AN EXAMINATION OF COVID 19 EFFECT ON COLOMBO STOCK EXCHANGE

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ABSTRACT

This study examines the impact of the COVID-19 outbreak on the Colombo Stock Exchange. In this regard, the daily closing price of our sample stocks during the period of July 26, 2019 to June 30, 2021 was collected. Research has identified three main events of interest to represent the COVID-19 01 and 02 waves in Sri Lanka. Furthermore, research has examined whether vaccination trials have any significant impact on Colombo stock exchange performances. Our sample consists of companies listed in the S&P SL 20 blue-chip index in Sri Lanka. The impact of COVID-19 on stock returns was analyzed using the event study method by comparing the calculated abnormal return before and after the event day. The event study method is based on the celebrated finance theory Efficient Market Hypothesis, implying that security prices quickly absorb market-moving news and react accordingly.

Our abnormal returns revealed that the first positive case recorded on January 27, 2020, had no material impact on the security prices; however, the first confirmed positive case happened in the second phrase (05 October 2020) had a material impact on the security prices. Researcher further examined the abnormal returns around the kick-off day of the vaccination program in Sri Lanka, and this event had a material impact on the security prices.Furthermore, this study has identified that certain significant news disseminated through public media, such as the announcement of the Kandakadu cluster, the Peliyagoda Fish Market, and the Minuwangoda apparel company cluster, had a notable impact on security prices during our observation window.

However, this study witnessed that despite the negative sentiment prevailing in the market, positive abnormal returns were observed around the event dates. The cumulative abnormal returns around phases 01, 02, and the Vaccination phase were found to be not significant in this study, indicating the short-term nature of the COVID-19 pandemic. Researcher conducted descriptive static analysis pre- and post-COVID time periods and revealed that volatilities across the abnormal return and cumulative abnormal return were significantly increased during the COVID 19 period.

During COVID-19 phase one, the Colombo Stock Exchange remained closed continuously, and travel bans imposed on the country hindered active participation in capital market activities by investors. The researcher has identified these factors as key limitations of this study.

Keywords: Abnormal Return, COVID 19, Colombo Stock Exchange, Event Study

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List of abbreviations

S&P SL 20	Standard and poor Sri Lanka 20 Index
CSEALL Index	Colombo Stock Exchange All Share Index
CSE	Colombo Stock Exchange
CAR	Cumulative Abnormal Return
AR	Abnormal Return
Covid 19	Coronavirus Disease 2019
VIX	Volatility Index
IDH	Infectious Disease Hospital

CHAPTER 01: INTRODUCTION

Background for Study

The ongoing worldwide outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), commonly referred to as Covid 19, has caused significant damage on social, economic, and human resources worldwide. It was on January 30, 2020, when the World Health Organization officially labeled the COVID-19 outbreak as a Public Health Emergency of International Concern, marking a critical turning point. Subsequently, on March 11, 2020, it was declared a global pandemic, amplifying the urgency of the situation. Governments across the globe have responded to the pandemic by implementing diverse public health strategies. These measures encompass mobility restrictions, statewide lockdowns, travel prohibitions, vaccination drives, and stringent border controls. The implications of Covid-19 and the measures taken to mitigate its spread have been profound, affecting not only individuals, families, and communities but also national economies and global trade networks. In this paper we examine the effect of covid 19 on area of capital market decisions.

Following the COVID 19, investors from all over the world have started moving their money to safe havens like gold and other valuables. The majority of stock market activity have been severely disrupted, particularly by the Covid-19 pandemic. Worldwide, fear of natural disasters, significant losses, and unanticipated market price declines were seen in every stock index. The greatest single-day percentage down since the 1987 stock market disaster was experienced by the US Dow Jones Industrial Average, the S&P 500, and the UK's FTSE 100, which plunged 10.87%. It’s biggest one-day decline since 1940 occurred when the Canadian S&P/TSX Composite Index fell by 12%. The FTSE MIB Italian index closed down -16.92%, the biggest loss in its history. The National Stock Exchange of India's NIFTY 50 dropped 7.89%, closing over 20% below its latest top, while the Bombay Stock Exchange's BSE SENSEX dropped 2,919 (or 8.18%) to 32,778. The volatility index (VIX) also experienced

** The VIX, a volatility tracking index, managed by Chicago Board Options Exchange (CBOE) and calculated volatility using S&P 500 options.*

significant increases, indicating a shift towards higher risk. Comparing the VIX score of 84.57 for the COVID-19 virus to other high-risk events such as the 9/11 terrorist attack (41.75), the 2011 U.S. debt crisis (48), the 2008 global financial crisis (46.72), and the most recent US-China trade war (2018), it's evident that the markets are deeply concerned about this virus. These fluctuations in stock market index values reflect the prevailing sentiment among investors regarding the Covid-19 pandemic.

The COVID-19 pandemic, often referred to as "the Great Lockdown," necessitated strict containment measures worldwide. These measures led to significant downgrades in economic growth forecasts by several international organizations. For instance, the International Monetary Fund revised its global growth projections for 2020 to -3%,this was a 6.3% dip compare to it's previous forecast (IMF, 2020). The Asian Development Bank (ADB) estimated the global economic impact of COVID-19 to exceed US$4.1 trillion, vastly surpassing the estimated US$30-100 billion cost of the SARS outbreak (2002-2003) (Smith, 2006) (Thestar.com, 2020). Similarly, the Organisation for Economic Co-operation and Development (OECD) predicted that a continued outbreak could reduce global economic growth by 1.5% in 2020 (OECD, 2020). Additionally, the International Labour Organization (ILO) projected that global unemployment could increase by approximately 25 million (ILO, 2020) (McKibbin & Fernando, 2020).

The first case of COVID-19 in Sri Lanka was reported on January 28, 2020, involving a Chinese tourist who subsequently recovered and returned to China. The second wave began on March 10, 2020, with the detection of a Sri Lankan tour guide, which led to a rapid increase in cases. This tour guide was among the country's initial recoveries. By March 31, 2020, the All Share Price Index (Colombo) had plummeted over 20%, reaching a five-year low. Prior to the Colombo Stock Exchange (CSE) closing on March 20, 2020, due to the lockdown, the S&P SL 20 share index experienced a nearly 12% drop to 1943.55, marking its largest intra-day decline, while the All Share Price Index fell by over 6% to 4571.63, driven by panic selling. During the 51-day lockdown, the market remained shuttered, only to reopen for trading on May 11.

However, on this momentous day, the Colombo Stock Exchange (CSE) faced an exceptional event within minutes, it was automatically closed for the first time in its history. This closure was triggered as the S&P SL 20 index plummeted over 10% from the previous close. At the day's end, the S&P SL20 Index was down to 1,750.49 (10.11%) points, and the All-Share Price Index dipped to 4,384.10 (4.10%) points, with a turnover of LKR 24.89 million. Over the following two days, the decline persisted, driven by selling pressure from foreign investors, resulting in the S&P SL 20 index hitting a lower bound of 1690.60 and the ASPI dropping to 4247.95. Reflecting trends seen in other economies, uncertainty surrounding Sri Lanka's economic slowdown spurred a sell-off in the financial market and led to capital outflows. Despite these challenges, the CSE showed signs of improvement after May 12, hinting at a gradual shift towards positive investor sentiment. Figure 1 depicts how Colombo All Share Price Index responds to various key Covid 19 related information.

The COVID-19 pandemic placed additional demand on the country's specially skilled healthcare workforce, PCR (polymerase chain reaction) equipment, laboratory systems, quarantine centers, facemasks, and vaccinations. In the early stages of the pandemic, the government utilized travel bans, mobility restrictions, curfews, and mandatory face mask rules as primary prevention tools. However, with the development of COVID-19 vaccination trials globally, Sri Lanka transitioned to the vaccination phase. The Sri Lankan government launched the COVID-19 vaccination campaign on January 28, 2021, with objectives to reduce disease and death, halt virus spread, and stimulate the economy. As of December 2023, the Sri Lankan Ministry has authorized five different types of vaccinations, as illustrated in Table 1. Among these, the World Health Organization (WHO) has authorized two variants of the AstraZeneca vaccine, formulated by Oxford and the Serum Institute of India. An initial stride in Sri Lanka's vaccination campaign commenced when India donated 500,000 doses of the AstraZeneca vaccine, marking the initiation of the nation's vaccination drive.

