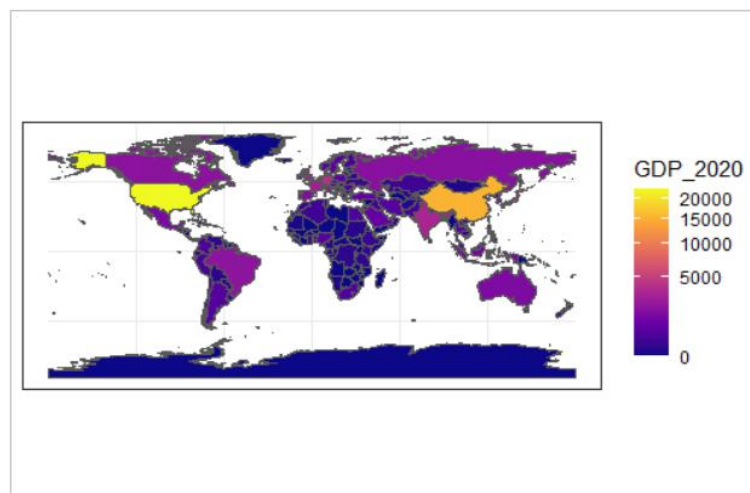
The following map gives the COVID 19 positive cases across the World.
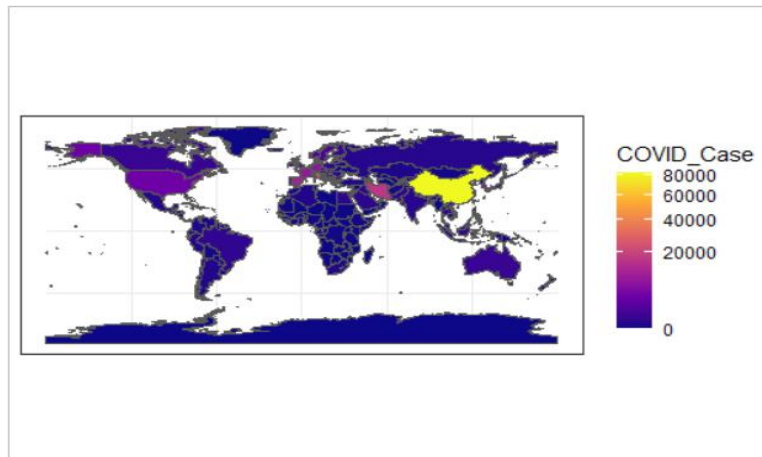
Figure 7: COVID 19 positive cases across the world

The total population and the number of COVID 19 positive cases and its distribution indicate the impact of the disease on the economic policies of the nation. In this map the number of cases is higher in China, followed by USA, European countries when compared to Asian and African countries.

The following map gives the predicted GDP 2020 by countries across the world.

Figure 8: Predicted GDP 2020 across the world

Countries predict the GDP for 2020 considering past performances, reforms and policies, Government regulations, population, productivity in different sectors, trade, tourism, agriculture and spending capacity of the population. There is great difference in the GDP of

developed and developing countries. Developed countries like USA, European countries have predicted higher GDP than the developing nations especially in Asia and Africa.

The following map gives the total GDP with COVID 19 positive cases in the countries considered for the study during 2019.
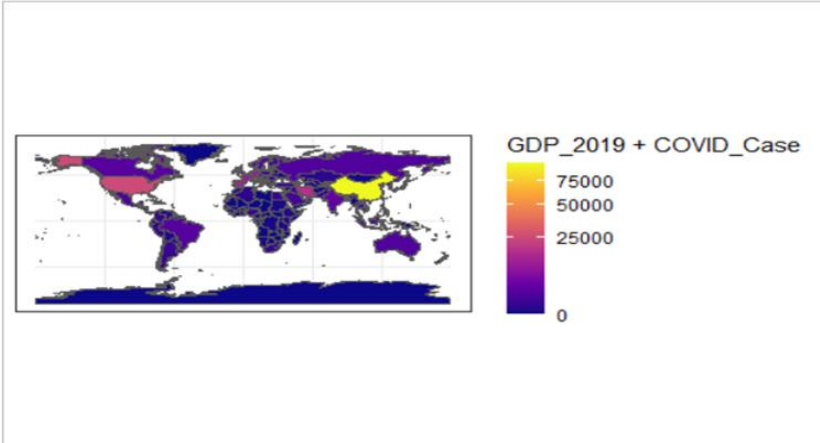

Figure 9: GDP 2019 plus COVID 19 cases across the world.

