Efficient Market Hypothesis During The Time of COVID

Gayathri P Pillai, Arjun Pillai

Abstract: This paper examines the efficiency of the Indian Stock Markets (NSE) during the time of COVID. It demonstrates the impact on the market on the announcement of two major events that is the declaration of COVID as a Public Health Emergency Of International Concern (PHEIC) on 30th January 2019 and the day when Prime Minister Narendera Modi declared first lockdown in India, 24th March 2019. The study uses the Event Study methodology to determine the efficiency of the markets. The study found that the markets were in fact inefficient during the period under study and that there were numerous opportunities to make abnormal profits. The study also conducted a sector wise comparison to analyze the impact of the above mentioned events and found a major difference in the way each sector was affected by the news, indicating different levels of efficiency in the semi strong form of market. The results of this research helps one to understand investor behavior and biases and the different opportunities one could make use of, in order to make abnormal profits.

Keywords: COVID, (PHEIC), (NSE).

I. INTRODUCTION

A. Stock Market: Overview

This An institution which has gathered immense interest and attention of the public and of the economists is the Stock Market. As a part of economic liberalization, the stock market has been assigned an important place in financing the Indian corporate sector. Besides mobilizing resources for investment directly from the investors, the stock market provides liquidity to the investors and plays a significant role in monitoring and disciplining company managements. The principal function of the stock markets is providing entrepreneurs and governments with a means for mobilizing resources directly from the investors, and liquidity for the investors. Liquid markets improve the allocation of resources and enhances the prospects of long term economic growth. Stock markets play a very important role in disciplining the company's managements. In India, Equity market development began in the very first phase of liberalization that is in the early 'eighties. Additional emphasis followed after 1991 as capital markets became an integral part of the restructuring strategy. Today, Indian markets are in conformity with the international standards both in terms of the structure and in terms of operating efficiency. The factors that affect the stock market can be divided into three categories, fundamental factors, technical factors, and market sentiment. Primarily market is influenced by the fundamentals, which, at the basic level, refers to a combination of earnings base, (such as earnings per share (EPS)) and A valuation multiple, (such as a P/E ratio). An owner of common stock has a claim on earnings, and earnings per share (EPS) are the owner's return on his or her investment. When you invest in a stock, you are purchasing a proportional share in the total future stream of earnings. The valuation multiple expresses expectations about the future. As explained earlier, it is f based on the model of discounted present value of all the future earnings. Technical factors are a combination of external factors that alter the demand for and supply of a company's stock. Inflation, Economic Strength of Market and Peers, Substitutes, Incidental Transactions, Demographics, trends, liquidity and news etc. Another factor with a major impact is the market sentiment. Market sentiment refers to the psychology of the market participants both in an individual and collective sense. This is perhaps the most vexing category. Market sentiment is often subjective, biased, and obstinate.

B. What is EMH?

The Efficient Market Hypothesis, known as EMH in the investment community, is one of the milestones in the modern financial theory. The efficient-market hypothesis (EMH) is a hypothesis in financial economics that was developed independently by Samuelson (1965) and Fama (1963, 1965), and in a short time, it became a guiding light not only to not just the practitioners, but also the academicians. In brief, EMH states that an asset price is reflective of all the available information. A direct implication or result of this theorem is that it is impossible to "beat the market" consistently on a risk-adjusted basis as the market prices should only be reacting to new information. Because risk adjustment forms the basis for the formulation of EMH, it results in testable predictions only when coupled with a particular model of risk. Since the information arrives randomly, the stocks' future price trajectories are quite predictable.

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In simple words the price increments and decrements are independent, which implies that no one can predict the future path of share prices based on their historic prices. Although, EMH has been developed and discussed extensively over the years, the concept that price increments or decrements are independent, unrelated, and unpredictable was initially introduced by Louis Bachieler. (**Bachelier, 1990**)

Fama (1963, 1965) studied the stock prices and exhibited leptokurtosis that characterizes the distribution of stock price increments. He concluded that price changes are uncorrelated and independent. Since then, majority of the literature focuses on studying whether the EMH is valid, that is, whether there is a random walk in the markets, then based on the examination of different empirical data, contradictory evidences and results have been found. The EMH provides the logic for modern risk-based theories of asset prices, and framework of intermediary asset pricing and consumption-based asset pricing can be thought of as the combination of the risk model and the EMH. In reality the markets are not always efficient. In security frauds or broadly speaking in financial market crimes, the efficiency market hypothesis is often used as an argument in courts or in related litigation cases. Suppose that a piece of information about the value of a stock (a future acquisition) is widely available to investors. If the share prices are not reflective of that information, then investors can trade on it, hence moving the prices until one can no longer trade on that information. This experiment does not necessarily imply that stare prices are unpredictable. For example, if the piece of information in question is about a financial crisis that is likely to come soon. A rationale investor would typically not hold stocks during a financial crisis, and would sell the stocks until the price drops enough so that the expected return compensates for the risk.

