

A Comparative Analysis of Stock Market Indices Worldwide during the Pandemic Outbreak.

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Abstract: Risk and return analysis is very crucial for any investment analysis and its decisions. Investors always look for higher returns with less risk, but aggressive investors look for higher returns with their capacity bear the risk of investment. Stock market is a volatile financial market, it is difficult to analyse, so we have got various statistical risk measures to make best analysis for smart investment. Now the world has come across big pandemic outbreak leading to economic crisis. Here the study has helped to examine various regional stock market indices to discern their concert during this crisis. NASDAQ has performed relatively better in compared to other regional stock market indices with good returns even breaking out this crisis and having even correlation with the global stock market index. It outcomes to be better investment set of stock market options consisting of certain returns with high market capitalization securities with sensible high risk.

Keywords: Risk, Return, Beta, Variance, Co efficient of correlation, Unsystematic Risk.

I. INTRODUCTION

We all know that, the year 2020 is a year of lament for all of us due to the pandemic effect of COVID-19 worldwide. The monetary disorder associated with this pandemic has literally aroused a widespread and rigorous impact upon financial markets, including stock markets. The volatility behaviour of market has greater effect on the stock market returns. Volatility could lead to impairment of the even functioning of the financial system and negatively affect economic recital. The world faced the economic crisis by the Corona Virus outbreak. The stock prices and stock markets enclosed by risk and return which are directly correlated. The World is exposed to unsystematic risk. The Unsystematic risk actually includes the losses incurred by labour problems, nationalisation of assets or weather conditions; it is the unique risk which may be specific to an industry or a firm, but in the year 2020 the world has faced the natural catastrophe by COVID-19. Unsystematic risk can be managed by spreading or diversifying our portfolio of investment, however major part of earth has faced this outbreak, even diversifying of assets will be tough. This study will help us to analyse the reaction and volatility study of major regional stock exchanges worldwide and plan better for unpredictable future.

II. PROBLEM STATEMENT, OBJECTIVES AND SCOPE

Problem Statement:

In the current pandemic outbreak scenario, interest rates are declining and fluctuate; it shows that the share market

has put more investors in the hitch. Decision making on Investments is very risky. As investments are uncertain in nature and have to consider various factors before making investments. Therefore the study aims to compare stock exchange indices of various regions in the form of their risk & return. "An overview of effect of stock market indices during Corona Virus out break and comparative risk and return analysis of the selected indices of worldwide in comparison with global index and each other."

Objectives :

- (1) To analyse the risks and returns involved in different stock market indices worldwide.
- (2) To compare the effect of selected stock market indices with each other and with global index.
- (3) To understand the pandemic effect on various stock market indices.
- (4) To conclude the best performance of index with maximum return in minimum risk.

Scope:

- (1) The study is to make comparative analysis of risks and returns associated with various stock market indices worldwide.
- (2) The study covers 10 country's regional stock market indices and one global index.
- (3) The study covers the period of past 6 months from December 2019 to May 2020 i.e before and after Corona Virus outbreak.
- (4) The study covers only stock market indices.

III. REVIEW OF LITERATURE

The traditional theory and modern theory are both mounted under the restraints of risk and return of financial assets, though earlier the study was made by considering individual financial securities and the latter by the combination of the securities. The Modern theory (1) is brought out by Markowitz and Sharpe to get most efficient portfolio basket by considering the theory of diversification using mathematical calculations and statistical analysis. Sharpe has found the beta relationship and stated it to be most important for stocks and explained about the existence of systematic and unsystematic risk and ways to avoid or condense such risks. The fundamental betas were found by Barr Rosenberg, which could be found by predicting relative response coefficient. Jack Treynor found asset performance measure backed by government securities. Even Jensen and Eugene Fama and have proposed risk adjusted performance measures. Stephen Sault had carried out a study on fundamental and technical analysis substantial attempt in assessing their relevant capability to explain share prices; they perpetually do so without orientation to each other. Cheol-Ho Park and Scott H. Irwin investigated market participants' know-how and views on technical analysis to find out on the effectiveness of technical analysis