The above map gives the number of COVID 19 positive cases and the GDP of 2019 in the countries considered for the study. In comparison to the map 5, we can see difference in GDP of countries affected by COVID 19 especially in countries like USA, Europe, and China and including India. The GDP is much lower in comparison to what is depicted in map 5.

In the following figure the map gives the total GDP with COVID 19 positive cases in the countries considered for the study for 2020.
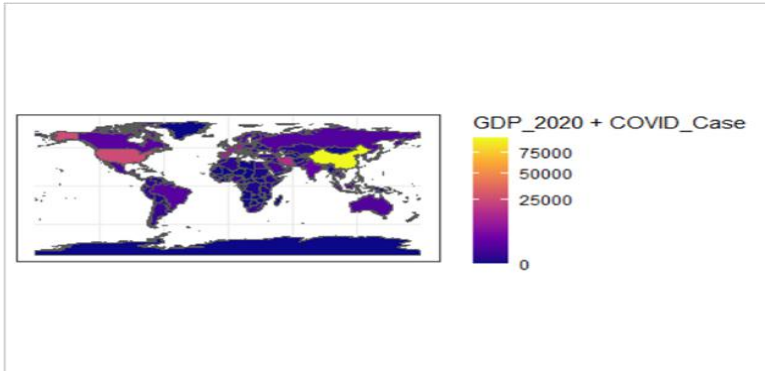

Figure 10: GDP 2020 plus COVID 19 cases across the world.

The above figure gives the COVID 19 positive cases in countries and the GDP for 2020. When compared to Maps 5 & 6, there is difference in the predicted GDP of countries like USA, China, Europe, and India. This shows the impact of COVID 19 on the economy of a country.

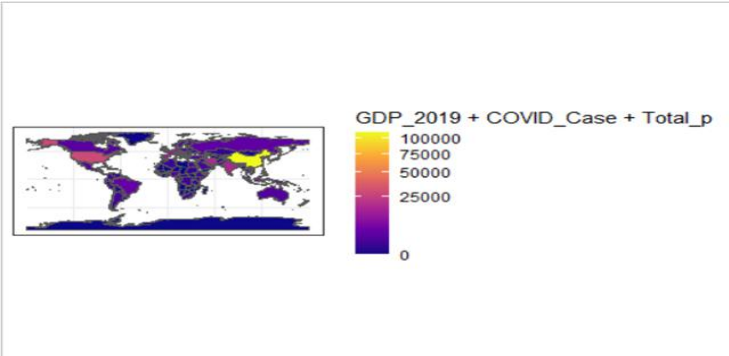The following figure gives the GDP for 2019 with COVID 19 cases and the total population of the country.

Figure 11: GDP 2019 plus COVID 19 cases across the world.

The above map indicates the total population of the countries, number of COVID 19 cases and GDP for 2019. This shows the impact of COVID 19 on the economy of the nations and hence decreased GDP when compared to the actual GDP for 2019.