C. Does Technical and Fundamental Analysis Work?

As per EMH the security prices adjusts to new information very rapidly. The technical analysis that is often used by many investors is based on the assumption that new information in the stock market is disseminated to the bulk of investors in a series of stages. The new information first passes onto the informed professionals, then to the aggressive investors and then finally to the general investors. Thus, technical analysts believe that the investors often take time to analyze the information. They believe that stock prices move to a new equilibrium in a slow manner after the release of new information, which results in trends in stock price movements which persist over a period of time. Thus, the EMH is in direct contradiction of the assumptions of technical analysis. If the capital markets are efficient in the weak form, the prices will fully reflect all the historical information about that stock. Hence by the time the information is available to the public, the price adjustments would have already taken place and technical trading systems which is based on analysis of the past trading data would have no value. In short, as per EMH, technical analysis is not valid. The investor will hence not be able to earn abnormal profits using the past historical data. Fundamental analysis, on the other hand, aims to find the intrinsic value of the firm in order to earn superior risk-adjusted returns. Hence, one must have knowledge of the various variables that would be

necessary to be perform the valuation of the firm.. The EMH contends that fundamental analysis is also bound to be a invalid. The recommendations of the analysts based on the publicly available earnings and other company information is not likely to be more accurate than those of competitor analysts. In simple words, it is difficult for analysts to get unique insights about the shares, which will help in evaluation of the firm's prospects. Thus, EMH is ad vocative of the passive investment strategy instead of active portfolio management. Passive investment strategy is all about buy and hold. A classic example of the same would be to create an index fund which replicates the performance of a broad-based index of stocks. Taxation related considerations are an absolute necessary to ensure real returns and often professionals in the field are better equipped to deal with the same than ordinary investors.

D. Weak, Semi Strong and Strong Form of Market

In Fama's review paper(1970), he categorizes the empirical tests of efficiency into "weak-form", "semi-strong-form", and "strong-form" tests. Weak Form EMH suggests that the prices are reflective of all the past information. Therefore, fundamental analysis does not provide a long-term advantage and technical analysis will not be valid. Semi-Strong Form EMH implies that both fundamental analysis and technical analysis are incapable of providing an advantage to an investor and that a new piece of information is instantly priced in to securities. Strong Form EMH says that all information, both public and private, is absorbed by the market and that no investor can earn abnormal profits and it is impossible to "beat the market".

E. Criticism of EMH

Investors, including Warren Buffett, George Soros, and academicians have disputed the efficient-market hypothesis both theoretically and empirically. Behavioral economists attribute these imperfections in financial markets to a combination of cognitive biases such as overreaction, overconfidence, representative bias, information bias, and various other human errors in information processing and reasoning. The more promising alternatives to EMH are the Behavioral psychology approaches to stock market trading. But Nobel Laureate co-founder of the programme Daniel Kahneman —announced his skepticism of investors beating the market: "They're just not going to do it. It's just not going to happen." (Kahneman) When you look at it from another perspective, Behavioral Finance in fact strengthens the case for EMH stating that it is the biases in individuals and not competitive markets that is responsible for the inefficiencies. For example, hyperbolic discounting is a major finding of the behavioral finance. It is not true for instruments such as bonds, mortgages, annuities etc. Hyperbolic discounting in the pricing would result in an arbitrage that will quickly eliminate any of the individual biases. Similarly, strategies such as diversification, use of derivative securities etc. assuage if not eliminate potential mispricing from the severe risk-intolerance of individuals that is a component of behavioral finance.

Further empirical work has examined and highlighted the impact of transactional costs on the efficiency of the market, with bulk of the evidence suggesting that any anomalies pertaining to market inefficiencies are because of the cost benefit analysis made by those who are willing to incur the cost of acquiring the valuable information that is necessary in order to trade on it. Additionally, the concept of liquidity is a critical component in the study of market inefficiencies.

Any test of this proposition would face the problem of joint hypothesis, where it is impossible to accuratey test for market efficiency, as that would require the use of a measuring stick against which abnormal returns can be compared —one cannot check for market efficiency if one does not know if a model correctly stipulates the required rate of return. Consequently, a common situation that arises is where either the asset pricing model is incorrect or the market is inefficient, but one has no way of knowing which of them is the case. In this paper, we aim to test the Efficient Market Hypothesis during the time of COVID-19, in the Indian stock Market. We used the World Health Organization (WHO) announcement of COVID as a pandemic and the first announcement of lockdown in India as the two major events. This paper examines how the Indian stock market particularly the Nifty index, reacted during the COVID-19 outbreak (31.10.2019-31.05.2020). Using simple event study method, we juxtapose the released news with the respective market performance in order to examine if the stock market always incorporated the available information in time. On 30 January, WHO declared the outbreak a Public Health Emergency of International Concern (PHEIC) 2 , and on 24th March, Prime Minister Narendra Modi declared the first lockdown in India. The COVID-19 outbreak gives us the opportunity to examine the Efficient Market Hypothesis (EMH) in an extremely stressful period, and to suggest some new factors that should henceforth be included in the EMH study, such as the promptness and the rationality of the stock markets. Additionally this study examines the number of days within which the market is able to slowly absorb the information and the news no more has a statistically significant impact on the share prices.

