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The Post COVID-19 Global Economy: An Econometric Analysis

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Abstract
In this paper the principal purpose has been made to forecast the post COVID-19 global economy using the econometric techniques based on the cross-sectional data of 178 countries. Also another important purposes has been made to find the impacts of lockdowns, international and domestic travel restrictions, infected people due to COVID-19, unemployment and change of human quality index on economic growth based on cross sectional data of these countries. In this paper an attempt has also been made to predict the growth rate of day wise cumulative confirmed cases and to detect the rate of change of average day wise death with respect to confirmed cases of individual countries using econometric methods. From the estimated results it is found that in the year 2020, the average loss of GDP of 178countries is 83765.17 million $, on an average the economy of these countries will be contracted 16.04% of the total GDP, and on an average the economy of these countries will be downgraded for 7.67 years, all of these are statistically significant at any significance level. It is also found that in the year 2020, the world economy will be contracted 17.07% of the total GDP and downgraded for7 years due to COVID-19. Thus it can be said that the world economy will decline significantly due to COVID-19 and the global recessionary phase will be started. From the estimated results it is found that the variables, total confirmed cases, lockdowns, domestic travel restriction, air travel restriction, unemployment and change of human quality index have negative impacts on economic growth of which the impacts of lockdowns and domestic travel restrictions are statistically significant. It is also found that the average growth rate of day wise cumulative total confirmed cases is 2.865 with maximum value is 5.89 in India and minimum value is 0.26 in Brunei and the average value of the rate of change of the number of deaths with respect to total cases is 1.647 percent with maximum value is 24.48 in Yemen and minimum value is 0.03 in Cyprus, these are also statistically significant at any significance level. From the estimated results it is found that on an average the global stock markets erased about 3.08% in 2020 relative to 2019 including 110 countries and on an average the unemployment rate increases 1.36% in 2020 relative to 2019 of 112 countries. Since global economy is going through a transition period, thus in the meantime, government around the world can implement the following policies to recovery the economy: increase investment to build skilled human capital; increase investment to cope with changing and more digitized world; emphasize should be given on robotics, and liberal trade policies; inject liquidity into the market, thus, increasing the ability of financial institutions to disburse more money and when people will have more money in hand, they will spend more. Finally it can be concluded that since lockdowns and travel restrictions will contract the global economy, thus to save the lives and global economy the protective measurements should be implemented rather than lockdowns and restrictions by the governments of these countries.

Keywords: *COVID-19, Global Economy, Econometric Techniques, GDP Loss, Lockdowns, Travel Restrictions, Growth Rate, Rate of Change of Average Deaths,*
JEL Classification: C12, C13, C23, C32, C33, C51, C52, C53, C54, C55, O11, O50, O57, Q40

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I. Introduction

The incidence of any pandemic traditionally has long lasting and multi-dimensional impacts in the world. Few pandemics from last century-Asian flu, Spanish flow, Swine flu, Ebola virus and Zika virus from

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21st century have resulted in thousands to death and destroyed the global economy as well. In 2019, there was an adverse effect of US-China trade war, the BREXIT and the US presidential election, on global economy. On account of these, the IMF had predicted that the global economic growth will be 3.4 percent. But COVID-19 – the disease caused by severe acute respiratory syndrome coronavirus 2 (SARSCoV-2), a novel strain of coronavirus from the SARS species – changed the all types of predictions unexpectedly. The world has now entered the 12th month of the COVID-19 pandemic situation. We have seen that health care system or medical crisis has caused into a multi-system game changer which will pose significant challenges for all countries of this globe. It has been seen that economies shrink to Great Depression levels relative to 1930s, unfolding unemployment crisis is increasing sharply which is caused due to lockdowns, international travel restrictions, and domestic travel restriction for COVID-19. This deep dive assesses the emerging trends from the COVID-19 pandemic and its impact on the world. The first report of a disease caused by COVID-19 was in Wuhan, China, in December 2019. The World Health Organization (WHO) declared the COVID-19 outbreak a Public Health Emergency of International Concern on January 30, 2020 and a pandemic on 11 March 2020. As of November 24, 2020, more than 59.6million cases of COVID‐ 19 have been reported in over 219 countries, resulting in over 1.41 million deaths. Here, continent wise confirm cases, death and recovered cases are given below in Table-1.

Table-1: Continent wise covid-19 statistics as of 24thNovember, 2020

Continent	Confirmed Cases	Total Death	Total Recovered	Death Rate	Recovery Rate	% of Total Confirmed Cases	% of Total Death
Europe	16143688	368060	6502601	2.28	40.28	26.79	25.95
North America	15133020	396867	9279299	2.62	61.32	25.11	27.99
Asia	16035752	282506	14376909	1.76	89.66	26.61	19.92
Africa	2107101	50442	1782743	2.39	84.61	3.5	3.56
South America	10796690	319255	9713878	2.96	89.97	17.92	22.51
Oceania	44136	1011	32995	2.29	74.76	.07	.07
Total	60260387	1418141	41688425	2.35		100	100

Table-1 shows Europe has the highest number of confirm cases with 26.79% of total cases. Asia is in the second position with 26.61% of total cases followed by North America, South America, Africa and Oceania. North America has the highest number of death with 27.99% of total death followed by Europe, South America, Asia, Africa and Oceania. Death rate is higher in South America with 2.96% of total confirm cases and North America with 2.62% of total confirm cases. Death rate is considerably lower in Europe and Oceania but the lowest death rate is in Asia with only 1.76% of total confirm cases. Mean death rate is 2.35% of total confirm case. Recovery rate in Europe is lower because total recovery data of Spain, UK, Sweden and Netherland is not available. That is why all the recovered case in Europe is not conclusive. Recovery rate is almost similar for Asia and South America with close to 90% of total confirm cases. Recovery rate in Africa is almost 85% of total confirm case. Recovery rate is considerably lower in North America and Oceania with 61.32% and 74.76% of total confirm case. Also from our observations, it is found that the confirmed cases for high incomes countries is approximately three times higher than the cases in low and lower-middle income countries. Total death in G-20 and European countries are six times higher than low and lower-middle countries. Death ratio (3.29%) is also higher in the wealthier nations (G-20 and European countries) than low and lower-middle income country's death ratio (2.00%). This result is quite confusing. Because wealthier nations have developed health care system than the low and lower-middle income countries. So, total confirm cases and death case assumes to be higher in low and lower-middle countries. This study predicts less connection with epicenter of corona virus, testing difference, demographic characteristics of the country can be the reasons of lower reported cases and total death in the low and lower-middle income countries. According to Hisaka et al. (2020) in wealthier nation's tests of prospective cases in each day is higher than poor nations because poor nations are less equipped with testing facilities and other relevant logistics. China, the USA, UK, Spain, Italy are closely associated with epicenter of corona virus in globalized economy where connection of African and Asian countries with the epicenter is quite low. Besides, geographically Africa is remote from the epicenter of corona virus. Density of population is normally high in megacity. Wealthier nations are the home of majority of megacity where population density is extremely high. Thus, it becomes very easy to spread virus in such situation. On the other hand, countries with vast rural area can follow social distancing policy and prevent the transmission of corona virus. Besides, density of population is lower in the rural area than mega city. Poorer countries comprise mostly by rural area where industrialization is also low. The elderly people are more vulnerable to corona virus. According to world bank data, the percentage of people over 60 years of age in Asia, Africa, North America, and Europe are 12%, 5%,21% and 24% respectively. Thus, it may one of the main reasons for which mortality rate in Europe and North America due to COVID are higher than Asia and African countries. At the beginning, governments were

slow to respond but due to COVID-19 outbreak they tried to save lives by implementing travel restrictions, lockdowns, shut-down educational institutions, and facility closures. The COVID-19 pandemic and subsequent response has caused unprecedented, social, economic, political, cultural, education, disruption including the largest global recession since the Great Depression and global famines affecting 265 million people of the world. Postponement and cancellation of sporting, social, political and cultural events which caused the economic loss of the globe. Schools, universities and colleges have also been closed either on a nationwide or local basis in 219 countries, affecting a proximately 98% of the world's student population which caused the loss of future global productivity. The pandemic and the response has caused shocks of seismic and global magnitude. Unprecedented not just due to its severity, depth and broad scale, but also because it is now just the latest crisis converging to a cacophony of issues demanding urgent and immediate attention. The world is now deeply facing economic, political, social, environmental, educational, health care, and leadership crises due to COVID-19 broke out. Due to fear and uncertainty, and to rational assessment that firms' profits are likely to be lower due to COVID-19, on an average global stock markets erased about 3.08% in 2020 relative to 2019 of 110 countries. Due to outbreak of COVID-19, demand for product and services are decreasing which causes in production cut and employee termination. It is found that, on an average the unemployment rate increases 1.36% in 2020 relative to 2019 of 112 countries. Private investment is in decreasing trend and demand for loan is low. Thus, banking sector is facing difficulty. Price of oil is also decreasing and thus oil-based economy is also suffering greatly. Howsoever, tourism, travel, entertainment and aviation industry has suffered greatly because of movement restrictions and lockdowns. The International Air Transportation Association (IATA) stated that the air travel industry would lose US$113 billion due to COVID-19 outbreak. The tourism industry was affected as the travel opportunities for Chinese tourists, who usually spend billions annually, were severely curtailed. There were increased flight cancellations, cancelled hotel bookings and cancelled local and international events worth over $200 billion. The flow of goods through global supply chains vastly reduced significantly given that China was the world's largest manufacturer and exporter, and the Chinese government ordered the closure of major factories in the country. Lockdowns, international and domestic travel restrictions are seemed to be an effective measure to stop spreading the corona virus globally as well as locally. Now countries are facing dilemma whether they should impose lockdown to save lives. Because lockdown and travel restrictions have adverse impact on global economy. Lockdowns and travel restrictions along with the loss of lives may have result in long term economic recession of the globe. In March 2020, IMF stated that it expected a global recession that would be at least as bad as the 2007-8 global financial crisis followed by a recovery in 2021.But the cause of the 2020 global recession was novel in modern history. The COVID-19 outbreak triggered a new type of recession that was different from the past triggers of a recession. Due to COVID-19 outbreak, in IMF projection, the global economy will be downgraded and outbreak it's all earlier projections. Therefore in this paper to know the real scenarios of post COVID-19 global economy, the principal purpose has been made to predict the post COVID-19 global economy using the econometric techniques based on the cross-sectional data of 178 countries, to predict the loss of economy due to COVID-19 of these countries and to testify whether the loss of economy is statistically significant or not. Another purposes has also been made to find the impacts of total confirmed cases, lockdowns, international and domestic travel restrictions for COVID-19, unemployment and change of human quality index on economic growth based on cross sectional data of these countries using econometric methods. Also in this paper another important purpose has been made to predict the growth rate of day wise cumulative confirmed cases and to detect the rate of change of average day wise death cases with respect to confirmed cases of individual countries using econometric methods. The organization of the paper is outlined as follows: Section II presents a literature review; Section III discusses data sources and empirical models including some fundamental descriptive statistics of different variables; Section IV provides methodology and empirical analysis and finally section V concludes with a summary of the main findings and policy implications.

