COVID-19 – DOWNTURN FOR THE GLOBAL CAPITAL MARKETS

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ABSTRACT

Purpose: The purpose of present study is to find out if there is significant difference in the mean returns and growth rate of stock indices and associated risks of selected five countries due to the outbreak of Covid-19. An attempt is also made to find out the impact on stock markets of selected five countries on account of the policy measures taken by the Governments of these countries to fight the Pandemic.

Design/methodology/approach: The five countries are selected on the basis of highest number of reported corona cases as on 31st May 2020 and these are USA, Brazil, Russia, India and UK. The time period selected in the study is from October 1, 2019 to May 31, 2020 which is divided into different sub-periods on the basis of Covid-19 being declared as "Public Health Emergency of International Concern (PHEIC)" and "Global Pandemic" by World Health Organization (WHO). The objectives are tested for using paired sample T-test, several risk-adjusted measures and Panel Regression Model.

Findings: Covid-19 is found to have a significant negative effect on the stock market returns of all the countries especially during Public health emergency period. However, the markets showed recovery with positive generation of returns during the pandemic period. The results of panel regression fixed effects model are coming out to be very significant for both entire period and sub-periods. Overall results suggest that S&P 500 and BSE 100 are most defensive ones to invest during this tough time of Covid-19 by the investors.

Originality: The uniqueness of our study lies in the fact that we have made an extensive research on multiple fronts on the behavior of stock markets of selected five countries before and during the outbreak of Covid-19.

Research implications: The research has implications for the investors as they can reallocate their investment portfolios during the times of pandemics.

Keywords: Stock Market Returns, Covid – 19, Corona Virus, WHO, Health Emergency, Pandemic, Panel Regression, Risk adjusted Models.

1. INTRODUCTION

The Covid-19 disease also known as Coronavirus disease/pandemic has its presence in almost all the countries of the world since the beginning of year 2020. It is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It was declared as a Public Health Emergency of International Concern on 30th January 2020 and a pandemic on 11th March 2020 by World Health Organization. The disease spreads at an exponential rate. Within six months, it has shaken the world economy with its grave aftermaths on the mankind and the economy at large. It hasn't spared any country of the world. There is great fear associated with the disease for which no vaccine exists yet. It has not only adversely impacted almost all the economies but also the personal lives of the population across the globe. According to the report of **Johns Hopkins University,** "there are more than 37.8 million cases of Covid-19 reported in more than 188 countries and territories, resulting in more than 1.08 million deaths and more than 26.2 million people have recovered from the same as on 13th October 2020." [1]

Because of Covid-19 in the last six months, the world has adopted to the "New Normal". Use of technology to stay connected, work from home wherever possible, limited social gatherings, basic sanitization habits, wearing of masks and so on has become common practices because of the fear associated with the catching of disease. There is a serious impact on the manufacturing business because of closure of factories initially during lockdown and later due to lack of availability of adequate raw materials and labor force to carry out the production process smoothly. A lot of people got laid off from their jobs due to industry wide shutdowns and reduced demand. The extent of economic losses caused by the downturn will probably be felt over many years.

Why is it important to find out the impact of epidemics on the stock market and the overall economy? This is because such epidemics have serious repercussions for human life, society and the economy at large. They create fear and panic among the investors and make them more risk averse. Because of increased risk aversion, potential investors put a halt on their buying of stocks and existing investors try to liquidate their holdings in cash foreseeing a further fall in the market. All this leads to an overall depression in the market. Therefore, this study has made an attempt to find what impact does the Covid-19 brought on the stock market returns of selected five countries.

An attempt has been made in the present

[1] "COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)". *ArcGIS*. Johns Hopkins University. Retrieved 13th October 2020.

study to find out if there is significant difference in the mean returns of stock market of selected five countries due to the outbreak of Covid-19.

The five countries selected in the study are on the basis of Worldometer's daily ranking of countries with reported number of Covid-19 confirmed cases. So, the first five countries with highest number of corona cases as on 31st May 2020 are USA, Brazil, Russia, India and UK. These countries are selected for further analysis. For the comparison of mean returns, the entire sample period is divided into two parts. The period starting from 30th January 2020 till 10th March 2020 is the first period when Covid-19 was declared as a PHEIC (Public Health Emergency of International Concern) by WHO and the disease started spreading in the countries outside China. During this period, although the fear and panic has penetrated in the markets worldwide but still stock markets were rising up ignoring the potential threats associated with this deadly disease. The second period starts from 11th March 2020 till 31st May 2020 when Covid-19 was declared as a Pandemic by WHO and stock markets across the world reacted strongly to this by way of recording a significant fall in the benchmark indices on the very next day of this announcement. However, several policy decisions taken by the governments in term of bail out packages, monetary stimulus, moratorium of loans, relaxations in monetary policy measures through lower policy interest rates, fiscal measures and so on created positive hopes in the mind of people that this period of crisis shall also pass away soon. This optimism of the people despite a continuous increase in the number of Covid-19 confirmed cases has probably made the stock markets to again rise particularly April 2020 onwards.

It has also been tried to find out the impact on stock markets of selected five countries on account of the policy measures taken by the Governments of these countries to fight the Pandemic.

These policy measures are represented by 17 indicators that are compiled into four main indices, namely, Government Response Index, Containment and Health Index, Stringency Index and Economic Support Index.

Objectives of the Study

The key objectives of the paper are:

1. To examine the price discovery process of above-mentioned indices in terms of growth rate.
2. To study the behaviour of these indices across the periods, i.e., Health Emergency Period and Pandemic Period.
3. To study whether return differs significantly across these indices in different time periods.
4. To evaluate the performance of these indices using various risk-adjusted measures in

different time periods.