II. REVIEW OF LITERATURE

A study into the existing literature reveals that large number of studies have examined the existence of the Efficient Market Hypothesis in the developed and under developed markets with varying results across timelines. An Empirical Analysis of Weak Form of Market Efficiency: Evidence from Chittagong Stock Exchange(CSE) of Bangladesh, published by Md. Siddikur Rahman, H. M. Simon and Md. Murad Hossain, aimed at finding evidence on Efficient Market Hypothesis (EMH) using various parametric and non-parametric tests .Some of the variables used in this study were the Index prices, the real rate of return, lag number, lag length etc. The statistical tools used in this study were Wald-Wolfowitz Runs Test, Variance Ratio Test , Kolmogorov Smirnov (K-S) Goodness of Fit Test) ,Augmented Dickey-Fuller (ADF) Test and Autocorrelation Function Test (ACF). The study concluded that the Chittagong Stock Exchange(CSE) does not follow the random walk hypothesis and is inefficient in the weak form for the given period under study. (Md Siddikur Rahman)

Testing of Efficient Market Hypothesis: A study on Indian Stock Market, published by Neeraj Gupta and Ashwin Gedam aimed to find out whether the past prices of the stock are reflected on the future price and whether the market is efficient in the weak form. Four companies were taken as the sample in this study. Some of the variables used in this study were closing stock prices of the companies taken from NSE, Total Number of Runs, Number of Positive Price Changes, and number of Negative Price Changes. The main statistical tool used in this study was the run test. The result of this study was that in most of the cases, the stock prices are independent of the past prices and the market is weakly efficient. It is in favor of the random walk theory. (Gedam) Testing of weak form of efficient market hypothesis: evidence from the Bahrain Bourse, published by Iqbal Thonse Hawaldar, Babitha Rohit and Prakash Pinto had the following objectives- to test the weak form efficiency of individual stocks listed on Bahrain Bourse, to examine the randomness of individual stock prices and to test the independence of individual stock price changes. The sample of this study was 43 companies. Some of the variables used in this study are the daily prices - return at time t , pt Log is the logarithmic price at time t logarithmic, at time t-1. Run Test using standard normal Z-statistic, Kolmogrov-Smirnov goodness of fit test (K-S test) is the statistical/research tools used to facilitate this study. The results of the tests did not support the randomness of the returns of the individual stocks. Therefore, it was difficult to conclude that successive returns of the stocks listed on Bahrain Bourse follow a random walk. Autocorrelation tests revealed that share prices exhibit low to moderate correlation varying from negative to positive values. (Iqbal Thonse Hawaldar) Testing Weak for of Efficient Hypothesis (EMH): Empirical Evidence from Leading Stock Exchanges in India was published by Rahul Sarkar in the International Journal on Recent Trends in Business and Tourism. The main objective of this study was to give an overview of Efficient Market Hypothesis (EMH) and on how the different forms of EMH can be tested, to test weak form of market efficiency of Bombay Stock Exchange (BSE) and to test weak form of market efficiency of National Stock Exchange (NSE). This study was facilitated by Run test, Autocorrelation test or Serial Correlation coefficient test, Kolmogorov-Smirnov Goodness of Fit Test (K-S test) and other such related statistical tools. Some of the variables used in this study were Daily stock prices of Sensex and Nifty, return at time t , pt Log is the logarithmic price at time t logarithmic,at time t-1, lag of the period, covariance between the return of an index over time period (t) and its lagged return t-k periods earlier, variance on the return of a security over time t period etc. The result supports the previous conclusion that the Indian stock market is not efficient in the weak form and security prices do not reflect all past information and it is possible to earn super-normal gain by utilizing past information as share prices do not adjust instantaneously in response to any new information release in the market. (Sarkar) The Testing of Efficient Market Hypotheses: A Study of Indian Pharmaceutical Industry was published by Abhay Kumar, Rashmi Soni, Iqbal Thonse Hawaldar, Meghna Vyas and Vaibhav Yadav.

The main objective of this study was to test whether the Indian Stock Market was efficient in the weak form, semi-strong form, and the strong form .The sample in this study was 10 listed pharmaceutical companies. Some of the variables used in this study were the Closing stock prices of the companies taken from NSE, Total Number of Runs, Number of Positive Price Changes, and Number of Negative Price Changes.

The main statistical tool used in this study was the run test. The study concluded that Pharmaceutical companies' stock prices are efficient in the weak form of an efficient market hypothesis. But the Indian stock market is not efficient in the semi-strong and the strong form of EMH. (Abhay Kumar)

Testing Weak form of Market Efficiency: A Study on Indian Stock Market was published by Ajju Patel, Rajan Rajpal and Ashish .The main objective of the study was to test whether Indian Stock Market followed Random Walk Model and whether it was efficient in the weak form of market. The sample used in this study was the 30 companies in the Bombay Stock Exchange. Some of the variables used in this study was Mean, Total runs, Number of Observation, Expected no. Of runs, Variance of runs, STDEV of Runs, Standard Value, and Likelihood of total number of runs etc. The main statistical tool used in this study was the run test. The study concluded that the market follows certain trends and violates random walk theory hence investors can outperform the market by predicting and analyzing various trends. The conclusion of this study was that the market is not efficient enough that to adjust readily by the news regarding the factors which may affect the prices of the stock market so there may be opportunities to outperform the market.(Ajju Patel) Market efficiency in India: An empirical study of Random Walk Hypothesis of Indian Stock Market – NSE Midcap was published by Dr. Satish Kumar and Mr. Lalit Kumar. The main objective of this study was to test the validity of RWH in NSE Midcap 50 F&O Segment. The main statistical tools that were used in this study were the Autocorrelation Test, Q-statistics and the Run test. The sample taken for this study were 50 companies from the National Stock Exchange. Some of the variables used in this study were Closing prices of NSE Midcap 50 Index, return at time t etc. The results of the autocorrelation and runs test indicate that the Indian stock market is not random and hence, inefficient in the weak form during the given testing period. The conclusion of this study was that it is possible to achieve abnormal returns by predicting the future price movements based on past stock price movements. (Kumar) Empirical Evidence on Indian Stock Market Efficiency in Context of the Global Financial Crisis was published by P K Mishra, K B Das and B B Pradhan in the Global Journal of Finance and Management. The main objective of the study was to provide some empirical evidence on the efficiency of Indian stock market in the context of recent global financial crisis using. The sample used in this study was the 50 companies –NSE (Nifty50) and 30 companies-BSE (Sensex shares). Some of the variables used in this study were Daily stock return, Daily closing Sensex at time t, the monthly compounded rate of return calculated on the basis of BSE and NSE monthly stock price indices etc. The main statistical tools used in this study were the Unit root test, Phillips-Perron (PP) test and then the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test which has been conducted as the confirmatory test of unit root. The study concluded that unit roots do not exist, and the series are