IV. RESEARCH METHODOLOGY:

Data and their sources:

The study is based on secondary data collected from various stock market websites of worldwide. For the comparison of risk and returns of Stocks market indices monthly closing prices of the selected indices are collected from their respective stock exchange websites. The reason behind choosing the monthly prices is that short term fluctuations in the market prices of the stocks due to internal and external factors can be catch hold off. The reference period is 6 Months from December 2019 to May 2020. The period considered for study is short but there we can observe that it was crucial time of COVID-19 outbreak in the world.

Sample Size:

The Sample size considered for the study is 10 regional stock market indices and a Global index for comparison of risk and returns analysis.

Data Collection Method:

The sample of the stock market indices for the purpose of collecting secondary data has been selected on the base of Random Sampling. The stocks are chosen based on top market capitalization of stock market indices.

The Following Stock market indices are considered for the study with a global index i.e MSCI Global Index:

BSE SENSEX, HANGSENG INDEX, S & P 500, NASDAQ, NIKKIE 225, DAX 30, FTSE 100, CAC 40, FTSE MIB, S & P, ASX 200

Statistical Tools used for the Study:

To analyse the data in the project various statistical tools are used. They are:

(1) Beta:

Beta is a statistical measure of relative volatility; it in fact measures the systematic risk of a security or portfolio in contrast to the market as a whole. A stock that sways more than the market over time has a beta above 1.0 if a stock moves less than the market, the stock's beta is less than 1.0. High beta stocks are hypothetically to be riskier but provide higher returns and low beta stocks are of lower returns.

$$\beta = \frac{(N\sum XY - (\sum X)(\sum Y))}{N\sum X^2 - (\sum X)^2}$$

Where,

- B - Beta of the Stock Index
- N - Number of observations.
- X - Yearly return of Index.
- Y - Yearly return of the sector average.

(2) Co Efficient of Determination:

Co efficient of Determination is a measure of the goodness of fit of the relationship between the dependent and independent variables. Stock returns are dependent on market returns, hence to know their fir in the market this measure is used.

$$R^2 = \left[\frac{((N\sum XY - (\sum X)(\sum Y)))}{(N\sum X^2 - (\sum X)^2)(N\sum Y^2 - (\sum Y)^2)} \right]^2$$

- R² - Co - efficient of determination.
- N - Number of observations.
- X - Yearly return of Index.
- Y - Yearly return of the sector average.

(3) Standard Deviation:

Standard Deviation is a statistic measure useful in investing and trading strategies to evaluate market and security volatility and envisage performance trends. Aggressive stocks are with higher standard deviation. A large scattering shows how much the return on fund is deviating from the probable normal returns.

$$\sigma = \sqrt{(Y - Mean Y)^2}$$

Where,

- σ - Standard deviation
- N - Number of observations.
- Y - Yearly return of stock indices

(4) Alpha:

Alpha is one of the chief risk management indicators. If alpha is less than zero, it means the investment is too risky with the particular returns, if it is equal to zero the investment has earned a return proportionate with the risk and if alpha is greater than zero means investments have over performed. Hence alpha compares with relative return.

$$\alpha = \bar{Y} - \beta (\bar{X})$$

Where,

- X - Average return of Regional Stock Index.
- Y - Average return of Global Stock Index.

(4) Variance:

The variance of stock returns is a measure of how much a stock's return varies with respect to its average daily returns. A large variance indicates that the stock could be quite risky while a small variance can indicate lesser risk.

$$\sigma^2 = \sum \frac{(X - \mu)^2}{N}$$

Where,

- X - Monthly Return of Regional Stock Index
- μ - Average of Regional Stock Index Return.
- N - Total Number of Observations.