II. Literature Review

Initially China was the epicenter of the disease and mostly reported cases were the Chinese people or traveler from China. Since January 2020 few more epicenters have come into forth-Italy, Spain, UK, Western European countries, the USA has become new epicenters from time to time. India is becoming the new epicenter of corona virus with reported cases reaching close to 90,000 every day since last week of august 2020. The evolution of deadly COVID-19 disease and associated uncertainty how this disease going to affect the economy, employment generation, education, tourism and other macroeconomic indicators has made it difficult for the policy makers to devise appropriate macroeconomic policies. A large number of studies have been conducted regarding pandemic, health issues and economy and a very few empirical studies have been conducted to show how pandemic affect the overall economy see for example: Bloom and Sachs, 1998; Hacker, 2004 have found that public health have impact over economic welfare and economic growth Public health is traditionally measured through infant mortality, maternal mortality, life expectancy, child mortality rate. Public health can

affect economic welfare and economic growth several ways. Costs of illness can be direct or indirect. The medical costs are the direct cost and the loss of the service of the patients in the form of losing working hours are called indirect costs. Previous studies have found that economic costs of illness are traditionally underestimated in the deadly disease case which have no vaccine like SARS, AIDS and Influenza. The experience of earlier deadly disease outbreak will help us to predict the implication of COVID-19.Hacker (2004) found that outbreak AIDS has triggered government to spend more money in the public health service. Because government has to spend in awareness program, purchasing testing materials, providing support to the AIDS affected people. He found that although AIDS has long-term impact but its effect can be minimized through implementing preventive measures. Hyams et al. (2002) found that SARS (previously identified corona virus which was not as deadly as Covid-19) has negative psychological effect. People feel they are at risk during the pandemic even if the chance of dying is very low. Lee and Mckibbin (2003) and Chou et al. (2004) have found SARS epidemic during 2003 had broader macroeconomic effect. Consumption of products and service got reduced. Costs of business operation had increased, employment level decreased, investment decreased throughout the China. The impact of SARS on other economies was based on their susceptibility and the exposure to the SARS virus. Bloom et al. (2005) opined that borderless economies are susceptible to more risk during any global shock. In todays globalized economy no country is safe from the negative impact of COVID-19.Bernie (2020) suggests that due to COVID-19 government will loss the revenue and have to increase their government spending. They predict COVID-19 will reduce consumption and thus government will be unable to collect indirect tax which is charged on consumer goods. This study also finds people of higher income range will suffer more economically than the lower income range individual. Lemieux (2020) predicts the impact of COVID-19 on the labor force in Canadian economy. He finds workers with less bargaining power will hit harder than the worker with more bargaining power. He finds existence of trade union increase bargaining power. He also finds 32% reduction in the total weekly working hours and 15% reduction in the new employment creation. Weems et al. (2020) finds COVID-19 results in unemployment. Long term isolation has psychological effect. Unemployment together with isolation increase the rate of suicide. Peterson Ozili and Thankom Arun (2020) explores what is the impact of social distancing on stock market and economic activities. This study found raising the number lockdown, restrictions on travel and restrictive monetary policy significantly affect the stock price move down and economic activities. This study also finds increase in fiscal spending and internal travelling restrictions has significant positive impact on economic activities. This study finds no association between the numbers of confirm COVID-19 cases and economic activities. Baker et al. (2020) predicts the economic shock of COVID-19 will be greater in magnitude than the recession of 2008-2009 and similar to the great recession of 1929-1933. Gossling et al. (2020) finds corona virus pandemic has negative effect on tourism sector and low paid workers who are engaged in tourism sector suffer enormously. Tourism based economic countries are the worst sufferer as lockdown and external travel ban have imposed.

Achikoz and Gunay (2020) opines that corona virus pandemic has negative effect over trade, employment, financial market, supply chain. They cannot estimate the exact influence of pandemic on the economy as the uncertainty exists about when to end the pandemic. They predict corona pandemic may change the current world politics context permanently. This pandemic will shift the trade, manufacturing, health system, production, employment, security policies permanently. They also predict some countries will get benefitted from this pandemic and will dominate the world in post COVID-19 era. Nuno Fernandes (2020) predicts that countries which depend on service sector more will be affected badly and more jobs are likely to be at risk. He also predicts that uneducated, less skilled and younger employees are more vulnerable to lose their job. Coibion et al. (2020) explorers the initial short-term effect of corona pandemic on the employment level. They have found significant reduction in the employment creation. But interestingly they have found unemployment rate is not increasing proportionately which suggests recently unemployed workers are not looking for a new job. Montenovo et al. (2020) find Hispanic, workers with age range 20-24 years and workers with high school degree are mostly losing their job in the USA. They also find job loss is greater for the job that needs interpersonal interaction as providing service remotely is not possible. Mai Bui et al. (2020) have found recession caused by COVID-19 affect employment outcomes. Previous research on recession did not have any significant association between recession and employment level. But they have found unemployment rate for the workers' aged 65 or above is higher than the unemployment rate for the workers' aged between 20 and 25 in the USA in April, 2020. They also find unemployment rate of women is greater than the unemployment rate of men at any age level. Chodorow and Coglianese (2020) have used simulation approach to predict whether short term unemployment will persist in the future. They predict rise in the unemployment rate in the long run but they estimate unemployment rate will be lower than the great recession of 1929-1933. Most of the existing studies on COVID-19 qualitatively explains the possible future outcome of this pandemic.

According to the knowledge of the authors, still now no one is conducted econometric analysis to predict the post COVID-19 global economy, the loss of global economy due to COVID-19, to detect the impacts of lockdowns, travel restrictions, unemployment and change of human quality index on economic growth, to detect the growth rate of total confirmed cases of individuals countries and the rate of change average day wise

death with respect to total cases of individual countries using econometric techniques. Thus this study shall fill the gap in the literature by exploring the impact of COVID-19 empirically on economic growth globally using the econometric techniques. This study also predicts how COVID-19 will change the shape of future economies of 178 countries as well as globally using econometric techniques based on the cross sectional data. This study also estimates rate of change of day wise cumulative total confirmed cases and also the rate of change of average day wise death with respect to total cases using the econometric method based on day wise data of 160 countries. This study will add value to existing very limited literature on COVID-19 pandemic research by answering the research question empirically. This research will help policy makers to develop appropriate policies in the post COVID-19 era as study predicts political power shift is very likely.

III. Data Collection and Some Fundamental Descriptive Statistics

Annual time series data for GDP (constant 2010 $) are used to predict the GDP in the 2020 and 2021 for 178 individual countries. Day wise time series data for total cases and total deaths from 1st of January, 2020 to 24th of November, 2020 are collected for 160 countries in order to find the growth rate of total confirmed cases and also to find the rate of change of average death with respect to total cases of individual countries. The cross-sectional data for 112 countries are used in order to find the impacts of lockdowns of covid-19 related restrictions (social distancing policy, lockdown, restriction of movement etc.), total infected cases, unemployment and change of human quality index on economic growth. Due to different limitations of data, there is no consistency of the number of countries in different econometric analyses. This study collects data of different variables from different sources. The data of total cases, total deaths, total recovered cases, total population, day wise total cases and day wise total deaths of all individual countries are collected from worldometers.info. Data of lockdown is collected from each country's different government website, newspaper and https://en.wikipedia.org/wiki/COVID-19pandemiclockdowns. Data on average international travel restriction (AITR) and average domestic travel restriction (ADTR) are collected from ox CGRT database (Oxford COVID-19 Government Response Tracker database). This is a vastly used database in COVID-19 research arena. It provides data for international movement restriction (IR) and internal travel restriction (RIM). By averaging the RIM score for 1st of January to 24th of November 2020 this study calculates the ADTR and by averaging IR for the same period it gets AITR. Unemployment rate and GDP data are collected for 2020 from the World Bank development indicator. Human Capital Index (HCI) is vastly used to capture the efficiency of any country's education and health care system. It measures how much capitalized country forgoes due to lack of proper health and education system. Due to COVID-19 almost everywhere in the world educational institutions are closed for a while. Although online based class is going on but this cannot be the substitute of physical education system. On the other hand, countries around the world are facing difficulties in providing medical facilities due to shortage of medical supplies, skilled personnel. Thus, to capture the effect of education and health care system on economic growth through the difference of HCI between 2020 and 2019, the data of HCI are collected from the World Bank development indicator. This study collects stock markets data from each country's leading stock market index for the year 2019 and the latest available index score in 2020.This study takes closing price of each index in consideration. Difference of index price (SMI) between the 2020 and 2019 is used as a proxy variable of stock performance.

3.1. Empirical Models

The growth rates of day wise cumulative total confirmed cases (GRTC), of the individual countries are obtained using the following growth model:

$$TC_{it} = TC_0(1+r_i)^t e^{\varepsilon_{it}}, \qquad t = 1, 2, ..., T_i, \; i = 1, 2, ..., 160 \tag{1}$$

where, TC_{it} is the day wise cumulative total confirmed cases of the ith country at time t, r_i is the growth rate of confirmed cases of the ith country, ε_{it} is the random error term . The estimated value of r_i is given by:

$$\hat{r}_i = Exp(\hat{\beta}_i) - 1, \text{ where } \beta_i = \ln(1+r_i) \tag{2}$$

The rate of changes of average day wise death due to COVID-19 with respect to confirmed cases (RDTC) are obtained for individual countries by considering the simple linear regression equation of the type:

$$TD_{it} = \beta_0 + \beta_i TC_{it} + \varepsilon_{it}, \qquad t = 1, 2, ..., T_i, \; i = 1, 2, ..., 160 \tag{3}$$

where TD_{it} is the number of deaths of the ith country at time t and TC_{it} is the total confirmed cases of the ith country at time t, ε_{it} is the random error term .

The GRTC and RDTC are estimated using the software RATS based on the day wise time series data for all individual countries which are reported below in Table-2. The death ratio to the total cases (DRTC), recovered ratio to total cases (RRTC) and death ratio to total recovered cases (DRTR) for all the countries are also estimated which are also reported in Table-2.

Table 2: The estimates of GRTC, RDTC, DRTC, RRTC and DRTR

COUNTRY	GRTC (in %)	RDTC (in %)	DRTC (in %)	RRTC (in %)	DRTR (in %)
Afghanistan	3.48	2.67	3.7809	79.7747	4.7395
Albania	2.43	1.98	2.1337	48.3669	4.4116
Algeria	3.01	1.06	3.0237	65.1416	4.6418
Andorra	1.69	0.64	1.2056	85.7392	1.4061
Angola	3.57	2.71	2.3029	50.2323	4.5844
Argentina	4.20	2.98	2.7005	87.5726	3.0837
Aruba	2.62	0.60	0.9500	97.2556	0.9768
Australia	2.69	0.40	3.2571	91.6939	3.5521
Austria	1.82	0.40	1.0117	71.6972	1.4111
Azerbaijan	3.19	1.25	1.2175	67.6683	1.7991
Bahrain	2.90	0.38	0.3947	97.8239	0.4035
Bangladesh	4.20	1.31	1.4266	81.1693	1.7575
Barbados	0.90	0.81	2.6923	92.6923	2.9046
Belarus	3.22	0.08	0.8759	83.3655	1.0507
Belgium	3.36	0.34	2.8139	6.4376	43.7105
Belize	3.36	1.35	2.2861	54.8104	4.1710
Benin	2.72	1.22	1.4746	88.4431	1.6673
Bermuda	0.80	0.67	3.9648	88.1057	4.5000
Bhutan	2.47	NA	0	94.0415	0
Bolivia	3.82	3.69	6.1902	82.9998	7.4581
Bosnia	2.80	2.22	2.9288	58.1424	5.0373
Botswana	3.54	0.29	0.3102	76.9816	0.4030
Brazil	4.62	2.42	2.7848	89.4397	3.1136
Brunei	0.26	0.32	2.0000	96.6667	2.0690
Bulgaria	2.51	1.39	2.4559	30.5891	8.0286
Burkina Faso	1.38	2.25	2.4691	92.6652	2.6646
Burundi	2.44	0.00	0.1506	86.5964	0.1739
Cabo Verde	3.19	0.74	1.0095	95.0398	1.0622
Cambodia	1.90	0.00	0.00	96.7320	0
Cameroon	2.76	1.50	1.8245	93.0165	1.9615
Canada	3.61	0.72	3.4131	79.7497	4.2797
Chad	2.20	6.49	6.1286	89.5631	6.8428
Chile	3.36	1.15	2.7867	95.4700	2.9189
China	1.21	2.09	5.3595	94.2681	5.6853
Colombia	4.14	2.92	2.8271	92.3439	3.0614
Congo	2.78	0.86	1.6513	88.5653	1.8645
Costa Rica	3.45	1.20	1.2404	61.4808	2.0176
Croatia	2.45	0.58	1.3378	80.9228	1.6532
Cuba	2.30	1.43	1.6753	93.3621	1.7945
Cyprus	1.21	0.03	0.4918	22.9686	2.1411
Czech	2.36	0.63	1.4820	81.7461	1.8129
Denmark	1.85	0.30	1.0915	78.1624	1.3964
Djibouti	2.08	0.94	1.0762	98.2534	1.0953
Dominica. Rep.	3.32	1.46	1.6646	81.3101	2.0473
Ecuador	2.80	4.79	7.1124	88.2034	8.0636
Egypt	3.82	5.99	5.7858	89.9454	6.4326
El Salvador	3.73	2.61	2.8666	91.3182	3.1392
Eritrea	1.81	NA	0	84.7670	0
Estonia	1.48	1.10	0.9253	59.1987	1.5630
Ethiopia	4.42	1.53	1.5546	61.9935	2.5076
Finland	2.89	0.93	1.7228	68.6437	2.5098
France	3.58	0.52	2.2956	7.1150	32.2638
Gabon	3.13	0.42	0.6448	98.3497	0.6556
Gambia	3.92	2.76	3.3011	96.1353	3.4338
Georgia	2.47	0.68	0.9399	82.4688	1.1397
Germany	3.13	0.42	1.5427	67.0429	2.3011
Ghana	3.02	0.55	0.6341	97.3656	0.6512
Gibraltar	0.93	0.00	0.5097	90.2141	0.5650
Greece	2.04	1.31	1.8429	10.7402	17.1589
Guatemala	3.95	3.36	3.4467	90.8164	3.7952
Guinea	2.73	0.58	0.5831	92.3346	0.6315
Guyana	2.73	2.14	2.8328	78.2693	3.6192
Haiti	3.15	2.06	2.5152	85.4944	2.9419
Honduras	3.54	2.51	2.7269	44.3072	6.1545
Hong Kong	1.93	0.35	1.8679	91.2141	2.0478