stationary. This provides evidence that the stock markets of India do not show characteristics of random walk and thus, are not efficient in the weak form. The share prices may not necessarily reflect the true value of stocks. Market inefficiency may imply mean reversion of prices that may cause expected returns to vary. Market inefficiency may imply excess price volatility in the short run because prices change by more than the value of the new information. (P K Mishra) A Study of Semi-Strong Form of Market Efficiency of Indian Stock Market was published by T. Mallikarjunappa & Janet Jyothi Dsouz in the Amity Global Business Review. The main objective of this study was to test whether Indian stock market follows semi strong form of EMH and to test the stock market reactions to quarterly earnings announcement. The sample for this study was 160 companies from BSE. Some of the statistical tools used in this study were Parametric Significance Test, Non Parametric Significance Test, Run Test, Sign Test etc. The results of the Run test show that AAR occurs randomly throughout the window period. The Sign test results indicated no significant difference between the number of positive and negative AARs. The 't' test statistics accept the null hypothesis that AAR values are close to zero. The results of the AARs and CAARs indicate that investors would be able to earn abnormal returns by analyzing the quarterly earnings of June 2008 and by selling the stocks after the results are announced. Therefore, they concluded that Indian stock market is not efficient in the semi-strong form. Since the investors incur abnormal losses by buying the stocks and earn abnormal profits by going short on these stocks, the Indian market is slow in reacting to the publicly available information. (Dsouz) Efficiency of Indian Stock Market: A Study from National Stock Exchange was published by Prof. Mrityunjaya B Chavannavar and Poonam V. Patel aimed at examining whether Indian Stock Market is efficient in weak form & semi-strong. The sample taken for this study were companies from Nifty 50 index & Nifty 50 stocks. Some of the variables used in this study were Residual return, Total Number of Runs, Number of Positive Price Changes, Number of Negative Price Changes etc. The main statistical tools used in this study were the Auto Correlation Test, Run Test and the Residual Test. Correlation Test reveals that the correlations were insignificant for Nifty 50 stocks and market in both the phases. From this evidence we can say that there is an independent movement of stock prices. In the Run Test the Z values of Nifty shows insignificant return in the first period and third period but in second period the market return shows that some factors were affecting. However the overall period provides a strong evidence of weak form of efficiency. The residual Test shows informational efficiency in the market and shows the market is efficient in semi-strong form. The conclusion of this study is that Future prices cannot be predicted by the past performance of the stock prices. (Patel) Efficient Market Hypothesis: An Empirical Study of NSE Midcap Liquid 15 Index Companies was published by Rahul Sarkar.

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It gives an overview of Efficient Market Hypothesis (EMH) and how different forms of EMH can be tested and to test weak form of market efficiency of NSE Midcap Liquid 15 Index companies individually using Run test, Autocorrelation test, Kolmogorov-Smirnov Goodness of Fit Test, Ljung-Box Q (LBQ). (Sarkar, 2019) A Comparative Analysis of Stock Price Behavior on the Bombay, London, and New York Stock Exchanges was published by J. L. Sharma and Robert E. Kennedy .The objective of the study was to test the random-walk model, by runs analysis and spectral densities, against representative stock market indexes of the Bombay, New York, and London Stock Exchanges.