5. To measure the response of stock markets on account of policy measures taken by the governments of respected countries.

Hypotheses of the Study

For achieving the purpose of our study, following hypotheses have been tested:

1. Efficiency of price discovery process is same for all the indices.
2. There is no significant impact of Covid-19 being declared as Health Emergency and Pandemic on the growth of indices.
3. There is no significant difference in the returns of various indices in different time periods.
4. Performance of all the indices is similar in different time periods using various risk-adjusted measures.
5. Stock markets are immune to the policy measures taken by the governments of respected countries.

The uniqueness of our study lies in the fact that we have made an extensive research on the behavior of stock markets of selected five countries before and during the outbreak of Covid-19. A cross country examination is performed to compare the mean returns (using paired sample T-test) and associated risks (using several risk-adjusted measures) in the stock markets of selected countries. The growth rate in the stock indices is also compared for the entire sample period as well as across the periods considered in the study. Most importantly, the response of stock markets to the policy measures taken by governments of selected countries has also been taken into account.

2. LITERATURE REVIEW

Covid-19 is no less than a "Black Swan Event" that has created fear, havoc and panic across the stock markets of the world. Investors indulged in panic selling, stocks fell miserably due to uncertainty with respect to future, huge fall seen in the demand of majority of the commodities and it made people focus only on essential items and unavoidable medicinal requirements. All this led to an overall recession in the economies worldwide. Baker et al. (2020) in the context of USA, emphasized on the fact that due to the severe health impact of the pandemic and the diffusion of such information at a rapid pace on account of advanced communication channels and increased connectedness of the modern economies are some of the critical factors causing much higher volatility in the stock market of USA. Ehrlich et al. (2020) analyzed the financial loss caused by Covid-19 due to countermeasures to be adopted while running the North American Leagues. Velde (2020) tried to find out what happened to USA economy in 1918 when there was outbreak of Influenza. They concluded that not much impact was seen on the retail sector of the economy and the economy rebounded

within months of the outbreak with very little policy interventions by the government.

There are a number of studies that have been conducted in the recent times to find out the impact of Covid-19 on the stock markets of different countries of the world. Ali, Alam and Rizvi (2020) analyzed the impact of covid-19 on financial markets by dividing the entire sample period on the basis of two parameters. First is the date, when Covid was declared as a Pandemic by WHO (i.e., 11th March 2020). So, December to March 10, they considered it as an Epidemic period and post that, they referred to it as Pandemic period. The second basis for division of time was on the basis of its trajectory of spread. Phase I – Covid Deaths limited to China; Phase II – European spread; and Phase III – North American spread. Surprisingly, China experienced a relatively lower fall in returns in both epidemic and pandemic phases. On the other hand, more developed economies of USA, UK, Germany, etc. displayed an increase in the volatility with fall in returns.

Ngwakwe (2020) tried to find out the early effects of Covid-19 on selected stock markets of the world. They focused on the stock markets of USA, Europe and China. The results came varying for different stock markets. While, USA stock index experience significant reduction in the mean stock values during the period of pandemic, surprisingly, the Chinese mean stock values came significantly higher than the mean values before the outbreak of pandemic. However, Al-Awadhi, et.al. (2020) tested the effect of the COVID-19 on the Chinese stock market using Panel Data analysis and found that this pandemic disease interacts negatively with stock market returns.

Ashraf, B.N. (2020) made an attempt to find out the response of stock markets of 64 countries due to the spread of pandemic and found that the stock markets reacted negatively to the growing Corona cases with a fall in stock market returns. Zhang, Hu and Ji (2020) found out the impact of Covid-19 on the major financial markets including USA, UK, Japan, Singapore, Spain, Italy, China and so on. There have been dramatic and unprecedented movements seen in all the major stock markets due to the exponential spread of corona virus in almost all the countries across the globe. The markets have become highly risky and volatile due to the great deal of uncertainty associated with disease. The countries are taking individual steps to combat with this ongoing pandemic. Liu et al. (2020) also pointed towards the sensitive response of stock market indices of 21 leading stock markets on account of pandemic related news using event study methodology. The markets recorded a fall immediately after the outbreak of the disease and according to them; Asian markets experienced a greater fall than the stock markets of other countries.

Zeren and Hizarci (2020) also tried to find out the impact of covid-19 on the stock markets of some highly infected countries, i.e., countries with highest number of corona confirmed cases using Maki (2012) co-integration test with built-in structural breaks. It was found that during the times of crisis, the markets tend to follow behavioural finance theories instead of efficient market hypothesis. Further, they suggest people to invest in gold, crypto currencies and derivative products instead of direct investment in company stocks in order to mitigate the risk. Anh and Gan (2020) conducted a study in Vietnamese context and confirmed the adverse impact of the daily rising number of COVID-19 cases on stock returns.

Nippani and Washer (2004) made an attempt to find out the impact of SARS outbreak on the stock markets of selected countries including Canada, Singapore, Thailand, Vietnam, China, etc., using T-test and Mann-Whitney test. They found only Chinese and Vietnamese stock market to get negatively impacted due to SARS outbreak. Similar study was conducted by He et al. (2020) to find out the direct effects and spillovers of Covid-19 on the stock markets of Republic of China, Italy, USA, Japan, South Korea, Germany, Spain and France. They found Covid-19 to have negative but short-term impact on the stock markets of selected countries. Further, Covid-19 was also found to have bi-directional spill-over effects among selected countries.