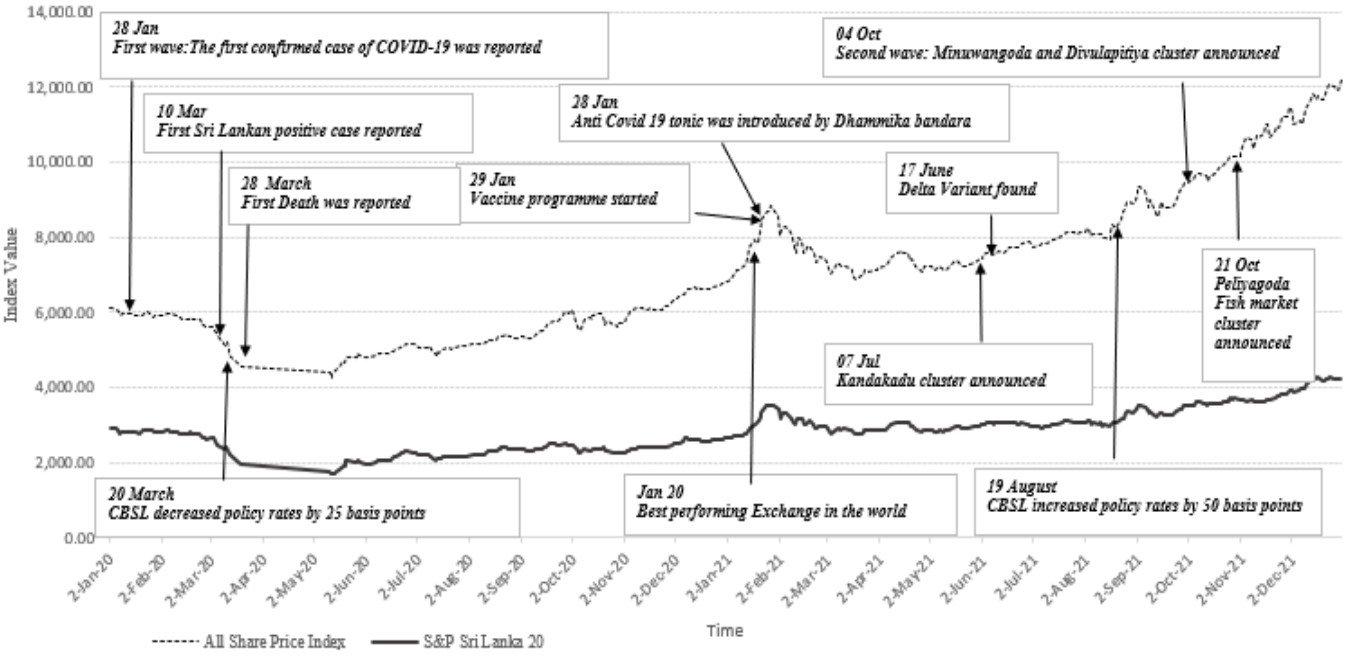

Figure 1: All Share & S&P SL 20 Index behavior
Source: Colombo Stock Exchange data, Author's analysis

Table 01: Total Vaccine dozes administered by Sri Lanka as of November 2023

AstraZeneca		Sinopharm		Sputnik V		Pfizer				Moderna	
1st dose	2nd dose	1st dose	2nd dose	1st dose	2nd dose	1st dose	2nd dose	1st Booster dose	2nd Booster dose	1st dose	2nd dose
1,479,631	1,418,593	12,054,824	11,267,138	159,110	155,812	2,645,395	1,123,923	8,220,002	202,571	804,801	787,361

Source: Ministry of Health. Sri Lanka, Epidemiology Unit

Researchers have observed that the advancement of vaccination trials correlates with notable shifts in stock market performance. For instance, Oanh (2022) determined that COVID-19 vaccination initiatives yield positive outcomes for stock markets in developing nations, while simultaneously exerting a negative influence on those in developed countries. Some scholars may argue that the vaccine initiation rate, responses to vaccine trials, and the number of daily doses administered have a significant impact on stock market performance. Hence, this study aims to examine whether the announcement of the first COVID-19 vaccination campaign in the country

had a material impact on investor sentiment. Sri Lanka initiated the vaccination program in different phases according to available supplies and funding. The first phase mainly focused on frontline healthcare workers actively engaged in COVID-19 prevention, such as hospital staff, doctors, and military personnel. Currently, Sri Lankan literature is in the early stages of investigating the impact of COVID-19 on stock market performance, and this study will help establish a sound literature framework within the academic community.

This paper examines the impact of Covid-19 on the Colombo Stock Exchange. Specifically, we analyze how the stock market responded immediately after the announcement of Sri Lanka's first confirmed Covid-19 case. To discern any notable differences between the two waves of Covid-19 in Sri Lanka, we investigated the market's reaction to the first positive case in each phase. Our goal is to understand how different phases of Covid-19 affected the market in unique ways. Additionally, we explore how the stock market reacted to Sri Lanka's vaccination program. Employing the Event Study method, a standard technique in finance based on the Efficient Market Hypothesis, we assessed the impact of Covid-19. This method involves analyzing the actual returns of the Colombo All Share Price Index, comparing them with individual stock returns, and determining abnormal returns on the day of a significant event. By studying these returns over time, we gain insights into how events influence stock performance.

In this research, we focused on three key events: the first Covid-19 case in Sri Lanka, the Minuwangoda Brandix apparel cluster outbreak (starting point of second wave), and the commencement date of the vaccination program. We identified these as significant market-moving events and analyzed the abnormal returns before and after each event. In the Sri Lankan context, there's a notable lack of literature regarding the impact of COVID-19 and stock market impact.

See appendix A for how media channels reported few market moving incidents.

Problem statement

In the Sri Lankan context, understanding the capital market's reactions to pandemic diseases remains elusive. News of such outbreaks does influence investor behavior, which is subsequently reflected in stock market indices. A prime example of such a phenomenon is the reaction of the Colombo All Share Index to the 2019-nCoV outbreak. It experienced its largest intraday dip and sustained losses due to the Covid-19 disease. Therefore, our fundamental research question is: "How did the Colombo Stock Exchange react to Covid-19 related information?.

Research Objective

Primary Objective

The aim of this research is to observe the stock returns of the Colombo Stock Exchange before and after the COVID-19 pandemic using an event study. For this purpose, we analyze the daily returns of the Colombo All Share Price Index (ASPI) and the S&P SL 20 both before and after the declaration made by the Ministry of Health regarding the first positive case during waves 01 and 02.

Secondary objectives

Another goal of this research is to assess whether the sub-events that occurred during the event windows had a significant effect on the performance of the CSE.

The third goal of this research is to explore whether vaccinations significantly impact stock market performance. The researcher selected the kickoff day of the vaccine trial as a focal event for this case.

Significance of study

i. Identification of impact on these kind of crisis to stock markets help to manage the crisis financial impact and encourage investors to take sound investment decisions.

ii. Assening the impact on Covid 19 help policy makers to promote investment actions while engaging the mobility restrictions and preservation of their capital.

iii.. Relationship between disease and Stock exchange performance can be used to predict the investor’s behavior and it has a subsequent impact to equity market behavior after the special incidence take place in the economy.

iv. The stock market reflects a country's developmental landscape, making it crucial to analyze factors influencing the Colombo Stock Exchange (CSE). Understanding these factors aids in facilitating the policy-making process and enhancing the regulatory framework of the market.

v. Identification of Covid 19 impact on stock market enable security analysis houses and equity financial Analyst to incorporate investor sensitive factors to their security fair value calculations and increase the quality of their valuation parameters.

The remainder of the paper is organized as follows: First, we provide a brief review of the literature. Second, we describe the data utilized for empirical analysis. Lastly we have described and interpreted our results.

02.LITERATURE REVIEW

This chapter evaluate the existing literature of the COVID 19 and it's capital market impact in local and global context. Further identifies how similar type of pandemic events and impact on stock markets. Furthermore, this study aims to assess whether the COVID 19 vaccination campaign positively influences stock market performance.

The Effect of Covid 19 in developed stock markets

Khatatbeh, Hani, and Abu-alfoul (2020) conducted a study utilizing event study methodology applied to developed economies. Their research revealed that global stock markets accurately predicted the devastating effects of COVID-19, evident in substantial negative abnormal returns (ARs) and cumulative abnormal returns (CARs), especially after the WHO announcement. These findings are consistent with reports from both journalistic sources and academic studies, emphasizing the dull impact of COVID-19 on the global economy.

Hong, Bian, and Chiang Lee (2021) investigated the volatility and uncertainty of the US stock market returns from January 1, 2019, to June 30, 2020, using an econometric model. Their discoveries indicated that the pandemic crisis caused market inefficiency, opening profitable opportunities for traders and speculators. Furthermore, it worsened income and wealth disparities between market participants with abundant liquidity and those encountering financial constraints.

Alfaro, Chari, Greenland, and Schott (2020) conducted a analysis based on stock level returns and market wide aggregated returns. Drawing on a sample of 4,070 United States stock market listed firms and utilizing data from Yahoo Finance and Bloomberg L.P, their parameter estimates indicated that a doubling of expected infections the following day led to lowered overall US market returns, and vice versa. The findings suggested that market losses were amplified by leverage and capital intensity, particularly in companies or industries highly conducive to disease transmission.

The Effect of Covid 19 in emerging stock markets

Panyagometh (2020) conducted a study based on sample of 46 listed companies in the Thailand stock exchange to analyze capital market reactions during the pandemic period. Abnormal returns and volatilities were measured during the event period from January 3, 2019, to April 1, 2020. The findings revealed that stocks in the banking and finance sector experienced negative and significant abnormal returns during the period of study. Additionally, the energy and transport sectors exhibited significant abnormal returns during this period due to the economic downturn. However, the healthcare and commerce sectors saw positive abnormal returns despite the pandemic situation. Overall, the majority of stocks in the Stock Exchange of Thailand were adversely affected by the pandemic, as evidenced by negative abnormal returns during the period compared to normal market environment.

Mittal & Sharma (2021) carried out an event study focusing on Indian healthcare and pharmaceutical stocks. They observed notable abnormal returns and cumulative abnormal returns in these sectors throughout the event window. Additionally, they detected significant positive abnormal returns post-event window, indicating favorable investor sentiment towards the healthcare sector.

Pandey & Kumari (2020) analyzed 49 stock market indices from both developed and emerging markets to evaluate the impact of lockdowns and restrictions aimed at curbing the spread of COVID-19. Their findings revealed that developed markets experienced more severe long-term impacts compared to emerging markets. The implementation of early lockdowns resulted in a sharp reversal in stock market returns, which helped rebuild investor confidence.

