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Commerce majoring in Finance.**

Title: COVID-19's Impact on the JSE-listed industry prices

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Declaration

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Abstract

This study aimed to examine the impact of the COVID-19 pandemic on the stock prices of companies listed on the Johannesburg Stock Exchange (JSE). Additionally, the study aimed to evaluate the market efficiency within select industries listed on the JSE, employing the Efficient Market Hypothesis (EMH) theory. The examination study focused on the period immediately following the announcement of lockdown measures, spanning 30 days. The fixed effect model was used to evaluate the relationship between JSE industry returns and independent variables such as COVID-19 metrics, Adjusted Share Price, and Exchange Rate over time. Further, the event study methodology was used to measure the abnormal returns on stock prices 30 days up to 30 days after the lockdown announcement and hence the efficiency of the stock market during this time. Notably, the regression analysis underscored that while the exchange rate may not wield significant influence over financial returns, the number of COVID-19 cases appears to have a statistically significant positive impact on stock prices, emphasising the pervasive influence of the pandemic on market dynamics. The event study revealed that 62.5% of the selected JSE industries exhibited support for the Efficient Market Hypothesis (EMH) theory. This suggests that a significant portion of the South African stock market demonstrates strong information efficiency. The findings suggest the importance of monitoring how the outbreak of pandemics has affected the general economy and the environment in which companies operate. Investors should be cautious during this time as there are additional risk factors such as national governments enforcing lockdown restrictions which will limit company activities. Further, the study reveals that investors who are investing in the South African stock exchange should use investment strategies that are aligned with investing in weak-form efficient markets.

Key Words

Pandemic, Covid-19, Returns, Cumulative abnormal returns, Efficient Market Hypothesis, Johannesburg Stock Exchange, JSE-listed industries, impact.

List of Acronyms

USD: United States Dollar

NYSE: New York Stock Exchange

JSE: The Johannesburg Stock Exchange

FTSE: The London Stock Exchange

GDP: Gross Domestic Product

US: United States

SA: South Africa

SARS: Severe acute respiratory syndrome

CPI: consumer price index

EMH: Efficient Market Hypothesis

APT: The Arbitrage Pricing Theory

ROA: Return on assets

ROS: Return on sales

ROE: Return on equity

CAR: Cumulative abnormal return

AR: Abnormal returns

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Chapter 1: Introduction and Background

1.1 Introduction

COVID-19 is an extremely transmittable airborne virus which is known to cause a high fever accompanied by flu-like symptoms (Briancina,2020). Covid-19 originated in Wuhan China and its first case was reported in December 2019. The virus was extremely contagious and infectious, and it quickly spread globally. The virus was spread to various countries through international travellers. This resulted in many countries closing their airports and implementing cross-border travel bans for non-native people. Consumer confidence significantly declined during this time as there was no clear preventable vaccine or detailed information about the virus (Zheng,2021). In March 2020 following travel bans and border control measures adopted by many countries, the aircraft industry and tourism industry declined and was negatively affected. Eventually, almost every economy, sector and industry was affected by the disruptions and loss in consumer confidence. The other major repatriations that came with the virus were restrictions placed on certain entertainment, services, and working environments as well as quarantine periods and forced lockdowns caused major declines in investor confidence, overall investment, and spending. Investor confidence usually influences stock price and performance which has eventually led to increased stock price volatility as potential returns and earnings became more and more unclear during the pandemic (Mockaitytė, 2020).

According to Green (2020), the onslaught of the COVID-19 pandemic drastically changed the contours of global financial markets, inducing unprecedented volatility and destabilization. This profound disturbance has catalysed shifts in currency valuations, equity markets, and stock valuations, and altered the financial behaviours of lenders and investors alike (Smith, Johnson & Kumar, 2021). Nations across the spectrum are grappling with dire economic ramifications, with innumerable investment ventures either postponed or abrogated (Davies, Thomas & Anderson, 2021). An immediate fallout has been a steep rise in unemployment rates, accentuated by the imposition of lockdowns, resulting in the halt of non-essential services aimed at curbing viral transmission (Mai,2021). Historically, only a handful of events, such as the Great Depression of the 1930s or the Global Financial Crisis of 2008, mirror the scale of the socio-economic challenges presented by COVID-19 (Martin, Thompson & James, 2020). In terms of economic disruptions, the SARS (Severe Acute Respiratory Syndrome) epidemic in the 2000s rendered global economic damages amounting to tens of billions of USD (Green & King, 2020), while the H1N1 epidemic in 2009 is estimated to have contracted global GDP

by 0.5-1.5% (Taylor & Mason, 2018). Periodic outbreaks, like the H5N1 bird flu or the H7N9 influenza, also brought about discernible economic downturns in affected regions. For instance, Brown and Nicholson (2015) deduced that regular influenza cycles inflict an annual economic strain on the US ranging from USD 10 million to nearly USD 1 billion. The Zika epidemic between 2016 and 2018 levied an economic toll approximated between USD 5 billion and USD 15 billion on South American economies (Global Health Council, 2019). The uniqueness of the current pandemic, however, lies in its timing - an era characterized by hyper-globalization and interwoven financial markets, and its origin in China, a pivotal nexus in the global economic lattice. While historical epidemics provide some reference points, the idiosyncrasies of the COVID-19 era demand distinct scrutiny (Smith,2021).

1.2 Background

According to Antony (2019), a stock market is a central market that allows companies and governments to raise capital by issuing shares or bonds to investors as well as where shares of companies that are publicly listed are bought and sold. These stocks and bonds are traded on stock exchange platforms such as the New York Stock Exchange (NYSE), the Johannesburg Stock Exchange (JSE) and the London Stock Exchange (FTSE) to name a few. Stocks present a unit of ownership in a company. Stock markets allow for secondary trading of these units of ownership (Azam,2022). Stock markets also allow companies to issue new stock to raise more capital, or for companies to buy back the stocks they have previously issued to reduce the ownership of the public in the company (Akinda,2021). Companies sell units of ownership to raise capital for various reasons, such as for expansion, and growth, to exploit a potentially profitable project to meet financial obligations, or to improve cashflows and liquidity within the company. The role of the stock exchange platforms is to create a fair, central, and competitive marketplace where stocks, bonds and other commodities, swaps and futures can be traded in a fair, transparent and easy manner (Larter, 2017).

According to Ozili (2020), the main public exchange platform in South Africa is known as the Johannesburg Stock Exchange (JSE). The creation of the JSE occurred in 1887 during the period of the first gold rush in South Africa; however, the JSE only became a stock exchange in 2005. The JSE is home to five financial markets namely, bonds, equities, interest rate derivatives and commodities (FTSE/JSE Multi-Asset Composite Index Series | Johannesburg Stock Exchange, 2021). The equity market is further broken down into 10 industries. These are- Oil & Gas (J500), Industrials (J520), Health Care (J540), Telecommunications (J560), Financials (J580), Basic Materials (J510), Consumer Goods (J530), Consumer Services (J550),

Utilities (J570) and Technology (J590). All stocks listed on the JSE fall into one of these industries (McGregor, 2017). This together with the number next to each of the industries listed above represents industry-specific index (Goker,2020). An industry-specific index is used to measure the overall price movements of all stocks within a specific industry and is used as a measure when one is attempting to determine the overall impact of various macroeconomic, financial, or industry-specific events on specific industries. It is also used as a benchmark for firms within the industry to see how the firm is performing in comparison to other firms in the industry they belong (Laichena and Obwogi, 2015).

Macroeconomic factors are trends that broadly affect the economy of a country (CFI, 2020). Factors known to contribute to the growth or stability of the economy are called positive factors, conversely, factors known to contribute to the shrinkage of the economy or economic uncertainty are negative factors (He,2020). Macroeconomic factors are also commonly used to help analysts and economists forecast the future of the economy. The most popular economic variables according to Gupta (2013), are interest rates, money supply, Gross Domestic Product (GDP), exchange rates, inflation rates, stock markets and unemployment levels. Studying the macroeconomic environment of a particular country is important as it influences financial market behaviour, which includes the behaviour of stock markets or stock exchanges (Davies,2021). A period of economic growth increases demand, which causes an increase in price levels, which could potentially lead to increased levels of potential earnings for investors. Conversely, slow economic growth or economic declines can be anticipated when there is an increase in the unemployment rate, which reduces investor confidence, which also causes a decrease in demand, which can ultimately cause a decline in the price of securities and earning potential of investors (Mosteanu, 2017).

Traditional finance and economics proclaim that stock prices are influenced by firm-specific characteristics or events as well as macroeconomic factors (Fama, 1970). Past studies indicate that; exchange rate, interest rate, inflation as well as GDP to name a few have been found to significantly impact stock prices and their fluctuations. Investors pay special attention to the macroeconomic variables and conditions facing companies when they attempt to value stocks or analyse stock price fluctuations. Based on a study by Imran, Irfan, Shahzad, Muhammad and Kamran (2014) exchange rate, inflation, GDP and interest rate were found to have an impact on the stock price in the long run. Additionally, a study by Soenen and Henniger (1998) found that there exists an inverse association between the domestic exchange rate and share prices. This implies that as the domestic exchange rate increases stock prices are expected to

fall. Similarly, when the domestic exchange rate of a country decreases stock prices are expected to increase. This relationship was also found in a study done by Imran et. al. in 2014. Further, the study found that there exists an inverse relationship between stock prices and the prime lending rate. When a country's interest rate increases it is likely to cause a decline in stock prices since it causes an increase in the rate of return which then causes a decline in the stock price, whilst higher rates of inflation were found to affect the stock market negatively (Imran et. al., 2014).

Prices of stocks that belong to companies sharing a common industry are known to react similarly to each other when faced with similar macroeconomic conditions (Moskowitz and Grinblatt 1999). A study done by Safitri and Kumar (2004) showed that macroeconomic variables such as gross domestic profit (GDP), interest rates, the consumer price index (CPI), exchange rates and inflation affect stock prices and thus also industry indices affect the stock price as investors expect stocks within specific industries to react to the macroeconomic environment in a similar manner. It is known that during periods of economic expansion (when GDP is increasing), the stock prices and stock indices rise as it shows that the earning potential of corporate and private companies has increased and thus investors are more bullish on stocks which ultimately drives up the stock prices and stock market indices. The converse is true for economic declines or recessions, that is, during periods when GDP is declining, it is expected that stock prices and stock indices would decline as it indicates a drop in earning potential (Mosteanu, 2017).

The global and rapid expansion of the COVID-19 virus struck fear in the world not only as a medical concern but also as a major concern to investors (Laichena,2021). COVID-19 was deemed to be a pandemic on the 11th of March by the World Health Organisation (WHO); many countries then imposed various restrictive measures namely such as lockdowns which resulted in a decline or shrinkage of general economic activities not just domestically but globally as well. Many companies and businesses were unable to work during such a period and had to forgo profits- reducing the earning potential of these companies (Ozili and Arun, 2020). Based on the study by Fernandez-Perez, Gilbert, Indriwan and Nguyen (2020) COVID-19 resulted in investors following certain cultural norms such as individualism and uncertainty avoidance which guided their investment choices when investing in the stock market. This led to changes in the price movement in the stock exchange. Some investors pulled out their investments because of the additional risks associated with the Covid-19 pandemic following a cultural norm called uncertainty avoidance (Fernandez-Perez et. al., 2020).

COVID-19 resulted in different sectors within the South African stock market being strained due to lockdown crises. According to Chen, Yang and Zhang (2020), the pandemic led to a rise in risks facing the overall economic and financial markets. As previously mentioned, stock prices are influenced by macroeconomic factors which represent the state of the economy at a national level. Thus, it was concluded that stock prices are impacted by the pandemic as the pandemic has had an impact on the domestic and global economies (Perez,2021). Further, since different industries are affected by macroeconomic determinants differently, all industries were not affected by the COVID-19 pandemic in the same way. Thus, this paper will attempt to measure the impact the pandemic has had on the specific industry prices in the JSE.

According to Goker (2020), the direct measurement of the impact of COVID-19 is not possible, as it requires one to evaluate how an economy or stock market performed during a specific event, in this case, the pandemic compared to how the economy or stock market would have performed if there was no pandemic. Since no real-time data showing what the economy or stock market performance would have been, it is not possible to measure the impact directly (Mockaitytė, 2020) The price fluctuations caused by the pandemic could potentially weaken or strengthen the efficiency of the stock market. It is vital to evaluate how the pandemic has impacted the JSE since there is a lack of research that measures the impact on the JSE during Covid-19. In addition, this study might assist in the identification of industries that do not perform well during events that impact the economy negatively, and hence provide investors with insights in the event there is another pandemic in the near future. This study will also assist in assessing the efficient market hypothesis (EMH) by using a timeline approach to view how quickly new information is incorporated into stock prices. In simplicity the EMH is a model of the capital market which claims market prices reflect all available information thus reflecting the intrinsic value of the underlying security at any point in time, this is known as informational efficiency. As a result, outperforming the market under EMH is not probable since all securities are correctly priced. Under EMH, to outperform the market an investor must invest in stocks that are deemed high-risk (Mai,2021). EMH claims that prices are only influenced by new relevant available information which arrives randomly in the market and not by factors namely; irrational behaviour of investors. In this model of reality of the capital market, it is assumed all investors are rational and behave rationally. Thus, prices change when new information arrives in the market about the expectations of an underlying security return (Fama, 1970).

1.3 Statement of the problem

According to Moskowitz and Grinblatt (1999), stock prices are influenced by the macroeconomic factors facing the general economy in a country. In a more recent study conducted by Fernandez-Perez et. al. (2020). it was concluded that the Covid-19 crisis caused the market participants, particularly the investors to follow the crowd or follow their intuition when making an investment decision. Increased levels of market volatility in the financial market, caused by changes in the economic situation in a country, results in an increase of risk to all stakeholders that are directly or indirectly invested in the particular financial market as in the study titled South African Stock Market by (O'Mahony, 2018). Particularly, an increase in market volatility experienced by the JSE causes an increase in price risks regarding stock prices and returns. Since COVID-19 is new, there are limited studies that investigate the impact of COVID-19 on stock markets in South Africa (Smith,2021). This leaves the investors with a plethora of information for future investment decisions. Therefore, this study will fill this gap by investigating the impact of COVID-19 on stock prices listed on the Johannesburg Stock Exchange (JSE) and this impact will be measured by using the change (either positively or negatively) in the stock price index during the period of observation.

1.4 The aim of the study

The aim is to determine the impact of Covid-19 on the stock prices of firms listed on JSE. The specific objectives are:

- To investigate the impact of COVID-19 on JSE-listed industry prices.
- To determine the market efficiency within specific industries listed on the JSE, based on the EMH theory. (When the lockdown was announced)- over a period of 30 days post-lockdown announcement.

1.5 Research Questions

- What was the impact of Covid-19 on the JSE industry prices?
- What was the level of market efficiency when COVID-19 was first announced in South Africa across the JSE-listed industries?

1.6 Significance of the Study

The study is most likely to benefit investors, fund managers and portfolio managers to make more calculated and wiser investment decisions when facing adversity and future crises similar to COVID-19. It will assist them in understanding the stock markets better and help them plan their future investments more rationally and prudently in the face of any crisis. This study will also add to existing studies in the area of stock price index analysis and act as motivation for future similar research. In particular, this study will most likely be beneficial to the following groups of individuals:

- **Individual Investors**

A paper examining the effects of the COVID-19 pandemic on the stock exchange would be highly valuable to individual investors seeking insights into the performance of the stock market during the pandemic. A thorough analysis of the pandemic's impact on the stock market would include an examination of the sectors that were most impacted, the magnitude of the impact, and the factors that influenced the market's performance. Such a study would equip individual investors with the necessary information to make well-informed investment decisions, by identifying sectors and stocks that are likely to perform well in a post-pandemic environment. Additionally, a comprehensive paper would serve as a historical record of the pandemic's impact on the stock market, providing investors with the ability to anticipate and respond to similar events in the future. While existing studies, such as Al-Awadhi et al. (2020) and Cheema et al. (2020), have provided some insights into the impact of COVID-19 on specific stock markets, a more comprehensive study would greatly benefit individual investors.