(5) Co-Variance:

Covariance indicates how two or more stocks move together. It tells us whether the two variables move together if they have positive covariance or they move in the opposite direction if negatively covariance.

$$Co\ variance = \frac{\sum (X - Avg X) \times (Y - Avg Y)}{N}$$

Where,

- X - Returns of region stock index
- Y - Returns of global stock index
- N - Number of Observations.

(6) Co efficient of Correlation:

Coefficient of correlation measures the correlation between the stocks, if it is above 0, the stocks have positive correlation and their returns are in same direction, if it is below zero they are in opposite direction, if it is zero it means they have no correlation, so no relationship between the stocks.

$$Correlation\ Co - efficient = \frac{Cov(X,Y)}{SDGI \times SDRI}$$

Where,

- Cov(X,Y) - Covariance between (Global Index, Regional Index)
- SDGI - S.D of Global Index
- SDRI - S.D of Regional Index
- S.D - Standard Deviation

V. ANALYSIS AND INTERPRETATION

Table 1. Stock prices data of selected regional stock market indices and Global index:

STOCK EXCHANGE	BSE SENSEX	HANG SENG INDEX	S & P 500	NASDAQ	NIKKEI 225	DAX 30	FTSE 100	CAC 40	FTSE MIB	S & P ASX 200	MSCI WORLD
COUNTRY	INDIA	HONG KONG	US	US	JAPAN	GERMANY	UK	FRANCE	ITALY	AUSTRALIA	GLOBAL
CURRENCY	INR	HKD	USD	USD	JPY	EUR	GBP	EUR	GBP	AUD	USD
Nov-19	40,793.81	26,346.49	3,140.98	8,665.47	23,293.91	13,236.38	7,346.50	5,905.17	7,542.40	6,846.00	258.18
Dec-19	41,253.74	26,312.63	3,225.52	9,150.94	23,178.10	12,819.59	6,472.60	5,175.52	7,286.00	5,998.70	285.80
Jan-20	40,723.49	26,129.93	2,954.22	8,567.37	21,877.89	11,586.85	6,076.60	4,695.44	6,580.60	5,755.70	295.44
Feb-20	38,297.29	23,603.48	2,584.59	7,700.10	20,193.69	10,861.64	5,901.20	4,572.18	5,672.00	5,522.40	288.96
Mar-20	29,468.49	24,643.59	2,912.43	8,889.55	18,917.01	9,935.84	5,672.00	4,396.12	5,901.20	5,076.80	327.00
Apr-20	33,717.62	22,961.47	3,044.31	9,489.87	21,142.96	11,890.35	6,580.60	5,309.90	6,076.60	6,441.20	328.85
May-20	32,424.10	24,776.77	3,232.39	9,924.75	23,205.18	12,981.97	7,286.00	5,806.34	6,329.10	7,017.20	331.27

(a) Table1. In the above table we can see that 10 regional stock indices and a global stock market index is being considered for the study. The regional stock indices are chosen based on their performance and also wrap the whole world. The month end closing prices from December 2019 to May 2020 is being considered for the study.

Table 2: Converted data of all stock market prices in to US Dollar rate of 1st of June 2020.