Irfan et al. (2021) evaluated the effect of COVID-19 on Islamic stock markets using Islamic stock indices from Indian and Thailand stock exchanges. They found that the Bombay Stock Exchange Shariah Index exhibited a negative response to the announcement of Covid-19 as a pandemic, while the Jakarta Islamic Index reacted positively. Additionally, their study revealed that the impact of Covid-19 on stock exchanges varied from one country to another depending on unique economic factors.

Sen Liew (2021) used an event study methodology to identify short-term abnormal returns in the Shanghai Stock Exchange Composite Index and its ten sectors. The findings indicated that the Wuhan lockdown during the pandemic initially negatively impacted all sectors. However, the healthcare and information technology sectors, which were essential in the pandemic response, showed resilience and outperformed the broader market despite the lockdown.

The Effect of Covid 19 in frontier markets

As per the MSCI country classification Sri Lanka has been categorized under country which having frontier capital market environment. Hence, it is important to evaluate peer frontier markets behavior to benchmark it against the Sri Lanka. Scholars group namely Adnan, Hasan and Ahmed (2020) conducted a study regarding capital market reactions against Covid 19 in Bangladesh stock market. They have used event study methodology to access the 311 stocks listed in Dhaka stock exchange during the period of 1st March 2020 to 15th March 2020.They have used first oisitive case reported date as their base case. Results of their study revealed that,

1. The media appearance of the first positive case of COVID-19 in Bangladesh had a notable adverse impact on stock market returns across all firms and industries.

2. The nonfinancial industry was notably susceptible to the announcement of the first COVID-19 case, as indicated by statistically significant negative Cumulative Average Abnormal Returns (CAARs) during both the event and post-event periods.

3. There were statistical disparities witness in the pre and post event date across all the industries including financial & non-financial, manufacturing & non-manufacturing.

4. The Dhaka Stock Exchange (DSE), previously characterized as market inefficient, this was further confirmed by their study.

5. The detection of the epidemic induced behavioral overreaction, leading to panic selling and a herd behavior among investors.

Anh and Gan (2020) investigated the impact of COVID-19 on Vietnam's stock market before and after the lockdown. They found that COVID-19 had a significantly negative

effect on stock returns prior to the lockdown. However, during the lockdown period, the overall market and various business sectors experienced a notably positive performance. The financial sector was particularly hard-hit during the outbreak. The study attributed the contrasting effects on stock returns to increased investor confidence in the Vietnamese government's response to COVID-19.Further they have documented that undervalue stock prices is key to active stock market participation during the lockdown among investors.

Yar (2020) investigated the impact of COVID-19 on the performance of the Pakistani stock market. Using data on confirmed positive cases, deaths and daily recoveries, and the closing values of the PSX 100 index for the first half of 2020, the study found that only COVID-19 negative cases influenced the behavior of the index, while daily new cases and deaths had an insignificant relationship with the stock exchange's performance.

Event study implication in Sri Lankan Context

In the local academic sphere, several researchers have utilized the event study approach as a tool to evaluate corporate actions, social, political, and economic events on investment decisions. Kodithuwakku and Samarakoon (2020) applied this approach to investigate the consequences of the Easter Sunday attack. They examined 33 samples from the hotel and travel sector, calculating AAR and CAAR during the event in 2019. Their findings revealed a significant initial decline in CAAR on the day of the event, followed by a sustained downward trend, indicating adverse impacts on listed companies in the hotel and travel sector.

Pathirawasam (2009) investigated the informational value of dividend declarations using data from the Colombo Stock Exchange in Sri Lanka covering the period from 1998 to 2007.They concluded that positive Abnormal Returns observed in the Sri Lankan stock exchange exceeded those reported internationally on the day of the announcement. Furthermore, they proposed that even when accounting for ruined information, abnormal returns linked with unadulterated stock dividends still showed notable positivity on the day of announcement.

Dunusinghe and Peiris (2017) scrutinized the application of the market model for their study. They examined 211 final dividend announcements declared from 2009 to 2013 and identified deficiencies in the precision and resilience of the market model utilized in the event-study technique.

Hua & Ramesh (2013) conducted a study on the impact of stock split declaration on the Colombo Stock Exchange. Examining a sample of 64 base events of the emerging market from 2009 to 2012, they discovered significant signal and informational content in stock split announcements, with the market generally reacting positively to such news. Their results also corroborated the semi-strong form efficient market hypothesis for the companies included in the study period, indicating that stock prices quickly adapt to public information, thus making it difficult for investors to attain abnormal returns subsequent to a stock split announcement..

Ramesh and Rajumesh (2014) investigated political event impact on the Colombo Stock Exchange (CSE) by analyzing 40 base political events spanning from 2008 to 2012. Their findings indicated that political events conveyed significant negative information to the CSE.

Covid 19 impact and Colombo stock exchange

A few amounts of studies research into the corrolation of COVID-19 on international capital markets. However, there is a lack of research in the local context regarding its effects on the Colombo Stock Exchange. Kumarapperuma et al. (2020) scrutinized the COVID-19 effect on 15 Asian stock markets, including Sri Lanka, employing the event study method. They compared abnormal returns before and after the event day (January 20, 2020). Additionally, they conducted panel regression to observe the influence of COVID-19 positive cases on stock returns in selected markets. Their findings revealed negative abnormal returns post-event, indicating a significant adverse impact of the COVID-19 outbreak on the stock returns of selected Asian markets. Their examination specifically revealed an immediate adverse effect of COVID-19 across all chosen markets, with prolonged negative consequences primarily noted in emerging and frontier markets. Furthermore, they detected a

negative association between confirmed COVID-19 cases and stock returns across all the selected Asian markets.

University of Ruhuna (2020) employed social science methodologies to explore the socio-economic impact of COVID-19. They observed that starting from February 2020, the pandemic has caused significant instability, withdrawals of investments, and a rush towards safer assets, leaving investors feeling anxious.

Amaratunga et al. (2020) analyzed the COVID-19 impact and policy implications for Sri Lanka. Their report highlighted several challenges faced by the country, including loss of wealth among various socioeconomic groups, difficulties in loan repayment, and disruptions in education. They also identified barriers in the COVID-19 management process, such as limitations in resources and inconsistent government decision-making.

The Colombo Stock Exchange annual report (2020) mentioned a decline in market activities during the second quarter of 2020 due to market closures, with a subsequent recovery observed from the third quarter onwards. The Central Bank annual report (2020) documented short-term volatilities throughout the year attributed to the challenges posed by the COVID-19 pandemic. Despite these challenges, Sri Lanka recorded a significant increase in average daily turnover, driven by domestic investors' preference for equity investments amidst low interest rates and attractive market valuations.

The Asian Development Bank (2021) in its Asian Development Outlook 2021 emphasized the importance of the progression of the vaccination program and the development of special economic zones in fostering economic growth and attracting foreign direct investment in Sri Lanka.

Sandamini & Rajeevan (2021) utilized panel data regression techniques to evaluate the short-term behaviour of the COVID-19 outbreak's impact on the stock market. They identified that the first lockdown induced panic selling, resulting in a negative effect on the stock market, while the second lockdown did not significantly impact the market.

Adhikari & Buddhika (2023) examined how the COVID-19 pandemic influenced stock market indices on the Colombo Stock Exchange. Through regression analysis, they discovered a positive correlation between the stock indices and the daily count of COVID-19 cases and deaths, along with a negative correlation with travel restrictions. Additionally, they found that government policy measures had a minimal effect on index fluctuations.

Chowdhury & Kalyan (2022) analyzed stock market reactions to COVID-19 using the GARCH model and an event study approach. They focused on the first COVID-19 positive case date and observed negative abnormal returns on the immediate next trading day across South Asian stock markets, except for Sri Lanka.

Stock market reactions to other similar pandemic situations

Chen et al. (2009) investigated the consequences of SARS on the stock prices of listed biotech firms in Taiwan. They scrutinized daily returns spanning from September 25, 2002, to May 21, 2003, encompassing 32 companies across diverse industries such as travel, airlines, wholesale and retail, and biotechnology. Employing event study and GARCH models, their analysis showed that SARS had an adverse effect on the share prices of companies in the tourism, airlines, and wholesale and retail sectors, while the biotechnology sector experienced positive outcomes.

Ichev and Marinč (2018) undertook an event study to explore the influence of the Ebola virus on the US stock market. They examined the value-weighted total rates of return of companies listed on the New York Stock Exchange (NYSE) and NASDAQ Composite, with the S&P 500 index serving as a benchmark, spanning from 2014 to 2016. Their investigation revealed that firms situated nearer to both the origin of the Ebola virus and major financial markets experienced the most significant impact from Ebola epidemic occurrences.

Kim et al. (2020) conducted research on 91 listed restaurant firms in the US from 2003 to 2016, focusing on scenarios involving Avian influenza, Swine flu, and Salmonella

infantis. Their study concluded that epidemic outbreaks negatively impacted the restaurant business, with brand reliability, promotional outcomes, and the non-manufacturing nature of the business serving as risk-mitigating factors.

Vaccination trials and Covid 19 performances

This study's secondary objective is to evaluate the possible effects of initiating vaccination programs on stock market performance. Although there is insufficient literature on the correlation between announcements of vaccination processes and stock market behavior, several studies provide insights into this matter. It is worth noting that no studies were discovered within a local context.

Chan et al. (2021) examined data related to 83 vaccine candidates from 50 countries, spanning both developed and emerging markets, between January 2, 2020, and April 30, 2021. Their analysis showed a significant upsurge in abnormal stock market returns, averaging 8.08 basis points (bps), coinciding with the onset of various clinical trial phases. Based on the total market capitalization of these countries before the pandemic, their regression estimate suggests an average increase of USD 46.4 billion in market capitalization on the first day of clinical trials.