Chen et al. (2018) tried to find out the impact on long run co-integration between Chinese stock market with the stock markets of four other Asian countries, namely Japan, Hong Kong, Taiwan and Singapore, due to the outbreak of SARS epidemic that took place in 2002-03. Their results pointed towards the weakened long run co-integration post SARS outbreak.

Ramelli and Wagner (2020) conducted a study in US context and found transportation and energy sector to be adversely affected due to the outbreak of Covid-19. Further, industries that are reliant on China for the import of raw materials or companies with Chinese exposure in any form are the worst sufferers. However, telecom and health care industries have satisfactorily performed during the crisis. Later, the improvement of situation in China and the spread of virus in US and European countries lead to feverish reaction of the aggregate stock market. Their results suggested that the health crisis morphed into an economic crisis amplified through financial channels. Griffith, Levell and Stroud (2020) tried to find out the impact of covid-19 on the stock prices of firms listed on London stock exchange across different industries. According to the results, it is tourism and leisure, insurance and some large manufacturing industries that got worst hit with the outbreak of pandemic, while, some

industries including firms in medical and biotech research, food and drug manufacturers/retailers and tobacco outperformed the market. Chen, Jang, and Kim (2007) substantiated the fact that Taiwanese tourism industry went through a major damage with decline in its stock prices during the period of SARS outbreak.

Continuing with this deliberation, we have made an attempt to find out the impact of Covid-19 on the stock markets of selected five countries.

3. DATA AND METHODOLOGY

3.1 Data

In this study we have selected five countries with highest number of reported Covid-19 cases as on May 31, 2020 as per https://www.worldometers.info/coronavirus/#countries. The selected five countries are USA, Brazil, Russia, UK and India. To examine the impact of Covid-19 on the stock markets of selected countries, their respective benchmark stock indices are chosen; S&P 500 Index for USA, IBOVESPA Index for Brazil, MOEX Index for Russia, FTSE 100 Index for UK, and BSE 100 Index for India. The proxy for international market is represented by S&P 1200 Global Index. The above indices are the most representative indices of these countries' stock markets. The data for the daily adjusted closing values of these indices for the period of October 1, 2019 to May 31, 2020 are collected from the yahoo finance (finance.yahoo.com). These values are then converted into simple percentage returns. Implicit yield on T-bills have been taken as a proxy for risk-free rate of return. Next, we calculated standard deviation, coefficient of variation, beta as a measure of systematic risk, unsystematic risk and various risk adjusted measures of all the indices taken in this paper. The data for government policy indicators has been sourced from "Oxford COVID-19 Government Response Tracker (OxCGRT) database". OxCGRT is a new database that monitors governments' policy response during the outbreak.[2]

The Oxford Covid-19 Government Response Tracker (GitHub repo, university website) tracks individual policy measures across 17 indicators. These 17 indicators are composed of three groups of policy measures:

C - Containment and closure policies (Eight indicators) including Schools and Workplace closure, cancellation of Public events, Restriction on gatherings, closure of Public Transport, Stay at Home requirements, Restriction on Internal movements and International travel controls.

E - Economic policies (Four indicators) including Income support and Debt/Contract

[2] https://github.com/OxCGRT/covid-policy-tracker/blob/master/documentation/index_methodology.md

relief for Households, Fiscal measures and International support.

H - Health system policies (Five indicators) including Public information campaigns, Testing policy, Contract tracing, Emergency investment in Healthcare and Investment in Vaccines.

On the basis of these 17 indicators across different categories, four indices have been calculated to give an overall impression of government activity:

1. Government Response Index - It records how the response of governments has varied over all indicators i.e. becoming stronger or weaker over the course of outbreak.
2. Containment and Health Index - It combines lockdown restrictions and closures with measures such as testing policy and contact tracing, investments in healthcare as well as in developing vaccine.
3. Economic Support Index - It records measures such as income support and debt relief for the welfare of people during this outbreak.
4. Stringency Index: It records strictness of lockdown policies to control the spread of virus in different economies.

The entire period of study is divided into different sub-periods. The break-up of time period is related to the announcement of Covid-19 as a "Public Health Emergency of International Concern (PHEIC)" and a "Global Pandemic" by World Health Organization (WHO). Covid-19 was declared as Public health emergency by WHO on January 30, 2020 and it was declared as a Pandemic on March 11, 2020. Thus, we have segregated our time period into three sub-periods. First period ranges from October 1, 2019 to January 29, 2020 and we call this period as pre-announcement period. Second period counts from January 30 to March 11, 2020 and we name this period as public health emergency period. Third period starts from March 12 to May 31, 2020 and known as pandemic period.

3.2 Methodology

3.2.1 Growth Rate Model

We are interested in finding out the growth rate of different indices taken in the paper. For this purpose, we have estimated the following regression equation (1) in respect of all the indices.

$$\text{Ln (Index Value)} = b_0 + b_1 T \quad \ldots\ldots (1)$$

Where, Ln (Index Value) = Natural Log of i^{th} Index Values

b_0 = Constant/Intercept of i^{th} Index Value

b_1 = Growth Rate of i^{th} Index Value

T = Time Period

"I" represents six indices namely S&P 500, IBOVESPA, MOEX, FTSE 100, BSE 100 and S&P 1200 Global Index.

To check for the growth rates of these indices during Public Health Emergency Period and Pandemic Period, we have inserted one dummy variable. We are interested in knowing the fact that how these indices behave during these periods and this can be achieved by fitting the following regression equation (2).