- **Fund Managers**

Fund managers are individuals who take up the role of implementing investment strategies and controlling trading activities for them to perfect their job, they must be aware of economic conditions (Houghton, 2016). Covid-19 can be seen as an example of these economic conditions. This study will provide up-to-date changes in the stock market in South Africa (SA).

- **Policy Makers**

Policymakers stand to benefit from this study as it will help them understand what happens during a pandemic or global crisis, and how it impacts the stock markets and overall economy. This will assist policymakers in being more confident in the methods of invention that will be

chosen to help stabilise the economy if or when there is another pandemic or global crisis (Gourinchas, 2020).

- **Portfolio Managers**

Portfolio managers have a paramount interest in understanding the multifaceted repercussions of global events on investment landscapes. A study on the impact of COVID-19 on the stock market would be of significant advantage to them. Such research provides insight into the resilience and vulnerability of various sectors during unprecedented disruptions, enabling portfolio managers to better assess risks and identify potential investment opportunities. According to Baker et al. (2020), stock market fluctuations during the COVID-19 era not only reflected immediate economic concerns but also indicated investors' perceptions about longer-term business environment changes. By delving into these patterns, portfolio managers can make informed decisions to optimize returns and minimize vulnerabilities in future scenarios of global crises.

- **Impact of the study**

The study highlights the critical need to monitor the impact of pandemics on both the overall economy and the business environment. It emphasizes that investors should exercise heightened caution during such times, as the implementation of government-enforced lockdowns introduces additional risk factors that can significantly constrain business operations. Moreover, the research underscores the importance of employing investment strategies tailored to the unique characteristics of the South African stock market, particularly those suited for weak-form efficient markets.

1.7 Contribution to Literature

The research gaps exist in the study of the impact of COVID-19 on the JSE. The COVID-19 crisis is fairly recent and it will take time for some researchers to gather the needed information about the effect of COVID-19 on the stock market. Of the limited studies that researched the impact of COVID-19 on the stock market, many did not use the event method. The only SA study that is based on the COVID-19 impact on the SA's stock market or JSE is that of Gbenga,

Kesi and Josue (2021) and the study used the fixed effect model method. A study by Nwosa (2021) which was based on the effect of COVID-19 on the Nigerian stock market used the Stochastic Frontier Approach. Thus, this paper will attempt to add to the literature in analysing the COVID-19 effect on stock price index analysis and therefore address the gap in the literature in this regard.

1.8 Scope and Limitations

The scope of this study is confined to the JSE-listed industry prices during the specified event window around the onset of the COVID-19 pandemic. The focus will be primarily on those industries that exhibited significant price fluctuations during this period.

However, there are certain limitations to this research:

- The study assumes that the JSE operates in an efficient market, wherein stock prices immediately reflect all available information.
- While the event study methodology is powerful, it's based on the assumption that no other significant event influenced stock prices during the chosen event window.
- This research assumes that historical stock prices can predict future stock prices, which might not always be the case.

1.9 Chapter Outline

Following the introduction, the subsequent chapters are structured as follows:

Chapter 2: Literature Review – This section will delve deeper into existing literature on stock market reactions to past pandemics or global crises. It will also revisit concepts like the efficient market hypothesis in the context of unpredictable, large-scale events.

Chapter 3: Methodology – Here, the research design, data sources, and statistical tools used for analysis will be discussed in detail.

Chapter 4: Findings and Discussion – This chapter will present the research findings and juxtapose them against existing literature and theoretical underpinnings discussed in Chapter 2.

Chapter 5: Conclusion and Recommendations – The study will be concluded with a summary of findings, implications for investors and policymakers, and recommendations for further research.

1.10 Chapter 1 summary

Chapter 1 lays the groundwork for the thesis by introducing the research topic. The chapter begins with a detailed discussion of the background, explaining the origins of the research problem. The chapter then articulates the aim of the study, specifying the specific objectives and also clearly discussing the significance of the study. Further, it explains how the research will address existing gaps in literature. Finally, the chapter concludes with a clear plan for the thesis structure that is followed, specifying the various chapters to follow and what will be discussed in each of the chapters. The next chapter presents the final discussions of the findings that are relevant to the study. Chapter five is the last segment of the dissertation will highlight the conclusions on the objectives, recommendations, and limitations as well as the overall contribution of the study.

Chapter 2: Literature Review

2.1 Introduction

This literature review begins by examining various financial and economic theories that impact stock exchange markets, these include; the efficient market hypothesis, behavioural finance, herding, investor sentiment and over-confidence bias. Thereafter the empirical review will follow, which discusses many previous studies and research that has been conducted on the impact of the Covid-19 pandemic on stock exchange markets, firstly by looking at international markets, then markets in Africa and finally a closer look at the South African market. This section will conclude by identifying the gaps in the literature as well as a brief discussion of why it is necessary to fill these gaps.

2.2 Relevant Theoretical Framework

A theoretical framework serves as the backbone of a research study, offering a lens through which a researcher can examine a particular phenomenon. Essentially, it provides a structured model that interlinks abstract concepts, theories, and their corresponding relationships concerning a specific research topic (Grant & Osanloo, 2014). By outlining the theories and concepts deemed relevant to the study, the theoretical framework assists researchers in establishing the context for their study, forming hypotheses, and interpreting findings. Importantly, it offers a structured approach to address the research question and ensures that the research's findings can be suitably situated within the larger domain of knowledge. In the realm of academic studies, the importance of a theoretical framework is paramount as it not only guides the research process but also ensures that the study remains coherent, focused, and contributes to the wider academic community. These theories that are discussed are relevant for explaining stock prices and they include, the efficient market hypothesis (EMH), behavioural finance which further breaks down into herding, overconfidence bias, Investor sentiment and lastly theory of imperfect substitution. Thereafter the empirical review will discuss numerous studies that have been conducted on the stock markets, firstly the international markets, followed by African markets and end with South African markets.

2.2.1 Efficient market hypothesis

In simplicity the efficient market hypothesis is a model of the capital market which claims that market prices reflect all available information thus reflecting the intrinsic value of the

underlying security at any point in time, this is known as informational efficiency. As a result, outperforming the market under EMH is not probable since all securities are correctly priced. Under EMH, the only way to outperform the market is to invest in high-risk stocks. EMH claims that prices are only influenced by new relevant available information which arrives randomly in the market and not by factors such as the irrational behaviour of investors. In this model of reality of the capital market, it is assumed all investors are rational and behave rationally. Thus, prices change upon the arrival of new information about the expectations of an underlying security return (Fama, 1970).

The efficiency of the market is based on the extent to which market prices incorporate available information. These three forms of the efficient market hypothesis are based on how well markets do this. The weak form asserts that security prices incorporate all historically available information thus one cannot beat the market using historical information or any form of technical analysis. The semi-strong form declares that security prices incorporate all historical and public information. If one is attempting to earn abnormal returns in a semi-strong form market, it is not possible to do so using technical or fundamental analysis but rather possible to do so using insider information. Thirdly, the strong-form market states that all prices incorporate all historical, public and insider information, thus making it impossible to consistently beat the market (Fama, 1970).

2.2.1.1 Weak Form EMH:

The Weak Form of the Efficient Market Hypothesis posits that the current stock prices fully reflect all available security market information, such as past price patterns, volume, or other historical market-based indicators. Consequently, it suggests that no investor can consistently achieve abnormal returns by exploiting patterns in historical prices or trading volumes. Technical analysis, which primarily revolves around examining past market data, particularly price and volume, to forecast future price movements, is deemed to have limited utility under this form of EMH. However, it doesn't negate the potential effectiveness of fundamental analysis, which relies on broader financial and economic data (Fama, 1970).

2.2.1.2 Semi-Strong Form EMH:

The Semi-Strong Form of the Efficient Market Hypothesis claims that all publicly available information, which includes past price data as well as broader financial and economic information, is fully and instantaneously reflected in asset prices. As such, neither technical analysis nor fundamental analysis can consistently provide investors with abnormal returns.

Only by accessing and trading on new, private (or insider) information, can one potentially achieve superior returns. A plethora of empirical studies have examined the semi-strong form EMH by testing the speed with which stock prices adjust to new public information, such as earnings announcements or macroeconomic news (Ball and Brown, 1968).

2.2.1.3 Strong Form EMH:

The Strong Form of the Efficient Market Hypothesis is the most stringent version, suggesting that stock prices instantaneously and fully reflect all information, both public and private. Hence, no investor, not even one with insider information, can consistently achieve abnormal returns. It's worth noting, however, that empirical evidence has shown some instances where individuals with insider information have managed to reap abnormal profits, thereby challenging the strong form of EMH in its purest sense (Jaffe, 1974). Nonetheless, legal constraints, such as insider trading laws, are put in place in many jurisdictions to prevent such activities.

2.1.1.4 Efficient Market Hypothesis (EMH)

Proposed by Fama (1970), the Efficient Market Hypothesis (EMH) is a seminal theory in finance that posits the efficiency of financial markets. According to EMH, financial markets are informationally efficient, implying that stock prices accurately reflect all available information, including historical data and current news (Fama, 1970). EMH further suggests that stock prices follow a random walk, making it extremely challenging for investors to consistently achieve returns greater than the overall market average.

EMH plays a crucial role in this research by providing a theoretical basis for understanding the behaviour of stock prices. It underscores the notion that stock prices are not predictable based on historical information alone and that any significant movements are typically driven by new, unexpected information. As such, EMH serves as a guiding principle for assessing the impact of unforeseen events, such as the Covid-19 pandemic, on stock prices.

2.2.1.5 Arbitrage Pricing Theory (APT)

The Arbitrage Pricing Theory (APT), developed by Ross (1976), offers an alternative perspective on stock pricing. APT builds upon the Capital Asset Pricing Model (CAPM) and the Law of One Price, aiming to connect stock market returns with macroeconomic variables. APT contends that the primary drivers of stock returns are unanticipated shifts in the risk premium, variations in anticipated levels of industrial production, and unexpected changes in

inflation and interest rates (Joseph, 2013). Each of these factors is assigned a coefficient that quantifies their influence on asset prices.

APT enriches the theoretical framework by introducing a multifactor model that considers the impact of macroeconomic variables on stock returns. It recognizes that stock prices are influenced by both systematic and unsystematic factors, with larger portfolios primarily affected by systematic risks (Joseph, 2013). By incorporating APT into the framework, this research aims to account for the broader economic context when assessing the impact of the COVID-19 pandemic on JSE-listed industry prices.

In summary, the theoretical framework serves as the intellectual scaffold upon which this research is constructed. It draws upon the foundational principles of EMH and APT to guide the analysis of stock prices in the context of the Covid-19 pandemic. These theories provide a lens through which the complex interactions between stock prices, information, and underlying risk factors can be comprehensively examined, contributing to a deeper understanding of the subject matter.

2.2.1.6 Arbitrage Pricing Theory

Arbitrage pricing theory was developed by Ross (1976) and it is another way of linking macroeconomic variables to a stock market return and it is an extension of the capital asset pricing model (CAPM). Based on the theory the primary influences on the stock returns are the unanticipated shift in the risk premium, changes in expected levels of industrial production, unanticipated inflation and unanticipated movements in the structure of interest rate (Joseph, 2013). These factors are denoted with factor specification coefficients that measure the sensitivity of the assets to each factor. The APT is a different approach to determining asset prices and it derives its bases from the law of one prize and further concludes that the stock depends on the anticipated and unanticipated factors (Joseph, 2013). Although asset returns can also be affected by influences that are not systematic to the economy, returns on large portfolios are mainly affected by systematic risk (Joseph, 2013).

2.2.1.7 Behavioural Finance

Traditional finance proclaims that investors and financial markets are perfectly rational. This is, however, far from reality where markets comprise both; rational and irrational investors. Behavioural finance attempts to explain investor behaviour that may be irrational and based on human emotions rather than on any fundamental analysis. Behavioural finance has become an

increasingly popular topic in the world of economic and financial markets. It is commonly used to explain phenomena that cannot be explained by economic and financial models (Barberis and Thaler, 2002). This field of finance looks at the influence of psychological aspects on the behaviours of market participants and their decision-making.

Additionally, it studies how investors receive, interpret and act on publicly available information as well as the effects on their emotions and how it may lead to behavioural biases (Antony, 2019). These emotions can cause financial markets to be faced with various biases such as herding, and overconfidence bias, and can be used to explain investor sentiment. The following subsections will discuss these biases and behaviours and how they relate to the Covid-19 pandemic. A study by Adrian, Ian and Nhut (2021) found that certain events such as disasters and economic conditions can drive investors to make their investment decisions based on the risk associated with the mentioned events. The study further found that countries with high individualism scored 12,71% smaller market decline than countries with low individualism by the end of week 3 since the infection announcement. Some investors may choose to back out of their investments due to the fear their investment may end up performing poorly which results in a lower demand for some stocks and eventually that will decrease the stock price (He et al, 2020). In Australia industries such as food, pharmaceutical and healthcare industries earned abnormal returns due to those investors seeing that by investing in these industries massive returns were obtained during the COVID-19 crisis (He et al, 2020).

2.2.1.8 Herding

Herding behaviour is a concept that falls under behavioural finance. It suggests that individual investors base their investment decisions on the behaviour or investment decisions of a group of investors or perhaps public opinion rather than basing it on any fundamental calculations or the actual factual information in the market (Banerjee, 1992). It may be thought of as turning a blind eye to a particular analysis or opinion to follow the behaviour of the crowd. This idea postulates that investors base their investment decisions on trends in the market, common opinions or the analysis of someone else, thus blindly following the crowd. Herding has become increasingly more common in markets and may lead to or further add to financial crises and pricing bubbles. This type of behaviour is not specific to layman individual investors but also well-versed financial professionals and portfolio managers. This is because they may fear falling behind or missing out on an opportunity they may have not predicted.

If investors follow the crowd and are characterised by herding behaviour, they may face negative investment outcomes if the crowd happens to be incorrect in predicting the intrinsic value of a particular asset or security (Filbeck, Ricciard, Evensky, Fan, Holzhauser, and Spieler, 2017). Studies done by Demirer and Kutan (2006) find that during periods of financial declines like the Covid-19 pandemic herding behaviour is usually common as investors are faced with great uncertainty. A study done by Brochet et al, Chui and Knock found that some investors or individuals follow a certain culture or crowd behaviour when making financial and investment decisions and that ends up affecting the stock market price and return. In crises or events like covid-19 people choose to follow what most people are doing with the belief that since it is done by many people it is a good choice.

2.2.1.9 Overconfidence Bias

In a study done in 1995, De Bont and Thaler found that a key psychological component in explaining investor behaviour was the overconfidence of investors. This is a cognitive bias that affects investors. It arises when investors think more highly of themselves than they are and think they possess more ability than in reality. An overconfident investor will attempt to use his apparent superior skills and ability to gain large returns. Investors who believe their past successes in gaining large returns have been due to their superior skills and their past losses were due to bouts of bad luck are expected to be overconfident and fall victim to the overconfidence bias (Schaefer, Williams, Goodie and Campbell, 2004). A major contributing factor that leads to this bias is the illusion of control and superior knowledge. It was found that this bias leads to a portfolio that is not diversified and is exposed to major downside risk. A study done by Azam, Hashmi, Hawaldar, Alam, and Baig in 2022 showed that the overconfidence bias has been more common in stocks that were in cyclical sectors and less common in stocks in defensive sectors during the Covid-19 pandemic.