Rouatbi et al. (2022) conducted a study to examine the relationship of COVID-19 vaccination on stock behavior worldwide. Analyzing data from 66 countries spanning from January 1, 2020, to April 30, 2021, they concluded that the initiation of COVID-19 vaccination programs contributed to stabilizing global economies while reducing stock market volatility.

Nguyen, Nguyen, & Nguyen (2021) explored the correlation between vaccine rollout rates and stock market volatility across 34 countries, comprising both emerging and developed nations, during the period spanning from January 1, 2020, to August 15, 2021. Their panel data regression analysis unveiled that widespread immunization notably decreased stock market volatility in both groups of countries. Furthermore, they observed that higher rates of population immunization contributed to stabilizing

the stock market, with this impact being more pronounced in developed countries compared to emerging ones.

Oanh (2022) investigated the influence of COVID-19 vaccination on the stock markets of 77 nations between March 2020 and October 2021. Employing the panel data vector autoregression (PVAR) model, they observed a positive correlation between COVID-19 immunization and stock markets in developing countries, while noting a negative impact on those in developed nations. The study recommended that policymakers in developing countries expedite mass vaccination initiatives to facilitate stock market recovery. Conversely, it suggested that governments in developed nations should adopt a blend of vaccination efforts and other preventive measures to counteract virus transmission, particularly in light of new variants like Omicron.

Event study method

Event studies have a rich historical background, with one of the earliest documented works by James Dolley in 1933. Dolley's study focused on analyzing the market impact of stock splits, examining price differences during the period of 1921-1931. From a sample of 95 split announcements, he observed price increases in fifty seven instances and price declines in only twenty six instances.

The sophistication of event studies method was grounded in 1930 to 1960. The modern version of the event analysis method was established by Ball and Brown in 1968. In their paper titled 'An Empirical Evaluation of Accounting Income Numbers,' they interpreted the rationale behind the event study method. The fundamental concept involves identifying abnormal returns associated with the event under examination by adjusting for market-wide price fluctuations.

Event studies cover a broad spectrum of event categories, investigating how stock markets react to various occurrences. These events can include aggregate economic events such as market shocks and regulatory alterations, as well as corporate actions like mergers & amalgamations, and earning fillings. Mackinlay (1997) expanded the

application of event studies to corporate actions, specifically examining how the information content of quarterly earnings announcements influences share prices. Mackinlay's analysis of quarterly earnings announcements for 30 firms in the Dow Jones Industrial Index over a five-year period from January 1989 to December 1993 revealed that negative earnings were succeeded by negative cumulative abnormal returns (CARs), whereas positive earnings announcements were followed by positive CARs.

The impactful studies conducted by Ray Ball and Philip Brown (1968) and Eugene Fama et al. (1969) introduced a event study methodology that has remained largely unchanged and continues to be utilized in contemporary research.

Literature gap of Study

While numerous scholars have investigated the stock market implications of the COVID-19 outbreak in local contexts, none of these studies have employed event study or abnormal return methodologies. This research aims to bridge this gap by exploring how investors respond to COVID waves 01 and 02 using publicly available information. Additionally, the study seeks to evaluate the impact of vaccination process-related news on stock market performance. By providing insight into how publicly accessible COVID information influences the stock market and whether investors react positively to the vaccination process, this research aims to offer a comprehensive understanding of investor behavior during the pandemic. Ultimately, this will assist policymakers in making informed decisions amid similar macroeconomic conditions and enable traders to capitalize on opportunities despite the challenges posed by the pandemic.

03.METHODOLOGY

Hypothesis Development

Based on the literature gap identified in the previous review and fundamental analysis, it is evident that scholars have largely overlooked the significant relationship of Covid-19-related news on stock market performances in Sri Lankan context. Throughout the COVID pandemic, various media channels have disseminated diverse information regarding the outbreak. This study seeks to investigate whether investors swiftly incorporate this information into their decision-making processes. Additionally, the researchers aim to ascertain whether the commencement of the Covid-19 vaccination process exerts a notable influence on security prices. To explore these aspects, the following three hypotheses have been formulated, each corresponding to Covid waves 01 and 02, as well as the vaccination process.

H1: The first reported positive Covid case in phase 01 significantly impacts Colombo Stock Exchange performances.

H2: The first reported positive Covid case in phase 02 significantly impacts Colombo Stock Exchange performances.

H3: The first day of vaccination trials significantly impacts Colombo Stock Exchange performances.

H4: Other sub-events occurring within the event window have a significant impact on the performance of the Colombo Stock Exchange.

In this study, we have used empirical method namely, Event study analysis. This method is widely acknowledged as one of the most acceptable and appropriate techniques for assessing the influence of an event on securities returns within a defined event period. This approach aids in predicting how securities and indices are likely to respond to the announcement of significant market-moving news.

According to the Efficient Market Hypothesis (EMH), the announcement of any company wide or economy wide event causing an changes to stock prices. Numerous studies have depicted that the event study stands out as the most effective approach

for evaluating post-announcement effects (Brown & Warner, 1985; MacKinlay, 1997). Following Bowman's proposal (1983), our estimation of abnormal returns (ARs) employs an event study framework, which encompasses decisions regarding the selection of the base event and specification of event window.

Conceptual Framework

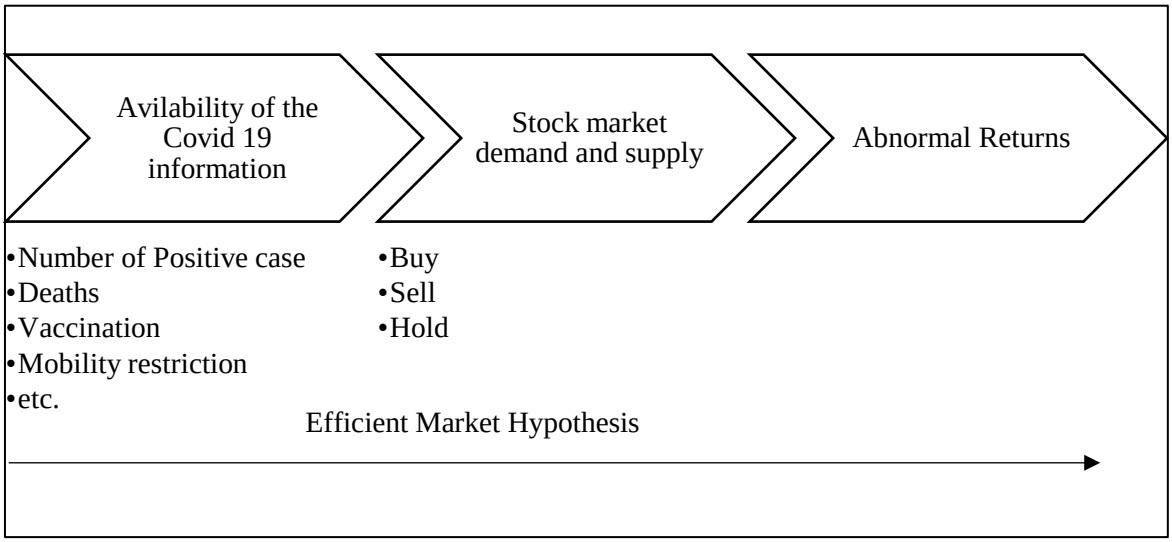

Figure 2: Conceptual framework

Source: Author's Analysis

According to the efficient market hypothesis, any market-moving information directly impacts the performance of the stock exchange. Based on this information, investors make buy, sell, or hold decisions. High demand for particular stocks puts upward pressure on stock prices, while lower demand pushes downward pressure on the market. Ultimately, these buying and selling decisions create abnormal returns during pandemic situations compared to normal market conditions. However, COVID-19 is one of the largest ongoing disasters, which has a significant impact on investor sentiment.

Event of Interest – Rational for selecting events

The short-term effects of the Covid-19 outbreak on stock market returns have been extensively explored in numerous studies. Similarly, in Sri Lanka, the first case of the virus was confirmed on January 27, 2020, involving a Chinese women, who was admitted to the Infectious Disease Hospital in Angoda, Sri Lanka. Consequently, for this study, January 27, 2020, serves as the event date, marking the emergence of news about the virus in the media.

Another notable event pertains to the second wave of Covid-19 in Sri Lanka. A positive COVID-19 case was reported on October 4, 2020, involving a 39-year-old woman employed at the Brandix garment factory in Minuwangoda. Subsequently, 45 individuals who had close contact with her were placed under quarantine.. Following this incident, Minuwangoda and Divulapitya were placed under a police and army curfew. The overall number of new infections on October 4 rose to 101 due to cases reported from the Minuwangoda garment plant. This occurrence was rapidly disseminated through mass media, prompting the researcher to identify it as a second event of interest.

The Sri Lankan government initiated its COVID-19 vaccination campaign through the COVAX facility, with the first batch of Oxford-AstraZeneca vaccines arriving in Sri Lanka on January 28, 2021, from the Serum Institute of India. Subsequently, the media announced the commencement of the vaccine program with the first batch on January 29, 2021. However, the initial batch was allocated to frontline medical staff. The researcher has designated this as a third significant incident for the study.

The researcher has identified several additional events that occurred during Phase 01 and Phase 02 of the event window, including the Kandakadu cluster, the Katunayake Investment Zone cluster, and the Welisara Navy Camp cluster, along with COVID-19 spread-related news. These additional sub-events were included in the analysis to further assess their impact on the market.