The following map gives the GDP for 2020 with COVID 19 cases and the total population of the country.
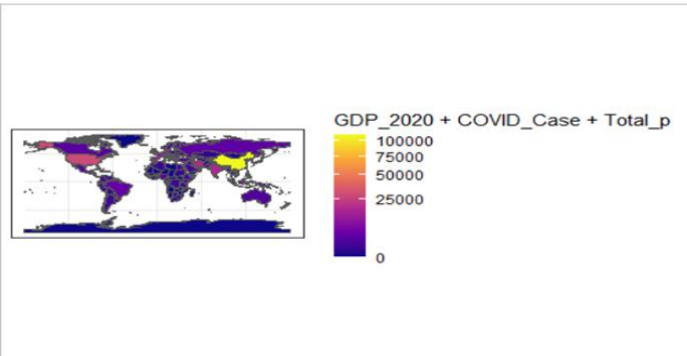

Figure 12: GDP 2020 plus COVID 19 cases across the world

The above map indicates the total population of the countries, number of COVID 19 cases

and GDP for 2020. The impact of COVID 19 on economic status of the different nations has decreased the GDP of many of the nations as evidenced in comparison to map 5 & 7. Countries like America, Europe, China and India are showing lesser GDP when compared to earlier predicted GDP. This reveals the burden of the disease and its long-term consequences in nation's economy.

The following map gives the total GDP for 2020 in all 247 countries with COVID 19 positive cases and the total population.
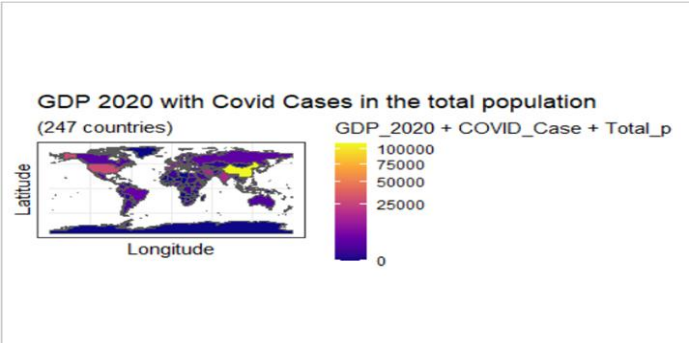

Figure 13: GDP 2020 in 247 countries plus COVID 19 cases across the world

The above map indicates the total population of all the countries, number of COVID 19 cases and GDP. This map indicates the revised GDP for all nations across the world because of COVID 19. The disease has not only brought about increased mortality and morbidity but significantly impacting economic policies, productivity, and per capita income which in long term lead to decreased GDP and necessitating revision in the economic policies to overcome the deficit.

SUMMARY:

The burden of communicable diseases where vaccines are available can be predicted but in instances like COVID 19 where vaccine is not available to control the spread of disease, it is highly unpredictable. The short-term strategies of many of the countries affected by the disease is diverted towards protection of people, rather than stimulating the economy and labour demand, supporting employment and incomes. This shift in focus may impact long term strategies and thereby necessitating revision of many of the policies and reforms. Countries have devised strategies on a war footing to address the immediate need of

protecting people, control spread of disease and thereby foregoing the economic policies devised earlier[33]. Further, the economy has been significantly impacted by the disease owing to national lockdown, reduced production, diversion of resources, shortage of resources because of border closure and tourism absenteeism. Communicable diseases need stringent strategies to be implemented to reduce the burden of the disease on the population but at the same time such strategies impact the economy. Players around the globe are feeling the impact irrespective of their earlier strengths.

The impact of the disease will have far reaching consequences not only in terms of economic revisions but also revisions across borders to combat against such incidences in the future. Countries are looking at each other in times of crisis and trying to adopt the best practices across the globe to rebuild their economy and improving the health of its citizens.

CONCLUSION

Modern technology when used for statistical analysis of the impact of burden of diseases on the population in different countries and comparing it with earlier values help understand the variations and differences in the predicted values with present scenario. This study was an attempt to map the GDP of different countries considering the total population, gender wise population and the number of COVID 19 cases and compare with each other and year wise. The study revealed that there is significant difference in the GDP of many of the countries affected by the disease and decreasing their GDP to what was predicted earlier for the year 2020. Researchers have warned and continue to warn that zoonotic diseases will continue to pose a threat to the lives of millions of people with potentially major disruption to an integrated world economy. The latest outbreak of COVID 19 has proven that a country cannot be an island in an integrated global economy as any country may be affected by the outbreak. Global cooperation, especially in the sphere of public health and economic development, is essential. All major countries need to participate actively and proactively before it becomes a pandemic as any attempt to close borders may be futile in containing the disease spread owing to the high mobility of population in modern times. The role of public health in improving the quality of life and its contribution to economic growth irrespective of their socioeconomic status is to be recognized by all countries. If countries continue to ignore this, then diseases generated in poor countries due to overcrowding, poor public health, and interaction with wild animals, can kill people of any socioeconomic group in any society[34].