Hungary	2.34	1.57	2.2036	24.2026	9.1050
Iceland	1.09	0.20	0.4908	95.9985	0.5112
India	5.89	1.15	1.4628	93.7418	1.5604
Indonesia	3.40	2.68	3.1821	84.0038	3.7880
Iran	2.13	5.24	5.1943	70.1517	7.4044
Iraq	4.06	1.84	2.2290	87.0375	2.5610
Ireland	1.94	0.85	2.8609	33.0415	8.6586
Israel	3.24	0.78	0.8527	96.4532	0.8840
Italy	2.86	0.67	3.5238	40.8224	8.6319
Jamaica	2.43	1.39	2.3107	53.3501	4.3313
Japan	3.19	0.35	1.4967	84.8222	1.7645
Jordan	2.77	1.21	1.2218	63.6983	1.9181
Kazakhstan	3.24	0.19	1.5332	89.5838	1.7115
Kenya	3.59	1.75	1.7895	66.7262	2.6819
Kuwait	3.20	0.50	0.6179	94.7527	0.6521
Kyrgyzstan	3.29	6.01	1.7636	87.5323	2.0148
Latvia	1.50	0.66	1.2780	12.0573	10.5996
Lebanon	3.15	0.75	0.7752	58.7821	1.3188
Lesotho	4.96	1.79	2.1093	61.1697	3.4483
Liberia	2.31	4.91	5.2869	85.8156	6.1608
Libya	4.48	1.41	1.4019	63.5312	2.2066
Lithuania	2.09	0.73	0.8281	23.4750	3.5274
Luxembourg	1.74	0.08	0.8775	70.7274	1.2407
Madagascar	3.27	1.38	1.4474	96.0556	1.5069
Malawi	3.41	2.96	3.0787	90.5808	3.3989
Malaysia	2.35	0.69	0.5795	75.0302	0.7723
Mali	1.78	3.27	3.3749	70.3652	4.7963
Mauritania	4.22	1.91	2.0693	93.1676	2.2211
Mauritius	0.43	0.14	2.0243	87.6518	2.3095
Mexico	5.10	9.01	9.7132	74.7784	12.9893
Moldova	2.83	1.45	2.2039	82.1821	2.6817
Mongolia	1.76	0.00	00	50.8929	0
Morocco	3.42	1.56	1.6475	84.0105	1.9611
Mozambique	3.43	0.72	0.8339	87.5571	0.9525
Myanmar	3.32	2.23	2.1924	74.3904	2.9472
Namibia	4.37	0.91	1.0434	95.2292	1.0957
Nepal	5.39	0.47	0.6074	91.4226	0.6644
Netherlands	2.02	0.33	1.8299	NA	0
New Zealand	1.39	0.04	1.2309	96.1595	1.2801
Nicaragua	3.79	2.66	2.7773	73.7991	3.7633
Niger	1.10	5.34	5.0688	84.4316	6.0034
Nigeria	3.89	1.78	1.7580	93.6814	1.8766
Norway	1.29	0.05	0.9463	63.1528	1.4984
Oman	3.74	1.27	1.1348	92.8838	1.2217
Pakistan	3.53	1.90	2.0385	87.3322	2.3342
Palestine	3.49	0.82	0.8746	80.0045	1.0932
Panama	2.72	1.66	1.9100	88.0160	2.1700
Papua New	3.25	0.21	1.1111	93.3333	1.1905
Paraguay	3.61	2.26	2.1603	71.4215	3.0247
Peru	3.50	3.90	3.7495	92.6452	4.0471
Philippines	4.46	1.86	1.9409	91.7173	2.1161
Poland	2.60	1.19	1.5746	50.0202	3.1479
Portugal	2.01	0.69	1.4996	66.7771	2.2457
Qatar	2.84	0.16	0.1715	97.8611	0.1752
Romania	3.03	1.82	2.4089	70.6420	3.4101
Russia	5.06	1.76	1.7314	76.4284	2.2653
Rwanda	2.40	0.53	0.8208	90.7614	0.9044
San Marino	0.95	0.66	3.0812	80.4622	3.8294
Saudi Arabia	3.28	0.46	1.6335	96.7870	1.6877
Senegal	2.76	1.96	2.0807	97.6050	2.1318
Serbia	2.18	1.20	0.9803	24.9915	3.9225
Sierra Leone	2.23	2.75	3.0756	75.9767	4.0481
Singapore	2.96	0.04	0.0481	99.8075	0.0482
Slovakia	2.12	0.33	0.7272	52.0427	1.3974
Slovenia	1.55	0.33	1.7233	67.9592	2.5358
Somalia	2.62	2.05	2.5422	76.7604	3.3118
South Africa	4.07	2.36	2.7240	92.3919	2.9483
South Korea	2.00	0.70	1.6266	85.2295	1.9085
South Sudan	2.79	1.18	1.9582	95.0392	2.0604
Spain	3.62	0.85	2.6841	NA	0
Sri Lanka	3.19	0.08	0.4328	71.9500	0.6015
Sudan	3.46	6.04	7.3154	59.9720	12.1981
Suriname	4.00	1.69	2.1899	97.6591	2.2424
Sweden	3.52	0.77	2.8817	NA	0

Switzerland	1.64	0.18	1.4042	69.4369	2.0222
Syria	3.58	4.31	5.2090	43.2488	12.0444
Tajikistan	1.46	0.56	0.7184	94.8542	0.7574
Tanzania	1.21	3.72	4.1257	35.9528	11.4754
Thailand	2.03	1.16	1.5298	96.1754	1.5907
Togo	2.46	0.53	2.2425	79.6776	2.8144
Trinidad &T.	2.41	0.93	1.7761	86.8263	2.0455
Tunisia	2.67	2.17	3.2087	71.5794	4.4827
Turkey	1.97	2.76	2.7586	83.3212	3.3107
UAE	3.68	0.27	0.3464	93.1187	0.3720
Uganda	2.92	0.89	0.9964	47.7567	2.0865
UK	3.52	0.67	3.6157	NA	0
Ukraine	3.70	1.88	1.7382	46.1989	3.7624
Uruguay	1.11	0.41	1.4907	79.0258	1.8863
USA	4.85	1.60	2.0640	59.0989	3.4925
Uzbekistan	2.91	0.84	0.8398	96.1040	0.8739
Venezuela	3.65	0.85	0.8718	94.8494	0.9191
Vietnam	1.75	3.02	2.6596	87.6140	3.0356
Yemen	3.23	24.48	28.9037	69.2454	41.7409
Zambia	3.40	2.00	2.0440	95.6544	2.1368
Zimbabwe	3.85	2.11	2.9330	89.0417	3.2939
World	3.72	2.18	2.35	69.1798	3.4033

Note: All the predictions are based on the information of COVID-19 up to November 24, 2020.

From the estimated results it is found that the growth rate of the total confirmed cases is highest for India which is equal to 5.89% and lowest for Brunei which is equal to 0.26% among 160 countries. The difference between highest and lowest growth rate is 5.63% which is quite high. It is also found that the average growth rate of day wise cumulative total infected people is 2.86 percent and the growth rate for the whole world is 3.72%. It is also found that the growth rates of total cases are smaller for Barbados, Bermuda, Iceland, Gibraltar, Mauritius, San Marino, and Uruguay. Therefore, the countries for which coronavirus is spreading rapidly can implement the experiences and policies of Barbados, Bermuda, Brunei, Iceland, Gibraltar, Mauritius, San Marino, and Uruguay to protect the people from human transmission of COVID-19 including other viruses. The growth rates of all 160 countries are graphed below in Figure-1. Thus from this Figure-1 we will get the clear idea about the growth rate pattern of different countries.

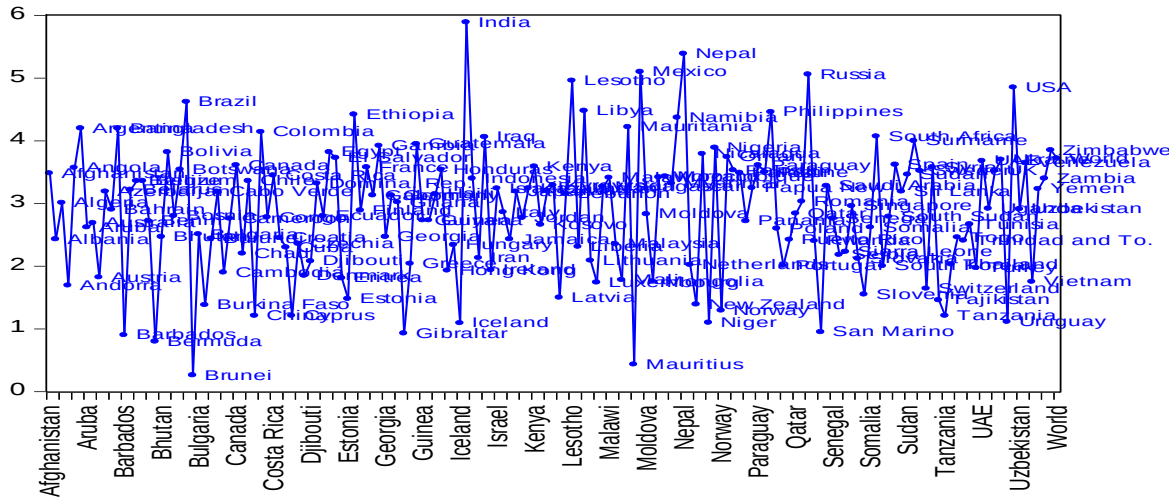

Figure 1: The growth rate of day wise cumulative total infected people

From the estimated values in Table-2, it is found that the in Yemen for increasing 100% additional infected people due to COVID-19, the average number of death will be 24.48 which is extremely high. Due to civil war, different crises are going on in Yemen thus it would be better not to compare the situation of Yemen with other normal economies. If we skip the country Yemen due to civil war, then it can be said that the average number of death for additional increasing in 100% infected people is highest for Mexico which is equal to 9.01 and second highest is for Chad which is equal to 6.49 and third highest is for Sudan which is equal to 6.04.It is also found that for additional increasing in 100% COVID-19 patients, the average number of death are also higher in Kyrgyzstan, Egypt, Iran, Ecuador, Niger, Syria, Peru, and Liberia. It is also found that the average death rate is lowest for New Zealand and Singapore which is equal to 0.04. The second lowest value is found for Norway which is equal to 0.05 and the third lowest value is found for Luxembourg and Sri-Lanka which is

equal to 0.08. The difference between the highest value and the lowest value is 8.97 which is quite large. Thus we can implement the experiences of those countries say Singapore, New Zealand, Norway, Luxembourg and Sri-Lanka including other countries in which the average number of death for additional increases in 100% COVID-19 patients are smaller to protect the lives. You will get the clear idea about the rate of changes of average day wise death with respect to infected people from the following graph.