STOCK EXCHANGE	BSE SENSE X	HANG SENG INDEX	S & P 500	NASDAQ	NIKKI E 225	DAX 30	FTSE 100	CAC 40	FTSE MIB	S & P ASX 200	MSCI WORLD
COUNTRY	INDIA	HONG KONG	US	US	JAPAN	GERMANY	UK	FRANCE	ITALY	AUSTRALIA	GLOBAL
CURRENCY	INR	HKD	USD	USD	JPY	EUR	GBP	EUR	GBP	AUD	USD
RATE IN USD	75.501	7.7514	N A	N A	107.59	0.8983	0.8012	0.8983	0.8012	1.4736	N A
Nov-19	540.31	3,398.93	3,140.98	8,665.47	216.51	14,734.92	9,169.37	6,573.72	9,413.88	4,645.77	258.18
Dec-19	546.40	3,394.56	3,225.52	9,150.94	215.43	14,270.95	8,078.63	5,761.46	9,093.86	4,070.78	285.80
Jan-20	539.38	3,370.99	2,954.22	8,567.37	203.35	12,898.64	7,584.37	5,227.03	8,213.43	3,905.88	295.44
Feb-20	507.24	3,045.06	2,584.59	7,700.10	187.69	12,091.33	7,365.45	5,089.81	7,079.38	3,747.56	288.96
Mar-20	390.31	3,179.24	2,912.43	8,889.55	175.82	11,060.71	7,079.38	4,893.82	7,365.45	3,445.17	327.00
Apr-20	446.59	2,962.24	3,044.31	9,489.87	196.51	13,236.50	8,213.43	5,911.05	7,584.37	4,371.06	328.85
May-20	429.45	3,196.43	3,232.39	9,924.75	215.68	14,451.71	9,093.86	6,463.70	7,899.53	4,761.94	331.27

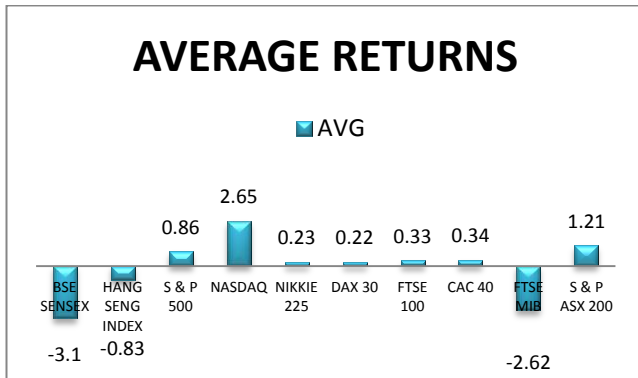
- (b) Table 2. The above table shows the stock market index prices of 10 regional indices and a global stock index. In order to obtain uniformity of data for the study, all the stock market index prices are being converted in to US Dollars.
- (c) Here the US Dollar currency rate as on 1st of June 2020 is considered to convert other currencies to bring consistency in the research.
- (d) For the calculation of returns percentage of the consecutive 6 months from December 2019 to May 2020, the closing prices of November 2019 is contemplated for the study. The prices are being considered in their respective country currencies.
- (e) Table 1. and Table 2. encompasses basic essential data for the analysis and interpretation of the research study. Here 6 months from Dec2019 to May 2020 is the considered as the period is before and after COVID-19 pandemic outbreak worldwide.

Table 3: Risk and Return Analysis of Regional Stock Indices and Global Stock Index:

STOCK EXCHANGE	BSE SENSE X	HANG SENG INDEX	S & P 500	NASDAQ	NIKKI E 225	DAX 30	FTSE 100	CAC 40	FTSE MIB	S & P ASX 200	MSCI WORLD
COUNTRY	INDIA	HONG KONG	US	US	JAPAN	GERMANY	UK	FRANCE	ITALY	AUSTRALIA	GLOBAL
Dec-19	1.13	-0.13	2.69	5.60	-0.50	-3.15	11.90	-12.36	-3.40	-12.38	10.70
Jan-20	-1.29	-0.69	-8.41	-6.38	-5.61	-9.62	-6.12	-9.28	-9.68	-4.05	3.37
Feb-20	-5.96	-9.67	12.51	-10.12	-7.70	-6.26	-2.89	-2.63	-13.81	-4.05	-2.19
Mar-20	-23.05	4.41	12.68	15.45	-6.32	-8.52	-3.88	-3.85	4.04	-8.07	13.16
Apr-20	14.42	-6.83	4.53	6.75	11.77	19.67	16.02	20.79	2.97	26.88	0.57
May-20	-3.84	7.91	6.18	4.58	9.75	9.18	10.72	9.35	4.16	8.94	0.74
Σ	-18.59	-5.01	5.16	15.89	1.39	1.30	1.95	2.03	-15.72	7.27	26.34
AVG	-3.10	-0.83	0.86	2.65	0.23	0.22	0.33	0.34	-2.62	1.21	4.39
α	1.34	-0.42	-1.72	-2.15	-1.84	5.52	1.34	1.07	-0.25	0.92	
β	-0.40	0.29	0.44	0.56	-0.18	-0.26	-0.31	-0.24	0.06	-0.21	