Ln (Index Value) = $b_0 + b_1d_1 + b_2T + b_3Td_1$ …..(2)

Where, Ln (Index Value) = Natural Log of i^{th} Index Values

d_1 = 0 for Public Health Emergency Period

d_1 = 1 for Pandemic Period

b_0 = Constant/Intercept for Public Health Emergency Period of i^{th} Index Value

$b_0 + b_1$ = Constant/Intercept for Pandemic Period of i^{th} Index Value

b_2 = Growth Rate for Public Health Emergency Period of i^{th} Index Value

$b_2 + b_3$ = Growth Rate for Pandemic Period of i^{th} Index Value

T = Time Period

3.2.2 *Comparative Study of Returns*

We have not estimated any equation for returns since there is much volatility in stock market of all the economies. In order to check whether there is a significant difference between the returns of indices taken, we have applied paired samples t-test. In applying t-test, we compare the returns for the public health emergency period as well as pandemic period. We have used simple percentage returns ($\frac{P_1-P_0}{P_0}$) in the study.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{{s_1}^2}{n_1} + \frac{{s_2}^2}{n_2}}}$$

where, $\bar{x}_1$ and $\bar{x}_2$ are the returns of two indices
S_1 and S_2 are the standard deviations of two indices
n_1 and n_2 are the sizes of two indices.

3.2.3 *Risk Adjusted Measures for Performance Evaluation*

We have employed following risk-adjusted measures as used in Tripathi and Bhandari (2015) for performance evaluation of various indices taken in the paper.

1. **Sharpe Ratio:** This ratio measures the return of the index in excess of risk-free, compared to total risk of the index. Since it uses standard deviation as a measure of risk, it does not assume that the index is well diversified. If AR_I is the average daily index return, R_F the risk free return and σ_I total risk of the index,

then Sharpe ratio can be calculated as:

$$\text{Sharpe ratio} = \frac{AR_I - R_F}{\sigma_I}$$

2. **Treynor Ratio:** This ratio measures the relationship between return of the portfolio, above the risk-free rate, and its systematic risk indicated by index beta (β_I). This ratio is particularly relevant for evaluating the performance of well diversified portfolio, since it only takes systematic risk into account.

$$\text{Treynor ratio} = \frac{AR_I - R_F}{\beta_I}$$

3. **M^2 Measure:** As per general theory of finance, risk and return moves in tandem. Generally we compare the returns of portfolios with different levels of volatility (standard deviation). Modigliani and Modigliani (1997) showed that portfolio and its benchmark must have the same level of risk to be compared in terms of risk-adjusted performance. But the question arises how do we create portfolios with the same level of risk as of benchmark and then compare their returns. In order to compute this measure, we imagine that a particular risky index (I) is mixed with risk-free asset (T-bills), so that the resultant or adjusted index (I*) matches the volatility of market index (S&P 1200 Global Index). The adjusted index (I*) would then have the same standard deviation as that of market index. With the same standard deviation of market index and managed index, we may evaluate their performance by comparing returns.

$$M^2 = R_I^* - R_M$$

Where, R_I^* = Return of Managed Index
R_M = Return of Market Portfolio

4. **Jensen's Alpha:** It is used to determine the abnormal return (α) of a security or portfolio of securities over the theoretical expected return. The theoretical return is predicted by a market model. A portfolio with a consistently positive excess return (adjusted for risk) will have a positive alpha and vice-versa. It can be calculated as:

$$R_P - R_F = \alpha + \beta_P (R_M - R_F)$$
Or
$$\alpha = R_P - [R_F + (R_M - R_F)\beta_P]$$

5. **Information Ratio:** It is also known as Appraisal Ratio and is defined as residual return of the index divided by tracking error, where residual return is the difference between the return of the index and the return of a selected benchmark index and tracking error is the standard deviation of residual return. It can be calculated as-

$$\text{Information Ratio} = \frac{E[R_I - R_B]}{\sigma_{ei}} = \frac{\alpha_i}{\sigma_{ei}}$$

Where, α_i = Jensen's alpha or abnormal return of the Index
σ_{ei} = Unsystematic risk of the index

3.2.4 Panel Regression Analysis

The paper makes use of panel data regression analysis where we have applied pooled least square, random effect and fixed effect regression models. Foremost, Redundant Fixed Effects-Likelihood Ratio test was employed to determine the necessity of using fixed effect model (FEM) surpassing pooled regression. Hausman test has also been conducted to identify the preferred model out of random and fixed effect. In the following equation, we are trying to estimate the impact of government policy on movement of stock market of five economies for the overall period, public health emergency period and pandemic period.

$Ln\_INDVAL_{it} = \beta_0 + \beta_1 GOV\_RES_{it} + \beta_2 CONT\_HEALit + \beta_3 ECO\_SUPP_{it} + \beta_4 STRIN_{it} + \eta_{it}$