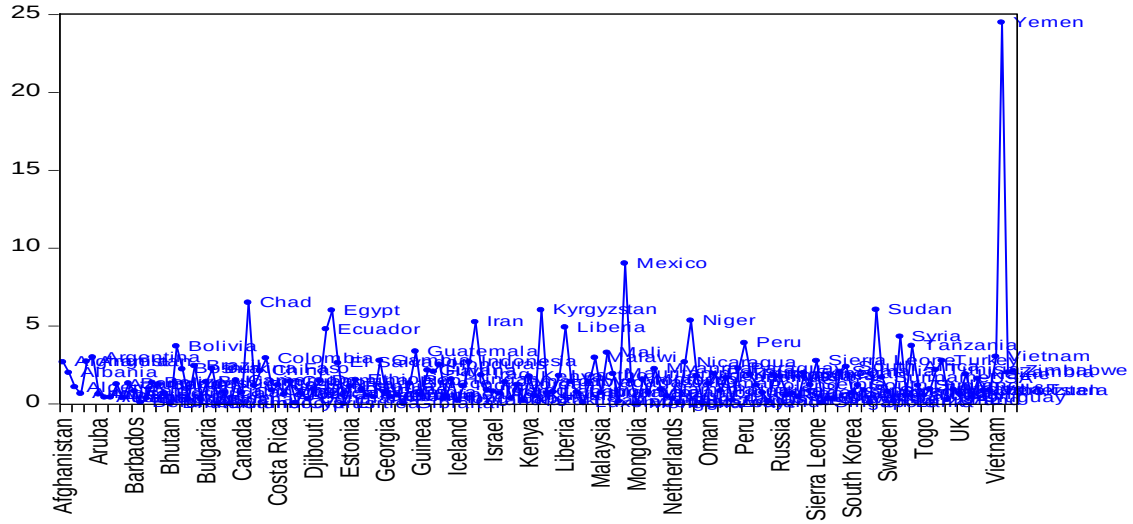

Figure 2: The rate of change of day wise average death with respect to total cases

From the estimated results in Table-2, it is found that the death ratio to total cases is highest for Yemen which is equal to 28.90%, second highest is for Mexico which is equal to 9.71% and third highest for is for Ecuador which is equal to 7.11. It is also found that the death ratios to conformed cases are larger for Sudan, Bolivia, Egypt, Chad, China, Iran, Liberia, Niger, Syria, and death ratios are zero Bhutan, Cambodia, Eritrea, and Mongolia, also it is found that the death ratios are smaller for Botswana, Burundi, Cyprus, Iceland, Gabon, Ghana, Gibraltar, Guinea, Kuwait, Malaysia, Nepal, Qatar, Singapore, Sri Lanka and UAE. The death ratios are graphed below in order get the clear scenario of the world.

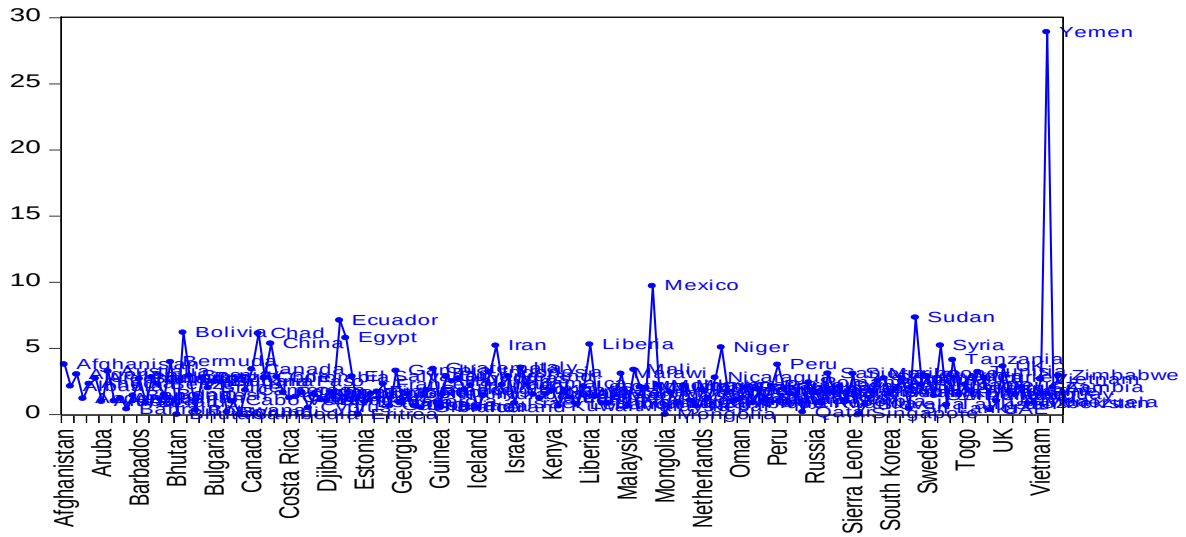

Figure 3: The death ratio to total cases

From Table-2, it is found that the recovered ratio to total cases is highest for Singapore which is equal to 99.81% and second highest for Gabon which is equal to 98.35% and third highest for Djibouti which is equal to 98.25. It is also found that the recovered ratio to total cases is above 90% for the countries-Qatar, Bahrain, Suriname, Senegal, Ghana, Aruba, Saudi Arabia, Cambodia, Brunei Israel, Thailand, New Zealand, Gambia Uzbekistan, Madagascar, Iceland, Zambia, Chile, Namibia, Cabo Verde, South Sudan, Tajikistan, Venezuela, Kuwait, China, Bhutan, India, Nigeria, Cuba, Papua New Mauritania, UAE, Cameroon, Oman, Barbados, Burkina Faso, Peru, South Africa, Colombia, Guinea Philippines, Australia, Nepal, El Salvador, Hong Kong,

Guatemala, Rwanda Malawi, Gibraltar. Thus it is found that the recovered ratio is above 90% for 33.33% countries, it lies between 80-90 % for 25% countries, between 70-80%, for 14.10 % countries and 60%-70% for 9.62% countries, for 7.05% countries it lies between 50-60% . It is also found that recovered ratio to total cases lies below 50% for 10.89% countries. It is found that the recovered ratio is lowest for Belgium which is equal to 6.44%, second lowest is for France which is equal to 7.11% and third lowest is for Greece which is equal to 10.74%. The recovered ratios for different countries are also graphed below to get the clear idea.

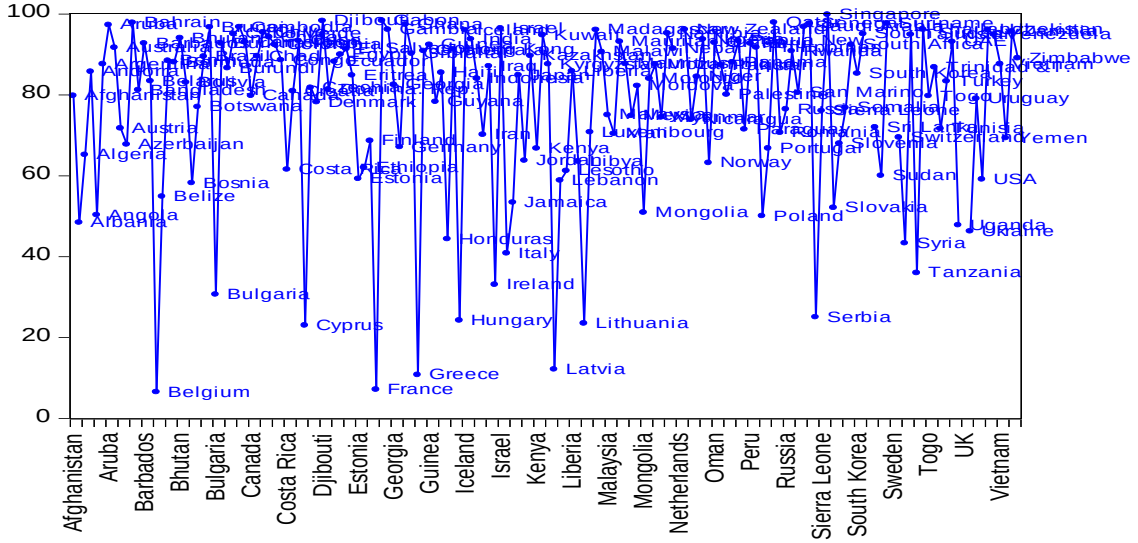

Figure 4: The recovered ratio to total cases

Also from Table-2, it is found that the death to recovered ratio is highest for Belgium which is equal to 43.71%, second highest for Yemen which is equal to 41.74, and third highest for France which is equal to 32.26%. It is also higher for Greece, Mexico, Sudan, Syria, Tanzania and Latvia and zero for Bhutan, Cambodia, Eritrea and Mongolia. It is lowest for Singapore which is 0.05% and second lowest is for Burundi which is equal to 0.17% and third lowest is for Qatar which is equal to 0.18%. The graph of death ratio to recovered cases for different countries is given below:

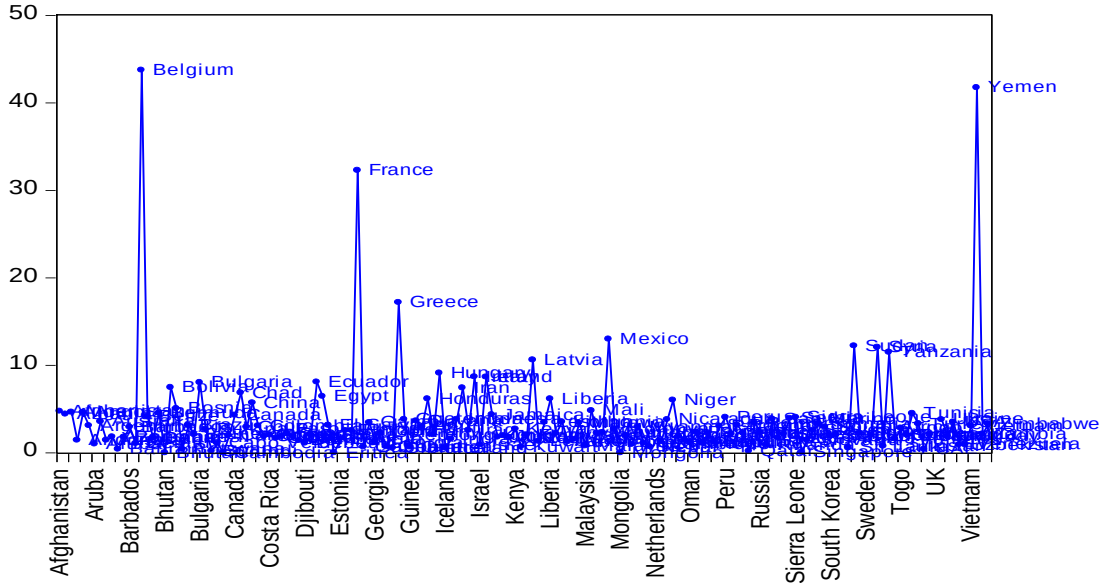

Figure 5: The death ratio to recovered cases

3.2: Descriptive Statistics

Some fundamental descriptive statistics say mean, median, standard deviation (Std. Dev), coefficient of variation (CV), skewness, kurtosis, t-test value, interval estimation, maximum (max.) and minimum (min. values of the variables total confirmed cases (TC), total deaths (TD), total recovered cases (TR), the death ratio to total confirmed cases (DRTC), the recovered ratio to total confirmed cases (RRTC), death ratio to recovered cases (DRR), the growth rate of day wise cumulative total confirmed cases (GRTC) and the average rate of

change of the death with respect to total cases (RDTC) are given below in Table-3 in order to detect the behaviors of these variables individually.