The sample taken for the study was companies from the BSE-603, NSE- 425 and the LSE- 500. Some of the variables used in this study were the stock price indexes, the number of runs etc. The main statistical tools used in this study were Run Test and the Spectral Analysis. In this study, no effort was made to explain any inconsistencies between the London F.T.-A. and the other indexes, although previous studies have attributed such differences partly to institutional factors. (Kennedy) Signaling with stock issues and repurchases: A test of semi strong form market efficiency by Alana M. Mackey and Frank W. Bacon was published in the Journal of Business and Behavioral Sciences in 2017. The main purpose of this research was to test semi-strong form market efficiency by examining how fast the risk adjusted rate of return of stock reacts to firms' stock repurchase and stock issue announcements. The study randomly selects two samples of firms, one sample consisting of firms announcing regular stock repurchases and the other sample consisting of firms announcing equity issuance. The variables used in this study were mainly the historical stock prices of the selected firms and S&P 500 index. This study used the Sample t Test to conclude that the market is semi-strong form efficient with respect to both the samples, stock repurchase announcements and equity issue announcements. (Bacon) Testing Semi-Strong Form Efficiency of Dhaka Stock Exchange by Md Abu Hasan and Md. Abdul Wadud had three main objectives. The first one was to examine the short run dynamics and long run equilibrium links between macroeconomic variables and stock prices. The second one was to explore the causal relationships and direction of causality between stock index and macroeconomic variables and the third and final objective was to investigate the semi-strong form efficiency of the stock market in Bangladesh. The variables used in this study was Industrial Production Index (IPI) as a proxy of GDP from the product market, Broad Money Supply (M2) from the money market, CrudeOil Price (OP) from the natural resources market, Exchange Rate (ER) from the foreign exchange market and one of the Indian (Bombay) stock market index (SENSEX) from the foreign market. This study uses various statistical tools. These were the Unit Root Test, The Johnsasen Cointegration Analysis and the Vector Error Correction Model (VECM). Since all the macroeconomic variables did significantly explain the stock prices of Bangladesh stock market either in the short run or long run or both, it was concluded that the Bangladesh stock market is not efficient in semi-strong form. (Wadud) Efficient market hypothesis: is the Croatian stock market as (in) efficient as the U.S. market, was published by Sonje, Velimir, Alajbeg ,Denis ,Bubas and Zoran in 2011. The main objective of this study was to supplement traditional statistical testing with the assessment of a chosen trading rule (trading system) and compare the results obtained on the Croatian market with findings on a more developed equity market (U.S.). The samples used in this study were essentially samples of broader market-cap weighted indices like the NYSE and NASDAQ. Some of the variables used in this study were income, wealth, risk appetite etc. The statistical tools used in this study were the Statistical test of autocorrelation of Returns and the Filter Test/ Mechanical Trading System. The study concluded that the system beat the CROBEX not only with regard to return; not less important is the fact that it was achieved at much less risk. The conclusion of this research was that statistical and trading rule analyses do not yield conclusive results regarding market efficiency. (Sonje)

III. RESEARCH DESIGN

A. Statement of the Problem/ Need for the study

The efficient market hypothesis (EMH), also known as the efficient market theory, is a hypothesis that states that the share prices will always be reflective of all information and that generation of consistent alpha is impossible. According to the EMH, stocks would always be trading at their fair value on exchanges, which makes it impossible for investors to be able to purchase undervalued stocks or sell stocks at inflated prices. But in reality, this is often not the case. A major theory challenging the efficient market hypothesis is behavioral finance. A combination of cognitive biases such as overconfidence, overreaction, representative bias, information bias, and various other predictable human errors in reasoning and information processing tend to cause imperfections in financial markets. The consequence being that there are some investors who are able to make abnormal profits and some incurring abnormal losses in all the three forms of market efficiency i.e. weak form, semi-strong form and strong form. Hence market being inefficient, contrary to the efficient market hypothesis (EMH).

B. Research Gap

The Semi-strong form efficient market is one where investors cannot use published as well as the historical information to earn abnormal profits. It is often seen that in the real market it may not necessarily be the same. Investors are often affected by various other factors and hence may not act in a rational manner. The factors responsible can be attributed to the theory of behavioral finance. This study hence examines whether the Indian Stock Market follow Semi Strong Form of Efficient Market Hypothesis.

C. Objectives of the Study

1) To ascertain whether the Indian Stock market is efficient in the Semi strong form of market efficiency.
2) To analyze the effect of the COVID 19 Pandemic on the Indian stock market.
3) To determine the number of days it takes the market pre and post the event, to absorb the information.
4) To analyze the sector wise impact of the Events under study.

D. Hypothesis

This study takes into consideration two hypothesis. The first one being the null hypothesis and the second one being the alternative hypothesis. The hypothesis being tested under this study assuming it to be true is called the null hypothesis and is denoted by H0. The hypothesis which differs from the null hypothesis is the alternative hypothesis and is denoted by H1. Thus in the context of this research, we have:

H0: Prices are reflective of all the publically available information and there is no statistically significant impact of the same on the share prices.

H1: Prices are not reflective all the publically available information there is a statistically significant impact of the same on the share prices.

E. Scope of Research

This paper uses the daily data of one of the leading stock exchanges in India, one of the fastest growing economy in the world, National Stock Exchange (NSE) during the period 1st January 2019 till May 31st 2020. The Nifty Index is the weighted average of 50 of the largest Indian companies that are listed on the National Stock Exchange (NSE). Daily stock prices of the Nifty index and the index shares from December 2019 till May 2020, the daily stock returns and the daily market returns are the variables used in this study. The window estimation period for the study has been taken as 200 days i.e. 1st January 2019 till 31st October 2019, the reason being that the market was quite stable during this period and was unaffected by the events under this study and would hence be suitable for the calculation of the variables Alpha and Beta. The date of announcement of COVID-19 outbreak as a Public Health Emergency Of International Concern (PHEIC), 30th January 2019 and the day when Prime Minister Narendera Modi declared first lockdown in India, 24th March 2019, has been taken as the two cut off dates for testing efficient market hypothesis. Forty days pre and post cut off dates i.e. 160 days in total has been analyzed to examine if the stock market incorporated the available information in time. The reason the study restricts the analysis to 160 days is that a preliminary analysis that was conducted for 180 days did not show a statistically significant difference but was a mere extension of the results of the 160 days analysis.