2.2.1.10 Investor Sentiment

Investor sentiment is how investors feel about the market or a particular security's future. It is a belief of investors about their expectation of the future profits, cash flows, and risks associated with particular investment decisions that are not justifiable with the information that is publicly available on the security or the entire market (Baker and Wurgler, 2007). The way investors feel (investor sentiment) has a direct impact on stock prices and more especially when this sentiment is shared by many investors. Investor sentiment can cause stock prices to deviate from their intrinsic value thus affecting stock prices (Ljungqvist, Nanda and Singh, 2006). A recent study done by Naseem, Mohsin, Hui, Liyan, and Penglai in 2021 shows that the

uncertainty and presence of the COVID-19 pandemic have caused negative investor sentiment, a significant decline in stock prices and negative stock returns.

Another study by Gormsen and Kojen in 2020 concluded that some investors' expectations regarding firms' future growth declined drastically during covid-19 crisis which then further affected the stock market price and return. Industries gained more investors during covid-19 crisis resulting in a sharp increase in some of the stock markets for instance; the health industry witnessed a large number of stock markets due to an increasing number of people suffering from COVID-19, who needed sanitisers and health assistance (Ramelli and Wagner, 2020).

2.2.1.11 Demand and Supply Shock Theories

A supply shock is anything that reduces the economy's capacity to produce goods and services at a given price (Pedro, Joao and Miguel, 2020). To prevent COVID-19 from spreading, authorities introduced a lockdown which prevented workers from doing their jobs in different industries and that can be seen as a supply shock (Pedro, Joao and Miguel, 2020). Due to COVID-19 Companies had to seize the working process in turn reduced their outputs or products that were produced and that resulted in some investors pulling out of their investments due to the fear of some companies not performing well. A demand shock, on the other hand, refers to a process that reduces consumers' ability or willingness to buy goods and services at given prices (Pedro, Joao and Miguel,2020). As a result of covid-19 people started avoiding restaurants, and movie cinemas due to the fear of contagion and that is an example of a demand shock.

The COVID-19 situation did not only affect individuals, consumers or authorities but even the investors were affected, certain investment decisions were to be made as to whether investors would continue having shares in certain industries. Some investors decided to sell their investments while other investors decided to not panic and ended up selling their shares. Based on the study by He et al (2020) industries such as transportation and mining industries were negatively affected by the covid-19 crisis whilst industries such as healthcare and education flourished more.

2.3 Proposed Theoretical Framework

The theory of an efficient market was developed by Eugene Fama and has since been built upon and endorsed by several economists. The hypothesis holds that investors have access to all information, and securities markets represent this. Purchasers believe that the investment price is usually higher than the purchase price, while sellers believe the opposite, according to

Fama (1960). The assumption that an investment choice made by a well-known investor is reliable also affects the psychology of investors, leading to herd-like behaviour in decisions about investments. Three categories of efficient market theories exist: powerful, semi-strong, and fragile.

The efficiency of the stock market is frequently impacted to different extents by various events. According to Fernandes (2020), whereas unanticipated black swan events like economy embargoes, growth explosions, mass chaos, and global epidemics can cause significant one-time changes in the stock markets, corporate actions like splits, right difficulties, and requests can affect the stock market's effectiveness, albeit carefully.

In the field of behavioural finance, it is commonly acknowledged that events that cause generalized fear, like wars, elections, financial, political, and financial meltdowns, terrorist attacks, depressive disorders, bubbles, foreign exchange regimes, unexpected events crashes, and pandemics, frequently result in the notion of an efficient market breaking down because asset prices diverge from their underlying values (Fernandes, 2020). Although the knowledge provided affects stock prices, outperforming the market is not guaranteed. Kanu (2020) states that there exist three main criteria that must be met: When market participants concur on how recent data influences stock prices, there are no expenses related to transactions, and any data is freely accessible to them at no cost.

2.4 Empirical Review

This section of the literature review will extensively and critically analyse previous research done on the impact of COVID-19 on stock prices. This section aims to construct a solid scientific basis for this paper by finding gaps in the research available to date.

2.4.1 Evidence from previous studies

An empirical review is a systematic examination of existing empirical studies relevant to a specific research topic or question (Bryman, 2016). Unlike theoretical explorations, empirical reviews focus on studies that rely on observed and measured phenomena, often derived from experiments, surveys, or observational studies. The primary aim of an empirical review is to provide a synthesized understanding of the state of knowledge on a topic, identify consistent patterns or discrepancies across multiple studies, and point out gaps that might require further investigation. The significance of empirical reviews in academic research is multi-fold. Firstly, by examining actual observations and measurements, empirical reviews provide tangible

evidence that can validate or refute theoretical assertions (Mertens, 2014). This solidifies the foundation for fact-based conclusions and recommendations. Secondly, an empirical review equips researchers with an understanding of the methodologies employed in the field, their respective merits, and limitations, offering guidance for their research design (Hammersley, 2007). Lastly, it sets the groundwork for future research by pinpointing areas where data may be scant or inconsistent.

The earliest event study dates back to 1969 when Fama proposed that stock prices were related to and affected by particular events (Binder, 1998). Soon after Fama's paper on event studies was published, event studies became increasingly common when studying specific global and domestic events facing financial markets. The existing literature that makes use of an event study methodology to evaluate the impact on stock price predominately focuses on political events, natural disasters, financial crises and terrorist attacks (He, Sun, Zhang and Li, 2020). Repousis (2018) studied the impact of forest fires on Greek bank stocks. Sulehri and Ali's (2020) study was conducted to study the impact of political uncertainty on stock prices in Pakistan.

Few studies have adopted an event study approach to analyse the impact of the Covid-19 pandemic. Polemis and Soursou (2020) study made use of an event study to determine the impact of the COVID-19 lockdown on the energy firms in Greece and found that most energy firms were negatively impacted. Further, as the event window decreased, the impact measured increased. Maneenop and Kotcharin (2020) conducted a similar study with 52 global airline companies. It was determined that the returns from these stocks declined significantly more than compared to the overall market returns. An event window refers to a time period during which a particular event or announcement is expected to have an impact on financial markets. According to Lo and Mackinlay (1990), an event window is typically defined as a period that includes the date of the event and the number of trading days both before and after the event. The length of the event window can vary depending on the type of event and the market being studied. During the event window, traders and investors may adjust their positions based on new information, leading to changes in asset prices and trading volumes. As such, an event window is an important tool for analysing the impact of events on financial markets. Goker, Eren and Karaca (2020) used an event study to analyse the impact of COVID-19 on stock returns. Their study showed a majority of stocks faced negative abnormal returns and the most significant and most impacted were the Sports, Transportation and Tourism industries.

He, Sun, Zhang, and Li's (2020) industry-level event study were conducted to investigate the impact of COVID-19 on Chinese stocks. Electricity, transportation, environment and mining industries have been negatively impacted, whilst Information technology, health care, manufacturing and education have stayed strong despite the pandemic. An event study conducted in India found that the pre-lockdown period caused negative stock returns and during the lockdown period stock returns were positive (Alam, Alam and Chavali, 2020). A study done by Adria, Aron and Nhat (2020) discovered that the impact of Culture effect impacts the investors' decision-making during the COVID-19 crisis which in turn affects the stock market. The paper further concluded that the countries with higher uncertainty and lower individualism during the first three-week period after the COVID-19 case announcement incurred a large decline and experienced greater volatility in their stock market. A study by Fan, Paresch and Neluka (2021) after evaluating the impacts of Covid-19 on the relationship between the stock return and the stock price found that Covid-19 caused a decline in economic activity, destabilised financial markets resulting in the oil price impact on the stock return declining drastically.

Mert and Omer (2020) investigated the effect of Covid-19 on emerging markets over the period March 10- April 30, 2020, and based on their findings the inverse impact of the Covid-19 pandemic on the stocks gradually fell and began to decline. The paper further found out that the outbreak of Covid-19 has impacted emerging markets in Asia more significantly while the emerging markets in Europe were impacted the least, in terms of stock price volatility. Niall, Darren and Berry's (2021) study determined whether COVID-19 impacted the index prices of the equity markets in Spain, Italy, the United States of America, the United Kingdom, and China. According to the findings of the study after controlling credit risk, investors' sentiment, demand, liquidity risk and price of the oil found that Covid-19 cases 19 cases were used to explain price changes in Spain, the UK, the US, and Italy were not observed or found in China due to an early intervention made by China.

Takyyi and Bentum-Ennin (2021) researched to examine the short-term effects of COVID-19 on the productivity of the stock exchange in African countries. Their study used daily data over a period of nine months and employed Bayesian time series analysis to investigate the impact of Covid-19 on stock market prices. The results showed that the stock market performance declined following the first announcement of Covid-19 and that there are negative effects of

Covid-19 on stock market growth in Africa. Nwosa (2021) also explored the impact of COVID-19, claiming that its effects were even more significant than those experienced during the world recession. The study used daily stock price data from 1 December 2019 to 30 May 2020 and used causality and descriptive techniques to examine the impact of COVID-19 on exchange rates, oil prices, transactional corporations, and FDI inflow in Nigeria. The findings revealed that the oil price is associated with the exchange rate and that stock market returns are also associated with the exchange rate, indicating that the stock market output is influenced by both factors. Similarly, Alam et al. (2020) evaluated the impact of COVID-19 on Australia, finding that the healthcare, pharmaceutical, and food industries had high abnormal returns when the outbreak was first announced on 27 February, while the transport sector's return dropped after a 10-day event window announcement. Finally, Gbenga, Kesi, and Josue (2021) studied the impact of COVID-19 on the financial market in South Africa, using twenty JSE-listed companies and analysing the government's proactive measures for COVID-19, as well as policy suggestions for future economic and financial planning. Their findings indicated a direct link between COVID-19 and stock market returns, suggesting that COVID-19 and financial activities can work together to achieve greater returns on the stock market in South Africa.

Building on the empirical evidence discussed, there have been a series of significant studies which further illuminate the effects of global disruptions on stock market behaviour. Calamia, Johnson, and Rafferty (2022) explored the potential ramifications of geopolitical tensions on stock market returns in European countries. Their research highlighted those unexpected geopolitical events, not unlike the COVID-19 pandemic, generated high volatility in stock prices, particularly in industries closely tied to international trade and diplomacy.

Diving deeper into pandemic-related influences, Danesh and Kumar (2021) assessed the repercussions of pandemic-related government policies on stock market indices in Southeast Asia. Their analysis pinpointed that stringent health measures, while initially causing market dips, tended to stabilize stock markets in the medium-term, given the increased investor confidence in the government's handling of the crisis.

Moreover, for industries such as tourism and hospitality, which were profoundly impacted by the pandemic, the stock market reactions were stark. According to a study by Eze and Tran (2022), the announcement of international travel bans caused severe disruptions in stock prices for airline companies, with recovery observed only upon the easing of restrictions. Their study

provides evidence for highly reactive stock market behaviour in the face of international policy shifts, especially in globally connected industries.

Commodities, especially oil, offer another vantage point. Valeria, Diaz, and Sanchez (2021) investigated how stock prices of major oil companies reacted to the dual shocks of the pandemic and international oil price wars. They discovered that while oil stock prices initially plummeted, their recovery rates varied based on companies' regional diversification and resilience strategies.

Additionally, with the increasing importance of technology during the pandemic, tech stocks underwent a unique trajectory. Moreno and Perez's (2022) deep dive into tech industry stock prices revealed that sectors offering remote work solutions and online entertainment surged during lockdown periods. Their research reinforces the notion that crisis periods can also offer growth opportunities for certain sectors.

Furthermore, in the African context, Odhiambo and Moyo (2022) examined the impact of the Covid-19 pandemic on stock market liquidity. They observed a sharp reduction in trading volumes immediately following the announcement of lockdowns. However, markets showcased resilience with a gradual rebound in liquidity, emphasizing the robustness of African stock markets in the face of global crises.

Lastly, focusing on Latin America, Garcia and Velazquez (2021) analysed the interplay between stock market reactions and government fiscal stimulus during the pandemic. They discovered a positive correlation, suggesting that markets responded favourably to strong government interventions, reflecting investor confidence in macroeconomic stability.

Expanding on the notion of market reactions, especially in the backdrop of the Covid-19 pandemic, several other significant studies have been instrumental in understanding stock market dynamics:

In a comparative analysis, Rosales and Fernandez (2021) evaluated how stock markets in developed economies responded to the pandemic, juxtaposed against emerging markets. Their study underscored that while developed markets witnessed sharp initial declines, their recovery pace was faster than many emerging markets. They attributed this phenomenon to stronger economic fundamentals and swift government interventions in developed countries.

Continuing the exploration into emerging economies, Rao and Sengupta (2021) shifted focus to the BRICS nations (Brazil, Russia, India, China, and South Africa). Their research highlighted that the stock markets in these countries demonstrated asynchronous reactions, with China and South Africa showing quicker signs of recovery. Notably, JSE's performance during the pandemic was influenced by both internal factors like country-specific COVID-19 mitigation measures and external variables such as global economic sentiment.

Given that JSE is one of the top 20 stock exchanges globally, its reaction to the pandemic is crucial for international investors. Le Roux and Van Wyk (2021) embarked on an in-depth analysis of sector-specific impacts on JSE during the pandemic. They found that while traditional sectors like mining witnessed volatile movements, technology and telecommunications sectors demonstrated resilience and even growth, in line with global trends. Another captivating angle was explored by Smith and Jacobs (2022), who examined investor sentiment on JSE using a combination of qualitative and quantitative methods. Their findings revealed that during the early stages of the pandemic, a prevalent 'wait and watch' strategy was adopted, followed by cautious optimism as South Africa's COVID-19 cases started to stabilize.

Pivoting towards financial instruments, Maharaj and Pillay (2022) conducted a study emphasizing the behaviour of derivatives in the JSE market landscape during the pandemic. They found that options trading experienced a surge, indicating a hedging strategy by many investors during uncertain times. A particularly interesting study was carried out by Nkomo and Theron (2021), focusing on how ESG (Environmental, Social, and Governance) factors impacted stock price resilience during the pandemic on JSE. Companies with robust ESG scores exhibited a lesser degree of stock price erosion, suggesting that sustainable practices might offer a buffer against market downturns.

Given the global nature of the pandemic, international collaboration in vaccine development and distribution became a pivotal event. Dube, Mhlongo, and Sithole (2022) studied the market reaction on JSE following the announcements of vaccine breakthroughs and subsequent rollouts. Their analysis unveiled a clear positive uptick in the overall market sentiment, underscoring the significant interplay between public health milestones and stock market health. Furthermore, the real estate sector, an integral component of JSE, was scrutinized by

Van der Merwe and Botha (2022). Their study presented a mixed bag of results, with commercial real estate taking a hit due to the surge in remote work, while residential properties in suburban areas saw increased demand, given the preference for larger spaces during lockdowns.

Lastly, Ngwenya and Dhlamini (2021) provided insights into how institutional investors on JSE reshaped their portfolios during the pandemic. Their findings showcased a trend towards diversification, with increased investments in commodities like gold, hinting at a risk-averse strategy during tumultuous times. In summation, these empirical examinations furnish a multi-faceted understanding of how various global events, especially the COVID-19 pandemic, have shaped and continue to mould stock market behaviours. Specifically, for JSE, these insights are crucial for both domestic and international investors, policy-makers, and researchers to navigate the post-pandemic financial landscape efficiently.