Table 3: Some Fundamental Descriptive Statistics

	TC	TD	TR	DRTC	RRTC	DRR	GRTC	RDTC
Mean	370789.9	8971.19	259889.4	2.247	76.886	3.820	2.865	1.647
Median	66759.50	833.50	35319.50	1.7828	84.221	2.255	2.905	1.155
Std. Dev	1354599	29472.86	1020300	2.597	21.095	5.767	1.023	2.332
CV	365.3279	328.5279	392.5901	115.58	27.437	150.97	35.706	141.59
Skew.	7.0961	6.0169	6.775	7.102	-1.455	5.767	-0.006	6.345
Kurt.	57.9643	44.911	50.379	71.052	4.701	32.025	3.00	59.293
t-Value	3.462	3.802	3.181	10.945	45.52	8.17	35.43	8.931
Interval Estimation	[160892.61, 580687.19]	[4346.144, 13596.24]	[99778.22, 420000.6]	[1.846 2.649]	[73.57, 80.196]	[2.90, 4.737]	[2.70, 3.024]	[1.286, 2.008]
Max.	12780938	263799	8604955	28.903	99.808	43.710	5.89	24.48
Min.	150	0	145	0.00	6.428	0.00	0.26	0.03

Note: All the predictions are based on the information of COVID-19 up to November 24, 2020.

From the estimated results in Table-3, it is found that the average value of total cases (TC) of 160 countries is 370789.9 with maximum number of confirmed cases is 12780938 in USA and minimum number is 150 in Brunei. The difference between maximum and minimum number is quite high, the mean is significantly different from zero. It is also found that the 95% confidence interval for population mean of confirmed cases is [160892.61, 580687.19]. The mean value of total deaths (TD) due to COVID-19 of 160 countries is 8971.19 with maximum number of deaths is 263799 in USA and minimum number is 0 in Mongolia, Eritrea, Cambodia and Bhutan. The difference between maximum and minimum values is very high. The mean is significantly different from zero and the 95% confidence interval estimation for the population mean of the number of deaths is [4346.144, 13596.24]. The mean value of total recovered cases (TR) is 259889.4 with maximum number of recovered cases is 860495 in India and minimum number is 145 in Brunei. The population mean is significantly different from zero and the 95% confidence interval estimation is [[99778.22, 420000.6]. The mean value of the variable the ratio of death to total cases in percentage (DRTC) is 2.247 with maximum death ratio is 28.903 in Yemen and minimum is 0 in Mongolia, Eritrea, Cambodia and Bhutan respectively. The mean is statistically significant at any significance level with 95% confidence interval estimation is [1.846, 2.649]. The mean value of the variable recovered ratio to total cases in % (RRTC) is 76.886 with maximum value is 99.808 in Singapore and minimum value is 6.4378% in Belgium. The mean is statistically significant at any significance level with 95% confidence interval estimation is [73.57, 80.196]. The mean of the variable death ratio to recovered cases in % (DRR) is 3.82 with maximum value is 43.71 in Belgium and minimum is 0 in Mongolia, Eritrea, Cambodia and Bhutan. The mean is statistically significant at any significance level with 95% confidence interval estimation is [2.90, 4.737].

The average value of the variable growth rate of day wise cumulative total confirmed cases is 2.865 with maximum value is 5.89 in India and minimum value is 0.26 in Brunei. The mean is statistically significant at any significance level with 95% confidence interval estimation is [2.70, 3.024]. The average value of the rate of changes of the number of death with respect to total cases is 1.647 with maximum value is 24.48 in Yemen and minimum value is 0.03 in Cyprus. The population mean is significantly different from 0 with 95% confidence interval estimation is [1.286, 2.008]. The frequency distributions for the variables total cases (TR), total deaths (TD), total recovered cases (TR), death ratio to total cases (DRTC), death to recovered ratio (DRR) and average rate of change of death with respect to total cases (RDTC) are positively skewed but for the variables recovered ratio to total cases (RRTC) and growth rate of day wise cumulative total cases (GRTC) are negatively skewed and leptokurtic for all the variables except GRTC. The coefficient of variation (CV) is highest for the variable TR and followed by TC, TD, DRR, RDTC, DRTC, GRTC and RRTC.

3.3. Correlation Matrix

In order to detect the association between different pairs of variables the correlation coefficients are estimated and are presented below in Table-4

Table 4: Correlation matrix

Variable	TC	TD	TR	TT	POP
TC	1.0000	0.9474	0.9669	0.7721	0.4997
TD	0.9474	1.0000	0.9007	0.6845	0.4099
TR	0.9669	0.9007	1.0000	0.7331	0.5753
TT	0.7721	0.6845	0.7331	1.0000	0.8007

POP	0.4997	0.4099	0.5753	0.8007	1.0000

From the estimated values it is found that total cases are highly associated with total deaths, total recovered cases and total tests. The total deaths is also highly associated with total recovered cases and total tests, total recovered is highly associated with total tests. The association between total tests and total population is very strong.

IV. Methodology

In order to detect the loss of GDP due to lockdowns for COVID-19 of all individual countries at first we predicted the GDP of the year 2020 using the Holt-Winters' seasonal additive method. The component form of the Holt-Winters' additive method to forecast the GDP is given by:

$$\hat{GDP}_{t+h|t} = L_t + hT_t + S_{t+h-m(k+1)} \quad (4)$$

$$L_t = \alpha(GDP_t - S_{t-m}) + (1-\alpha)(L_{t-1} + T_{t-1}) \quad (5)$$

$$T_t = \beta(L_t - L_{t-1}) + (1-\beta)T_{t-1} \quad (6)$$

$$S_t = \gamma(GDP_t - L_{t-1} - T_{t-1}) + (1-\gamma)S_{t-m} \quad (7)$$

The predicted value of GDP at time t is given by:

$$\hat{GDP}_t = L_{t-1} + T_{t-1} + S_{t-m} \quad (8)$$

where k is the integer part of $(h-1)/m$, which ensures that the estimates of the seasonal indices used to forecast come from the final year of the sample, m is the frequency of the seasonality, i.e., the number of seasons in a year. The level equation (5) shows a weighted average between the seasonally adjusted observation $(GDP_t - S_{t-m})$ and the non-seasonal forecast $(L_{t-1} + T_{t-1})$ for time t. The trend equation (6) is identical to Holt's linear method which indicates a weighted average between the adjusted level observations and trend rate at time (t-1). The seasonal equation (7) shows a weighted average between the current seasonal index, $(GDP_t - L_{t-1} - T_{t-1})$ and the seasonal index of the same season last year.

The equation for the seasonal component is often expressed as

$$S_t = \gamma^*(GDP_t - L_t) + (1-\gamma^*)S_{t-m} \quad (9)$$

If we substitute L_t from the smoothing equation for the level of the component form above, we get

$$S_t = \gamma^*(1-\alpha)(GDP_t - L_{t-1} - T_{t-1}) + (1-\gamma^*(1-\alpha))S_{t-m} \quad (10)$$

which is identical to the smoothing equation for the seasonal component we specify here, with $\gamma = \gamma^*(1-\alpha)$. The usual parameter restriction is $0 < \gamma^* < 1$, which implies that $0 < \gamma < (1-\alpha)$.

Then the loss of GDP which is happened due to lockdowns for COVID-19 of the ith country is obtained by using the following technique

$$PGDPL_i = \frac{PGDP20_i}{365} \times Lockdown_i ; \; i = 1, 2, ..., 178 \quad (11)$$

where $PGDPL_i$ indicates the predicted value of GDP loss due to lockdowns for COVID-19 of the ith country in the year 2020, $PGDP20_i$ is the predicted GDP of the ith country in the year 2020 and $Lockdown_i$ is the no of days of lockdown for COVID-19 of the ith country in the year 2020. The software RATS is used to forecast the GDP for the years 2020 and 2021 using the Holt-Winters' additive method for all the individual countries and hence the number of years that the economy will be downgraded for each and every country due to COVID-19 are also forecasted which are given below in Table-5.

Table 5: GDP loss, predicted GDP in million $ for 2020 and 2021 and no. of years that economy will be downgraded.

COUN	No. of Lockdown	Predicted GDP Loss in 2020	Predicted GDP Loss in 2020	Predicted GDP in 2020	Predicted GDP in 2021	No. of

	Days		(in %)			Years
Afghanistan	42	2675.4131	11.51	20575.2005	21866.6246	4
Albania	80	3309.5838	21.92	11790.3923	9373.8208	11
Algeria	52	29398.8058	14.25	176958.1964	169253.2045	7
American Sa.	20	27.9721	5.48	482.5186	472.5649	0
Angola	15	4047.0175	4.11	94430.4087	91414.4274	9
Antigua	125	528.8022	34.25	1015.3003	800.2262	18
Argentina	101	122853.5675	27.67	321122.1963	297327.7541	16
Armenia	41	1670.4924	11.23	13200.9645	13187.4849	2
Aruba	190	1793.9687	52.05	2812.9580	2579.9266	4
Australia	82	334842.5642	22.47	1155615.1911	926568.1379	10
Austria	28	35263.8148	7.67	424425.1992	422306.6942	4
Azerbaijan	152	25138.6571	41.64	35227.1971	19072.5759	15
Bahamas	14	420.3989	3.84	10540.0022	10672.1608	2
Bahrain	20	1929.2688	5.48	33279.8872	33091.7930	3
Bangladesh	66	40984.3387	18.08	185671.4738	159155.8638	3
Barbados	36	459.7020	9.86	4201.1659	4037.2076	18
Belarus	28	4910.3792	7.67	59099.9217	56707.7340	10
Belgium	18	27504.9635	4.93	530234.5736	541519.0864	3
Belize	179	805.4008	49.04	836.8970	589.4058	22
Benin	14	599.5467	3.84	15031.4921	15530.9171	0
Bermuda	28	457.4203	7.67	5672.1542	5593.2012	3
Bhutan	31	221.9274	8.49	2391.0887	2470.7620	2
Bolivia	131	10978.4461	35.89	19610.3541	11239.2326	10
Bosnia& H.	14	792.0034	3.84	19856.6566	16206.1417	3
Botswana	28	1491.0174	7.67	17945.4593	19489.3845	3
Brazil	21	138990.6498	5.7534	2276799.2153	2317046.5913	4
Bulgaria	94	16504.0470	25.75	47580.8165	45081.0803	14
Burkina	20	968.1127	5.48	16699.9444	17331.9236	2
Burundi	14	94.0320	3.84	2357.5169	2382.8421	2
Cabo Verde	20	123.3255	5.48	2127.3647	2145.8817	2
Cambodia	66	4048.6727	18.08	18341.7143	17687.5296	3
Cameroon	42	4722.3035	11.51	36316.7628	34956.4310	4
Canada	50	272030.7661	13.7	1713793.8264	1618735.2509	8
Cayman	14	174.4228	3.8356	4564.6000	4789.0000	4
Chad	15	555.3030	4.1096	12957.0696	13305.2567	1
Chile	180	144452.9361	49.32	170710.0000	249430.0000	19
China	75	2513503.007	20.55	10376000.000	13708294.019	4
Colombia	97	108618.2144	26.58	300099.8089	238792.8907	10
Congo D.R.	20	2110.2338	5.48	36401.5328	36934.7045	2
Congo, Rep.	48	1883.3930	13.15	12438.2414	11518.4743	9
Costa Rica	172	24767.6032	47.12	33113.0000	30347.4539	17
Cote d.I.	107	14003.1236	29.32	33764.5411	29628.7507	6
Croatia	32	6008.9255	8.7671	62530.3806	59754.5430	4