(f) Table3. In the above table the returns are being calculated for the 6 months ranging from December 2019 to May 2020. From the above table we can see that the total return of NASDAQ is highest with 15.89% and BSE Sensex is lowest with -18.59% in this time range. Here total returns refer to the sum of all the

returns percentages found with changes in returns percentage of its original value due to price volatility.

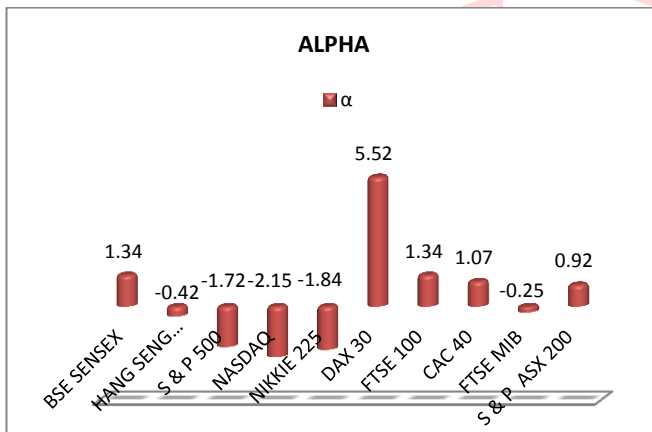


Graph 1. Average returns of Regional stock indices.

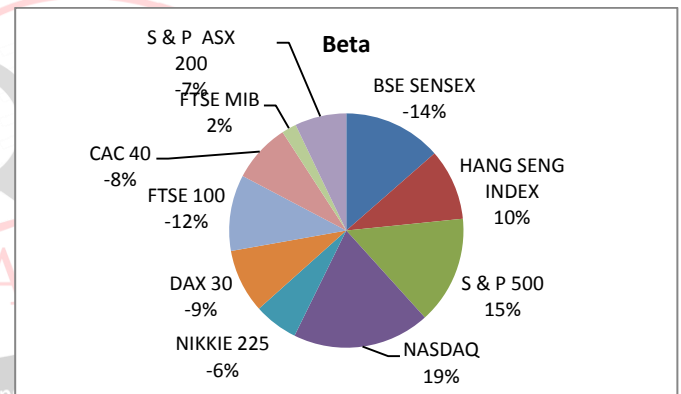
(g) From the above Graph 1. we can see that NASDAQ has highest average returns with 2.65% and BSE Sensex has the least with -3.1%. if we consider the strategy of mean reversion, even then the NASDAQ shows the chances of getting back or balancing with average return value in forthcoming months and BSE Sensex's May 2020 return value and average return value are closer, it means that it may reconcile with negative average return value in next Prospective months. NASDAQ may hit greater prices than its average return based on its returns stream.

(h) By consideration of risk measure alpha (Graph 2.), we can interpret that DAX 30(Germany) with highest alpha value of 5.52 denotes to be less risky and it can be interpreted that it is outperforming in comparison to global market index and NASDAQ (U.S) with lowest alpha value of -2.15 investments are with high risk in comparison with the global index it low performing. The surfeit return of stock market indices relative to the return of a benchmark index i.e. global index is the stock index's alpha.

(i) Beta is one of the significant risk measuring factor through which (Graph 3.) we can interpret that none of the regional stock indices has Beta value more than 1. It means that that none of the indices are more volatile than global market index, since all are having Beta Value less than 1. Nasdaq has highest Beta value amongst the set, which shows that, this stock index is more volatile in these months compared to other indices. Though it has not outperformed better than global index, but still it is worth to invest in with high risk and high returns. BSE Sensex with less Beta value seem to be less volatile compared to others and it has underperformed than other regional indices and global stock market index.