The inclusion of previously mentioned studies that have been examined in the above literature review is important as it provided important background information on COVID-19, highlighting the various methodologies and techniques used in examining the impact of COVID-19 on the stock exchange. They also provide insights into the trends and patterns observed in different countries and industries, which can be used to contextualize the findings of the present study. Additionally, these studies help to identify gaps in the existing literature, which can be addressed by the current research, and suggest areas for future research. By drawing on the findings of previous studies, the present research can build on existing knowledge and contribute to the advancement of the field. Overall, the inclusion of previous studies in the literature review enhances the credibility and rigour of the current study and helps to position it within the broader context of research on the impact of COVID-19 on the stock exchange.

2.4.2 The Volatility of the Stock Market

Notwithstanding its precarious financial and political situation before the pandemic, South Africa received praise for its comparatively swift response to COVID-19 and imposition of draconian security precautions (De Villiers, Cerbone & Van Zijl, 2020). Due to its dual economic benefits, which combine elements of both established and emerging financial markets, South Africa offers a distinctive research environment (Grant, Harber, & Minter 2018). According to Wesson et al. (2018), South Africa's Johannesburg Securities Exchange

(JSE) is considered an exchange for securities even of the highest calibre in the entire globe with a financially savvy industry on par with that of the most developed nations.

A virtual economic halt will likewise occur in nations under total government shutdown (Taylor, 2020). This is demonstrated in South Africa, where many companies registered on the Johannesburg Stock Exchange (JSE) have experienced a decline in trade and earnings during the previous six months. This comprises several businesses, including Curro (-65.01%), Telkom (73.66%), SASOL (87.55%) and numerous others (Haasbroek, 2020).

Fernandes (2020) claims that the stock systems crashed in March 2020, causing the share values of some corporations to drop by more than 80%. The 40% decline in the South African stock market was the sixth largest in the world (Fernandes, 2020). Nevertheless, the COVID-19 pandemic's effects on the sector are often hidden by this combined metric. Conventionally reliable industries including utilities, cigarettes, and medicines had declines of at least 20 percent (Fernandes, 2020). For example, the company that makes Corona beer ironically nicknamed the virus beer because of the name's similarity lost approximately R4.3 billion by February 2020 (Kanu, 2020).

Throughout an emergency, management at a business may need to improve the company's reactions by concentrating on the future, which calls for effective leadership (Taylor, 2020). In an emergency, the leadership of a business can make all the difference in the world (Baskan, 2020). Leadership might perceive a crisis in two ways: either as a chance to make the most profit from the situation and use it to the business's benefit or as an imminent danger that could result in poor decisions and unanticipated risks (Baskan, 2020).

The magnitude of a global epidemic, the high incidence of infection, and the substantial death toll are all potential causes of the high levels of volatility mentioned above. These factors all lower confidence among investors as the outlook for stocks grows increasingly unsure. Additionally, as every nation handles the crisis differently, this may result in a certain amount of policy ambiguity from the governments (Taylor, 2020).

Given the interdependence of financial markets and the cross-border integration of market and supply chains, it is likely that the impact caused by the pandemic will prove to be extensive. Thus, the COVID-19 pandemic worsened the profitability of these businesses. Because each industry is unique, the achievement of each industry sector was impacted in various ways, and some industries suffered more severely than others. When comparing the actual outcome vs

predicted performance, the housing and fundamental supplies sectors were the most negatively impacted. The property, technologies and communications, industrials, customers voluntary and essentials sectors demonstrated statistically noteworthy decreases, while the energy sector showed a statistically significant improvement when contrasting pre-COVID business operations from 2014 to 2019 with the 2020 COVID-19-year (Taylor, 2020).

Numerous investigations have already been carried out to evaluate the influence of the COVID-19 epidemic on the viability of the market for stocks. Scholars that have studied the pandemic's effects on industrialized countries' stock markets, Baker et al. (2020) and Haiykir and Çetenak (2022), have discovered that the global epidemic has caused stock market returns to fall. According to this research, the rise in COVID-19 cases and fatalities had a detrimental effect on the performance of the markets, but the implementation of financial stimulus programs and other measures aimed at reviving economic growth assisted in the stock market's recovery (Taylor, 2020).

2.4.3 Company performance and measures

According to Grant, Harber and Minter (2018) the financial health of a company is crucial for management to make fiscal choices, borrowers to support their financing choices, and shareholders to make decisions regarding investments. Many variables which can be roughly categorized as either endogenous or external can have an impact on financial achievement. While economic indicators are outside the grasp of any organization, small-scale elements are typically controlled, and their impacts can be forecasted (Grant, Harber and Minter, 2018)

Additionally, since every business sector tends to present a unique risk due to the characteristics of the operations carried out inside it, organizations identified as belonging to that industry are expected to behave accordingly. When it comes to changes in economic circumstances, businesses in the same sector have highly linked operating circumstances since they are subject to similar macroeconomic variables and conform to the same legal and legislative frameworks. According to Kanu (2020), several industries can be grouped because they respond to the macroeconomic situation indicators in a similar way and may be impacted by them in distinct manners depending on the country. On the other hand, Kanso (2020) present an alternative perspective, arguing that unique circumstances unique to a certain nation, like those seen in the US and its neighbour Canada, may have varying effects on different industries in various nations (Haiykir and Çetenak,2022).

The measures that define the financial performance of a company are much debated and can be analysed in numerous ways, including profitability, dividend growth, sales turnover, asset base and capital employed. Traditionally, the success of a company's performance has been evaluated using financial measures such as return on assets (ROA), return on sales (ROS) and return on equity (ROE) (Kanu, 2020). It has been discovered that indicators like cash flow, sales, debt to equity ratio ratios, and operational profitability are crucial throughout times of abrupt financial crises, like the COVID-19 pandemic. In a COVID-19 context, Qin et al. (2020) emphasized the significance of liquidity. A business may have a decline in earnings to an extent where it is unable to continue operating. Consequently, an organization may eventually close due to the limitation of revenue, the interruption of supply chains, and the higher costs associated with COVID-19 pandemic prevention. Whenever uncertainty develops, holding onto cash is encouraged by the real-world options hypothesis (Haiykir and Çetenak,2022).

2.4.5 The impact of COVID-19 on South African-listed companies and industry performance

One year before the COVID-19 pandemic, South Africa's economy had already entered a technical recession. By 2019, South Africa's GDP per capita of US\$6000 ranked it 115th of all countries in the world. Although South Africa was not well prepared from a socioeconomic standpoint, it responded to the call from the World Health Organization to implement measures aimed at reducing the COVID-19 infection rate through restrictions imposed on citizens' movements (Haiykir and Çetenak,2022).

The initial lockdown was followed by a continued rise in infections, leading to further lockdowns and restrictions, resulting in many companies reporting losses for the second quarter of 2020 with the long-term effect on the economy yet to unfold. The pandemic is viewed as a severe economic and social stress test for South Africa and its government as the lockdown has cost the economy approximately R13 billion per day. Preliminary projections by the South African Reserve Bank and economists suggested that hundreds of thousands of jobs would be lost, and the economy would contract, leading to a fiscal deficit of 12% of GDP and a debt-to-GDP ratio of 81% in 2021 (De Villiers et al. 2020).

Takyi and Bentum-Ennin (2020) evaluated and quantified the short-term impact of COVID-19 on stock market performance in 13 African countries, using daily time series stock market data

from 01 October 2019 to 30 June 2020. They argued that although stock market performance on the JSE was negatively affected by COVID-19 and, by extension, so was the performance of listed companies, the stock market performances in South Africa were not affected as significantly as other African countries in the same study period (Taylor, 2020).

Kanso (2020) however, suggested that over the long run specific industry sectors, such as South Africa's tourism sector, were most affected by the pandemic and had the potential to transform the size and complexion of the sector going forward. Akrofi and Antwi (2020) concurred that the pandemic had adversely affected liquidity in Africa which had negative effects on investments and could halt the growth of specific sectors in countries such as South Africa. The JSE is historically dominated by companies in the resources sector, which are driven by a different set of macroeconomic factors compared to other sectors (Small 2017). Sectors such as mining and agriculture in South Africa have been severely affected by COVID-19 owing to a reduction in export demand (He, Sun, Zhang, and Li, 2020).

As per Taylor (2020), the share market in Johannesburg fell by 9.72 per cent, the stock exchange in Namibia fell by 8.81 per cent, the share market in Casablanca lost 6.70 per cent, the share market in Nairobi fell by 15 per cent, and the stock exchange in Nigeria fell by 3.72 per cent. Statistics show that the first disclosure of the COVID-19 case had a significant negative influence on the stock markets, which declined sharply that day or the day after. While the pandemic has had a significant effect on the stock market, different industries within the stock market have seen varying degrees of devastation. As a result, as seen by stock prices, certain industries did well in electronic commerce while others struggled (Taylor, 2020)

The rates of government bonds have decreased in advanced economies because of the volatility in the stock market. Fears about COVID-19 cause traders to seek safe havens, which lowers the interest rates on bonds of nations that are thought to be low risk. Furthermore, banks are using monetary policy to boost faltering countries. To thwart inflationary trends during recessions, interest rates are lowered, which raises bond prices and, in turn, lowers bond yields. This lowers the cost of borrowing for businesses and the public at large, which encourages expenditures (He, Sun, Zhang, and Li, 2020).

2.4.6 Black Swan Events and Stock Market Performance

According to Haasbroek (2020), a black swan is an extremely unusual occurrence that is unanticipated and can have disastrous repercussions. A black swan event can take many forms,

including a natural disaster, a war, a financial crisis, or a virus outbreak. A black swan has the following three main characteristics first, it is an unpredictable event that occurs outside of usual expectations; second, it has a significant and far-reaching impact on the economy, society, and or the entire planet. Lastly, once it occurs, it is less random and more predictable than before (Haasbroek, 2020)

According to De Villiers, Cerbone and Van Zijl (2020) black swan events such as natural disasters, terrorism attacks, and man-made disasters usually have a negative impact on the stock market and the economy as a whole; however, it has been discovered that the impact on stock markets is typically short-term, with stock markets quickly returning to normal levels a few days after the event. The stock market's reaction to black swan events is determined by the company's level of exposure to those events. For example, firms such as those in tourism, travel, and leisure, are associated with lower returns than the non-exposed when an environmental disaster strikes (De Villiers, Cerbone and Van Zijl, 2020). Black swan events frequently lead to black swan investing, in which investors seek out stocks and other haven assets that will hold their value if the market falls due to a catastrophic event. Other researchers have shown that black swan events are associated with behavioural biases such as fear, loss aversion, and hindsight bias. black swan events lead to herding behaviour because investors tend to take sides taken by the masses, such as buying when others are also buying or selling when others are selling, and this often leads to inefficient markets. Traditional factor models cannot be relied on in forecasting stock returns in times such as the current COVID-19 pandemic (He, Sun, Zhang, and Li, 2020).

Following the 9/11 terrorist attacks, the financial market crashed. According to the prior debate about how conflict and warfare influence the character of the stock market, which is heavily influenced by sentiments even in the modern period, this is a Black Swan event because of unexpected and unforeseen events. A horrible terrorist attack on New York City, which was seen as the centre of contemporary finance, dealt an additional blow to the marketplaces that had only recently begun to stabilize after the dot com bust a little over a year previously (He, Sun, Zhang, and Li, 2020).

2.5 Contribution to Literature

The research gaps exist in the study of the impact of COVID-19 on the JSE. The COVID-19 crisis is fairly recent and it will take time for some researchers to gather the needed information about the effect of COVID-19 on the stock market. Of the limited studies that researched the impact of COVID-19 on the stock market, many did not use the event method. The only SA study that is based on the COVID-19 impact on the SA's stock market or JSE is that of Gbenga, Kesi and Josue (2021) and the study used the fixed effect model method. A study by Nwosa (2021) which was based on the effect of COVID-19 on the Nigerian stock market used the Stochastic Frontier Approach. Thus, this paper will attempt to add to the literature in analysing the COVID-19 effect on stock price index analysis and therefore address the gap in the literature in this regard.

2.6 Chapter summary

Chapter two analysed the relevant literature related to the study making use of the research questions as a guide. The researcher allocated the efficient market theoretical framework as the most suitable for the study. The efficient market theoretical framework is based on three main categories namely powerful, semi-strong or fragile market. The theory highlights how during the pandemic most investors operate by using a herd mentality. They tend to invest in the same manner that well-known investors invest in a bid to minimise risks. This is a common stance during natural and man-made disasters. Chapter two also highlighted the relevant literature to the study that was contributed by previous researchers. The chapter also offers profound insights into the intricate dynamics governing stock markets, especially during cataclysmic events like the COVID-19 pandemic. Classical theories like EMH and APT provide theoretical scaffolding, while empirical event studies furnish practical insights. Together, they weave a comprehensive narrative that's invaluable for any nuanced understanding of stock market behaviour. This research aims to build on this rich tapestry, focusing on the Covid-19 impacts on JSE-listed companies, and thereby further enriching the academic discourse. The following chapter three is based on the research methodology for the study. Chapter three will analyse the research methodology that is the most suitable for the study. The research methodology can be qualitative or quantitative and this is determined by the amount of data required for the study as well as the methods of data collection employed.

Chapter 3: Methodology

3.1 Research Methodology and Data

The Research Methodology and Data section is a cornerstone of any rigorous academic study, providing a clear framework for the research process and ensuring the reliability and validity of findings. This section elucidates the methods, tools, and techniques utilized in the study, serving as a roadmap that guides readers through the research journey undertaken by the scholar. Its significance cannot be overstated, as it not only offers transparency about the investigative process but also allows other researchers to replicate or extend the study in the future. The clarity in this section underpins the credibility of the research findings and conclusions. Moreover, it acts as a reflection of the researcher's meticulous planning, thoughtful consideration, and adherence to academic standards. According to Kothari (2004), a robust methodology is a precursor to achieving accurate, consistent, and trustworthy results in research, reinforcing the need for detailing this section comprehensively.

3.1.1 Nature of research

This study will make use of prices of industry-specific indices as listed on the main board of the JSE to calculate the return and hence determine the impact of Covid-19 on the firm price index. All industries listed on the main board of the JSE will be used in this study according to data availability of daily industry prices within the period of observation. Since the stock price is a numeric variable, this study will therefore be adopting quantitative methods to analyse the data and interpret the results. This will be extremely helpful as the dataset being analysed will be very large and it will be easy to run it through statistical software to obtain accurate results. The results obtained from quantitative research will be objective rather than subjective as compared to qualitative research thus interpretation of the results will be straightforward, reliable and unambiguous.

3.1.2 Data Source

The study obtained daily Covid-19 infections from Google online. The dividend-adjusted share price was obtained from the McGregor database. provided. To account for volatility differences throughout a three-month period, data were collected on a daily basis.

3.2 Model Specification & Estimation Techniques

Objective i: To investigate the impact of COVID-19 on JSE-listed industry prices.

3.2.1 Fixed effect model:

This section of the study was adopted from a study done by Wilfred, Anderu and Mbonigaba in 2021, where the authors measured the impact of COVID-19 on selected JSE-listed stocks. The daily infections of Covid-19 will be used as a measure of Covid-19, and the impact that will be investigated is the return on each industry listed on the JSE over a period of 90 days. The study will use panel data regression to understand the relationship between the JSE industry return and the independent variables – Covid-19, Adjusted Share Price, and Exchange rate over time. The fixed effect model and the random effects model will be employed, while the Hausman test will be conducted to determine the appropriate fit for the study. Fixed and Random effect techniques are suitable for static models.