Cuba	125	27631.0827	34.25	53051.6789	42265.1224	15
Cyprus	173	13884.9562	47.4	16072.0000	24140.0000	24
Czech R.	27	19349.7446	7.4	242230.1355	240461.8837	3
Denmark	30	31819.0110	8.22	355312.2893	355811.1197	4
Dominica	90	128.1206	24.66	391.4795	419.3645	18
Dominican R.	45	11135.0114	12.33	79182.3030	75938.5186	3
Ecuador	15	3710.1171	4.11	86569.3988	86543.2379	4
Egypt	95	83236.3378	26.03	236566.4336	294800.4739	7
El Salvador	21	1357.0275	5.75	22229.4029	21760.2791	3
Equatorial G.	62	2201.9012	16.99	10760.9045	10804.8828	16
Eritrea	21	97.5695	5.75	1598.3000	1659.2000	10
Estonia	64	5009.4807	17.53	23560.2140	14032.1625	5
Eswatini	93	1454.0753	25.48	4252.7793	4149.5659	12
Fiji	18	216.2843	4.93	4169.4801	4298.3384	3
Finland	63	25665.7571	17.26	230924.2320	210647.7631	16
France	55	456709.7720	15.07	2574182.3512	2461699.6604	15
Gabon	58	2953.2276	15.89	15631.7392	14885.2634	9
Gambia	22	118.0272	6.03	1840.1508	1924.2012	2
Georgia	21	1122.3328	5.75	18384.8798	18146.6863	2
Germany	28	308978.4394	7.67	3718776.2171	3929724.1876	5
Ghana	13	2169.6679	3.56	58747.9319	61201.5402	0
Greece	42	30080.6529	11.51	231334.5453	213347.9266	23
Greenland	15	118.1528	4.11	2756.8981	2798.6442	3
Grenada	46	135.9675	12.6	942.9052	1009.8814	4
Guam	27	391.2563	7.4	4897.9487	5476.8669	10
Guatemala	120	19061.2200	32.88	39345.3214	48643.0000	13
Guinea	62	2112.2452	16.99	10322.7465	13175.1589	4
Guyana	90	834.8063	24.66	2550.7969	2273.1242	8
Haiti	105	2330.0177	28.77	5769.5676	5168.7929	43
Honduras	58	3597.3180	15.89	19040.9765	18523.1550	5
Hungary	13	6377.3299	3.56	172678.4709	177567.6655	0
India	74	637601.9792	20.27	2507326.7021	2163861.8039	4
Indonesia	57	198034.8210	15.62	1070082.8922	1038766.8612	4
Iran	37	56326.4087	10.14	499326.0014	400821.1093	5
Iraq	20	12877.0530	5.48	222129.1649	238357.3347	0
Ireland	67	76001.9605	18.36	338038.5706	328957.6976	4
Isle of Man	14	298.1406	3.84	7474.8107	7589.9848	4
Israel	14	12690.3407	3.84	318164.9708	324669.7107	2
Italy	70	413850.0812	19.18	1744082.4849	1590793.1652	27
Jamaica	7	275.5848	1.92	14094.1945	14046.8360	3
Japan	40	688242.0558	10.96	5591966.7036	5502301.3823	11
Jordan	43	3989.7191	11.78	29876.5009	28476.0101	7
Kazakhstan	78	45571.2495	21.37	178864.4678	158373.1174	8
Kenya	136	25467.8218	37.26	44109.5454	27301.9966	9

Kosovo	22	502.2200	6.03	7830.0662	7817.7660	2
Kuwait	15	5761.6129	4.11	134437.6347	136896.4311	8
Kyrgyz R.	58	1179.8148	15.89	6244.8820	5880.3672	5
Lao PDR	63	2390.0104	17.26	11456.8752	9849.0454	4
Latvia	78	7697.2174	21.37	28321.8127	24489.2023	6
Lebanon	13	1354.1660	3.56	36666.6477	33806.6667	11
Lesotho	34	284.2875	9.32	2767.6222	2731.6462	6
Liberia	19	136.0220	5.21	2477.0327	2534.7665	8
Libya	174	24301.3575	47.67	26675.6281	39317.3064	9
Lithuania	93	13275.6351	25.48	38827.6641	33713.0517	10
Luxembourg	44	8553.5829	12.05	62402.2753	58637.9323	5
Macao	5	473.3344	1.37	34080.0792	35911.4940	4
Madagascar	28	1038.7934	7.67	12502.6206	12861.6556	3
Malawi	21	584.8242	5.75	9579.9781	9927.8621	2
Malaysia	83	95290.0675	22.74	323756.6148	295023.1825	6
Mali	120	5353.5693	32.88	10930.2040	12665.5978	8
Maldives	139	1741.4877	38.08	2793.6000	2945.2000	9
Malta	36	1514.1321	9.86	13837.4854	13611.6174	3
Mauritania	58	1302.5309	15.89	6894.4307	7254.0925	6
Mauritius	86	3389.7942	23.56	10997.1230	12849.0000	8
Mexico	70	257260.8508	19.18	1084170.7282	1021834.8838	10
Micronesia	21	17.9968	5.75	294.8045	294.6627	6
Moldova	60	1691.0025	16.44	8595.9291	8525.6648	5
Monaco	36	787.3091	9.86	7195.1302	6563.7963	5
Mongolia	6	253.9125	1.64	15192.4321	15638.0191	0
Montenegro	171	2561.9760	46.85	2906.5693	4057.9808	21
Morocco	83	29492.1643	22.74	100202.2930	112350.0000	9
Mozambique	120	6032.6077	32.88	12316.5741	15633.0000	9
Namibia	38	1503.8216	10.41	12940.7810	12025.5774	8
Nauru	14	4.1952	3.84	105.1802	112.9574	0
Nepal	82	5785.8890	22.47	19968.3729	19111.0000	4
Netherlands	57	153326.6668	15.62	828501.9890	745873.5094	14
New Zealand	49	26322.0158	13.42	169750.1429	157220.8712	5
Niger	63	2374.8072	17.26	11383.9963	11268.5842	3
Nigeria	13	17539.0136	3.56	474902.5209	477306.0993	1
North M.	50	1657.9815	13.7	10445.2836	9853.9548	6
Norway	24	33181.6974	6.58	471456.6175	470169.4919	4
Oman	49	10293.2170	13.42	66380.7465	65872.7193	6
Pakistan	46	33286.0870	12.6	230831.7772	190564.7579	4
Panama	170	24579.1180	46.58	28193.6941	36616.0000	11
Papua N.G.	14	883.5890	3.84	22152.8389	22851.1575	0
Paraguay	44	4649.2332	12.05	33918.2695	33107.3469	5
Peru	106	63202.8716	29.04	154429.6579	119028.2643	9
Philippines	49	51440.4847	13.42	331738.6363	321993.1103	2

Poland	29	54588.9316	7.95	632478.6558	608314.9664	2
Portugal	14	9935.0900	3.84	249086.8997	250053.5953	2
Puerto Rico	116	27753.6147	31.78	59574.5696	58703.3030	33
Qatar	184	88851.4658	50.41	87402.8006	156540.0000	13
Romania	84	56445.0747	23.01	188822.2141	174237.6459	6
Russia	43	210528.1650	11.78	1576513.2355	1520315.1029	9
Rwanda	29	975.9392	7.95	11307.4334	12114.8237	1
Samoa	13	28.0070	3.56	758.3446	761.5450	3
San Marino	52	241.6769	14.25	1454.7090	1281.3553	23
Sao T. & P.	90	71.0640	24.66	217.1400	270.6738	8
Saudi Arabia	180	357566.5862	49.32	367498.9914	630820.0000	18
Senegal	65	4868.2461	17.81	22468.8280	21544.0000	4
Serbia	20	2836.0582	5.48	48922.0034	49835.4971	2
Seychelles	21	87.7694	5.75	1437.7461	1458.8787	1
Sierra Leone	38	407.7759	10.41	3509.0189	3498.8332	2
Singapore	55	52411.9550	15.07	295412.8375	279865.2232	6
Slovak R.	40	13012.2931	10.96	105724.8815	105048.8323	4
Slovenia	55	8739.8778	15.07	49261.1293	45927.1375	5
Solomon I.	2	4.3408	0.55	787.8553	790.3117	9
South Africa	35	41806.8689	9.59	394179.0501	373137.4468	9
Spain	56	245907.4155	15.34	1356881.9893	1214860.6085	7
Sri Lanka	95	23488.9328	26.03	66758.0195	50643.6194	9
St. Kitts & N.	25	64.1598	6.85	872.5728	902.5005	5
St. Lucia	54	259.8510	14.79	1496.5493	1518.5960	10
Sudan	105	21505.5713	28.77	53251.8908	37678.1494	14
Suriname	72	920.2168	19.73	3744.7713	3330.5002	14
Switzerland	50	94462.5193	13.7	595113.8719	548326.6894	9
Tanzania	90	14507.6461	24.66	44328.9186	49195.0000	5
Thailand	67	85866.9694	18.36	381915.7743	355422.2982	7
Timor-Leste	60	190.4499	16.44	968.1201	961.6111	9
Togo	14	226.3649	3.84	5675.2903	5891.6738	0
Tonga	178	210.5398	48.77	221.1851	225.0133	37
Trinidad & T.	14	801.9806	3.84	20106.7988	19640.8123	14
Tunisia	28	4037.1951	7.67	48590.5266	48688.4300	5
Turkey	4	14307.4525	1.1	1291247.5894	1348800.3602	0
Uganda	120	14792.6403	32.88	30201.6407	37780.6334	8
Ukraine	38	14148.3225	10.41	121750.0387	113265.8271	5
UAE	22	25250.5319	6.03	393678.7476	400945.5873	3
UK	103	839597.4607	28.22	2135675.0943	2329000.0000	20
USA	86	4423221.689	23.56	14349754.083	12205839.270	15
Uzbekistan	89	20954.2295	24.38	64981.6554	71965.1203	6
Venezuela	57	60404.4081	15.62	326395.7489	322397.7087	16
Vietnam	31	18246.7868	8.49	196594.4126	198354.2061	2
West bank G.	5	172.4394	1.36	12415.6388	12653.8977	0

Yemen	120	6188.1961	32.88	12634.2337	11589.5560	29
Zambia	21	1760.8737	5.75	28844.7875	29226.0250	3
Zimbabwe	33	1412.8840	9.04	14214.4690	10358.5215	9
World	10342	14904846.597	17.0654	72433771.086	64392404.091	7

Note: All the predictions are based on the information of COVID-19 up to November 24, 2020.

From the estimated results it is found that the total GDP loss in the year 2020 of 178 countries due to lockdown for COVID-19 is 14904846.597 million $ and the average GDP loss is 84208.172862 million $ and it is statistically significant at any significance level. The 95% confidence interval estimation for the population mean of GDP loss is [26082.6924, 142333.6533]. It is also found that in the year 2020 the average GDP loss in terms of percentage is 15.9466 of 178 countries and it is statistically significant at any significance level. The 95% confidence interval estimation for the population mean of GDP loss in terms of percentage is [14.1264, 17.7720]. The GDP loss in terms of totality and percentage are shown below graphically.