F. Operational Definition of Concepts

(a) NIFTY 50

The NIFTY 50 often called the benchmark is the weighted average of the largest 50 Indian companies that are listed on the National Stock Exchange. Nifty 50 is owned and managed by NSE Indices that was previously known as the India Index Services & Products Limited and is a wholly owned subsidiary of the NSE Strategic Investment Corporation Limited. The NIFTY 50 index is a free float market capitalisation weighted index covering 14 sectors of the Indian Economy.

(b) Stock Returns

This represents that return on a particular stock on a particular day. This is computed as the ratio of the change in the closing stock price in comparison to the previous day to that of the closing price of the previous day. The stock prices under consideration are the closing prices of the respective shares on the NSE.

(c) Market Returns

This represents the return on the NIFTY Index on a particular day. This is computed as a ratio of the change in the closing stock price in comparison to the previous day to that of the closing price of the previous day. The price of NIFTY Index under examination is the closing price of the NIFTY Index on a particular day.

(d) Alpha

Alpha (α) often referred to as the "edge" in investment strategy, is the performance of an investment or stock relative to the return of a benchmark index. Active portfolio managers aim to generate alpha in diversified portfolios, with diversification that is intended to eliminate the unsystematic risk.

For the purpose of this study, the alpha is computed as the intercept of the line $r = Rf + beta (Rm – Rf) + Alpha$ where Rf is the risk free rate of return and Rm is the market return and r is the expected return.

(e) Beta

Beta is the measure of systematic risk or volatility of a security in comparison to the market as a whole. It is used in the capital asset pricing model (CAPM) and describes the relationship between the expected return on assets and the systematic risk. It is calculated as the slope of the line $r = Rf + beta (Rm – Rf) + Alpha$ where Rf is the risk free rate of return and Rm is the market return and r is the expected return.

IV. DATA DESCRIPTION

A. Event Study

This study can be considered an event study. The two events under consideration are the date of announcement of COVID-19 outbreak as a Public Health Emergency Of International Concern (PHEIC), 30th January 2019 and the day when Prime Minister Narendera Modi declared first lockdown in India, 24th March 2019. These were the two major events that had a significant impact on markets across the globe. 40 days prior and post the event that is 80 days in total have been analyzed to examine efficient market hypothesis, to check if there was a significant impact on the market in absorbing the news that is publicly available. For the purpose of this study, the authors have used the Microsoft Excel as the tool to calculate the variables alpha, beta and the abnormal returns for each stock. The analysis is being performed on the NIFTY 50 index constituent shares; reason being that all the information for these shares is more widely available than the non index shares and dissemination of information is expected to be faster. These stocks should have traded at an average impact cost of less than or equal to 0.5% in the last six months for a minimum of 90% of the observations and should have float adjusted market capitalization of at least twice that of the current smallest index constituent. One must be able to trade the stock in futures and options segment on the NSE for it to be eligible for inclusion in the index. There are requirements with respect to the other important factors like Market capitalization, liquidity and trading frequency etc.

The following variables were computed for the analysis of Efficient Market Hypothesis-

1) Daily Stock Returns

   $ST1-ST0$, where ST1 and ST0 are the closing stock $ST0$ prices on Day 1 and Day 0 respectively.

2) Daily Market Returns

   $MT1-MT0$, where MT1 and MT0 are the closing $MT0$ NIFTY Index prices on Day 1 and Day 0 respectively.

3) Normal Returns

The computation of the expected normal returns was done using the CAPM or the Capital Asset Pricing Model. This model is widely used in the field of finance and gives the pricing of the securities and helps in generating expected returns given the risk of the asset and cost of capital. The expected return is given as

r = Rf + beta (Rm – Rf) + Alpha

where, r is the expected return, Rf is the Risk Free Rate of Return, Rm is the return on the Market (Nifty 50 Index). The Alpha and Beta are the intercept and slope of the line **r = Rf + beta (Rm – Rf) + Alpha** respectively.

3.1) Risk Free Rate of Return

The risk free rate of return is usually considered as the yield on the 10 Year Government of India Bond. The 160 days under consideration in the study occur in the months of December 2019, January 2020, February 2020, March 2020, April 2020 and May 2020. Hence the risk free rate of return has been taken as the average of the yield of the 10 Year Government of India Bond during the aforementioned months. As per the RBI NSDP (National Summary Data Page), the average yield for the relevant period is 6.473%.The real risk free rate of return is the risk free rate of return less the rate if inflation in the economy. The average of the inflation during the months of the months of December 2019, January 2020, February 2020, March 2020, April 2020 and May 2020 is 6.808%. The real risk free rate of return is negative (- 0.335%), during the period under consideration. This is undoubtedly as a result of the pandemic. For ease of study, as the risk free rate of return is not statistically significant, it has been rounded off to 0. The CAPM (Capital Asset Pricing Model) calculation for expected normal returns would be

r = Beta * Rm + Alpha

where, r is the expected return and Rm is the return on the Market (Nifty 50 Index). The Alpha and Beta are the intercept and slope of the line **r = Beta * Rm + Alpha** respectively.

Table- I: RBI Data 10 Yr GOI Yield and Inflation (Data Source: RBI)

Period	10 Yr Of Govt India Yield	Inflation
19-Dec	6.74	7.35
20-Jan	6.86	7.59
20-Feb	6.65	6.58
20-Mar	6.26	5.84
20-Apr	6.54	7.22
20-May	5.79	6.27
Average	6.4733333	6.8083333

4) Abnormal Return

   It has been computed as the difference between Stock Returns and Normal Returns.