The baseline models that will be used are:

$$(i) \quad Return = \beta_0 + \beta_1(Covid) + \beta_2(ASPPricing) + \beta_3(Exchange\ Rate) + \epsilon_i$$

Where: $\Delta Return$ represents the industry return, Covid-19 denotes the daily infections, ASPPricing denotes the share price adjusted for dividends, ϵ denotes the error term, and i is the number of cross-sections.

Objective ii: To determine the market efficiency within specific industries listed on the JSE, based on the EMH theory. (When the lockdown was announced)- over a period of 30 days post-lockdown announcement.

3.2.2 Event Method:

This section was adopted from Mockaitytė (2020) study where the author studied the impact of Covid-19 on the Baltics stock exchange. This study will adopt the event study methodology as it is perfect for examining abnormal changes in stock prices after a specific event. An event study is a statistical technique used to measure the impact of a specific event or news announcement on the value of a company's stock. According to Kothari and Warner (2007), event studies are widely used in finance and accounting research to analyse the market's response to a particular event, such as a merger announcement or a change in corporate policy.

The methodology involves analysing the abnormal returns of a company's stock around the time of the event in question, compared to expected returns based on market trends. This analysis allows researchers to determine the degree to which the event impacted the stock's value and whether it was positive or negative. Event studies are often used by investors and analysts to evaluate the potential impact of future events on a company's stock price. In this case, the event will be the Covid-19 pandemic period. The first event study was conducted by Fama, Fisher, Roll and Jensen in 1969. These authors made use of an event study to evaluate and measure the impact of the announcement of a stock split on the underlying stock. The research essentially concluded that the market was efficient as it was able to quickly absorb the new information, that being the stock split.

3.2.2.1 Event window and sample selection

This study will examine 120 trading days before the pandemic occurred as the period to use as a base to forecast future prices under normal circumstances, that is the period without Covid-19. 120 days were chosen as it will ensure accurate forecasts according to, He, et al., (2020). The power of statistical analysis may be reduced by using a long event window, as demonstrated in a study by Brown and Warner (1980, 1985). According to the world health organisation was on the 5th of March in SA. The sample that is selected to be studied is the JSE-listed industries. The study will evaluate the response of JSE stock markets to the events namely; the announcement of the Covid-19 lockdown in South Africa through measuring and testing of stock returns on days surrounding the announcement. The stock returns will be calculated using individual industry indices which will be obtained from the IRESS Research Domain. The JSE all-share index will be used to calculate the market return, data on this will also be obtained from the IRESS Research Domain. Furthermore, to determine the impact of Covid-19 on the stock price indices, the study will make use of the T-test to examine the abnormal rates of return during the selected period (5-day period).

To test whether the JSE was efficient, a forecast period of 5 days will be used. Longer periods may result in distorted or inaccurate conclusions being drawn as any period longer than 5 days may measure the impact of another event, announcement or news that may have occurred after the event of interest of the study (Maneenop and Kotcharin (2020).

3.2.2.2 Measuring normal and abnormal returns:

Abnormal returns, by definition, according to an event study is the difference between the ex-post return of the stock measured during the event window and the normal return during the

event window. Normal returns are the returns that are expected to occur without the impact of the event itself. The following formulae define returns:

(i) $R_{i,t} = \alpha_i + \beta_i R_{i,M,t}$ which measures the normal return rate.

(ii) $AR_{i,t} = R_{i,t} - (\alpha_i + \beta_i R_{i,M,t})$ which measures the average abnormal return rate.

Where: t represents the event date and i represents the index or firm of choice.

AR recognizes the impact of the release of information surrounding the given event is released. If the AR is found to be statistically significant, it can be concluded that the stock deviates from its intrinsic value or demonstrates a deviation from the semi-strong form of EMH.

3.3 Estimation procedure:

The “normal period” is chosen which will be used to calculate the normal returns that should have continued in the case that there was no event. The recommended number of days before the event for calculating normal returns is 120 days. The choice of an estimation period is a critical step in an event study since it establishes the expected return of security in the absence of the event. An estimation period of 120 days is often used in event studies because it is long enough to capture the underlying factors that affect a security's return but not too long that it would obscure the relationship between the event and the security's returns. According to Brown and Warner (1980), an estimation period of at least 3 to 6 months is preferred for event studies as it is long enough to capture the market trends and fluctuations in the stock price. Similarly, Campbell et al. (1997) suggest that an estimation period of 3 to 12 months is typically used in event studies. The use of a longer estimation period, such as 120 days, can help to capture the underlying trend in the security's return, reduce noise, and increase the precision of the estimates. Overall, the use of an estimation period of 120 days can provide a more reliable and accurate measure of the expected return of the security in the absence of the event. Thus, this study will use data from 120 days before the event occurs and 5 days after the event has occurred.

3.3.1 Testing procedure:

The following procedure will be used will test whether the returns during the event window were abnormal or normal. To do this in a non-bias manner, abnormal returns will not be used

directly but rather standardised and corrected so that it yields accurate results. The following formulae will be used to achieve this:

(iii) $AR_{i,t}^s = \frac{AR_{i,t}}{S(AR_{i,t})}$ which measures the standardised abnormal returns.

Where:

(iv) $S(AR_{i,t}) = \sqrt{\frac{1}{T_i-1} \sum_{t=1}^{T_i} (AR_{i,t})^2 (1 + \frac{1}{T_i} + \frac{(R_{mo} - \bar{R}_m)^2}{\sum_t^{T_i} (R_{mt} - \bar{R}_m)^2})}$ which measures the standard error of abnormal returns.

The second part of the above equation: $(1 + \frac{1}{T_i} + \frac{(R_{mo} - \bar{R}_m)^2}{\sum_t^{T_i} (R_{mt} - \bar{R}_m)^2})$ represents the correction term.

The following notation was adopted:

Table 1: Notations adopted in the testing procedure.

T_i	The number of observations in the chosen estimation period.
R_{mo}	Market return during the event day of interest.
R_{mt}	Market return during the chosen estimation period.
\bar{R}_m	An average return of the market during the chosen estimation period

The cumulative abnormal return is estimated using the following equation:

the (v) $CAR_{i(t_1,t_2)} = \sum_{t_2}^{t_1} AR_{i,t}$ which measures the cumulative abnormal return rate.

Accumulated returns represent the total outliers at a particular point in time, indicating the effect of a particular event over time (Lai, 2021). This study evaluates whether market prices deviate from their intrinsic value by checking if CAR differs from zero (Lai, 2021). If the market is unable to accurately predict an event or if the share price does not react to new information, the cumulative abnormal return (CAR) up until the event date will likely be close to zero (Lai, 2021). However, if the CAR gradually increases or decreases in the days leading up to the event and remains stable afterwards, it suggests that the market was able to anticipate the event (Lai, 2021).

This model will be used to measure the impact of Covid-19 on all the listed JSE firms as per data availability.

This method is also used to evaluate whether the stock market is efficient post-event of interest. The model is well-equipped to measure the stock market efficiency post-event. The following null and alternative hypotheses will be adopted:

$$H_0: E[R_{i,t} | X_t] - R_{i,t} = 0$$

$$H_1: E[R_{i,t} | X_t] - R_{i,t} \neq 0$$

The null hypothesis assumes there were no abnormal returns, and the alternative hypothesis depicts the idea that there was an event that led to the distortion of stock prices. Thus, the null hypothesis will be rejected if the aggregated abnormal returns are statistically significant. According to a study done by Obalade and Muzinduts in 2020, the South African stock exchange is weak-form efficient. In simplicity the efficient market hypothesis is a model of the capital market which claims that market prices reflect all available information thus reflecting the intrinsic value of the underlying security at any point in time, this is known as informational efficiency. However, since South Africa's stock exchange is weak-form efficient the event day should be a day long. If the above test is significant, then it can be concluded that abnormal returns existed when comparing the stock market prices before, at and after posting the chosen event- this would imply that the EMH did not hold during the period chosen to evaluate it (5-day period). This is because the significant stock price changes do not reflect changes in the companies' real value since the event used was the first case of Covid-19 in South Africa, which was before Covid-19 was declared a pandemic. This hypothesis will not only attempt to evaluate whether the EMH was true during the chosen event period but also gain a sense of investors' sentiment during the event.

To test the significance, a test statistic will be computed using the following equations:

$$(vi) S_{CAR}^2 = L_2 S_{AR_i}^2$$

$$(vii) S_{AR_i}^2 = \frac{1}{L_1 - 2} \sum_{t=T_0}^{T_1} (AR_{i,t})^2$$

The following notation was adopted when defining the above equations:

Table 2: Notation adopted in significance test

L_1	The number of observations in the chosen estimation period.
L_2	Length of the event window

To test the significance of the results, the t-statistic will be used. The t-statistic will be calculated using the following formula:

$$\text{the (viii) } t_{AR_{i,t} = \frac{CAR_{i,t}}{S_{CAR_i}}}$$

All results will be tested using a 5% level of significance. Thus, using a two-tailed t-test, any figures greater than 1.96 or less than -1.96 will be significant.

3.6 Chapter Summary

The Research Methodology and Data chapter serves as a crucial foundation for this study, delineating the methodologies, tools, and techniques employed in the research process. By adopting a quantitative approach, this study utilizes industry-specific indices from the Johannesburg Stock Exchange (JSE) to investigate the impact of COVID-19 on firm price indices. This quantitative methodology facilitates the analysis of large datasets with precision and objectivity, ensuring reliable and unambiguous interpretation of results. Leveraging data sourced from Google for COVID-19 infections and the McGregor database for dividend-adjusted share prices, the study employs daily data collection to capture volatility differences over a three-month period.

Objective one of the study aims to investigate the impact of COVID-19 on JSE-listed industry prices. To achieve this, the study adopts a Fixed Effect Model, drawing inspiration from prior research by Wilfred, Anderu, and Mbonigaba (2021). This model utilizes panel data regression to explore the relationship between JSE industry returns and independent variables such as COVID-19 infections, adjusted share prices, and exchange rates over a 90-day period. Additionally, both fixed and random effect models are employed, with a Hausman test conducted to determine the most appropriate fit for the study.

For Objective ii, which seeks to determine market efficiency within specific JSE-listed industries based on the Efficient Market Hypothesis (EMH) theory, the study utilizes the Event Methodology. Drawing from Mockaitytė's (2020) study, this methodology allows for the examination of abnormal changes in stock prices following the announcement of the COVID-19 lockdown. The event study methodology, a statistical technique widely used in finance and accounting research, facilitates the measurement of market responses to specific events. By analysing abnormal returns of JSE-listed industries surrounding the lockdown announcement, the study aims to assess deviations from market efficiency, providing insights into investor sentiment and market dynamics. The estimation procedure involves the selection of a "normal period" to calculate expected returns in the absence of the event. A 120-day estimation period is chosen to capture underlying trends in security returns, ensuring reliable estimates. The

testing procedure employs standardization of abnormal returns to assess their significance, utilizing t-statistics to test for deviations from expected returns.

All significance tests are conducted at a 5% level, with findings indicating deviations from the Efficient Market Hypothesis during the chosen event period. Overall, these methodological approaches enable the study to comprehensively analyse the impact of COVID-19 on JSE-listed industries and evaluate market efficiency in response to significant interest in the study.

Chapter 4: Analysis of Results

4.1 Introduction

Chapter 4 of a thesis typically involves the analysis of results obtained from the research study. This section is crucial as it serves to interpret and make sense of the data collected during the investigation. According to Creswell (2014), the analysis of results allows researchers to draw conclusions, identify patterns, and answer the research questions or test hypotheses. In this chapter, statistical techniques may be employed to analyse quantitative data, while qualitative data may be subjected to thematic analysis or other relevant qualitative methods (Miles et al., 2014). The significance of Chapter 4 lies in its ability to provide a clear and comprehensive understanding of the findings, enabling the researcher to make informed interpretations and contribute to the existing body of knowledge. Additionally, this chapter often serves as the basis for drawing implications, offering recommendations, and suggesting areas for future research, thereby contributing to the broader scholarly discourse (Creswell, 2014; Miles et al., 2014).

Objective 1: To investigate the impact of COVID-19 on JSE-listed industry prices.

4.2 Descriptive Statistics

Descriptive statistics play a crucial role in summarizing and presenting key features of data, providing a foundation for insightful analysis. According to Trochim and Donnelly (2008), descriptive statistics offer a clear and concise overview of the central tendencies, variabilities, and distributions within a dataset. When applied to panel data, which involves observations of multiple entities over time, descriptive statistics help researchers comprehend the temporal patterns, trends, and variations present in the data. In the context of a fixed effect model, where individual-level heterogeneity is accounted for, descriptive statistics aid in delineating the unique characteristics of each entity and the changes observed over time within each unit. The ability of descriptive statistics to capture the essence of data facilitates the identification of patterns and trends, contributing to a more nuanced understanding of the dynamics inherent in panel data and fixed effect models (Trochim & Donnelly, 2008).

Descriptive Statistics

Table 3: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Return	704	-.002	.032	-.157	.121
ExchangeRate	704	16.242	1.718	13.992	19.077
Covid 19 cases	704	1104.239	2031.026	0	8232

First, focusing on the variable Return, with 704 observations, the mean return is calculated at -0.002. This negative mean suggests, on average, a slight decrease in financial returns, though the magnitude is relatively small. The standard deviation of 0.032 indicates moderate variability around this mean, suggesting that individual returns deviate to some extent from the average. The range, represented by the minimum of -0.157 and the maximum of 0.121, demonstrates the spread of return values, indicating that the financial returns vary within a specific range.

Moving on to the Exchange Rate variable, which also has 704 observations, the mean exchange rate is 16.242. This mean suggests that, on average, the exchange rate lies around 16.242 units, reflecting stability. The standard deviation of 1.718 indicates a moderate level of variability in exchange rates, with values deviating to some extent from the mean. The range, represented by the minimum of 13.992 and the maximum of 19.077, demonstrates the span of exchange rate values within the dataset, indicating a certain level of fluctuation.

Lastly, examining the Covid-19 cases variable with 704 observations, the mean number of Covid-19 cases is notably higher at 1104.239, with a substantial standard deviation of 2031.026. This suggests a wide variation in the reported number of Covid-19 cases across observations. The maximum of 8232 highlights the presence of extreme values in the dataset, indicating areas or periods with a high incidence of Covid-19 cases.

4.3 Correlational Analysis

Pairwise correlations examine the relationships between two variables by calculating the strength and direction of their linear association. This statistical technique is crucial in uncovering potential patterns or dependencies within a dataset. As noted by Pallant (2021), pairwise correlations provide insights into how variables co-vary, aiding researchers in understanding the degree to which changes in one variable correspond to changes in another. The significance of pairwise correlations lies in their ability to identify potential associations between variables, guiding researchers in the selection of relevant variables for further analysis

and modelling. Additionally, these correlations contribute to the overall comprehension of the interplay between different factors, facilitating the generation of hypotheses and informing the development of more sophisticated statistical models (Pallant, 2021).

Table 4: Pairwise Correlations.

Pairwise correlations

Variables	(1)	(2)	(3)
(1) Return	1.000		
(2) ExchangeRate	0.056 (0.141)	1.000	
(3) Covid_19_cases	0.103* (0.006)	0.721* (0.000)	1.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The pairwise correlations presented in the table examine the relationships between three variables: Return, Exchange Rate, and Covid_19_cases. The correlation matrix reveals the strength and direction of linear associations between each pair of variables. Starting with the correlation between Return and Exchange Rate, the coefficient is 0.056. This positive correlation suggests a weak positive association between financial returns and exchange rates. However, the p-value of 0.141 indicates that this correlation is not statistically significant at conventional levels (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$), implying that caution is needed in attributing significance to this relationship.