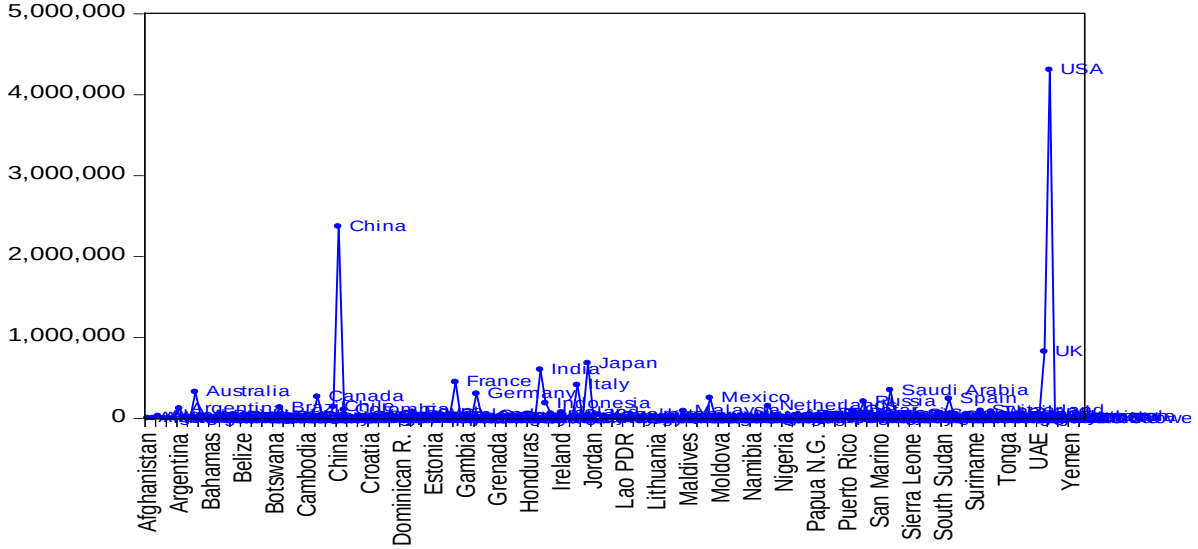

Figure 6: The loss of GDP in million USD

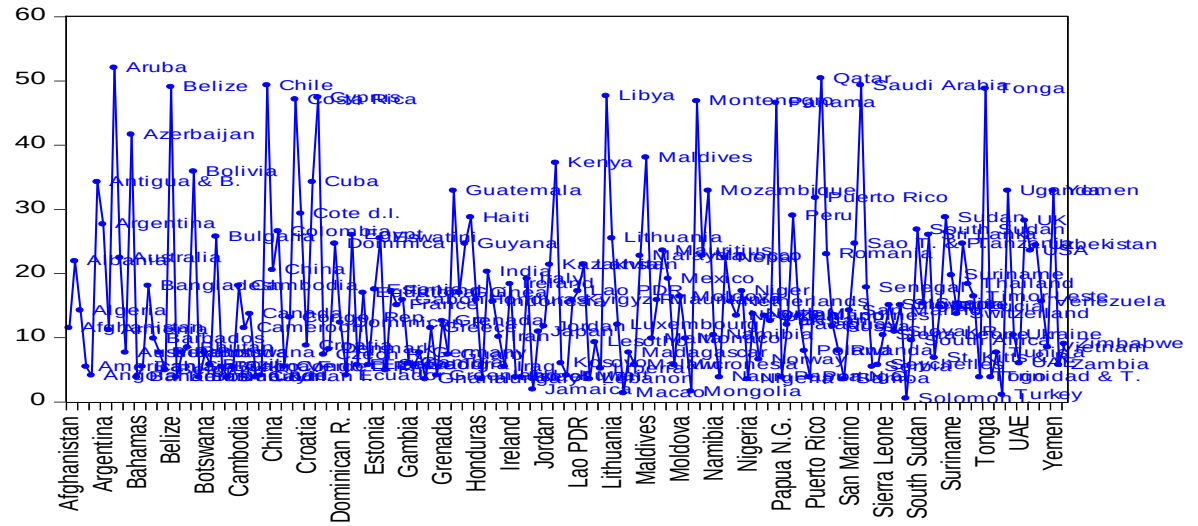

Figure 7: Loss of GDP in percentage of the total GDP (constant 2010 $) .

From Figure 6, it is found that in terms of totality the GDP loss is highest for USA and followed by China, UK, Japan, India, Italy etc. and from Figure-7 it is found that in terms of percentage the GDP loss is highest for Aruba and followed by Qatar, Chile, Saudi Arabia, Belize Libya, Tonga, Libya, Cyprus, Costa Rica, Montenegro, Panama etc. and lowest for Solomon Island, and followed by Turkey, Macao, Mongolia, and Jamaica etc.

It is found that the average number of years of 178 countries that the economy will be downgraded is 7.6667 which is also statistically significant at any significance level. The 95% confidence interval estimation for the population mean of the number of years of 178 countries that the economy will be downgraded is [6.6352, 8.6981]. It is also found that in the year 2020, the world GDP will be contracted 17.0654% due to COVID-19 and the world economy will be downgraded 7 years due to COVID-19 outbreak. The predicted number of years that the economy will be downgraded due to COVID-19 for all countries are presented graphically below:

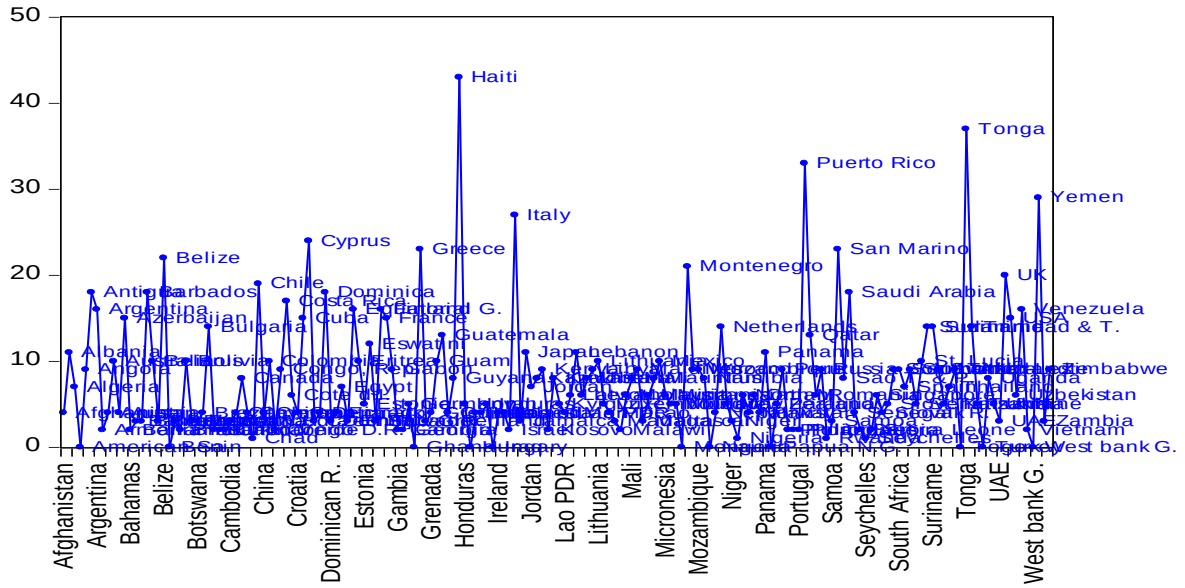

Figure 8: The number of years that the economy will be downgraded

It is highest for Haiti which is equal to 43 years and second highest for Tonga which is equal to 37 years and third highest is for Puerto Rico which is equal to 33 years. It is also found the number of years that the economy will be downgraded are larger for Yemen, Italy, Cyprus, Greece, San Marino, Belize, Montenegro, UK, Chile, Antigua, Barbados, Dominica, Saudi Arabia, Costa Rica, Argentina, Equatorial G. Finland, Venezuela, Azerbaijan, Cuba, France, USA, Bulgaria, Netherlands, Sudan Suriname, Trinidad & Tobago, Qatar and so on. The number of years will be zero for American Samoa. Benin, Ghana, Hungary, Iraq, Mongolia, Nauru, Papua N. G., Togo, Turkey, West Bank Gaza. The distribution is positively skewed. The measure of kurtosis is 8.38 means its distribution is leptokurtic, and its peakness is much higher than normal distribution

The predicted GDP for the years 2020 and 2021 are presented graphically below including the GDP of 2019.

From the Figure-9 given below, it can be said that the post COVID-19 GDP will be declined for most of the countries. From the predicted GDP in the year 2020 and 2021 it can be said that for the countries Afghanistan, Benin, Bhutan, Brazil, Burkina Faso, Chad, China, Congo, Cyprus, Egypt, Eritrea, Fiji, Gambia, Germany, Greenland, Ghana, Guam, Guatemala, Guinea, Hungary, Iraq, Israel, Kuwait, Libya, Macao, Madagascar, Maldives, Mauritania, Mauritius, Montenegro, Nigeria, Panama, Papua New Guinea, Portugal, Qatar, Saudi Arabia, Solomon Island, Tanzania, Togo, Tunisia, Turkey, Uganda, United Arab Emirates, UK, Uzbekistan, Vietnam and Zambia, the GDP will be declined for the year 2020 but again the GDP will be increased from year 2021. Thus it can be said these countries can recovery their economies due to implementation of their appropriate policies due to COVID-19 but for rest of the countries the GDP will be downgraded for a number of years.

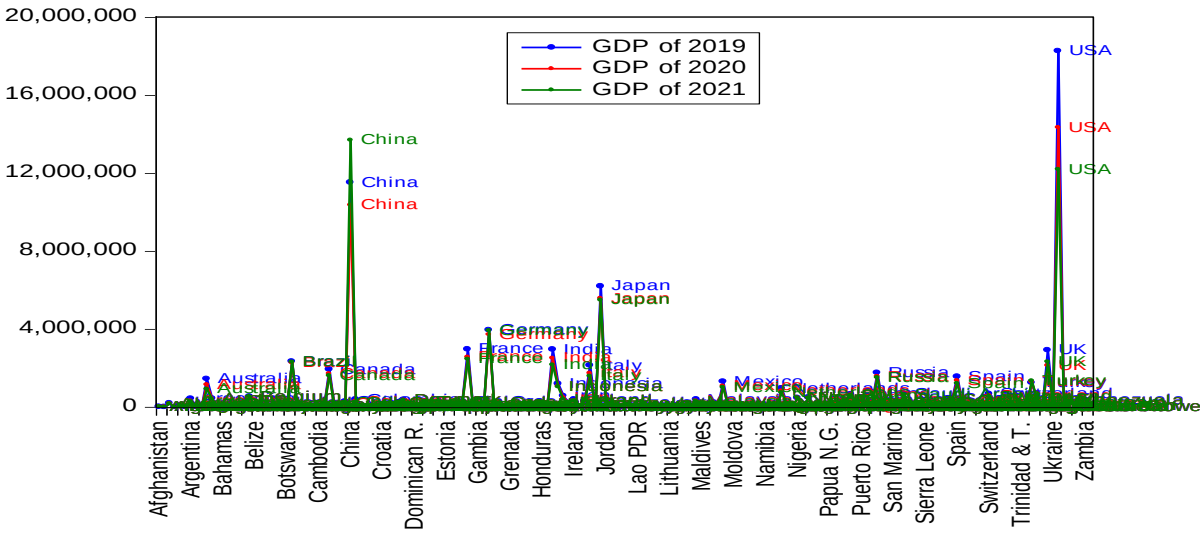

Figure 9: GDP for 2019, 2020 and 2021

From the estimated results, it can be said that the global economy will be declined significantly due to COVID-19 outbreak and the recessionary phase will be started.

4.1. Model Specification

In order to find the impacts of lockdown, travel restrictions, human quality, number of infected people and unemployment rate on economic change the following regression equation is considered:

$$GDPC_i = \beta_0 + \beta_1 LNCC_i + \beta_2 LNLOCK_i + \beta_3 AITR_i + \beta_4 ADTR_i + \beta_5 UN_i + \beta_6 CHCI_i + \varepsilon_i \quad (12)$$

where, $GDPC_i$ is the % change in GDP of the ith country which is defined as ,

$GDPC_i = \frac{GDP20_i - GDP19_i}{GDP19_i} \times 100$; $GDP20_i$ is the predicted GDP (constant 2010 $) in the year 2020 and $GDP19_i$ is the GDP in 2019 of the ith country.

$LNTC_i$ = natural logarithm of confirmed cases of the ith country

$LNLOCK_i$ = natural logarithm of total lockdown days of the ith country

$AITR_i$ = average of international travel restriction index of the ith country

$ADTR_i$ = average of domestic travel restriction index of the ith country

UN_i = unemployment rate in the year 2020 of the ith country

$CHCI_i$ is the % change in human capital index of the ith country which is defined as $CHCI_i = \frac{HCI20_i - HCI19_i}{HCI19_i} \times 100$; $HCI20_i$ is the human capital index in the year 2020 and $HCI19_i$ is the human capital index in the year 2019 of the ith country.