where, Ln_INDVAL = Natural Log of Index Value

GOV_RES = Government Response Index

CONT_HEAL = Containment and Health Index

ECO_SUPP = Economic Support Index

STRIN = Stringency Index

4. EMPIRICAL RESULTS

Table 1: Daily Return and Risk of Various Indices

Index/ Average Return (%)	Pre-Announcement Period (Oct. 1 – Jan. 29)	Public Health Emergency Period (Jan. 30 – March 11)	Pandemic Period (March 12 – May 31)
S&P 500	0.116	-0.573	0.335
IBOVESPA	0.125	-1.043	0.279
MOEX	0.163	-0.786	0.221
FTSE 100	0.015	-0.784	0.149
BSE 100	0.075	-0.529	0.334
S&P 1200 Global	0.101	-0.587	0.378
Standard Deviation (%)			
S&P 500	0.605	2.731	2.584
IBOVESPA	1.029	3.864	3.287
MOEX	0.716	2.087	2.154
FTSE 100	0.788	1.957	2.340
BSE 100	0.694	1.505	3.070
S&P 1200 Global	0.513	2.088	2.189
Coefficient of Variation			
S&P 500	5.201	-4.762	7.719
IBOVESPA	8.251	-3.704	11.749
MOEX	4.386	-2.653	9.769
FTSE 100	52.067	-2.498	15.755
BSE 100	9.202	-2.843	9.189
S&P 1200 Global	5.088	-3.558	5.799
Beta			
S&P 500	1.111	1.258	1.175
IBOVESPA	1.169	1.644	1.226
MOEX	0.554	0.117	0.375
FTSE 100	1.131	0.805	0.684
BSE 100	0.363	0.389	0.516
S&P 1200 Global	1	1	1
Systematic Risk (%)			
S&P 500	0.580	2.669	2.503
IBOVESPA	0.608	3.475	2.533
MOEX	0.289	0.196	0.958
FTSE 100	0.586	1.682	1.792
BSE 100	0.168	0.804	1.422
S&P 1200 Global	0.513	2.088	2.189
Unsystematic Risk (%)			
S&P 500	0.172	0.576	0.644
IBOVESPA	0.830	1.690	2.094
MOEX	0.655	2.078	1.929
FTSE 100	0.527	1.001	1.505
BSE 100	0.674	1.272	2.721
S&P 1200 Global	0	0	0

Table 1 shows the return and risk elements of various indices taken in the paper during three sub-periods i.e. pre-announcement period, public health emergency period and

pandemic period. During pre-announcement period, MOEX generated highest daily return (0.163%) than that of other indices. In the public health emergency period, stock prices of most of the companies around the world fell down and hence the returns of their respective indices were also negative. Our findings confirm that Covid-19 had least negative impact on the Indian stock market with the return of -0.529%. However, during pandemic period, it is evident that most of the countries started recovering from the shock of Covid-19 as their respective indices are producing positive returns for them. After market proxy, S&P 500 (0.335%) and BSE 100 (0.334%) are producing the best possible daily returns for their investors.

When we consider standard deviation (an absolute measure of risk), it shows that Brazilian Index IBOVESPA is the riskiest index than all other indices in all the three sub-periods. In public health emergency period, BSE 100 is considered to be the least risky index because of least number of Covid-19 cases in India at that time. However, when we consider coefficient of variation (a relative measure of risk), we find that MOEX had least coefficient in first two sub-periods and S&P 500 had least coefficient in third sub-period. It is important to note here that BSE 100 also had lowest coefficient after MOEX and S&P 500 in public health emergency period and pandemic period respectively.

Higher beta of IBOVESPA during all the sub-periods suggests that this index is most sensitive to market conditions than other indices in the study. We decompose our total risk into two parts i.e. systematic risk and unsystematic risk with respect to all the indices. Since systematic risk is attributable to broad macro factors, it cannot be reduced with diversification, we discover that IBOVESPA is more risky followed by S&P 500 in all the three sub-periods. Because of less representation of India and Russia in S&P 1200 Global Index, unsystematic risk of MOEX and BSE 100 is higher than that of other indices in different time periods. The above results suggest that S&P 500 and BSE 100 are most defensive ones to invest during this tough time of Covid-19 by the investors.

Table 2: Value of Intercept and Growth Rate for the Various Indices (Total Period)

Parameters (Equation 1)	S&P 500	IBOVESPA	MOEX	FTSE 100	BSE 100	S&P 1200 Global
Constant (b_0)	8.039*	11.584*	7.976*	8.862*	9.384*	7.826*
T (b_1)	-0.002*	-0.005*	-0.002*	-0.003*	-0.004*	-0.002*
R Square	0.145	0.439	0.214	0.411	0.544	0.229

**significant at 1% level of significance*

Table 2 shows the result of growth rate model for the overall period. Coefficient of determination (R^2) is better in case of BSE 100 Index (i.e. 0.544) as against other indices. This indicates that growth in BSE 100 is adequately

captured by time period under consideration. All the intercept values are significant at 1% level which implies that there are some other factors besides time-period which have significant effect on growth rate. However, due to limitations on scope of our study we have not considered the other factors.

Table 3: Paired Sample T-Test Result (Total Period)

Pairs	Differential Return (%)	t-value	p-value
Return BSE 100 – Return S&P 500	0.0371	0.090	0.928
Return BSE 100 – Return FTSE 100	0.2456	0.589	0.557
Return BSE 100 – Return MOEX	0.1437	0.461	0.646
Return BSE 100 – Return IBOVESPA	0.2043	0.395	0.694
Return BSE 100 – Return S&P 1200	0.0171	0.048	0.962
Return S&P 500 – Return FTSE 100	0.1761	0.436	0.664
Return S&P 500 – Return MOEX	0.1144	0.323	0.748
Return S&P 500 – Return IBOVESPA	0.1672	0.400	0.690
Return S&P 500 – Return S&P 1200	0.0093	0.023	0.982
Return FTSE 100 – Return MOEX	-0.0691	-0.250	0.803
Return FTSE 100 – Return IBOVESPA	-0.0413	-0.086	0.931
Return FTSE 100 – Return S&P 1200	-0.2126	-0.660	0.511
Return MOEX – Return IBOVESPA	0.0606	0.129	0.897
Return MOEX – Return S&P 1200	-0.1435	-0.395	0.694
Return IBOVESPA – Return S&P 1200	-0.1872	-0.353	0.725

Growth rate of all the indices are coming out to be significantly negative in the overall period. Growth rate of S&P 500 and MOEX is -0.2% daily followed by FTSE 100 (-0.3%), BSE 100 (-0.4%) and IBOVESPA (-0.5%). All the growth rates were significant at 1% level of significance.