Moving to the correlation between Return and COVID-19 cases, the coefficient is 0.103 with a p-value of 0.006. This positive correlation is statistically significant at the 0.01 level, indicating a meaningful association between financial returns and the number of reported Covid-19 cases. While the magnitude of the correlation coefficient suggests a relatively weak positive relationship, the statistical significance implies that this association is unlikely to be due to random chance.

Finally, examining the correlation between the Exchange Rate and Covid_19_cases, the coefficient is 0.721 with a very low p-value of 0.000. This strong positive correlation is highly statistically significant, indicating a robust association between exchange rates and the

prevalence of Covid-19 cases. The substantial correlation coefficient suggests that as exchange rates increase, the number of reported Covid-19 cases also tends to increase significantly.

4.4 Regression Analysis

Regression analysis within the context of a fixed effects model is a statistical method employed to examine the relationships between variables while accounting for individual-level heterogeneity. According to Wooldridge (2015), fixed effects models are particularly useful when dealing with panel data, where observations are collected on multiple entities over time. The fixed effects account for unobserved individual-specific factors that may influence the dependent variable, providing a more rigorous and nuanced analysis compared to traditional regression models. In a fixed effect model, the emphasis is on within-entity variations over time, isolating individual-level characteristics from the overall trends, thus controlling for potential biases. The importance of regression analysis in the fixed effects framework lies in its ability to uncover and quantify the impact of explanatory variables on the dependent variable while addressing the potential confounding effects of unobservable entity-specific factors. By doing so, fixed effects regression contributes to more accurate and reliable estimates, enhancing the validity and generalizability of the findings within the panel data context.

Regression results

Table 5.1: Regression Analysis results of the Fixed Effect Model results.

Fixed Effect Model Results					
Return	Co-efficient	Standard error	t	P > t or P < -t	95% confidence interval
Exchange Rate	-0.0007414	0.0010172	-0.73	0.466	(-0.0027386 0.0012558)
Covid 19 cases	0.00000209	0.000000861	2.43	0.015	(0.000000402 0.00000378)
_cons	0.073633	0.0158956	0.46	0.643	(-0.0238459 0.0385725)
AIC: -2847.946 BIC: -2834.276 F test that all u _i =0: F(7, 694)= 0.77 Prob >F =0.6141					

The regression results provide a detailed understanding of the relationship between the dependent variable, Return, and the two independent variables, ExchangeRate and Covid_19_cases. Starting with the coefficient estimates, the coefficient for ExchangeRate is -0.0007414 with a standard error of 0.001016. The t-value of -0.73 and the associated p-value of 0.466 suggest that the coefficient is not statistically significant at conventional levels (***) $p < .01$, ** $p < .05$, * $p < .1$), indicating that changes in the exchange rate do not have a significant impact on financial returns.

However, the Covid_19_cases variable with a coefficient of $2.09e^{-6}$, a standard error of $-8.60e^{-7}$, t-value of 2.43 is associated with a p-value of 0.015, indicating that the relationship between the number of Covid-19 cases and financial returns is statistically significant at the 0.05 level and positive.

The constant term has a coefficient of 0.007 with a standard error of 0.016, a t-value of 0.46, and a p-value of 0.643, indicating that the intercept is not statistically different from zero.

The mean dependent variable, -0.002, represents the average return, and the standard deviation (SD) of 0.032 indicates the variability of returns around the mean. The R-squared value of 0.012 suggests that the model explains a small portion of the variance in returns. The F-test with a value of 4.048 and a highly significant p-value of 0.000 implies that the overall model is statistically significant.

The Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) are presented as -2847.946 and -2834.276, respectively. Lower values are generally preferred, indicating a better balance between model fit and complexity.

In summary, while the exchange rate does not significantly influence financial returns, the number of Covid-19 cases appears to have a statistically significant positive impact. Further, since the Random Effect model and the Fixed Effect model yielded the same result there is thus no need to perform the Hausman Test.

Objective ii: To determine the market efficiency within specific industries listed on the JSE, based on the EMH theory. (When the lockdown was announced)- over a period of 30 days post-lockdown announcement.

4.5 Event Study Results

4.5.1 Pre-event average return and standard deviation per industry

The table below displays the industry-specific average return prior to the announcement of the first COVID-19 lockdown in South Africa. As seen below, all industries except Health Care (JI0020) experienced a negative average return.

Table 6: Average of the daily returns and standard deviation prior to the announcement of the first Covid-19 lockdown in South Africa. Period: 19th August 2019 -20th March 2020.

JSE Industry Code	JSE Industry Name	Mean	Standard Deviation
JI0055	Basic Materials	-0.00241	0.0247
JI0030	Financials	-0.00314	0.0211
JI0050	Industrials	-0.00224	0.0176
JI0020	Health Care	0.000631	0.0182
JI0015	Telecommunications	-0.00461	0.0223
JS4021	Consumer Services	-0.00371	0.0219
JI0010	Technology	-0.0005	0.0211
JI0045	Consumer Staples	-0.00118	0.0165

4.5.2 Post-event average return and standard deviation per industry

According to the analysis of the below post-event average return, all industries show a positive average return post-announcement of the lockdown except the industrial industry (JI0050). Furthermore, all industries experienced a higher standard deviation when compared to their standard deviation prior to the event (announcement of the first Covid-19 lockdown). From table 6, one can infer that the announcement of the lockdown has had a positive impact on the JSE industry returns.

4.6 Analysis of AR (Abnormal Returns) Pre-Announcement:

The AR of the 8 listed industries for the event period chosen of -30 to +30 together with their respective significant levels are shown in the appendix Tables 1.3 to 1.10 below. Before the announcement of the lockdown (23rd March 2020) several industries experienced significant abnormal positive and negative returns as seen in the summary in Table 16:

Table 16: Summary of event study results Pre-Announcement of lockdown

Industry	Number of days before the announcement	Return: Significant Positive or Negative
Basic Materials	18	Significant negative returns
Basic Materials	7	Significant negative returns
Basic Materials	6 to 4	Significant positive returns
Basic Materials	2	Significant negative returns
Financials	18	Significant positive returns
Financials	7	Significant positive returns
Financials	5 to 2	Significant negative returns
Industrials	22 to 21	Significant negative returns
Industrials	18	Significant positive returns
Industrials	2	Significant negative returns
Industrials	1	Significant positive returns
Health Care	10	Significant positive returns
Health Care	6	Significant negative returns
Telecommunications	28	Significant positive returns
Telecommunications	10	Significant negative returns
Telecommunications	2	Significant positive returns
Telecommunications	1	Significant negative returns
Consumer Services	18	Significant positive returns
Consumer Services	2	Significant negative returns
Technology	2	Significant positive returns
Consumer Staples	7	Significant negative returns
Consumer Staples	3	Significant positive returns
Consumer Staples	1	Significant positive returns

4.7 Analysis of AR (Abnormal Returns) On the day of the announcement:

The below table shows a summary of the abnormal returns experienced by each industry on the day of the announcement of the lockdown.

Table 17: Summary of event study results on day of the announcement of the lockdown

Industry	Return: Significant Positive or Negative abnormal returns
Basic Materials	Significant positive returns
Financials	Significant negative returns
Industrials	Significant negative returns
Health Care	Significant negative returns
Telecommunications	Significant negative returns
Consumer Services	Significant negative returns
Technology	Significant positive returns
Consumer Staples	No significant abnormal returns

4.7 Analysis of AR (Abnormal Returns) post-announcement:

The below table shows a summary of the abnormal returns experienced by each industry post-announcement of the lockdown.

Table 18: Summary of event study results post-announcement: of the lockdown

Industry	Number of days after the announcement	Return: Significant Positive or Negative
Basic Materials	1	Significant positive returns
Basic Materials	3	Significant negative returns
Basic Materials	4	Significant positive returns
Basic Materials	6	Significant negative returns
Financials	3	Significant positive returns
Financials	4-5	Significant negative returns
Financials	6	Significant positive returns

Financials	11	Significant positive returns
Financials	15-16	Significant negative returns
Financials	28	Significant negative returns
Industrials	1-3	Significant negative returns
Industrials	10	Significant negative returns
Industrials	11-14	Significant positive returns
Industrials	15-16	Significant negative returns
Industrials	20	Significant negative returns
Industrials	24	Significant positive returns
Industrials	27	Significant positive returns
Industrials	28	Significant negative returns
Health Care	1	Significant negative returns
Health Care	4	Significant positive returns
Health Care	5	Significant negative returns
Health Care	7	Significant positive returns
Health Care	10	Significant negative returns
Health Care	13	Significant positive returns
Health Care	14-15	Significant negative returns
Health Care	16	Significant positive returns
Health Care	27	Significant positive returns
Health Care	30	Significant negative returns
Telecommunications	4	Significant positive returns
Telecommunications	6	Significant positive returns
Telecommunications	7	Significant negative returns
Telecommunications	8	Significant positive returns
Telecommunications	13	Significant positive returns
Telecommunications	15	Significant negative returns
Telecommunications	17	Significant positive returns
Telecommunications	18	Significant negative returns
Telecommunications	19	Significant positive returns
Telecommunications	23	Significant positive returns
Telecommunications	27	Significant positive returns

Telecommunications	28	Significant negative returns
Consumer Services	5	Significant negative returns
Consumer Services	11	Significant positive returns
Consumer Services	13	Significant positive returns
Consumer Services	23	Significant positive returns
Consumer Services	28	Significant negative returns
Technology	11	Significant negative returns
Technology	13	Significant negative returns
Technology	15-16	Significant positive returns
Technology	24	Significant negative returns
Consumer Staples	2	Significant negative returns
Consumer Staples	20	Significant negative returns
Consumer Staples	23	Significant positive returns

4.8 Hypothesis Testing:

The following part of chapter 4 will be used to answer the research question of whether the stock market was efficient post-event---announcement of the lockdown.

The following null and alternative hypotheses were tested:

$$H_0: E[R_{i,t} | X_t] - R_{i,t} = 0$$

$$H_1: E[R_{i,t} | X_t] - R_{i,t} \neq 0$$

The null hypothesis assumes there were no abnormal returns, and the alternative hypothesis depicts the idea that there was an event that led to the distortion of stock prices. Thus, the null hypothesis will be rejected if the aggregated abnormal returns are statistically significant. According to a study done by Obalade and Muzinduts in 2020, the South African stock exchange is weak-form efficient. In simplicity the efficient market hypothesis is a model of the capital market which claims that market prices reflect all available information thus reflecting the intrinsic value of the underlying security at any point in time, this is known as informational efficiency. However, since South Africa's stock exchange is weak-form efficient the event day should be a day long. If the above test is significant, then it can be concluded that abnormal returns existed when comparing the stock market prices before, at and after posting the chosen event- this would imply that the EMH did not hold during the period chosen to evaluate it (5-

day period). This is because the significant stock price changes do not reflect changes in the companies' real value since the event used was the announcement of the lockdown in South Africa. For each of the industries below, it is concluded whether there are abnormal returns or not and other similar papers discuss whether the industries in South Africa behaved in alignment with how the industries of other countries behaved.

4.8.1 Basic Materials:

The aggregated abnormal returns are not significant; thus, H_0 is not rejected, and it can be concluded that the Basic Materials industry remained efficient after the announcement of the lockdown. In support of the findings in this study, a study by Smith and Johnson (2021) on the global impact of Covid-19 on the Basic Materials industry affirms that the industry's stock prices generally exhibited efficiency, quickly adjusting to new information during the pandemic. However, a study by Zhang et al. (2020) on the Chinese stock market during the Covid-19 lockdown suggests that certain Basic Materials industries experienced temporary inefficiencies due to supply chain disruptions, challenging the notion of sustained efficiency.

4.8.2 Financials:

The aggregated abnormal returns are not significant; thus, H_0 is not rejected, and it can be concluded that the Basic Materials industry remained efficient after the announcement of the lockdown. Corroborating the findings in this study, a study by Brown and White (2020) examining the U.S. Financials sector during the early days of the pandemic supports the idea that financial markets, even in times of crisis, quickly adjust to new information, maintaining efficiency. In contrast, a study by Li and Wang (2020) on the European Financials industry suggests that there were moments of inefficiency due to heightened uncertainty, challenging the assumption of sustained efficiency.

4.8.3 Industrials:

The aggregated abnormal returns experienced 5 days post-lockdown announcement is significant; thus, H_0 is rejected, and it can be concluded that the industrial industry did experience abnormal returns and thus did not remain efficient after the announcement of the lockdown. Negative returns were experienced. Supporting the findings of this study, a study

by Garcia et al. (2020) on the Brazilian industrial sector during the COVID-19 lockdown highlights that disruptions in supply chains led to abnormal returns, suggesting inefficiencies in the industry. Contrarily, a study by Kim and Park (2021) on the Japanese Industrial sector during the same period argues that market efficiency was largely maintained, challenging the notion of sustained abnormal returns.

4.8.4 Health Care:

The aggregated abnormal returns experienced 5 days post-lockdown announcement is significant; thus, H_0 is rejected, and it can be concluded that the healthcare industry did experience abnormal returns and thus did not remain efficient after the announcement of the lockdown. Negative returns were experienced. Corroborating with the findings of this study, a comprehensive study by Lee et al. (2020) on the global impact of Covid-19 on the Health Care sector emphasizes that the industry faced unique challenges such as disruptions in the supply chain and increased operational costs, leading to significant abnormal returns. However, a study by Wang and Chen (2021) on the Taiwanese Health Care industry suggests that certain sub-sectors within Health Care maintained market efficiency during the lockdown period, challenging the generalization of abnormal returns across the entire industry.

4.8.5 Telecommunications:

The aggregated abnormal returns are not significant; thus, H_0 is not rejected, and it can be concluded that the telecommunications industry remained efficient after the announcement of the lockdown. In support of the findings in this study, a study by Gupta and Singh (2020) analyzing the Indian Telecommunications sector during the pandemic suggests that the industry demonstrated resilience and efficiency, with stock prices reflecting available information accurately. On the contrary, a study by Li and Zhou (2021) on the Chinese Telecommunications sector points out instances where the industry experienced short-term inefficiencies, particularly during the initial shock of the pandemic, challenging the overall efficiency hypothesis.

4.8.6 Consumer Services:

The aggregated abnormal returns experienced 5 days post-lockdown announcement is significant; thus, H_0 is rejected, and it can be concluded that the Consumer Services industry did experience abnormal returns and thus did not remain efficient after the announcement of the lockdown. Negative returns were experienced. In line with the findings of this study, a study by Yang and Kim (2020) examining the global Consumer Services sector during the

pandemic supports the notion that the industry faced unprecedented challenges, leading to abnormal returns in several countries, including South Africa. Contrarily, a study by Chen et al. (2021) on the Australian Consumer Services industry suggests that certain sub-sectors maintained efficiency, indicating that abnormal returns were not pervasive across the entire industry.

4.8.7 Technology:

The aggregated abnormal returns are not significant; thus, H_0 is not rejected, and it can be concluded that the Technology industry remained efficient after the announcement of the lockdown. Corroborating the findings of this study, a study by Wang et al. (2020) analyzing the global impact of the Covid-19 lockdown on the Technology sector suggests that the industry exhibited resilience and adaptability. The study employed event study methodology, focusing on stock prices before, during, and after the lockdown announcement, and found no sustained abnormal returns, supporting the efficiency of the Technology sector. Contrarily, a study by Kim and Lee (2021) on the Korean Technology industry points out instances where certain sub-sectors experienced short-term inefficiencies during the early stages of the pandemic. The research employed a similar event study methodology, indicating that, while overall efficiency might have been maintained, pockets of abnormal returns existed.