Use of statistical tools can enhance the understanding of the impact of disease in various sectors and aid in decision making for policy makers. The information containing map polygon can be used to produce high quality mapping functionality in support of spatial health econometric and statistical analysis.

REFERENCES

[1] Bill Chappell, (2020), "Coronavirus: COVID-19 Is Now Officially A Pandemic, WHO Says," National Public Radio, March 11, 2020, https://www.npr.org/sections/goatsandsoda/2020/03/11/814474930/coronavirus-covid-19-is-now-officially-apandemic-who-says.

[2] Mapping the Spread of the Coronavirus in the U.S. and Worldwide (2020) , Washington Post Staff (2020), The Washington Post, March 4, 2020. https://www.washingtonpost.com/world/2020/01/22/mapping-spread-new-coronavirus/?arc404=true.

[3] OECD Interim Economic Assessment (2020): Coronavirus: The World Economy at Risk, Organization for Economic Cooperation and Development. March 2, 2020. http://www.oecd.org/economic-outlook/#resources

[4] Samson, Adam and Hudson Lockett (2008), Stocks Fall Again in Worst Week Since 2008 Crisis, Financial Times, February 28. https://www.ft.com/content/4b23a140-59d3-11ea-a528-dd0f971febbc.

[5] Taylor, Adam, Teo Armus, and Rick Noak (2020), Live updates: Coronavirus Turmoil Widens as U.S. Death Toll Mounts; Xi Cancels Japan Trip. The Washington Post, March 5, 2020, https://www.washingtonpost.com/world/2020/03/05/coronavirus-live-updates/

[6] Shih, Gerry (2020), China is Subtly Stoking Coronavirus Conspiracy Theories That Blame the U.S. for Outbreak, The Washington Post, March 5, 2020. https://www.washingtonpost.com/world/2020/03/05/coronavirus-live-updates

[7] International Monetary Fund (2020), IMF Makes Available $50 Billion to Help Address Coronaviris, March 4, 2020.

[8] John Plender (2020), "The Seeds of the Next Debt Crisis," Financial Times, March 4, 2020.

[9] Emre Tiftik, Khadija Mahmood, Jadranka Poljak, and Sonja Gibbs (2020), "Global Debt Monitor: Sustainability Matters," Institute for International Finance, January 13, 2020.This includes debt held by governments, financial institutions, nonfinancial institutions, and households.

[10] McKibbin, W. and R. Fernando (2020) The Global Macroeconomic Impacts of COVID-19: Seven Scenarios. https://www.brookings.edu/research/the-global-macroeconomic-impacts-of-covid-19-seven-scenarios/

[11] OECD (2020), Interim Economic Outlook, March 2020

[12] International Labour Organization (ILO) Note (2020) COVID-19 and the world of work: Impact and policy responses. ilo.org/global/topics/coronavirus

[13] Angelos Delivorias and Nicole Scholz (2020), Economic impact of epidemics and pandemics. EPRS | European Parliamentary Research Service.

[14] CRS In Focus (2020) IF10112, Introduction to Financial Services: The International Foreign Exchange Market.

[15] Pritchett, L. and L. H. Summers, (1996). Wealthier Is Healthier. Journal of Human Resources 31(4), 841-868

[16] Bloom, D. E. and J. D. Sachs, (1998). Geography, Demography, and Economic Growth in Africa. Brookings Papers on Economic Activity 0(2), 207-73

[17] Bhargava, A. and et al., (2001). Modeling the Effects of Health on Economic Growth. Journal of Health Economics 20(3), 423-40.