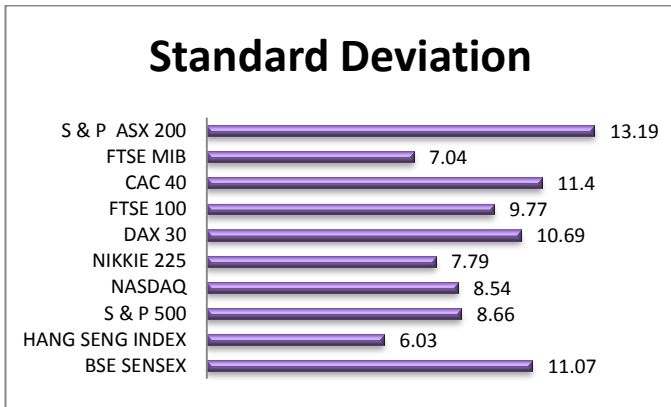
Graph 2. Alpha of Regional stock indices.



Graph 3. Comparison of Beta Value

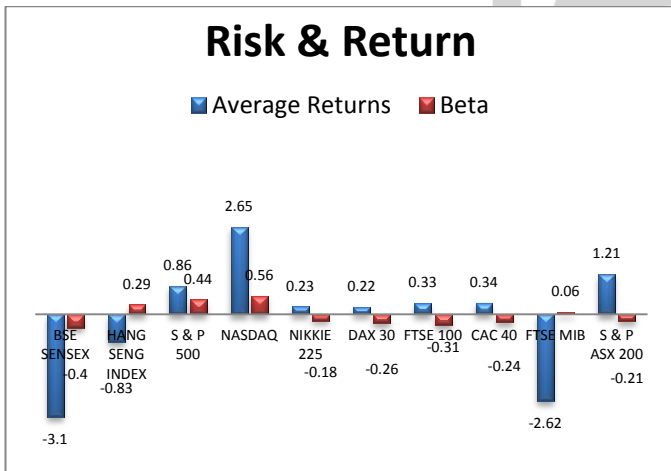
STOCK EXCHANGE	BSE SENSEX	HANG SENG INDEX	S & P 500	NASDAQ	NIKKIE 225	DAX 30	FTSE 100	CAC 40	FTSE MIB	S & P ASX 200	MSCI WORLD
COUNTRY	INDIA	HONG KONG	US	US	JAPAN	GERMANY	UK	FRANCE	ITALY	AUSTRALIA	GLOBAL
S.D	11.07	6.03	8.66	8.54	7.79	10.69	9.77	11.40	7.04	13.19	5.61
Variance	122.49	36.39	74.94	72.95	60.70	114.20	95.54	129.87	49.53	174.09	31.52
Co Variance	-32.63	16.57	29.88	33.57	-13.81	-25.41	30.72	-33.11	14.70	-42.25	
r	-0.53	0.49	0.61	0.70	-0.32	-0.42	-0.56	-0.52	0.37	-0.57	
R ²	-0.52	0.26	0.71	0.93	0.03	-0.95	-0.57	-0.53	0.08	-0.53	

Table 4 : Risk Analysis of Regional Stock Indices and Global Index:



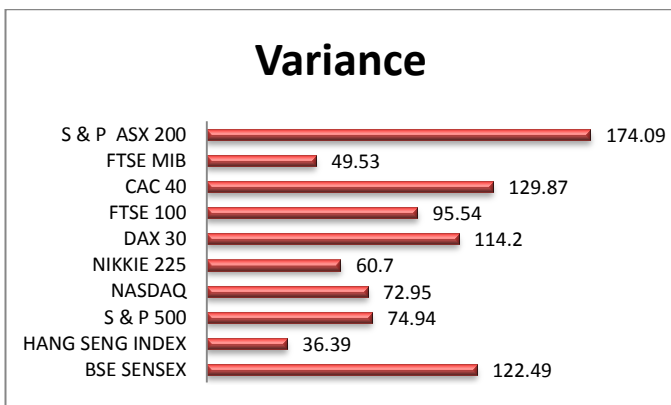
Graph 5. Standard Deviation of Regional Stock indices.