It is evident from Table 3 that BSE 100 and S&P 500 both are producing higher returns than other indices but none of the difference is coming out to be statistically significant. S&P 500 Index is performing better in terms of both price discovery as well as returns. However, BSE 100 Index is performing better in terms of return only. Therefore, our results are not in conformity with the Fama's arguments that when the markets are efficient then there is equivalence in price discovery as well as returns. This shows that BSE 100 and S&P 500 are outperforming other indices in terms of return in the overall period. Thus, in the international market, Indian companies and USA companies are well rewarded in terms of higher returns.

- ***Analysis for Public Health Emergency Period and Pandemic Period***

Table 4: Value of Intercept and Growth Rate for the Various Indices during Public Health Emergency Period and Pandemic Period

Parameters (Equation 2)	S&P 500	IBOVESPA	MOEX	FTSE 100	BSE 100	S&P 1200 Global
Constant (b0)	8.154*	11.723*	8.089*	8.971*	9.440*	7.934*
d1 (b1)	-0.472*	-0.665*	-0.414*	-0.486*	-0.418*	-0.456*
T (b2)	-0.006*	-0.009*	-0.006*	-0.007*	-0.004*	-0.006*
Td1 (b3)	0.010*	0.012*	0.009*	0.010*	0.008*	0.009*
R Square	0.865	0.935	0.850	0.926	0.923	0.886

**significant at 1% level of significance*

Table 5: Value of Intercept and Growth Rate for the Various Indices

Parameters		Intercept	Growth Rate
S&P 500	PHEIC	8.154*	-0.006*
	PP	7.682*	0.004*
IBOVESPA	PHEIC	11.723*	-0.009*
	PP	11.058*	0.003*
MOEX	PHEIC	8.089*	-0.006*
	PP	7.675*	0.003*
FTSE 100	PHEIC	8.971*	-0.007*
	PP	8.485*	0.003*
BSE 100	PHEIC	9.440*	-0.004*
	PP	9.022*	0.004*
S&P 1200 Global	PHEIC	7.934*	-0.006*
	PP	7.478*	0.003*

** significant at 1% level of significance*

Table 6: Paired Sample T-Test Result

Pairs	Differential Return (%)		t-value		p-value	
	PHEIC	PP	PHEIC	PP	PHEIC	PP
Return BSE 100 – Return S&P 500	-0.1100	-0.0088	-0.236	-0.019	0.816	0.985
Return BSE 100 – Return FTSE 100	0.2567	0.1576	0.725	0.328	0.475	0.745
Return BSE 100 – Return MOEX	0.2571	0.0789	1.076	0.167	0.292	0.868
Return BSE 100 – Return IBOVESPA	0.4945	0.0593	0.631	0.116	0.534	0.908
Return BSE 100 – Return S&P 1200	0.0630	-0.009	0.182	-0.019	0.857	0.985
Return S&P 500 – Return FTSE 100	0.1887	0.1862	0.284	0.439	0.778	0.663
Return S&P 500 – Return MOEX	0.3671	0.1016	0.850	0.273	0.403	0.786
Return S&P 500 – Return IBOVESPA	0.4255	0.0521	0.605	0.129	0.550	0.898
Return S&P 500 – Return S&P 1200	-0.0936	-0.036	-0.131	-0.071	0.897	0.944
Return FTSE 100 – Return MOEX	0.0005	-0.085	0.001	-0.199	0.999	0.843
Return FTSE 100 – Return IBOVESPA	0.5129	-0.083	0.662	-0.153	0.514	0.879
Return FTSE 100 – Return S&P 1200	-0.1967	-0.222	-0.997	-0.444	0.327	0.659
Return MOEX – Return IBOVESPA	0.2366	-0.033	0.309	-0.066	0.760	0.948
Return MOEX – Return S&P 1200	-0.1941	-0.166	-0.480	-0.403	0.635	0.688
Return IBOVESPA – Return S&P 1200	-0.6900	-0.066	-0.826	-0.111	0.416	0.912

If we look at the coefficient of determination in Table 4, we observe that R^2 is quite good for all the indices which suggest that growth is adequately captured by time period under study. Intercept of all the indices are coming out to be significant which signifies that there are some other factors besides the time period which have significant effect on growth rate. However, we have not considered other factors in this study.

After the declaration of health emergency by WHO on January 30, 2020 huge drops were observed in the stock markets of many countries as investors started losing interest in the stock market. We can see the effect of shock i.e. health emergency on all the indices. We can observe from Table 5 that the growth rates of all the indices are negative in this period. However, the growth rate of BSE 100 (i.e. -0.4%) is less negative than other indices. Thus, Indian stock market shows a high degree of resilience compared to the other countries by its rebounding performance. All the growth rates are significant at 1% level of significance. However, the growth rates during the pandemic period are significantly positive for all the indices. This is the indication of the fact that now the countries have started recovering from the distress position. The growth rate of S&P 500 and BSE 100 is 0.4% on daily basis which is higher than the growth rate of other indices.