[18] Cuddington, J. T., (1993a). Further results on the macroeconomic effects of AIDS: the dualistic, labour-surplus economy. World Bank Economic Review 7(3), 403-17.

[19] Cuddington, J. T., (1993b). Modeling the macroeconomic effects of AIDS, with an application to Tanzania. World Bank Economic Review 7(2), 173-89.

[20] Robalino, D. A., C. Jenkins, et al., (2002a). The Risks and Macroeconomic Impact of HIV/AIDS in the Middle East and North Africa: Why Waiting to Intervene Can Be Costly. Policy Research Working Paper Series: 2874, 2002. The World Bank. [URL:http://econ.worldbank.org/files/16774_wps2874.pdf] URL

[21] Haacker, M., Ed. (2004). The Macroeconomics of HIV/AIDS. IMF, Washington DC.

[22] WHO Commission on Macroeconomics and Health, Ed. 2001. Macroeconomics and Health: Investing in Health for Economic Development. World Health Organization.

[23] Schoenbaum, S. C., (1987). Economic impact of influenza. The individual's perspective. American Journal of Medicine 82(6A), 26-30.

[24] Meltzer, M. I., N. J. Cox, et al., (1999). The economic impact of pandemic influenza in the United States: priorities for intervention. Emerging Infectious Diseases 5(5), 659-71

[25] Bloom, E., V. d. Wit, et al., (2005). Potential economic impact of an Avian Flu pandemic on Asia. ERD Policy Brief Series No. 42. Asian Development Bank, Manila. http://www.adb.org/Documents/EDRC/Policy_Briefs/PB042.pdf

[26] The World Bank, (2006). Socioeconomic Impact of HIV/AIDS in Ukraine. The World Bank and The International HIV/AIDS Alliance in Ukraine, Washington D.C. . http://siteresources.worldbank.org/INTUKRAINE/Resources/3283351147812406770/ukr_aids_eng.pdf.

[27] World Bank Group, (2017), 'From panic and neglect to investing in health security: financing pandemic preparedness at a national level'.

[28] Lee J-W and W. McKibbin (2004) "Estimating the Global Economic Costs of SARS" in S. Knobler, A. Mahmoud, S. Lemon, A. Mack, L. Sivitz, and K. Oberholtzer (Editors), Learning from SARS: Preparing for the next Outbreak, The National Academies Press, Washington DC (0-309-09154-3)

[29] Chou, J., N.-F. Kuo, et al., (2004). Potential Impacts of the SARS Outbreak on Taiwan's Economy. Asian Economic Papers 3(1), 84-112.

[30] Hai, W., Z. Zhao, et al., (2004). The Short-Term Impact of SARS on the Chinese Economy. Asian Economic Papers 3(1), 57-61.

[31] Sui, A. and Y. C. R. Wong, (2004). Economic Impact of SARS: The Case of Hong-Kong. Asian Economic Papers 3(1), 62-83.

[32] Rowland, Christopher and Peter Whoriskey, (2020), U.S. Health System is Showing Why it's Not Ready for a Coronavirus Pandemic, The Washington Post, March 4, 2020. https://www.washingtonpost.com/business/economy/the-us-healthsystem-is-showing-why-its-not-ready-for-a-coronavirus-pandemic/2020/03/04/7c307bb4-5d61-11ea-b29b9db42f7803a7_story.html

[33] Fan V. Y., Jamison D. T. & Summers L. H., (2018), Pandemic risk: how large are the expected losses? Bulletin of the World Health Organization.

[34] Kostova D., Cassell C.H., Redd J.T., Williams D.E., Singh T., Martel L.D., Bunnell R.E. (2019), 'Long-distance effects of epidemics: Assessing the link between the 2014 West Africa Ebola outbreak and U.S. exports and employment', Health Economics.

[35] www.ourworldindata.org.