5) Cumulative Abnormal Return

   It is calculated as the sum of the abnormal returns over a specific period.

$$CAAR = \sum_{t=t_1}^{t_2} AAR_t$$

B. Test Statistics

(a) Significance Testing

Hypothesis Testing or One sample t test is a parametric test that is used to determine whether the null hypothesis needs to be rejected given the sample data. It is based on the following assumptions.

• The dependent variable is continuous.
• The observations are independent.
• The dependent variable is approximately normally distributed.
• The dependent variable does not contain any outliers.

Under this test, each abnormal return is divided by the standard error of the estimation period.

$$\text{T statistic} = \frac{\text{Abnormal Return}}{\text{Standard Error}}$$

$$\text{Standard Error or SD} = \sqrt{\frac{1}{(n-2)}\left[\sum(y-\bar{y})^2 - \frac{\left[\sum(x-\bar{x})(y-\bar{y})\right]^2}{\sum(x-\bar{x})^2}\right]}$$

where x and y are the sample means average market returns and average stock returns respectively, and n is the sample size. The t statistic for the CAR or Cumulative Abnormal Return is computed as-

$$\text{t statistic} = \frac{CAR}{((N)^{(1/2)}) * \text{Standard Deviation}}$$

where N is the number of days in the window from the event day, for each day respectively.

C. Methodology

This study tests if the two events had a statistically significant impact on the prices of the stocks. To do so, the following steps were performed:

a) Step 1 – The closing stock prices of the NSE index constituent shares and the closing prices of the NIFTY Index was collected from the NSE website.

b) Step 2 – The Daily stock returns, Market returns, Normal Returns, Abnormal Returns was calculated using the formula mentioned above.

c) Step 3 – Choosing of confidence Interval and determining critical value . For the purpose of this study the confidence interval has been taken as 95% based on the previous studies.
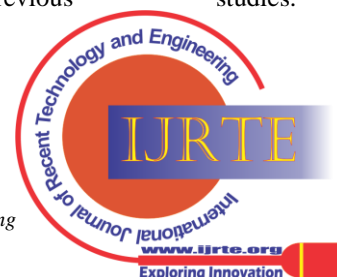
The critical value at 95 % confidence interval or 5% significance level is
+/- 1.96.

d) Step 4 – Computed t statistic for all the window estimation and event window period using the formula aforementioned.

e) Step 5 – Computed Cumulative Abnormal Return and t statistic of the Cumulative Abnormal Return.

D. Limitations of The Study

The analysis and interpretations is purely applicable for the period under study. Hence an overall opinion on the efficiency of the market cannot be drawn from the resulting conclusion. The prices considered are the closing prices of the stocks. The opportunities for making abnormal profits are being calculated based on the closing prices.

It could be possible that there were numerous times during a particular trading day when the investor or trader could make abnormal profits. But that is beyond the scope of this study.

V. DATA ANALYSIS AND INTERPRETATION

The results of this study indicate that the news announcements had statistically significant impact on the share prices of the shares. As per the t test, the t value is supposed to less than or equal to =+/- 1.96 for the news to be statistically insignificant. In this case, majority of the values are above the critical value indicating that there were numerous opportunities for investors to make abnormal profits.

A. General Analysis of Efficiency

a) On an average the t values were less than or equal to +/-1.96 for Event 1, 91.8% of the times.

b) On an average the t values were less than or equal to +/-1.96 for Event 2, 57.7% of the times.

Event	% of Efficieny
Event 1	91.80%
Event 2	57.70%

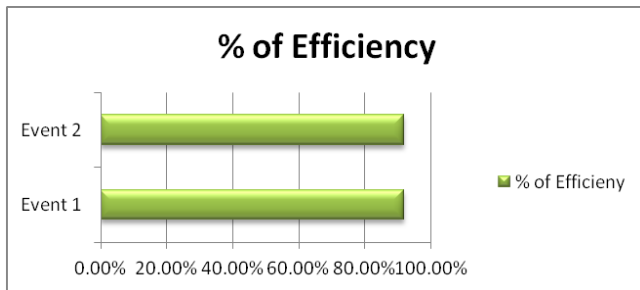**Table- II Table of Efficiency for Event 1 and Event 2**

Chart-I- Chart of Efficiency for Event 1 and Event 2

B. Comparison of Event 1 and Event 2

Table III- Efficiency Percentage of Event 1 and Event2 for all 50 NSE Index Shares