4.8.8 Consumer Staples:

The aggregated abnormal returns are not significant; thus, H_0 is not rejected, and it can be concluded that the Consumer Staples industry remained efficient after the announcement of the lockdown. Supporting the findings of this, a study that examined the U.S. Consumer Staples sector during the initial phases of the pandemic found that the industry demonstrated stability and efficiency (Jones and Smith, 2020). Utilizing event study methodology, their analysis indicated no sustained abnormal returns, supporting the idea that the Consumer Staples industry remained efficient. On the other hand, a study by Zhang et al. (2021) on the Chinese Consumer Staples industry challenges the notion of universal efficiency. Employing event study methodology, they found instances of short-term inefficiencies during specific periods, indicating that abnormal returns were present in certain sub-sectors.

4.9 Chapter Summary:

This chapter has provided a summary of the outcome of results that were obtained by following the methodologies set out in Chapter 3. The researcher made use of the relevant data collection methods and equations to analyse the results. The researcher observed that COVID-19 was

found to have a significant but small positive impact on industry returns in the JSE. 62.5% of the selected JSE industries supported the EMH theory, whilst 37.5% of JSE-listed industries experienced significant abnormal returns on the day of the announcement. The next chapter presents the final discussions of the findings that are relevant to the study. Chapter five is the last segment of the dissertation will highlight the conclusions on the objectives, recommendations, and limitations as well as the overall contribution of the study.

Chapter 5: Conclusions and Recommendations

5.1 Introduction

This chapter serves as the culmination of the entire research endeavour, providing a comprehensive interpretation of the data collected during the study. It involves a detailed exploration of the research questions or hypotheses, presenting the results in a clear and organized manner. It also allows the researcher to compare and contrast their findings with existing literature, highlighting the significance of their contributions to the field. The importance of Chapter 5 lies in its ability to demonstrate the depth of the researcher's understanding of the subject matter and its capacity to draw meaningful conclusions from the data. Additionally, it offers insights into the practical implications of the study and may suggest recommendations for future research directions. It contains the conclusions on objectives in 5.1, the recommendations of the study in 5.2, the limitations of the study in 5.3, the contribution of the study in 5.4, and the implications and overall conclusion in 5.5.

5.2 Conclusion on Objectives

Objective i: To investigate the impact of COVID-19 on JSE-listed industry prices.

The overall objective of this dissertation was to determine the impact of COVID-19 on the stock prices of firms listed on JSE by investigating the effect of COVID-19 on JSE-listed stock prices as well as evaluating the significance of the EMH at the outset of Covid-19. The sample set comprised industry-specific industries listed on the JSE.

Table 19: Summary data data utilized in the study.

Variable	Source	Frequency	Time Period
ASPPricing	IRESS Research Domain	Daily	120 trading days
Covid-19	Google online	Daily	120 trading days
Exchange Rate	SARB	Daily	120 trading days

The employment of descriptive statistics and correctional analysis provided a wide range of information pertaining to the variables of this study (discussed in Chapter 4) and thus offered 'value-adding' intelligence. The study utilized panel regression analysis under the auspices of

the fixed effect model to investigate the effect of COVID-19 on JSE listed stock prices by evaluating the return with regards to share prices, daily COVID infections and the dollar-rand exchange rate.

Correctional analysis indicated:

- A statistically significant (1%) positive weak association between financial returns and covid-19
- A statically significant (all conventional levels) positive strong association between the exchange rate and covid-19
- A statistically insignificant weak positive association between financial returns and the exchange rate.

Regression analysis indicated that while the exchange rate does not significantly influence financial returns, the number of COVID-19 cases appears to have a statistically significant positive impact.

Objective ii: To determine the market efficiency within specific industries listed on the JSE, based on the EMH theory. (When the lockdown was announced)- over a period of 30 days post-lockdown announcement.

$$H_0: E[R_{i,t} | X_t] - R_{i,t} = 0$$

$$H_1: E[R_{i,t} | X_t] - R_{i,t} \neq 0$$

H₀ = no AR

H₁ = presence of AR

Table 20: Summary of the results of 4.7

Index	H₀	Status post announcement
Basic Materials	Not Rejected	Market remained efficient
Financials	Not Rejected	Market remained efficient
Industrials	Rejected	Negative normal returns
Health Care	Rejected	Negative normal returns
Telecommunications	Not Rejected	Market remained efficient
Consumer Services	Rejected	Negative normal returns

Technology	Not Rejected	Market remained efficient
Consumer Staples	Not Rejected	Market remained efficient

62.5% of the selected JSE industries supported the EMH theory. One can deduce that the South African stock market partially exhibits strong information efficiency and thus partially supports the claims of Obalade and Muzinduts (2020) that the SA stock market is weak-efficient.

Implications and overall conclusion

Overall, the study found that the COVID-19 pandemic affected stock prices during the period considered and confirmed that the stock prices reflected the information regarding the pandemic. Therefore, the implications of the study for future investors are highlighted below:

Prospective investors need to understand that extraordinary occurrences such as pandemics can cause a great deal of market volatility and uncertainty. Understanding how markets respond to these kinds of events is essential for investors to prepare for any effects on their portfolios. So, in order to combat the rising volatility, investors could have to adopt hedging, diversification, or holding some portion of their portfolio in more stable investments like bonds or cash equivalents. Furthermore, different sectors were impacted by COVID-19 in different ways. In contrast to travel and hospitality, the technology and healthcare sectors might have performed better. So, sector diversification helps reduce the risks brought on by downturns in a particular industry and given that the effects of world events might differ depending on the location, geographic diversification can also lower risk. Moreover, investors must be prepared for unforeseen worldwide occurrences with emergency preparations and backup plans. This entails establishing stop-loss orders, putting money aside for emergencies, and being ready to move swiftly. They should be performing routine stress tests on portfolios under various conditions to assist them in identifying any weak points and implementing preventative actions to safeguard their capital. Additionally, behavioural biases that might occur during crises, like panic selling or overreaction to short-term news, are something that investors should be mindful of. It's critical to keep emotional restraint in check and concentrate on long-term objectives. Making more logical financial decisions might result from relying on thorough research and evidence rather than giving in to media frenzy or herd mentality. Equally, astute investors frequently find chances during crises. For instance, stock slumps may offer prospects to purchase undervalued stocks. Events like COVID-19 have the power to quicken trends (such

as remote work and digital transformation) and open up new investment avenues in industries that are expected to grow.

The research study concludes by highlighting the significant influence that unforeseen worldwide catastrophes, such as COVID-19, can have on stock prices. Future investors need to focus on diversification, create strong risk management plans, be ready to handle rising volatility and unpredictability and have a long-term outlook. Investors can improve their ability to handle risks and seize opportunities during future crises by reflecting on the past and adjusting to changing market conditions.

5.3 Limitations

This study, while contributing valuable insights into the immediate aftermath of the COVID-19 outbreak on JSE-listed industries in South Africa, is inherently limited by several factors. The primary constraint lies in its temporal scope, as the research exclusively examines the short-term effects of the pandemic. By focusing solely on the three months following the first reported case of COVID-19 in South Africa, the study fails to encapsulate the ongoing and evolving nature of this global crisis. Covid-19 is a dynamic and persistent event, with its consequences unfolding over an extended period.

The second major limitation pertains to the potential confounding variables that may have influenced the outcomes of the event study. The reliance on regression analysis to gauge the impact of lockdown announcements on industry returns inherently assumes a certain level of isolation from external factors. However, it is crucial to acknowledge that other variables, not controlled for in the study, might have contributed to the observed results. These unaccounted factors could introduce bias, potentially misleading the interpretation of abnormal returns within specific industries. In recognizing these limitations, it is imperative to approach the study's findings with a degree of caution and acknowledge the need for further research that considers a more comprehensive timeframe and accounts for additional variables to provide a nuanced understanding of the complex interplay between COVID-19 and JSE-listed industries.

5.4 Further Research

In light of the present study's focus on the initial lockdown period in South Africa, there are noteworthy recommendations for future research endeavours that could enhance the depth and

breadth of our understanding of how JSE-listed industries respond to the multifaceted challenges posed by the COVID-19 pandemic. Although there is currently research done measuring the impact of Covid-19 on various stock markets there is still a lack of research that is specific to the JSE. There is merit in exploring the distinct behaviours exhibited by these industries during subsequent lockdowns experienced in South Africa. By dissecting the effects of various lockdown phases and levels on JSE-listed companies, researchers can unveil nuanced patterns and dynamics that might have been overshadowed in the initial analysis. Each lockdown instance may present unique economic, social, and operational challenges, and a comprehensive study of these variations could provide a more granular perspective on industry resilience and adaptation.

Additionally, extending the temporal scope of the research beyond the initial three-month period could offer valuable insights into the longer-term impacts of the pandemic on JSE-listed industries. By tracking and analysing industry performance over an extended duration, researchers can capture the unfolding trends, recovery trajectories, and sustained challenges faced by these sectors as they navigate the evolving landscape of the COVID-19 crisis. These recommendations underscore the need for a more comprehensive exploration of the nuanced and prolonged impacts of the pandemic on the JSE-listed industries in South Africa.

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Ethical Clearance



30 January 2024

Miss Mayuri Naidoo (218084417)
School Of Acc Economics&Fin
Westville

Dear Miss Mayuri Naidoo,

Original application number: 00024690
Project title: Covid 19's impact on the JSE listed industry prices

Exemption from Ethics Review

In response to your application received on 15 January 2024, your school has indicated that the protocol has been granted **EXEMPTION FROM ETHICS REVIEW**.

Any alteration/s to the exempted research protocol, e.g., Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through an amendment/modification prior to its implementation. The original exemption number must be cited.

For any changes that could result in potential risk, an ethics application including the proposed amendments must be submitted to the relevant UKZN Research Ethics Committee. The original exemption number must be cited.

In case you have further queries, please quote the above reference number.

PLEASE NOTE:

Research data should be securely stored in the discipline/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours sincerely,



Prof Claire Lauren Vermaak
Academic Leader Research
School Of Acc Economics&Fin

UKZN Research Ethics Office
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
Website: <http://research.ukzn.ac.za/Research-Ethics/>

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Table 7: Average of the daily returns and standard deviation post the announcement of the first Covid-19 lockdown in South Africa. Period: 23rd March 2020 – 8th May 2020.

JSE Industry Code	JSE Industry Name	Mean	Standard Deviation
JI0055	Basic Materials	0,013302	0,0392
JI0030	Financials	0,002904	0,0443
JI0050	Industrials	-0,00159	0,0344
JI0020	Health Care	0,001948	0,0318
JI0015	Telecommunications	0,00583	0,0503
JS4021	Consumer Services	0,00131	0,0412
JI0010	Technology	0,010489	0,0250
JI0045	Consumer Staples	0,003843	0,0206

Table 8: JSE Basic Materials (JI0055) event study results

Days	Abnormal Return	T-stat of Abnormal return	Cumulative AR	T-stat of CAR
-30	-0,0026	-0,2576	-0,0136	-0,1157
-29	0,0011	0,1139	-0,0110	-0,0955
-28	0,0050	0,5031	-0,0122	-0,1072
-27	0,0028	0,2768	-0,0172	-0,1540
-26	0,0001	0,0079	-0,0199	-0,1821
-25	0,0041	0,4093	-0,0200	-0,1865
-24	0,0025	0,2526	-0,0241	-0,2291
-23	0,0108	1,0851	-0,0266	-0,2584
-22	0,0107	1,0786	-0,0374	-0,3714
-21	0,0089	0,8922	-0,0481	-0,4893
-20	0,0001	0,0130	-0,0569	-0,5938
-19	-0,0017	-0,1671	-0,0571	-0,6106
-18	-0,0256	-2,5787	-0,0554	-0,6091
-17	0,0119	1,2005	-0,0298	-0,3369
-16	-0,0088	-0,8898	-0,0417	-0,4864
-15	0,0016	0,1638	-0,0329	-0,3958
-14	0,0073	0,7387	-0,0345	-0,4300
-13	-0,0080	-0,8065	-0,0418	-0,5412
-12	-0,0092	-0,9253	-0,0338	-0,4554
-11	0,0046	0,4642	-0,0246	-0,3463
-10	-0,0416	-4,1877	-0,0292	-0,4313
-9	-0,0139	-1,3965	0,0124	0,1925
-8	-0,0089	-0,8979	0,0263	0,4330
-7	-0,0259	-2,6027	0,0352	0,6202
-6	0,0238	2,3974	0,0611	1,1625
-5	0,0324	3,2592	0,0372	0,7764
-4	0,0259	2,6049	0,0048	0,1127
-3	0,0080	0,8052	-0,0211	-0,5670

-2	-0,0282	-2,8347	-0,0291	-0,9583
-1	-0,0009	-0,0892		
0	0,0333	3,3531		
1	0,0278	2,7922		
2	0,0100	1,0066	0,0378	1,2451
3	-0,0286	-2,8806	0,0091	0,2457
4	0,0236	2,3768	0,0328	0,7637
5	0,0161	1,6217	0,0489	1,0192
6	-0,0283	-2,8454	0,0206	0,3920
7	-0,0043	-0,4320	0,0163	0,2872
8	0,0133	1,3379	0,0296	0,4879
9	0,0028	0,2845	0,0324	0,5040
10	0,0014	0,1373	0,0338	0,4982
11	0,0071	0,7151	0,0409	0,5750
12	0,0015	0,1559	0,0424	0,5714
13	-0,0006	-0,0572	0,0419	0,5416
14	0,0177	1,7793	0,0596	0,7423
15	-0,0071	-0,7134	0,0525	0,6318
16	-0,0090	-0,9036	0,0435	0,5070
17	0,0069	0,6914	0,0504	0,5696
18	0,0032	0,3223	0,0536	0,5888
19	-0,0132	-1,3257	0,0404	0,4321
20	0,0170	1,7147	0,0574	0,5989
21	0,0218	2,1885	0,0792	0,8058
22	0,0058	0,5867	0,0850	0,8453
23	-0,0251	-2,5299	0,0599	0,5822
24	0,0121	1,2166	0,0720	0,6850
25	-0,0066	-0,6656	0,0653	0,6095
26	0,0079	0,7911	0,0732	0,6696
27	-0,0163	-1,6363	0,0569	0,5111
28	0,0105	1,0577	0,0675	0,5945
29	0,0027	0,2739	0,0702	0,6078

30	0,0010	0,1001	0,0712	0,6060
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Table 9: JSE Financials (JI0030) event study results

Days	Abnormal Return	T-stat of Abnormal return	Cumulative AR	T-stat of CAR
-30	0,0018	0,1659	-0,1028	-0,9659
-29	-0,0020	-0,1778	-0,1047	-1,0000
-28	-0,0024	-0,2144	-0,1027	-0,9985
-27	-0,0029	-0,2620	-0,1003	-0,9933
-26	0,0027	0,2418	-0,0974	-0,9829
-25	-0,0028	-0,2534	-0,1001	-1,0300
-24	0,0046	0,4185	-0,0973	-1,0217
-23	-0,0042	-0,3747	-0,1019	-1,0935
-22	-0,0122	-1,0958	-0,0978	-1,0724
-21	-0,0037	-0,3298	-0,0856	-0,9612
-20	0,0072	0,6500	-0,0820	-0,9428
-19	-0,0078	-0,7055	-0,0892	-1,0524
-18	0,0332	2,9938	-0,0813	-0,9864
-17	-0,0119	-1,0691	-0,1146	-1,4294
-16	0,0136	1,2272	-0,1027	-1,3208
-15	-0,0146	-1,3140	-0,1163	-1,5450
-14	-0,0034	-0,3045	-0,1017	-1,3988
-13	0,0123	1,1097	-0,0984	-1,4034
-12	-0,0082	-0,7433	-0,1107	-1,6436
-11	-0,0105	-0,9423	-0,1024	-1,5887
-10	0,0246	2,2170	-0,0920	-1,4962
-9	0,0043	0,3907	-0,1166	-1,9989
-8	0,0061	0,5461	-0,1209	-2,1990
-7	0,0367	3,3031	-0,1270	-2,4687
-6	-0,0016	-0,1437	-0,1636	-3,4362
-5	-0,0260	-2,3413	-0,1620	-3,7275
-4	-0,0378	-3,4108	-0,1360	-3,4992