Event Window

Event windows has chosen as per below timeline.

Table 2: Event Window

Event	Estimation Window	Observation Window	Event Date
	(-120, +120)	(-40, +40)	(0)
Covid Wave 01	29/07/2019-15/09/2020	05/11/2019-20/05/2020	27/01/2020
Covid Wave 02	14/02/2020-05/04/2021	06/08/2020-01/12/2020	5/10/2020
Covid Vaccination trail	04/08/2020-30/06/2021	27/11/2020-31/03/2021	29/01/2021

Source: Author

Estimation Window

In the literature, most studies utilize an estimation period ranging from 120 to 200 days, which encompasses the period just prior to the observation window. Therefore, in order to ensure precision in testing market efficiency, this study adopts a daily return dataset spanning 120 trading days leading up to our event date.

Computation algorithm

Abnormal Returns (ARs) and Cumulative Average Abnormal Returns (CAARs) are computed for distinct periods preceding and succeeding the announcement date to gauge the market response to Covid-19 announcements. The computation of abnormal returns necessitates the calculation of both actual market returns and expected returns for the designated periods.

The definition of the actual returns of security i on a specific day t is as follows:

Equation 01-

$$R_{it} = \frac{p_{it} - p_{it}}{P_{it}}$$

The actual returns of security *i* on a particular day *t* are calculated using the closing price of security *i* on day *t* (*Pit*) and the closing price of security *ii*on the previous day, *t*−1 (*Pit*−1).

Expected Return

We will employ the market model to estimate the parameter values for Equation 02. An 80-day estimation period has been utilized to generate alpha and beta for the equation below.

Equation 02 -

$$E(R_{it}) = \alpha_i + \beta_i R_{mt}$$

Where,

E *(*R*it)* = The expected return of stock (i) on day (t) within the window period is given by:

α*I* = intercept (alpha) of stock i, and

β*it*= beta of stock i.

Abnormal Return

The calculation of Abnormal Returns (ARs) for each day within the sample entails assessing the variance between the actual rate of return and the anticipated rate of return. This comparison is conducted utilizing the following model:

Equation 03 -

$$AR_{it} = R_{it} - E(R_{it})$$

Where,

AR*it* = abnormal return of security i on event day t, and

R*it* = actual return of security i on day t.

T statistics for Abnormal return

The t-statistic for the abnormal return (AR) is calculated as follows:

Equation 04 –

$$t_{AR_{it}} = \frac{AR_{i,t}}{\hat{s}_i}$$

where:

$AR_{i,t}$ = Abnormal Return of security i on event date t, and

$S\hat{}_i$ = the sample standard deviation.

Cumulative Abnormal Return

The calculation of the Cumulative Abnormal Return (CAR) of index i over a window from t_0 to t_1 is performed using the equation below:

Equation 05 –

$$CAR_i(t_0, t_1) = \sum_{t=t_0}^{ti} AR_{it}$$

Where,

t_o = Event date

t_1 = Estimation period date

$AR_{i,t}$ = abnormal return of stock i on day t,

T statics for Cumulative Abnormal Return

Equation 06 –

$$t = \frac{CAR}{\sigma AR / \sqrt{n}}$$

Where,

CAR = represents the average of abnormal returns,

σAR = represents the deviation of abnormal returns and

n = is the number of days of the event window.

Sample Design

Since the objective of the study is to analyze the influence of the Covid-19 outbreak on the Colombo Stock Exchange, we have selected companies listed in the Standard & Poort Sri Lanka 20 index as the sample for this research.

04.FINDINGS AND DISCUSSION

Covid 01st wave Analysis

Descriptive statistics

Descriptive Statistics of major target variables are represented in the table No:3. Table data contain the information regarding pre and post event date. Compared to the pre-event timeline, post covid window witness wider dispersion between the target variables. Greater standard deviations for each variable in the post-event window indicate volatility related to the pandemic event in the blue chip Index and the CSEALL index. The average values of all the variables during the post-event period were negative, indicating notable declines in the indices.

Table 3: Covid 01st wave descriptive analysis

Pre event window (0, -120)					
Items		Minimum	Maximum	Mean	Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic
S&P SL 20 Index Return	120	-0.02679	0.041952	-0.00012	0.008802085
Market Return	120	-0.02134	0.020612	0.000166	0.005523145
Normal Return	120	-0.03368	0.031765	-0.00013	0.008616106
Abnormal Return	120	-0.01275	0.01306	8.6E-06	0.00425641
Cumulative Abnormal Return	120	-0.02043	0.02352	0.00391	0.011678134
Post event window (0, +120)					
Items		Minimum	Maximum	Mean	Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic
S&P SL 20 Index Return	120	-0.12466	0.067467	-0.00145	0.021997357
Market Return	120	-0.06419	0.037106	-0.00058	0.01310675
Normal Return	120	-0.10053	0.057496	-0.0013	0.02044653
Abnormal Return	120	-0.03812	0.02503	-0.00015	0.00801913
Cumulative Abnormal Return	120	-0.03149	0.06515	0.010346	0.017009334

Source: Author's analysis

Visual examination of event window – Covid 01st wave

A visual analysis of the abnormal return reveals a highly volatile cluster around the post-estimation window and a slight dip around the event window. As soon as the event day ended, the Cumulative Abnormal Return (CAR) decreased in observation window +27.Significant volatility clusters are represented by the post-event window +27,+41, which are followed by news flow relating to pandemics. On the other hand, visual analysis also shows notable volatility following the event day.

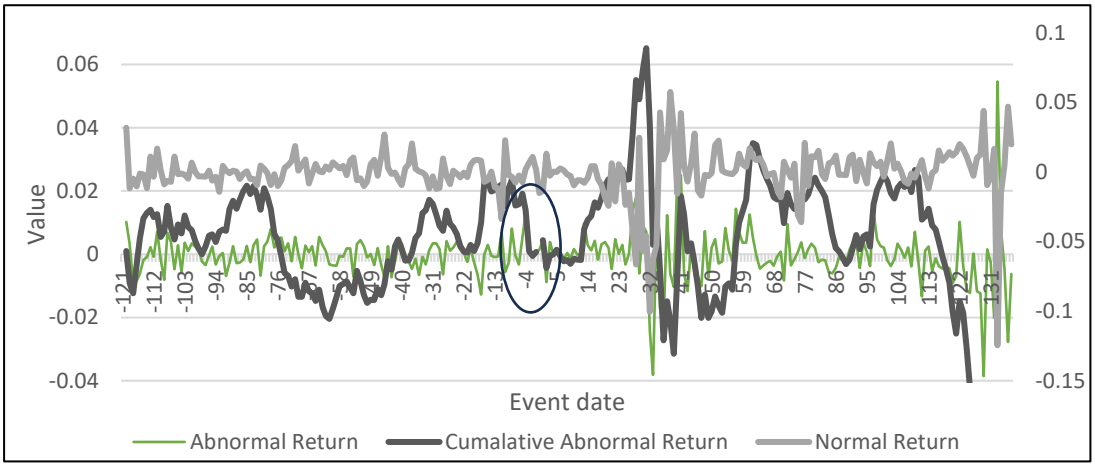

Figure 3: Covid wave 01 return behavior

Source: Author's analysis

Application of event model: Covid 01st wave

The researcher has carried out a critical test to check whether the above-mentioned scenarios are statistically significant in order to get a comprehensive understanding of the event. The researcher has used the market model to examine the target variable of abnormal returns and regression analysis to derive values for equation 2. Regression analysis was performed on the data in the estimation period (-40,-120), assuming that market participants had zero exposure to the COVID-19 information. The regression analysis results are depicted below.

Table 4: Regression model results

Regression Statistics	
Multiple R	0.888052793
R Square	0.788637764
Adjusted R Square	0.785927992
Standard Error	0.004166329
Observations	80

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.005051867	0.005051867	291.034703	4.79388E-28
Residual	78	0.001353947	1.73583E-05		
Total	79	0.006405814			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	-0.000393586	0.00046816	-0.840706662	0.403082128	-0.001325621
X Variable 1	1.556044334	0.091211496	17.05973924	4.79388E-28	1.374456195

Source: SPSS & Author's analysis

Researcher has regressed the CSEALL share index return against the S&P SL 20 index during the period of absence of COVID-19 impact (appendix B). As per the ANOVA results, our overall model is significant at 99%, with 78% of the variability explained by independent variable of market return. Applying the above values to the market model equation 2 is depicted below.

$$E(R_{it}) = \alpha_i + \beta_i R_{mt}$$

E(Rt) = 0.000393+1.556044* Actual return

After that, the researcher calculated the abnormal return of each security and critical test around the observation window by applying the below-mentioned equation 03.

Equation 03-

$$AR_{it} = R_{it} - E(R_{it})$$

Reacher has carried out comprehensive analysis, believing that the first COVID-19 incident happened on January 27, 2020 (Event Date: 0), having a significant negative impact on sample portfolio performances. However, the statistics associated with abnormal returns and cumulative abnormal returns have no significance at 95%, implying that there is no impact on the first COVID-19 incident in sample portfolio performances. However, this was contrary to the visual portfolio examination we discussed in previous section. However, researchers believe that T-statistics-based abnormal returns are more precious to provide a valid conclusion. Moreover, researcher carried out post-event observation window analysis and identified several event dates having material impact due to pandemic-related news flows. The below table 5 depicts the summary of results and observations we have obtained through post-observation (0+40) window analysis.