Security	Event 1	Event 2	Security	Event 1	Event 2
HINDALCO	85.19%	32.10%	DIVISLAB	90.12%	69.14%
RELIANCE	98.77%	59.26%	DRREDDY	97.53%	53.09%
SUNPHARMA	98.77%	55.56%	HEROMOTOCO	98.77%	48.15%
ADANIPORTS	100.00%	95.06%	INDUSINDBK	86.42%	46.91%
GAIL	100.00%	87.65%	IOC	97.53%	3.70%
POWERGRID	91.36%	87.65%	BAJAJFINSV	97.53%	39.51%
BAJFINANCE	92.59%	43.21%	ASIANPAINT	82.72%	41.98%
UPL	93.83%	11.11%	ICICIBANK	100.00%	74.07%
BPCL	100.00%	92.59%	TCS	90.12%	60.49%
BRITANNIA	100.00%	72.84%	INFY	91.36%	53.09%
HCLTECH	79.01%	49.38%	SBIN	93.83%	4.94%
NESTLEIND	96.30%	66.67%	HDFCBANK	100.00%	83.95%
TECHM	85.19%	46.91%	SBILIFE	61.73%	18.52%
HINDUNILVR	75.31%	32.10%	ITC	60.49%	66.67%
AXISBANK	93.83%	32.10%	HDFC	100.00%	86.42%
BHARTIARTL	85.19%	90.12%	SHREECEM	83.95%	49.38%
BAJAJ-AUTO	91.36%	76.54%	ONGC	71.60%	86.42%
NTPC	100.00%	81.48%	CIPLA	100.00%	37.04%
KOTAKBANK	95.06%	64.20%	JSWSTEEL	91.36%	79.01%
M&M	95.06%	62.96%	HDFCLIFE	87.65%	41.98%
MARUTI	95.06%	59.26%	COALINDIA	97.53%	95.06%
TATASTEEL	95.06%	13.58%	TATAMOTORS	95.06%	74.07%
GRASIM	100.00%	74.07%	LT	100.00%	96.30%
ULTRACEMCO	88.89%	43.21%	TITAN	97.53%	81.48%
WIPRO	93.83%	55.56%	EICHERMOT	86.42%	8.64%

- Event 2 that is announcement of the first lockdown in India had a larger impact on the share market than Event 1. This could be as a result of the cumulative impact of Event 1 or because of the anticipation of a bigger fall in the markets as a result of the pandemic.

- Event 1 was statistically insignificant 22% of the time with 100 percent of the values less than or equal to the critical value of 1.96.

C. Sectoral Analysis

a) Sector wise analysis of the hypothesis indicates the sector that was significantly impacted by the events under consideration. Event 1 was completely absorbed by the Infrastructure and Constructions Sector with the zero number of opportunities to earn abnormal profits. Insurance sector was the slowest with respect to dissemination of information with 75.69% of efficiency.

b) Event 2 had a higher impact on the market in comparison to event 1and efficiency lies between the range of 30.25% and 96.3%.Construction, Energy and Mining, Telecommunications and Infrastructure sector were more efficient compared to the other sectors.

c) Insurance sector was the least efficient for both Event 1 and Event.This is a quite expected reaction from the investors because the insurers of losses would be the worst affected when the world is hit with a pandemic. Investment portfolio stress, muted earnings, challenges to distribution, and elevated mortality claims . The reputational or litigation risks in case of neglecting policyholder concerns etc are the other reasons.

Table- IV- Sector wise Efficiency percentage for Event 1 and Event 2

Sector	Event 1	Event 2
Metals	90.95%	41.56%
Energy - Oil & Gas	93.58%	65.93%
Pharmaceuticals	96.60%	53.70%
Infrastructure	100.00%	95.06%
Energy - Power	95.68%	84.57%
Financial Services	96.71%	56.38%
Chemicals	93.83%	11.11%
Consumer Goods	85.39%	60.29%
Information Technology	87.90%	53.09%
Banking	94.86%	51.03%
Telecommunication	85.19%	90.12%
Automobile	93.62%	54.94%
Cement	90.95%	55.56%
Insurance	74.69%	30.25%
Energy & Mining	97.53%	95.06%
Construction	100.00%	96.30%

Chart –II-- Sector wise Efficiency percentage for Event 1 and Event 2
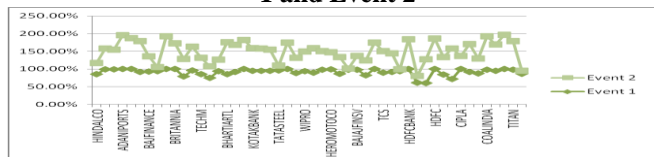
D. 40 Day Priod and 40 Day Post Event Analysis

Table- V- 40 day prior vs 40 day post event

Period	Event 1	Event 2
40 days prior	98.40%	52.00%
40 days post	85.00%	62.35%

a) On the event day for both the events, the news didn't not have a significant impact on the prices of ay of the shares under consideration

b) The market was 98.4% and 52% efficient during the prior event period timeline for event 1 and event 2 respectively.

c) The market was 85% and 62.35% efficient during the post event period timeline for event 1 and event 2 respectively.

d) Post event period gave more opportunities of earning abnormal returns when compared to prior event period for both Event 1 and Event 2.

VI. CONCLUSION

The purpose of this study was to examine the efficiency of the Indian Stock Markets during the time of COVID. The study made use of event study to determine the impact of the new information on the prices of shares. The study and the resulting analysis have shown that there were numerous opportunities to earn abnormal profits in each of the 50 NSE Index shares throughout the period under study. The sector wise analysis showed that the Insurance sector was the most inefficient during the period under study. On the other hand sectors like Infrastructure and Construction had their share prices reflect the publicly available news in an efficient manner. The reason for the same could be numerous. Investor behavior, Risk averse nature, Biases etcs are few of them. It is impossible for one to conclude on the entire market based on the above results. It is only relevant for the period under study wherein an investor could earn abnormal profits till the time market was reflective of all the publicly available news. A major limitation would be the consideration of just the closing prices of the shares and index. There is a possibility that there were numerous opportunities during the trading day when an investor could earn abnormal profits even when the study shows the closing price to be efficient for some of the days. This helps one to understand the various factors that's need to be considered while making investment decisions. It's not always about fundamental and technical analysis. Factors such as investor behavior and market sentiments etc are of immense importance to investment decisions.

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