It is also evident from Table 6 that again BSE 100 and S&P 500 both are producing higher returns than other indices but none of the difference is coming out to be statistically significant. Therefore, we can say that Fama's arguments did hold true for India since there is equivalence between return and prices in case of BSE 100. Results of paired samples t-test shows that return of BSE 100 and S&P 500 was higher than the return of other indices but the difference was not statistically significant since p-value was high. Our results also corroborate the fact that Fama's contentions do not hold valid during abnormal period. Period during health emergency was abnormal since markets were in bubbling stage. The results during the Pandemic period also show that the BSE 100 and S&P 500 are producing higher returns than other indices taken in the study but none of the difference is statistically significant. This result again upholds the argument of Fama that price discovery and returns move in tandem. Thus, it shows that Fama's argument of price discovery and returns is visible when there is an announcement of pandemic period around the globe. On the basis of above results, we can state that S&P 500 and BSE 100 both are more resilient during this tough phase of Covid-19.

Table 7 shows the risk adjusted measures for our indices in all the three periods. In this table we compare the risk adjusted coefficient of an index in one period with the coefficient of that index in another period.

Table 7: Risk Adjusted Measures

Index	Pre-Announcement Period (Oct. 1 – Jan. 29)	Public Health Emergency Period (Jan. 30 – March 11)	Pandemic Period (March 12 – May 31)
Sharpe Ratio			
S&P 500	0.1852	-0.2113	0.1294
IBOVESPA	0.1094	-0.2726	0.0828
MOEX	0.2036	-0.3847	0.0952
FTSE 100	0.0135	-0.4016	0.0633
BSE 100	0.0887	-0.3609	0.1052
S&P 1200 Global	0.1882	-0.2827	0.1723
Treynor Ratio			
S&P 500	0.0010	-0.0046	0.0028
IBOVESPA	0.0009	-0.0064	0.0022
MOEX	0.0026	-0.0687	0.0055
FTSE 100	0.0001	-0.0098	0.0022
BSE 100	0.0017	-0.0139	0.0062
S&P 1200 Global	0.0009	-0.0059	0.0038
Jensen's Alpha (%)			
S&P 500	0.0006	0.1909	0.0057
IBOVESPA	0.0081	-0.3287	-0.2099
MOEX	0.1043	-0.7697	0.1160
FTSE 100	-0.0957	-0.3114	0.0167
BSE 100	0.0194	-0.2658	0.1699
S&P 1200 Global	0	0	0
Information Ratio			
S&P 500	0.0037	0.3316	0.0089
IBOVESPA	0.0098	-0.1945	-0.1002
MOEX	0.1593	-0.3704	0.0601
FTSE 100	-0.1817	-0.3109	0.0111
BSE 100	0.0289	-0.2089	0.0624
S&P 1200 Global	……	……	……
M^2 Measure (%)			
S&P 500	-0.0036	0.1285	-0.0041
IBOVESPA	-0.0325	-0.1355	-0.2219
MOEX	0.0316	-0.3601	0.0058
FTSE 100	-0.0870	-0.2493	-0.0263
BSE 100	-0.0750	-0.0332	0.0067
S&P 1200 Global	……	……	……

We are not comparing the coefficient of an index with each other index because of different risk free rates in different countries.

If we look at the Sharpe Ratio coefficients, all the indices generated higher Sharpe ratios in pre-announcement period except of BSE 100 (i.e. 0.1052) and FTSE 100 Index (i.e. 0.0633). They produced higher coefficients in the pandemic period which indicates highest return per unit of total risk. It is also important to note here that all the indices generated negative coefficients of Sharpe ratio i.e. negative return per unit of total risk in the period of health emergency. A higher Treynor ratio in the period of pandemic by all the indices shows high return per unit of total systematic risk as against pre-announcement period and health emergency period. Like Sharpe ratios, all the indices produced negative return per unit of systematic risk in the period of health emergency.

Positive and higher Jensen's alpha during pandemic period signifies that all the indices (except of IBOVESPA) are able to earn abnormal return but the difference is statistically insignificant. In the pre-announcement period also, all the indices (except FTSE 100) produced positive abnormal returns from the market. However, during health emergency period only S&P 500 Index (0.19% daily) is able to earn abnormal return from the market. Similarly, a high information ratio shows that an investor can achieve higher returns more efficiently by taking on additional risk. Similar results are obtained for all the indices like that in Jensen's alpha in all the three periods.

M^2 measure determines that on creating index with the same level of risk equivalent to market index (S&P 1200 Global), S&P 500 Index showed positive value of 0.1285 in health emergency period and MOEX and BSE 100 showed positive value in pandemic period which describes that both of the indices generated returns higher than that of market index in their respective time periods. Thus, from the above results we can say that USA and India could be safer bet for investors in international market because they are being rewarded in terms of higher returns. During this period of Covid-19, investors around the globe put more confidence on Indian and USA companies and hence, impact of Covid-19 has been felt less negative in case of USA and India.

Table 8 shows the results for measuring the impact of policy measures taken by government on the growth of stock market. The fixed effect model (FEM) was referred for the analysis over pooled data as per the results of Redundant Fixed Effect test. Subsequently, Hausman test also advocated FEM over random effect model (REM) narrowing our discussion to FEM for overall period, health emergency period and pandemic period. The explanatory variables successfully explained around 99% of variation in the log of index value in all the

three periods employing FEM. The significant intercept values in all the periods imply that there could be some other factors besides explanatory variables taken in the equation.