Table 5: T statistics relating to Abnormal Returns: Covid 01st wave

Event date	Date	Abnormal Return	Critical t test	t statistics status
0	27-Jan-20	0.00139	0.333333333	Not Significant
13	14-Feb-20	0.00982	2.354916067	Significant
27	6-Mar-20	0.01372	3.290167866	Significant
28	10-Mar-20	0.01766	4.23501199	Significant
30	12-Mar-20	0.00912	2.18705036	Significant
34	12-May-20	0.00898	2.153477218	Significant

Source: Author's analysis

- Day: 0

  According to the data presented in the table above, the first confirmed case during phase 01 did not notably affect the market. All local media channels reported the first confirmed positive case in Sri Lanka, involving a 44-year-old Chinese tourist who was later admitted to the IDH in Angoda. This event serves as our baseline event and marks the initiation phase of the Covid wave 01 in Sri Lanka. Based on our Abnormal Return analysis, this scenario did not have a significant impact on stock market prices.

- Day: + 13

  There was some mixed news reported in the media. Thirty-three Sri Lankan families and students were evacuated from Wuhan and relocated to a military facility in Diyatalawa, where they were placed under quarantine. After two weeks of quarantine, they were discharged on February 14th.

- Day: + 27

  Various types of news were reported in the media. The local community was actively monitoring the spread of the disease. The government assured that there would be no significant impact on Sri Lanka. Individuals arriving from different countries such as Italy, Iran, and South Korea were subjected to a mandatory two-week quarantine upon admission to Batticaloa.

- Day: +28

  The initial case of COVID-19 in Sri Lanka was confirmed on March 10, involving a 52-year-old tour guide who had been accompanying a group of Italian visitors. Following a positive test result, he was admitted to the IDH in Angoda for treatment. Additionally, twenty-nine domestic patients and nine foreign patients were under observation in government hospitals.

- Day: +30

  Another Sri Lankan individual was confirmed to have COVID-19. The 44-year-old patient, currently undergoing treatment at the IDH in Angoda, was reportedly in close contact with the first Sri Lankan patient diagnosed with coronavirus.

False information regarding the COVID-19 illness of the tour guide's child spread widely on social media on March 12, 2020. Following a comprehensive investigation, the Ministry of Health dismissed the allegations, stating that the boy displayed no symptoms of the virus.

- Day: +34

  Following its reopening on May 11, the CSE experienced its first-ever automatic closure in a matter of minutes due to a decrease of more than 10% in the blue chip index from the previous close. The selling pressure from overseas investors fueled the subsequent two days' drop, which saw the Standard & Poors SL 20 index bottom at 1690.60 point and the ASPI at 4247.95 point.

  According to the event window analysis above, The first Coronavirus occurrence occurred on Day 0, and while it had little substantive effect on stock returns, following lags had a major effect on market performance. In particular, Day 28 was the first local example to be validated as having a material impact on stock markets, as indicated by a higher t value.

Covid 02nd wave Analysis

Descriptive statistics

The descriptive statistics of the primary target variables are outlined in Table 6. Table data contains the Covid second wave in Sri Lanka. Compared to the pre-covid period, the post-covid period shows improved market returns with lower volatility. Similar to the phase 01 results post-event window showing a wider dispersion in returns and the lower bound of each variable standing at higher negative values. However, compared to the phrase 01 pre-event window, all the variables show significant improvement in their mean values. Standard Deviation provides mixed sentiment regarding market reactions; the S&P SL 20 index shows lower volatility compared to the phase 01. This was mainly attributable to preventive measures taken by most of the listed companies to cope with the Covid-19 impact. Moreover, descriptive analysis of Phase 02 event windows shows a significant improvement in market variables, indicating investors are taking COVID-19 impact more carefully when making market decisions.

Table 6: Covid wave 2 descriptive analysis

Pre event window (0, -120)					
Items		Minimum	Maximum	Mean	Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic
S&P SL 20 Return	120	-0.12466	0.067467	-0.001	0.02222537
Market Return	120	-0.06419	0.037106	0.00027	0.01352733
Normal Return	120	-0.10053	0.057496	3.12E-05	0.02110264
Abnormal Return	120	-0.03856	0.02503	-0.00103	0.00918461
Cumulative Abnormal Return	120	-0.19087	-0.02016	-0.1311	0.02739006
Post event window (0, +120)					
Items		Minimum	Maximum	Mean	Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic
S&P SL 20Return	120	-0.07603	0.055339	0.001899	0.01774705
Market Return	120	-0.06782	0.049705	0.002134	0.01662387
Normal Return	120	-0.10619	0.077149	0.002939	0.02593324
Abnormal Return	120	-0.03181	0.04132	-0.00104	0.0117491
Cumulative Abnormal Return	120	-0.25437	0.00799	-0.12063	0.06056895

Source: Author's analysis

Visual examination of event window- Covid 02nd wave

A visual examination of the abnormal return shows the highest dip around the event date and larger fluctuations among normal and abnormal returns. Cumulative Abnormal Returns (CAR) largely stood in negative territory, representing significant losses in indices. CAR values further glided down to negative territory immediately after the event date, representing cumulative losses in indices. Compared to the phrase 01, the below graph clearly shows that Covid wave 02 has a significant impact on stock market performances.

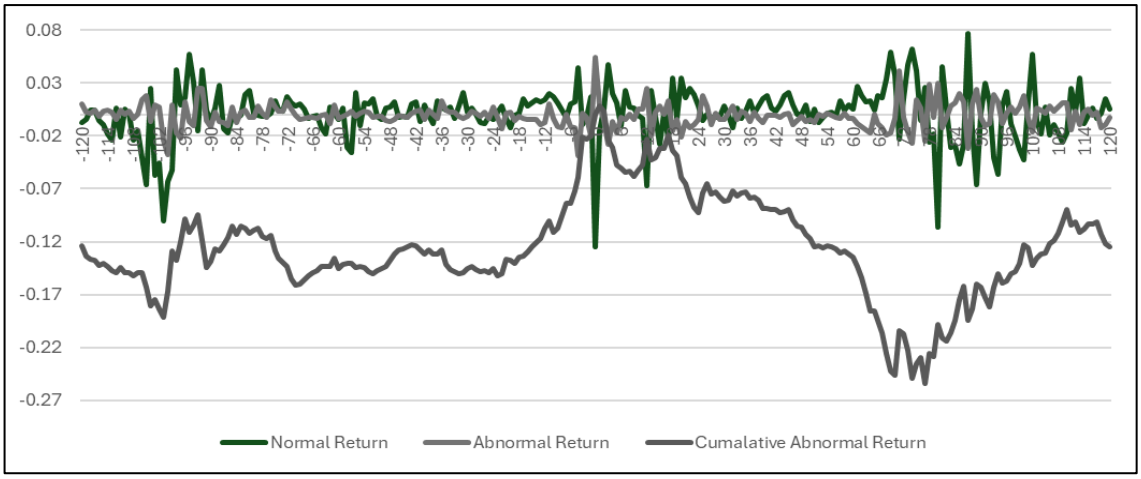

Figure 4: Covid wave 2 return behavior

Source: Author's analysis

Application of market model: Covid 02nd wave

The researcher has used the same market model equation (table 3) to compute the market return and abnormal return value associated with the event date, which is significant at the 95% level. The researcher has carried out an observation window for (0+40) for second place and information reaction for each event date mentioned below.

Table 7: T statistics relating to Abnormal Returns: Covid 02nd wave

Event Date	Date	Abnormal Return	t statistics	t statistics status
0	10/5/2020	0.05459	13.09113	Significant
12	10/21/2020	0.02465	5.91127	Significant
15	10/26/2020	0.00863	2.06954	Significant
17	10/28/2020	0.01276	3.05995	Significant
25	11/10/2020	0.01847	4.42926	Significant
26	11/11/2020	0.00852	2.04317	Significant
32	11/19/2020	0.00860	2.06235	Significant

Source: Author's analysis

- Day: 0

Sri Lanka was rewarded as one of the top countries in managing the Covid-19 pandemic, with the president and top officials receiving global recognition for their efforts. On October 4, 2020, an employee of an apparel company in Gampaha tested

positive for COVID-19. Forty-five of her family members and close contacts were subsequently placed in quarantine.

A police curfew was subsequently imposed in Divulapitya and Minuwangoda with military backing after the incident.

On that day, the postponement of the GCE Advanced Level and Scholarship Examinations announced by the Ministry of Education further signaled the fear of the disease.

- Day: +12

The Peliyagoda Fish Market cluster was reported in the media, with multiple additional cases recorded on October 21. The first patient was identified in Dompe. To prevent the potential spread of the disease, the fish market was completely closed, and individuals were subjected to PCR testing and self-quarantine.

- Day: +15

The 16th COVID-19-related death, involving a 70-year-old man with other non-communicable diseases, was reported in the media. News of this tragedy spread quickly through various outlets.

- Day: +17

The government announced the impending curfew schedule, which would begin the following day, and people are actively participating in preparation activities.

- Day: +25

The Bogambara jail cluster was widely highlighted in the media.

- Day: +26

The western provincial curfew has been removed.Investors actively participated in stock buying and selling operations.

- Day: + 32

A total of 439 coronavirus positive cases were found.

The above study clearly shows that the First Covid 19 Positive case in the second wave and subsequest phases aggressively responded to the market movement. Day +26 and Day +32 were noted as major phases, particularly due to the easing of curfews.In addition to the aforesaid data, the researcher conducted cluster analysis to determine whether a specific cluster's information presence on social media has a substantial impact on stock market performance.