(k) From (Graph 5.) we can interpret that S& P ASX 200 is with highest standard deviation value, denotes that its returns are more deviating from the probable normal returns of that average index returns and Hang Seng Index is less deviating with lowest standard deviation value. The graph shows the intensity of deviation of stock indices from their average returns of the past 6 months considered for the study. Higher the value indicates their deviation; hence it is better measure of volatility of stocks.



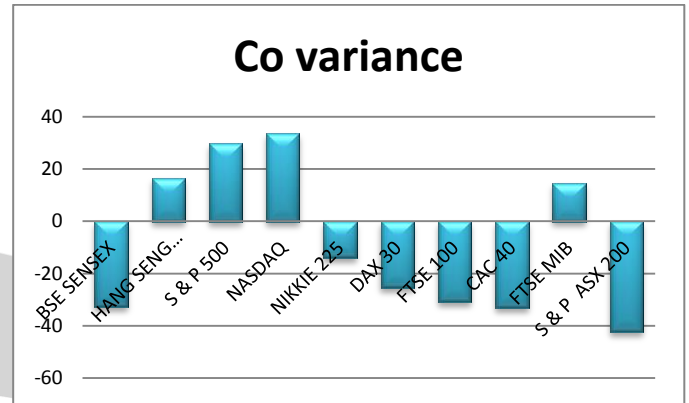
Graph 4. Comparison Risk and Returns.

(j) We can expound from the Graph 4, showing the clear comparison of risk and returns of stock indices. It stands as evidence for high risk lead to high returns and low risk lead to low returns.



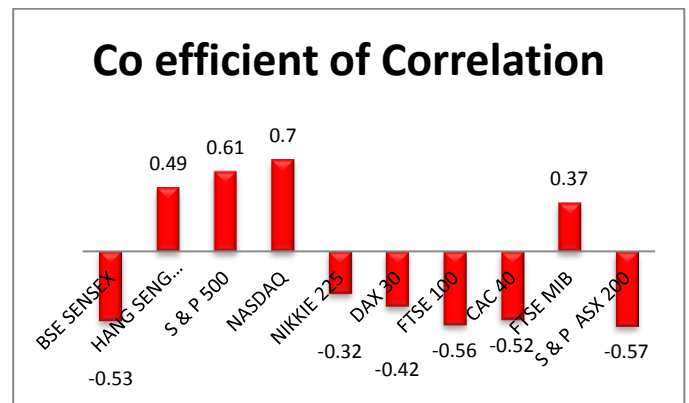
Graph 6. Variance and Co-variance of Regional Stock indices.

(l) Variance is similar to Standard Deviation, as per calculations S& P ASX 200 is again with highest variance value as same as standard deviation denoting to be more variant from its mean with high volatility trend in future as it has spread our far from its average returns and Hang Seng Index is least spread out from its mean, seem to be with least up down values from its mean value in the upcoming months as per its least variant value.



Graph 7. Co-variance of Regional Stock indices.

(m) For comparison of relationship between the movement of prices of global index and regional indices co variance is one of the tool used. Based on this from (Graph 6.) we can interpret that NASDAQ has Co Variance value of 33.57 , it shows that its prices are moving in the same direction as of global index as it has got highest positive co variance value and S& P ASX 200 has -42.25 indicating that its stock index prices are moving in the opposite direction of the global index with least negative value. It means this index behaviour is far from the whole market behaviour i.e of global stock index.