Table 8: Effect of Government Policy on Stock Market

Dependent Variable: Log Index Value			
Independent Variables	**Overall Period**	**Public Health Emergency Period**	**Pandemic Period**
C	9.1278*	9.2437*	8.8171*
Government Response Index	-0.0101	-6.1165	-0.0018
Containment and Health Index	0.0024	5.1757*	0.0112**
Economic Support Index	0.0009**	0.9401*	0.0024**
Stringency Index	-0.0146*	-0.0057***	-0.0091*
R-squared	0.9964	0.9987	0.9986
Adjusted R-squared	0.9963	0.9986	0.9985
F-statistic	11782.04*	10015.61*	19805.11*

,, *** significant at 1, 5 and 10 percent respectively*

We found that growth of stock market in terms of their index values are not immune to the policy measures taken by government of respective countries. Coefficients of all the four sub-indices representing the policy measures announced by different governments are significant with their expected signs of relationship with the index values in different time frames. If we look at the Stringency Index, it has a significant negative magnitude on the growth of index values of different countries in all the three periods. It ratifies the opinion that as governments of various countries imposes lockdown and restricts the movement of people, it will have an adverse impact on the growth of index values. Economic Support Index has a positive impact on the growth of index values of various countries. It endorses the belief that income support, debt relief and other stimulus packages as announced by various governments and international agencies lead to an upward movement in the growth of index values. Containment and Health Index of the countries taken in our study also advocates the positive impact on the growth of stock market. It can be argued that more testing, contact tracing, investment in hospitals as well as vaccination also leads to growth of stock market in terms of positive slope in all the three periods. Government Response Index shows a negative but insignificant growth rate of indices in all the three periods.

5. CONCLUSION AND POLICY IMPLICATIONS

From a Public Health Emergency of International Concern, Covid-19 soon transformed into a Pandemic as per WHO because of the exponential rate of growth in the number of confirmed corona cases worldwide. Covid-19 has a negative impact on the world economies, particularly it has led to a global supply shock in manufacturing

and labor-intensive industries. There is negative impact on the profitability of companies in almost all the sectors ranging from Automobile, Tourism and Hospitality to Education, Banking and Finance. Several businesses also got shut down leading to staff layoffs, due to inefficiency in dealing with fears and related issues associated with the pandemic. Investors perceive this pandemic to dampen the economic activity and ultimately the future earnings of the company. This is probably the main reason why financial markets worldwide came in the panic mode and started selling off their stock holdings, particularly in the initial phase of pandemic.

The present study has focus on analysing the impact of globally feared disease, Covid-19 on the stock markets of selected five countries with highest number of confirmed corona cases as on 31st May 2020. A comparison has been made between the stock markets of selected countries on the basis of mean returns, total risk and the two components of total risk, i.e., Systematic Risk and Unsystematic Risk. Such comparisons are made across the Sub - periods. Covid-19 is found to have a significant negative effect on the stock market returns of all the countries especially during Public health emergency period. However, the markets showed recovery with positive generation of returns during the pandemic period. The results of panel regression fixed effects model are coming out to be very significant for both entire period and sub-periods. The explanatory variables successfully explained around 99% of variation in the log of index value. Coefficients of all the four sub-indices representing the policy measures announced by different governments are significant with their expected signs of relationship with the index values in different time frames. Overall results suggest that S&P 500 and BSE 100 are most defensive ones to invest during this tough time of Covid-19 by the investors. One of the reasons for contagion is the fear sentiment of investors worldwide that acts as a channel of transmission for the effect of Covid-19 outbreak's on stock markets.

The stock markets across the world have seen huge drops and such drops are always temporary as proven by time and again. They provide an opportunity to the long-term investors to enter the market and earn higher returns. Every time such crisis has come in the past, the world has been able to combat these challenges and markets bounce back soon the crisis gets over. If we look at the history, indices world over has shown that these corrections are temporary but the growth is always permanent. It is found that the growth rates of all the indices are coming out to be significantly negative in the overall period. However, the growth rate during the pandemic period is significantly positive for all the indices. This is the indication of the fact that now the countries have started recovering from the distress position. The growth rate of S&P 500 and BSE 100 is 0.4% on daily basis

which is higher than the growth rate of other indices. The results of paired sample T-test also suggest S&P 500 and BSE 100 both are more resilient during this tough phase of Covid-19. The comparison of risk adjusted measures suggests that USA and India could be safer bet for investors in international market because they are being rewarded in terms of higher returns. During this period of Covid-19, investors around the globe put more confidence on Indian and USA companies and hence, impact of Covid-19 has been felt less negative in case of USA and India.

There are significant implications of the study's findings for Academicians, Government, Policy makers and Investors. For Academicians, the present research would provide further cues for conducting economic wise research during the Covid-19 times across countries. The research has implications for the investors as they can reallocate their investment portfolios during the times of pandemics. The study can also help the governments to mull over different economic and public health related policies and extend financial packages for the corporates particularly, MSMEs which are finding this time to be very challenging. In order to deal with the situation of similar pandemics in future, governments should increase the spending on public health and make necessary health infrastructure for their masses. Further, we can emphasize that the monetary policy measures taken by Central Bank in terms of lowering down of interest rates, moratorium of loan installments and Stimulus Packages announced by various governments (especially Govt. of India) are all welcoming steps to encourage the industries with liquidity crunch during this tough time.

The study also suffers from certain limitations. First, majority of our analysis is based upon the stock indices data that has a constraint if it comes to determining the impact of the crisis. There are a lot of small companies and some other companies that are not listed on the stock exchange and therefore their impact is not visible on the stock indices. Moreover, there are companies which are listed on international stock exchange(s) and their stock prices might get affected due to not only national but international movements. So, the stock indices have a majority but not the entire coverage of the economy. Second limitation is that we have only studied the direct and short-term impact of Covid-19 on the stock markets of selected countries' due to the short event window period and the evolving nature of the virus spread. Third, use of other sophisticated risk-adjusted techniques like Double and Modified Sharpe Ratio, Fama-French three factor model, Fama's Decomposition Measure, etc. could have been employed to evaluate the performance of various indices.

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