Cluster Analysis

- **Welisara Navy Camp cluster**

The largest COVID-19 cluster reported in the country is Welisara Navy Camp. This happened on April 23, 2020, and continued after that. However, at the same time, the Colombo bourse was closed due to significant losses during the period. Due to the unavailability of abnormal returns during the period, we are unable to provide a valid conclusion regarding the significance level of this scenario.

- **Kandakadu cluster**

Table 8: Kandakadu cluster statistics

Event Date	Date	Abnormal Return	t statistics	t statistics status
72	07/7/2020	0.00953	2.2853	Significant

Source: Author's analysis

It was announced that the Kandakadu Rehabilitation Center has another COVID-19 cluster. Two cases of COVID-19 were identified in Welikanda, while Rajanganaya reported five cases. Additionally, one case each was detected in Habaraduwa and Lankapura. It was established that they were close associates of Kandakadu Rehabilitation Center prisoners. Kandakadu cluster was a significant event, as per the study, due to significant abnormal returns around the event day.

- **Minuwangoda and Divulapitiya cluster**

Table 9: Minuwangoda & Divalapitiya cluster statistics

Event Date	Date	Abnormal Return	t stastics	t statistics status
0	10/5/2020	0.05459	13.09113	Significant

Source: Author's analysis

This is the base event for the second Covid wave analysis of this study and the detailed analysis described in the earlier section.

Peliyagoda fish market cluster

Table 10: Peliyagoda fish market cluster statistics

Event Date	Date	Abnormal Return	t stastics	t statistics status
12	10/21/2020	0.02465	5.91127	Significant

Source: Author's analysis

Detailed analysis described in the earlier section.

Katunayaka Investment Zone cluster

Table 11: Katunayaka Investment Zone cluster statistics

Event Date	Date	Abnormal Return	t stastics	t statistics status
5	10/12/2020	-0.01685	-4.04076	Not Significant

Source: Author's analysis

On October 12, 2020, seven individuals in the Katunayaka Investment Zone tested positive for COVID-19. The following day, an additional 42 workers tested positive for the virus. However, this information is not significant to our study.

Vaccination news flow Analysis

Following the global vaccination program, Sri Lanka was first admitted 500,000 vials of Oxford AstraZeneca from the India Cerum Institute. According to local media reports, Sri Lankan health officials administered the nation's inaugural COVID-19 vaccine to a senior consultant at the IDH on January 29, 2021. This physician has been

actively involved on the frontline of the pandemic response. Reachers has further extended its analysis by applying this vaccination event to our sample study.

In order to check the pandemic impact before and after the clinical trials, researchers have applied a market model using regression data before the clinical trials. Regression analysis results (Appendix C) for market model depicted below.

Table 12: Regression Results

Regression Statistics	
Multiple R	0.890934
R Square	0.793763
Adjusted R Square	0.792388
Standard Error	0.009712
Observations	152

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.054455	0.054455	577.3187	2.75469E-53
Residual	150	0.014148	9.43E-05		
Total	151	0.068603			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-0.00137	0.000788	-1.74034	0.083851
X Varable 1	1.266563	0.052713	24.02746	2.75E-53

Source: Author's Analysis

E(Rt) = -0.00137+1.266563* Actual return

Descriptive statistics

Descriptive statistics of the pre- and post-event window show some contractotry results; the mean values of the variables stood at the negative boundary after the vaccination process.This is mainly due to the pandemic related negative information having a greater impact to the market than positive vaccination news.

Table 13: Descriptive statistics: Vaccination trials

Pre event window (0, -150)					
		Minimum	Maximum	Mean	Std. Deviation
Items	Statistic	Statistic	Statistic	Statistic	Statistic
Sample stock return	150	-0.06999	0.055339	0.003239	0.013792036
Market Return	150	-0.07961	0.04004	0.003791	0.012376234
Normal Return	150	-0.1022	0.049342	0.00343	0.015675285
Abnormal Return	150	-0.02922	0.03806	-0.00019	0.00809016
Cumulative Abnormal Return	150	-0.105	0.03434	-0.04269	0.030257522
Pre event window (0, +150)					
		Minimum	Maximum	Mean	Std. Deviation
Items	Statistic	Statistic	Statistic	Statistic	Statistic
Sample stock return	150	-0.07603	0.045336	-0.00174	0.017025668
Market Return	150	-0.06782	0.049705	-0.00104	0.015737521
Normal Return	150	-0.08727	0.061583	-0.00269	0.019932568
Abnormal Return	150	-0.01625	0.01243	0.000946	0.00575783
Cumulative Abnormal Return	150	-0.01625	0.14775	0.046549	0.054999089

Source: Author's Analysis

Visual examination of Covid vaccination event window

Visual examination of abnormal returns shows a big dip in normal and abnormal returns in the sample portfolio, and the normal return variable highly fluctuates around zero. Abnormal returns are less fluctuating smooth variables throughout the period, and cumulative abnormal returns turn in a north-headed direction immediately after the event date.

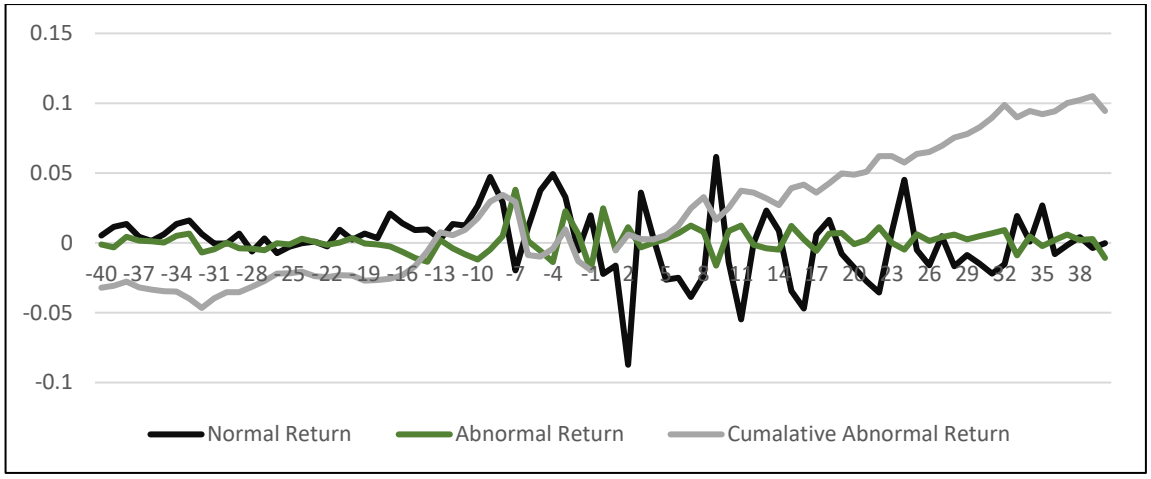

Figure 5: Covid Vaccination phase return behavior

Source: Author's analysis

Application of market model: Vaccination trial event

The researcher has performed a critical t test around the event date of January 29, 2021 (Day 0) to determine if the first COVID-19 clinical trail has a significant impact on the market. The below table summarizes the results of the t statistics around the event window.

Table 14: Vaccination trial event statistics

Event Date	Date	Sample stock return	Market Return	Normal Return	Abnormal Return	t statistics	T statistics status
-6	1/20/2021	0.0121261	0.0096193	0.0108121	0.00131	0.1348845	Not Significant
-5	1/21/2021	0.0319044	0.0308221	0.0376668	-0.00576	-0.5930801	Not Significant
-4	1/22/2021	0.0355294	0.040039866	0.0493416	-0.01381	-1.4219507	Not Significant
-3	1/25/2021	0.0553393	0.026918861	0.0327230	0.02262	2.3290749	Significant
-2	1/26/2021	0.0009222	-0.003286837	-0.0055343	0.00646	0.6651558	Not Significant
-1	1/27/2021	0.0003652	0.016729011	0.01981695	-0.01945	-2.0026749	Not Significant
0	1/29/2021	0.0025215	-0.016469404	-0.02223095	0.02475	2.5483910	Significant

1	2/1/2021	-0.0215818	-0.011720375	-0.016216004	-0.00537	-0.552923635	Not Significant
2	2/2/2021	-0.076025085	-0.067819463	-0.087269058	0.01124	1.157329918	Not Significant
3	2/3/2021	0.032736385	0.029439991	0.035916212	-0.00318	-0.327429639	Not Significant
4	2/5/2021	0.003289003	0.003737322	0.003362151	-0.00007	-0.007207571	Not Significant
5	2/8/2021	-0.023467234	-0.019783873	-0.026428935	0.00296	0.304777274	Not Significant

Source: Author's analysis

As per the above analysis, event zero is an significant variable to our model. On January 29, 2021, all major media channels reported the commencement of the country's inaugural COVID-19 vaccination program. Despite the previous Covid 19 phases event date -3 also significant variable to our model indicating that positive sentiment over the vaccination programme. Several medias were reported upcoming clinical trials of vaccination program of country during the pre event estimation window however official media announcement with real environment happen on 29th January 2021.This showed an positive sentiment over the clinical trials during the period of study.

Summary of Findings

The researcher has applied the event study approach to analyze the COVID-19-related information that has a material impact on the Colombo Stock Exchange. As per the semi-strong form of market theory, information gathered from public domains is reflected in security prices immediately after it's available to all the market participants. Reasercher has used three key events to represent information efficiency in the market.