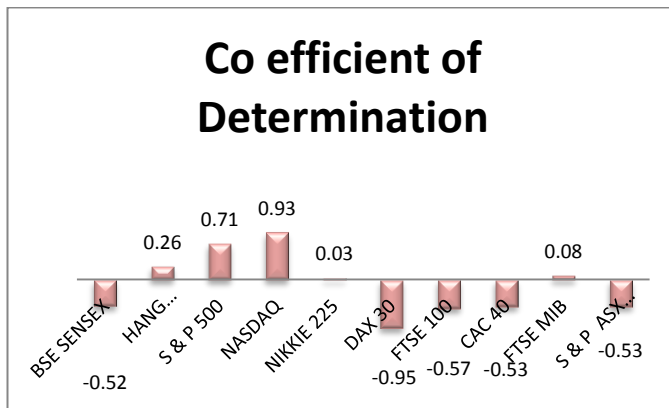


Graph 8. Co-variance of Regional Stock indices.

(n) Co efficient of Correlation helps us to know the correlation between the regional stock indices and global stock index. We can see that indices (Graph 6.)

are in the between +1 and -1, hence the positive coefficient values are quite correlating with the global index, indicating that even these indices are behaving similar as the global level, and the regional indices with negative coefficient value are showing returns in the opposite direction to global stock returns behaviour.

- (o) Co efficient of Determination indicates the dependability of regional stock indices price movement with the global stock index prices. It helps to analyse the goodness of fit in the relationship. Even in this measure NASDAQ with highest value shows to fit well with the relation of movement of stock index prices (Graph 9.) with global stock market index and S& P ASX 200 is with least value denoting the bad to fit in relation to movement of Stock market index values. Its dependability percentage is very less with the global index.



Graph 9. Co-efficient of Determination of Regional Stock indices.

VI. FINDINGS

Based on the contemplation of objectives of the study, these are the findings:

- (i) It is found that Stock indices of Unites states are outperforming with global stock market index by affording highest returns, followed by stock index of Australia, France, UK, Japan, Germany, Hong Kong, Italy and India.
- (ii) In consideration of Risk factors like Alpha, Beta and Standard deviation again US index is appearing with highest risk and market of volatility, unable to yet assure the movement. The greater volatility nature of this market has lead to highest returns amongst the selected sample. India is found to be in the down trend with negative returns and least risk of investment.
- (iii) COVID -19 pandemic effects can be observed with greater variation in the stock prices and returns by the end of month of February 2020. Most of countries have exposed the reaction to the vulnerable risk effect in that month and they have recovered to their best in the upcoming months. But countries like India, UK, Japan,

Australia have expressed their reaction in the month of March 2020.

- (iv) The US market index is moving in the same trend as of the global market index and beyond being more volatile during this pandemic outbreak still looks to be coming up with greater returns in the next future by overcoming the current crisis. 0.93 value of Co efficient determination of NASDAQ proves its index movement is 93% dependent on the global stock index movement.

VII. CONCLUSION

COVID 19 has lead to severe outbreak on worldwide economy and even on investment sector. This financial crisis has brought various unsystematic risks over the stock market investment returns. By considering various statistical risk analysing measures in this study, it is found that stock market of United States is dealing well even after this pandemic spread. Stock returns in US are in the increasing trend and match the same path as of the global stock market index. India emerges to be in hostile mode by budging in the opposite direction of the global market trend. The countries like UK, France, China and Japan are found to be coming up with promising returns with greater improvement as their returns are moving towards and above their mean returns. This pandemic has lead to economic and financial crisis worldwide, but based on the study we can conclude that US indices are outperforming along with global market index and emerges to be in the uptrend as per the study forecast. Countries like Japan, UK, Italy, France and China are found to be recovering in the lofty speed to get back to the trend. The country like India seem to work on economic backgrounds a lot to get back to track as earlier and Australia and Germany emerges to be very less dependent as per the movement of global trend of stock market. So as an elegant investor we have to choose securely in consideration of risk during this pandemic outbreak and economic crisis with subtle returns let us make smart choice of investment.

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