The software EViews is applied to estimate the equation (12), and the OLS estimates are presented below in Table-6.

Table 6: The OLS estimates and diagnostic tests results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	37.4623	4.6771	8.0097	0.0000
LNTC	-0.0914	0.2940	0.3110	0.7564
LNLOCK	-11.5843	0.7510	-15.4256	0.0000
AITR	-1.8219	1.1613	-1.5687	0.1197
ADTR	-2.6356	1.4563	-1.8098	0.0732
UN	-0.0668	0.1148	-0.5818	0.5620
HCI	-0.2604	0.1970	-1.3217	0.1891
R-squared		0.7247	Mean dependent var	-12.1782
Adjusted R-squared		0.7089	S.D. dependent var	11.4627
S.E. of regression		6.1843	Akaike info criterion	6.5424
Sum squared resid		4015.809	Schwarz criterion	6.7123
Log likelihood		-359.3728	Hannan-Quinn criter.	6.6113

F-statistic Prob(F-statistic)	46.0568 0.0000	Durbin-Watson stat	2.0599
Diagnostic Test		Test	Prob
Breusch-Pagan-Godfrey Test for Heteroscedasticity		11.3449	0.0783
LM Test for Autocorrelation		1.3750	0.5028
ARCH Test		0.2473	0.6190
VIF test for Multicollinearity		1.15	

From the estimated results it is found that the variables LNLOCK and ADTR have significant negative impact on economic growth. The variables LNTC, AITR, UN and HCI have negative impacts on economic growth but not statistically significant. Thus it can be said that the infected population due to COVID-19 will not be harmful for economic growth but the variables lockdowns and domestic travel restrictions will contract the economic growth significantly of these countries. Therefore, it can be concluded that the lockdowns and any other restrictions will be barriers for economic growth of the word.

4.2. Sensitivity Analysis

Diagnostic tests for heteroscedasticity, serial correlation, autoregressive conditional heteroscedasticity, and multicollinearity are conducted and the results are reported in Table-6. The tests results indicate that there is no problem of heteroscedasticity and autocorrelation. Also the autoregressive conditional heteroscedasticity is not present in the model. The test result also supports that there is no problem of multicollinearity.

4.3. CUSUM and CUSUMSQ Tests

Finally the stability of the parameters of the equation has been examined using cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests proposed by Borensztein et al.(1998). The related graphs of these tests are presented below in Figure-10.

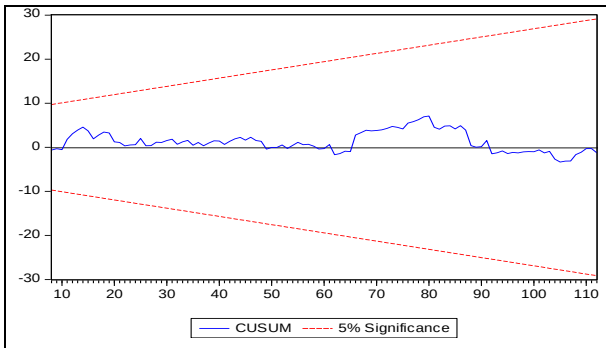

Figure 10(a): Plot of Cumulative Sum of Recursive Residuals

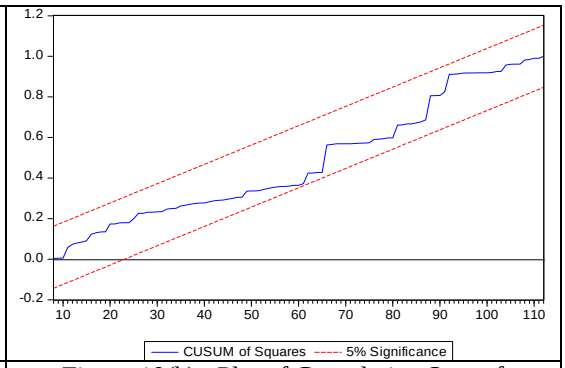

Figure 10(b) : Plot of Cumulative Sum of Squares of Recursive Residuals

From Figures 10(a) and 10(b) it can be seen that the CUSUM and CUSUMSQ tests results are within the critical bounds implying that all coefficients in the error correction model are stable. Therefore the preferred economic growth model can be used for policy decision making purpose, such that the impact of policy changes considering the explanatory variables of economic growth model will not cause major distortion in the level of economic growth, since the parameters in this equation seem to follow a stable pattern during the estimation period.

V. Conclusion and Policy Implications

Due to COVID-19 outbreak, lockdowns, international and domestic travel restrictions are imposed into a number of countries globally to save the lives but due to lockdowns and travel restrictions the global economic problem is going to be serious. People of the world including IMF, World Bank, etc. strongly assume that due to COVID-19 i.e. due to lockdowns, and travel restrictions the global economy will be downgraded significantly. That is why, to testify whether this assumption about global economic crisis, is true or false, in this paper the principal purpose has been made to forecast the post COVID-19 global economy using the econometric techniques based on the cross-sectional data of 178 countries, to forecast the loss of economy of these countries due to COVID-19 and to test whether the loss of economy is statistically significant or not. Also another important purposes has been made to find the impacts of infected people due to COVID-19, lockdowns, international and domestic travel restrictions, unemployment and change of human quality index on economic growth based on cross sectional data of 112 countries. In this paper we also estimate the growth rate of day wise cumulative confirmed cases and the rate of change of average day wise death cases with respect to confirmed

cases of 160 countries individually using econometric techniques. Due to different limitations of data, there is consistency of the number of countries for different econometric analyses. From the estimated results it is found that in the year 2020, the average loss of GDP of 178 countries is 83765.17 million $, which is statistically significantly at any significance level, on an average the economy of these countries will be contracted 16.04% of the total GDP, which is also statistically significant at any significance level, and on an average the economy will be downgraded for 7.67 years of these countries, it is also statistically significant at any significance level. It is also found that in the year 2020, the world GDP will be contracted 17.07% of the total GDP and the world economy will be downgraded for7 years due to COVID-19. From the predicted GDP in the year 2020 and 2021 it can be said that for the countries Afghanistan, Benin, Bhutan, Brazil, Burkina Faso, Chad, China, Congo, Cyprus, Egypt, Eritrea, Fiji, Gambia, Germany, Greenland, Ghana, Guam, Guatemala, Guinea, Hungary, Iraq, Israel, Kuwait, Libya, Macao, Madagascar, Maldives, Mauritania, Mauritius, Montenegro, Nigeria, Panama, Papua New Guinea, Portugal, Qatar, Saudi Arabia, Solomon Island, Tanzania, Togo, Tunisia, Turkey, Uganda, United Arab Emirates, UK, Uzbekistan, Vietnam and Zambia, the GDP will be declined for the year 2020 but again the GDP will be increased from year 2021but for rest of the countries the GDP will be downgraded for a number of years. From the estimated results, it can be said that the world economy will be downgraded significantly due to COVID-19 outbreak and the recessionary phase will be started. From the estimated results it is found that the variables, total confirmed cases, lockdowns, domestic travel restrictions, international air travel restriction, unemployment and change of human quality index have negative impacts on economic growth of which the impacts of lockdowns and domestic travel restrictions are statistically significant. The CUSUM and CUSUMSQ tests results suggest the policy changes considering the explanatory variables of economic growth equation will not cause major distortion in the level of economic growth. From the estimated results it is found that the average value of total cases (TC) of 160 countries is 370789.9 with maximum number of confirmed cases is 12780938 in USA and minimum number is 150 in Brunei. The difference between maximum and minimum number is quite high. The mean is significantly different from zero. It is also found that the 95% confidence interval for population mean of confirmed cases is [160892.61, 580687.19]. The mean value of total deaths (TD) due to COVID-19 of 160 countries is 8971.19 with maximum number of death is 263799 in USA and minimum number is 0 in Mongolia, Eritrea, Cambodia and Bhutan. The difference between maximum and minimum is very high. The mean is significantly different from zero and the 95% confidence interval estimation for the population mean of the number of deaths is [4346.144, 13596.24]. The mean value of total recovered cases (TR) is 259889.4 with maximum number of recovered cases is 860495 in India and minimum number is 145 in Brunei. The mean is significantly different from zero and the 95% confidence interval estimation is [99778.22, 420000.6]. The mean value of the variable the death ratio to total cases in percentage (DRTC) is 2.247 with maximum death ratio is 28.903 in Yemen and minimum is 0 in Mongolia, Eritrea, Cambodia and Bhutan respectively. The mean is statistically significant at any significance level with 95% confidence interval estimation is [1.846, 2.649]. The mean value of the variable recovered ratio to total cases (RRTC) is 76.886 with maximum value is 99.808 in Singapore and minimum value is 6.4378 in Belgium. The mean is statistically significant at any significance level with 95% confidence interval estimation is [73.57, 80.196]. The mean of the variable death to recovered ratio (DRR) is 3.82 with maximum value is 43.71 in Belgium and minimum is 0 in Mongolia, Eritrea, Cambodia and Bhutan. The mean is statistically significant at any significance level with 95% confidence interval is [2.90, 4.737]. The average value of the variable growth rate of day wise cumulative total confirmed cases is 2.865 with maximum value is 5.89 in India and minimum value is 0.26 in Brunei. The mean is statistically significant at any significance level with 95% confidence interval estimation is [2.70, 3.024]. The average value of the rate of change of the number of death with respect to total cases is 1.647 with maximum value is 24.48 in Yemen and minimum value is 0.03 in Cyprus. The population mean is significantly different from 0 with 95% confidence interval estimation is [1.286, 2.008]. The frequency distributions for the variables TC, TD, TR, DRTC, DRR, and RDTC are positively skewed but for the variables RRTC and GRTC are negatively skewed and leptokurtic for all the variables except GRTC. The coefficient of variation (CV) is highest for the variable TR and followed by TC, TD, DRR, RDTC, DRTC, GRTC and RRTC. From the estimated values it is found that total cases are highly associated with total deaths, total recovered cases and total tests. The total deaths is also highly associated with total recovered cases and total tests, total recovered cases is highly associated with total tests. The association between total tests and total population is very strong. From the estimated results it can be said that on an average global stock markets erased about 3.08% in 2020 relative to 2019 of 110 countries and on an average the unemployment rate increases 1.36% in 2020 relative to 2019 of 112 countries. COVID-19 pandemic is not only created threats but also opened up new dimensions of opportunities too. Some of the noticeable opportunities are followings: emphasize on safer working place conditions, shopping through online, increase awareness on clean environment, novelty in global supply chain, utilization of cost-efficient smart technology, and change in consumer purchasing habits and shifting into digital economy. Since global economy is going through a transition period, thus in the meantime, government around the world can implement the following policies to recovery the economic crises: increase investment to build skilled human capital, increase investment to cope with changing and more digitized world; emphasize should

be given on robotics, and liberal trade policies; inject liquidity into the market, thus, increasing the ability of financial institutions to disburse more money and when people will have more money in hand, they will spend more; facilitates working from home policy and encouraging such by providing tax benefit; government should initiate incentive and reskilling programs; providing small trader and sole proprietor enterprise with unemployment benefit or loan with favorable terms and encourage not to shut down their business; support small business enterprise supply chain by both private and public sector; safeguarding jobs by providing subsidies on wages, develop a robust view of who need to retain their jobs or find a new job;a heat map on country or state or city can be developed which will help private sector leader and government an opportunity to understand which sectors are vulnerable and thus require intervention for safeguarding the job; collaboration between government and private sector to keep people employed and train them; well-designed database can be created for matching job seeker and employer; upskilling or reskilling the individual in conformance with the need of future driven skill trend; enhancing digital literacy that will help the worker to find job in rapidly; changing labor market and encourage to establish small and medium enterprise and reduce regulatory barriers by issuing business license quickly. Finally it can be concluded that since lockdowns and travel restrictions will contract the global economy, thus to save the lives and global economy emphasize should be given on protective measurements say, using mask, sanitize, maintaining social distancing, increase awareness about COVID-19 to the people and using vaccine if possible rather than lockdowns and restrictions by individual countries.

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