The researcher initially focused on the first confirmed positive case in Sri Lanka, involving a 44-year-old Chinese female tourist detected on January 27, 2020. Analyzing the abnormal return around this event date suggested that it did not significantly impact stock market performance. However, subsequent events

following the first confirmed case resulted in statistically significant Abnormal Returns due to various COVID-19-related news stories covered in the mass media.

The researcher further examined the abnormal returns around the COVID-19 second wave starting point as a base event and found statistically significant abnormal returns. This showed that, compared to the first phase, the second phrase had a material impact on security returns.

The Covid-19 second wave in Sri Lanka was comprised of a few clusters, and the majority of those cluster events showed statistically significant abnormal returns.

In addition to the Covid wave analysis, the researcher also tested the first Covid-19 clinical trail, which also had a material impact on share market behavior. Researcher was selected on the kick-off day of the country's first Covid-19 program as a base event. This event had a material impact on market performances, as confirmed by statistically significant Abnormal Returns.

05.CONCLUSION

The researcher has examined the impact of COVID-19-related news flow and the performance of the Colombo Stock Exchange using a sample from the S&P SL 20 Index. Reacher has subdivided the time frame as per COVID wave 01, COVID wave 02, and kick-off day in the COVID-19 vaccine trails in Sri Lanka. Reaseacher has not found any significant abnormal returns around the event date of COVID wave 01 but found a few significant lags during the post-estimation period. The second phase showed a material impact for the study because it's comprised of significant abnormal returns during the event date.

Clinical vaccine trials are also a significant news event that largely weighs on the investor decision-making process due to the large positive abnormal returns hovering around the event date. The pre-estimation window of the clinical trail phase showed significant abnormal returns. This is due to the fact that some media announcements were made in advance regarding the possible arrival of vaccine stocks in Sri Lanka.

Further researcher has identified several subevents happen during the event window had an material impact for the CSE performances.

However, the researcher has been exposed to several limitations in conducting this event study. Especially during the period of the first wave, CSE was closed several times due to the travel restrictions and curfews imposed by the government. This is directly impacting the active participation of investors in the investment decision-making process. Travel bans and mobility restrictions directly impact the investor's investment decision-making process. Further, this study is based on a sample of blue-chip company indexes in Sri Lanka, and in order to get a better picture of the COVID-19 outbreak, we need to carry out a comprehensive sample study using small-cap companies. Further, we have only considered the COVID-19-related news flow for analysis, but these are company-specific and macroeconomic-level events that have a wider impact on security prices. Moreover, investors processed every piece of information subjective to their behavioral biases and analyzed these behavioral factors is out of this study.

Future researchers will be better able to incorporate macroeconomic variable influence on event date along with COVID 19. There is a is a limited amount of literature regarding COVID 19 influence on the Colombo Stock Exchange, so the researcher believed that this study significantly contributed to the development of pandemic outbreaks and stock market behavior-related literacy in Sri Lanka.

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Appendix A- Significant news appearance in media

Chinese woman Sri Lanka's first confirmed case of coronavirus

Chinese passengers wearing face masks walk past a thermal scanner set up to check the temperature of passengers at Colombo International airport in Colombo Saturday. | AP

REUTERS SHARE Jan 28, 2020

COLOMBO – Sri Lanka has confirmed the first case of coronavirus in the country, a senior Sri Lankan health official said on Monday.

"A Chinese lady, who is in her 40s, arrived on the 19th as a tourist and fell ill on the 25th and was confirmed as having the coronavirus following a test on Monday," Sudath Samaraweera, the chief epidemiologist with Sri Lanka's Ministry of Health, told Reuters,

Minuwangoda cluster increases to 832 COVID-19 cases (23:00 hours/06th Oct)

by Zulfick Farzan
06-10-2020 | 11:09 PM

Colombo (News 1st); 124 new COVID-19 cases were reported from the Minuwangoda cluster on Tuesday (06), said the Department of Government Information adding all cases are from the apparel factory in Minuwangoda.

Accordingly, the total number of COVID-19 cases from the Minuwangoda cluster is now at 832.

According to the update by the Department of Government Information Department as of 22:55 Hours on Tuesday (06) a total of 739 cases were reported during the day and 729 of them are from the Minuwangoda/Divulapitiya cluster.

The other 10 are returnees from overseas and the breakdown is as follows.

04 returnees from the United Arab Emirates

01 returnees each from Qatar, Kuwait, Japan

03 Indian seafarers.

The total confirmed COVID-19 cases in Sri Lanka at 23:00 hours on Tuesday (06) is 4252 with 3266 recoveries and 973 patients in hospital.

www.news.cn 新华网 News Asia&Pacific Edition Monday, May 20, 2024

Senior doctor first to receive anti COVID-19 jab in Sri Lanka

Source: Xinhua | 2021-01-29 17:26:28 | Editor: huaxia

A medical worker receives a dose of COVID-19 vaccine at the National Infectious Disease Hospital (IDH) in Colombo, Sri Lanka, Jan. 29, 2021. Sri Lanka's health officials on Friday kicked off the country's first COVID-19 vaccination program by inoculating a senior consultant physician at the National Infectious Disease Hospital (IDH) who has been in the front lines of the pandemic, local media reported. Dr. Ananda Wijewickrama was the first medical officer to receive the jab on Friday morning, which was monitored by hospital staff and government officials. A senior nurse at the IDH was the second to receive the jab while three military officers also received the jab at the Army Hospital in Colombo. The vaccination program is underway in six major hospitals in Sri Lanka where 250,000 health line workers will be vaccinated in the coming days. (Photo by A.Hapuarachchi/Xinhua)

COLOMBO, Jan. 29 (Xinhua) -- Sri Lanka's health officials on Friday kicked off the country's first COVID-19 vaccination program by inoculating a senior consultant physician at the National Infectious Disease Hospital (IDH) who has been in the front lines of the pandemic, local media reported.

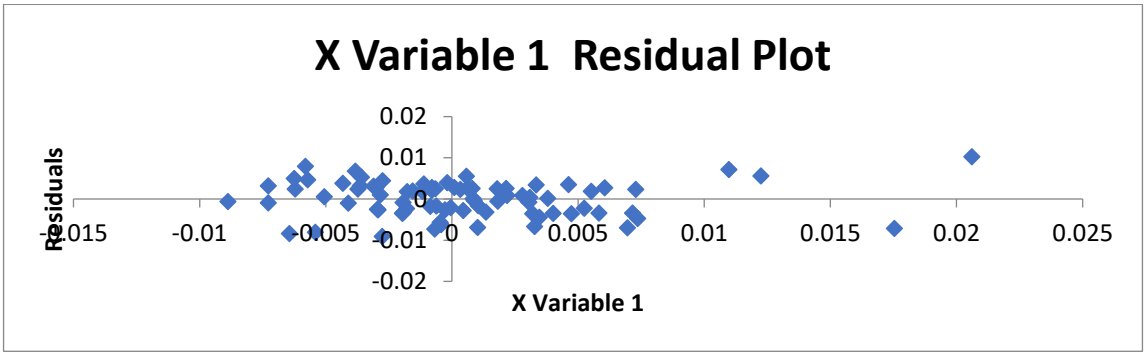
SUMMARY OUTPUT

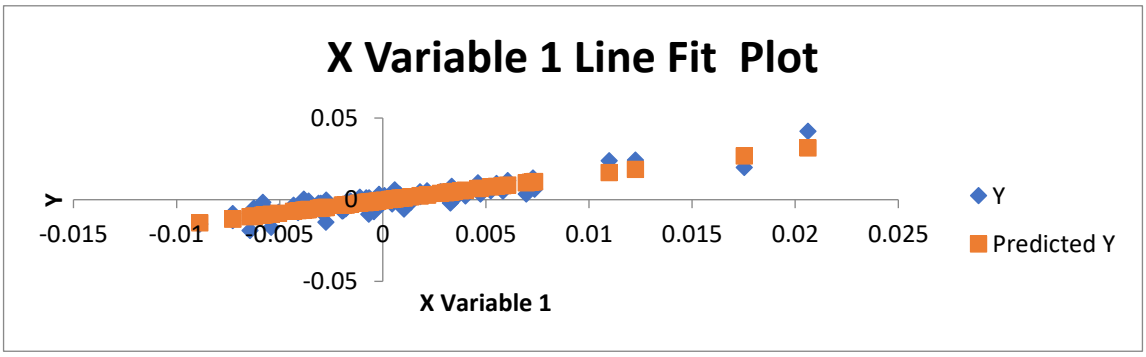
Regression Statistics	
Multiple R	0.888052793
R Square	0.788637764
Adjusted R Square	0.785927992
Standard Error	0.004166329
Observations	80

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.005051867	0.005051867	291.034703	4.79388E-28
Residual	78	0.001353947	1.73583E-05		
Total	79	0.006405814			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper*
Intercept	0.000393586	0.00046816	0.840706662	0.403082128	0.001325621	0.00053845	0.001325621	0.000
X Variable 1	1.556044334	0.091211496	17.05973924	4.79388E-28	1.374456195	1.737632473	1.374456195	1.7376





Appendix C- Vaccine phase regression output- Market model

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.890933802
R Square	0.793763 04
Adjusted R Square	0.792388127
Standard Error	0.009712 01
Observations	152

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.054454515	0.054454515	577.3187109	2.75469E-53
Residual	150	0.014148471	9.43231E-05		
Total	151	0.068602987			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.001371404	0.000788012	-1.740335434	0.083850934	-0.002928441	0.000185632	-0.002928441	0.000185632
Market Retrun	1.266563461	0.052713171	24.02745744	2.75469E-53	1.162407227	1.370719696	1.162407227	1.370719696