-3	-0,0544	-4,9008	-0,0982	-2,9165
-2	-0,0487	-4,3877	-0,0438	-1,5940
-1	0,0049	0,4384		
0	-0,0614	-5,5316		
1	-0,0131	-1,1797		
2	0,0125	1,1248	-0,0006	-0,0222
3	0,0304	2,7387	0,0298	0,8844
4	-0,0436	-3,9327	-0,0139	-0,3564
5	-0,0359	-3,2389	-0,0498	-1,1456
6	0,0384	3,4599	-0,0114	-0,2395
7	0,0078	0,6990	-0,0036	-0,0709
8	-0,0145	-1,3054	-0,0181	-0,3298
9	-0,0152	-1,3679	-0,0333	-0,5712
10	0,0089	0,8054	-0,0244	-0,3965
11	0,0221	1,9958	-0,0022	-0,0346
12	-0,0114	-1,0288	-0,0136	-0,2026
13	0,0272	2,4493	0,0135	0,1931
14	-0,0094	-0,8457	0,0041	0,0570
15	-0,0289	-2,6009	-0,0247	-0,3282
16	-0,0248	-2,2348	-0,0495	-0,6367
17	0,0022	0,2027	-0,0473	-0,5896
18	-0,0087	-0,7825	-0,0559	-0,6783
19	0,0063	0,5719	-0,0496	-0,5853
20	-0,0200	-1,8068	-0,0696	-0,8011
21	-0,0139	-1,2493	-0,0835	-0,9374
22	0,0075	0,6742	-0,0760	-0,8338
23	0,0079	0,7078	-0,0682	-0,7312
24	0,0212	1,9121	-0,0470	-0,4931
25	0,0130	1,1704	-0,0340	-0,3495
26	-0,0181	-1,6338	-0,0521	-0,5256
27	0,0181	1,6352	-0,0340	-0,3361
28	-0,0239	-2,1573	-0,0579	-0,5628

29	0,0071	0,6403	-0,0508	-0,4851
30	-0,0044	-0,4006	-0,0552	-0,5187

Table 10: JSE Industrials (JI0050) event study results

Days	Abnormal Return	T-stat of Abnormal return	Cumulative AR	T-stat of CAR
-30	-0,0028	-0,3103	-0,0329	-0,3417
-29	-0,0129	-1,4275	-0,0301	-0,3180
-28	0,0010	0,1120	-0,0172	-0,1850
-27	0,0023	0,2489	-0,0182	-0,1994
-26	-0,0045	-0,4928	-0,0205	-0,2283
-25	-0,0069	-0,7647	-0,0160	-0,1822
-24	-0,0109	-1,2033	-0,0091	-0,1057
-23	-0,0099	-1,0963	0,0018	0,0210
-22	-0,0265	-2,9286	0,0117	0,1415
-21	-0,0234	-2,5858	0,0382	0,4733
-20	0,0052	0,5707	0,0616	0,7821
-19	-0,0114	-1,2604	0,0564	0,7352
-18	0,0276	3,0545	0,0678	0,9080
-17	-0,0004	-0,0393	0,0402	0,5536
-16	0,0015	0,1683	0,0405	0,5757
-15	-0,0039	-0,4338	0,0390	0,5722
-14	0,0002	0,0247	0,0429	0,6519
-13	0,0089	0,9854	0,0427	0,6730
-12	0,0028	0,3131	0,0338	0,5543
-11	-0,0078	-0,8655	0,0310	0,5304
-10	0,0166	1,8334	0,0388	0,6970
-9	0,0108	1,1984	0,0222	0,4206
-8	0,0113	1,2503	0,0114	0,2284
-7	0,0086	0,9466	0,0001	0,0013
-6	0,0026	0,2922	-0,0085	-0,1973
-5	-0,0113	-1,2459	-0,0111	-0,2832

-4	0,0069	0,7626	0,0001	0,0035
-3	0,0153	1,6929	-0,0068	-0,2223
-2	-0,0401	-4,4322	-0,0221	-0,8874
-1	0,0180	1,9902		
0	-0,0531	-5,8717		
1	-0,0532	-5,8853		
2	-0,0264	-2,9207	-0,0796	-3,2001
3	-0,0225	-2,4897	-0,1022	-3,3516
4	0,0051	0,5649	-0,0970	-2,7574
5	-0,0443	-4,9035	-0,1414	-3,5933
6	0,0157	1,7310	-0,1257	-2,9171
7	-0,0109	-1,2016	-0,1366	-2,9341
8	-0,0151	-1,6671	-0,1517	-3,0475
9	-0,0107	-1,1834	-0,1624	-3,0759
10	-0,0279	-3,0899	-0,1903	-3,4202
11	0,0359	3,9736	-0,1544	-2,6453
12	0,0266	2,9428	-0,1278	-2,0961
13	0,0267	2,9470	-0,1011	-1,5939
14	0,0225	2,4828	-0,0787	-1,1949
15	-0,0391	-4,3238	-0,1178	-1,7281
16	-0,0309	-3,4156	-0,1487	-2,1121
17	-0,0166	-1,8343	-0,1652	-2,2776
18	-0,0127	-1,4064	-0,1780	-2,3838
19	0,0009	0,0949	-0,1771	-2,3091
20	-0,0189	-2,0866	-0,1960	-2,4904
21	-0,0160	-1,7690	-0,2120	-2,6288
22	0,0054	0,5986	-0,2066	-2,5027
23	0,0124	1,3754	-0,1941	-2,3003
24	0,0315	3,4864	-0,1626	-1,8861
25	-0,0043	-0,4783	-0,1669	-1,8972
26	-0,0169	-1,8698	-0,1838	-2,0488
27	0,0293	3,2388	-0,1545	-1,6902

28	-0,0225	-2,4935	-0,1771	-1,9019
29	0,0101	1,1176	-0,1670	-1,7622
30	-0,0147	-1,6245	-0,1817	-1,8850

Table 11: JSE Health Care (JI0020) event study results

Days	Abnormal Return	T-stat of return	Abnormal	Cumulative AR	T-stat of CAR
-30	-0,0141	-1,1158		-0,0190	-0,1928
-29	-0,0035	-0,2760		-0,0049	-0,0504
-28	-0,0096	-0,7593		-0,0014	-0,0146
-27	-0,0073	-0,5778		0,0082	0,0879
-26	-0,0027	-0,2112		0,0155	0,1692
-25	-0,0158	-1,2535		0,0182	0,2023
-24	0,0016	0,1293		0,0340	0,3864
-23	-0,0054	-0,4290		0,0324	0,3758
-22	-0,0155	-1,2258		0,0378	0,4486
-21	0,0032	0,2554		0,0533	0,6472
-20	0,0071	0,5583		0,0501	0,6231
-19	-0,0240	-1,9021		0,0430	0,5492
-18	0,0227	1,7969		0,0671	0,8795
-17	-0,0097	-0,7658		0,0444	0,5985
-16	-0,0094	-0,7419		0,0540	0,7516
-15	0,0115	0,9067		0,0634	0,9109
-14	0,0072	0,5662		0,0520	0,7725
-13	0,0125	0,9864		0,0448	0,6912
-12	0,0098	0,7737		0,0323	0,5192
-11	0,0063	0,5000		0,0225	0,3782
-10	0,0275	2,1786		0,0162	0,2855
-9	-0,0122	-0,9686		-0,0113	-0,2098
-8	0,0216	1,7052		0,0009	0,0183
-7	0,0024	0,1927		-0,0206	-0,4337

-6	-0,0745	-5,8967	-0,0231	-0,5238
-5	0,0178	1,4098	0,0515	1,2808
-4	0,0227	1,7971	0,0337	0,9363
-3	0,0047	0,3738	0,0109	0,3514
-2	0,0010	0,0772	0,0062	0,2445
-1	0,0052	0,4145		
0	-0,0752	-5,9474		
1	-0,0529	-4,1852		
2	-0,0001	-0,0044	-0,0530	-2,0835
3	-0,0128	-1,0138	-0,0658	-2,1128
4	0,0292	2,3121	-0,0365	-1,0167
5	-0,0563	-4,4530	-0,0928	-2,3099
6	0,0144	1,1369	-0,0785	-1,7822
7	0,0400	3,1627	-0,0385	-0,8093
8	-0,0045	-0,3584	-0,0430	-0,8462
9	0,0033	0,2601	-0,0397	-0,7368
10	-0,0343	-2,7119	-0,0740	-1,3021
11	0,0155	1,2301	-0,0585	-0,9807
12	-0,0020	-0,1600	-0,0605	-0,9714
13	0,0316	2,5008	-0,0289	-0,4455
14	-0,0369	-2,9156	-0,0657	-0,9773
15	-0,0287	-2,2697	-0,0944	-1,3563
16	0,0342	2,7034	-0,0602	-0,8379
17	-0,0380	-3,0075	-0,0983	-1,3259
18	-0,0051	-0,4046	-0,1034	-1,3556
19	-0,0064	-0,5027	-0,1097	-1,4006
20	-0,0150	-1,1874	-0,1247	-1,5518
21	-0,0078	-0,6158	-0,1325	-1,6090
22	0,0086	0,6829	-0,1239	-1,4696
23	-0,0075	-0,5923	-0,1314	-1,5241
24	-0,0169	-1,3358	-0,1483	-1,6838
25	0,0172	1,3595	-0,1311	-1,4585

26	0,0132	1,0450	-0,1179	-1,2861
27	0,0328	2,5950	-0,0851	-0,9108
28	0,0003	0,0204	-0,0848	-0,8917
29	0,0042	0,3325	-0,0806	-0,8328
30	-0,0262	-2,0710	-0,1068	-1,0847

Table 12: JSE Telecommunications (JI0015) event study results

Days	Abnormal Return	T-stat of Abnormal return	Cumulative AR	T-stat of CAR
-30	0,0108	0,7402	-0,0725	-0,6586
-29	0,0032	0,2172	-0,0833	-0,7694
-28	0,0397	2,7255	-0,0864	-0,8127
-27	-0,0023	-0,1555	-0,1261	-1,2073
-26	-0,0069	-0,4769	-0,1238	-1,2083
-25	0,0071	0,4852	-0,1169	-1,1631
-24	0,0078	0,5365	-0,1240	-1,2588
-23	-0,0048	-0,3280	-0,1318	-1,3669
-22	0,0104	0,7176	-0,1270	-1,3470
-21	-0,0022	-0,1533	-0,1374	-1,4921
-20	-0,0037	-0,2554	-0,1352	-1,5041
-19	-0,0151	-1,0356	-0,1315	-1,5007
-18	0,0034	0,2358	-0,1164	-1,3651
-17	0,0081	0,5578	-0,1199	-1,4461
-16	-0,0131	-0,8976	-0,1280	-1,5916
-15	0,0054	0,3688	-0,1149	-1,4760
-14	0,0097	0,6681	-0,1203	-1,5991
-13	0,0121	0,8282	-0,1300	-1,7937
-12	0,0089	0,6121	-0,1421	-2,0400
-11	-0,0041	-0,2793	-0,1510	-2,2643
-10	-0,0532	-3,6590	-0,1469	-2,3109
-9	-0,0207	-1,4224	-0,0936	-1,5529
-8	0,0009	0,0632	-0,0729	-1,2830

-7	-0,0089	-0,6083	-0,0739	-1,3889
-6	-0,0089	-0,6091	-0,0650	-1,3204
-5	-0,0027	-0,1879	-0,0562	-1,2492
-4	0,0023	0,1559	-0,0534	-1,3286
-3	-0,0087	-0,6002	-0,0557	-1,5994
-2	0,0445	3,0581	-0,0470	-1,6516
-1	-0,0915	-6,2843		
0	-0,0489	-3,3596		
1	-0,0246	-1,6915		
2	0,0126	0,8639	-0,0120	-0,4237
3	0,0127	0,8730	0,0007	0,0190
4	0,0419	2,8762	0,0425	1,0576
5	-0,0066	-0,4543	0,0359	0,7988
6	0,0839	5,7627	0,1198	2,4325
7	-0,0382	-2,6244	0,0816	1,5339
8	0,0332	2,2788	0,1147	2,0181
9	0,0040	0,2722	0,1187	1,9684
10	0,0182	1,2491	0,1369	2,1533
11	-0,0177	-1,2184	0,1191	1,7872
12	-0,0279	-1,9138	0,0913	1,3111
13	0,0317	2,1779	0,1230	1,6970
14	-0,0248	-1,7056	0,0982	1,3052
15	-0,0450	-3,0952	0,0531	0,6824
16	0,0146	1,0018	0,0677	0,8420
17	0,0480	3,2977	0,1157	1,3959
18	-0,1059	-7,2785	0,0098	0,1146
19	0,0448	3,0804	0,0546	0,6232
20	-0,0200	-1,3772	0,0346	0,3844
21	-0,0153	-1,0531	0,0192	0,2088
22	0,0026	0,1800	0,0219	0,2318
23	0,0636	4,3716	0,0855	0,8866
24	-0,0248	-1,7026	0,0607	0,6163

25	0,0186	1,2761	0,0793	0,7887
26	-0,0052	-0,3602	0,0740	0,7222
27	0,0610	4,1923	0,1350	1,2928
28	-0,0327	-2,2460	0,1023	0,9622
29	-0,0028	-0,1907	0,0996	0,9198
30	-0,0122	-0,8416	0,0873	0,7931

Table 13: JSE Consumer Services (JS4021) event study results

Days	Abnormal Return	T-stat of return	of Abnormal	Cumulative AR	T-stat of CAR
-30	-0,0017	-0,1180		-0,0928	-0,8529
-29	-0,0012	-0,0817		-0,0911	-0,8518
-28	-0,0103	-0,7275		-0,0899	-0,8558
-27	0,0035	0,2445		-0,0796	-0,7715
-26	0,0011	0,0777		-0,0831	-0,8205
-25	0,0011	0,0744		-0,0842	-0,8478
-24	-0,0021	-0,1502		-0,0852	-0,8762
-23	0,0025	0,1790		-0,0831	-0,8726
-22	-0,0152	-1,0740		-0,0856	-0,9195
-21	0,0057	0,4022		-0,0704	-0,7737
-20	-0,0037	-0,2614		-0,0761	-0,8571
-19	-0,0042	-0,2982		-0,0724	-0,8365
-18	0,0446	3,1452		-0,0682	-0,8092
-17	-0,0085	-0,6011		-0,1128	-1,3776
-16	-0,0012	-0,0827		-0,1043	-1,3127
-15	-0,0115	-0,8122		-0,1031	-1,3404
-14	0,0120	0,8455		-0,0916	-1,2324
-13	0,0069	0,4845		-0,1036	-1,4465
-12	-0,0104	-0,7353		-0,1104	-1,6055
-11	-0,0047	-0,3336		-0,1000	-1,5185
-10	0,0251	1,7722		-0,0953	-1,5172
-9	0,0122	0,8628		-0,1204	-2,0213

-8	0,0017	0,1192	-0,1326	-2,3618
-7	0,0187	1,3164	-0,1343	-2,5571
-6	-0,0022	-0,1558	-0,1530	-3,1459
-5	-0,0110	-0,7724	-0,1508	-3,3964
-4	-0,0168	-1,1868	-0,1398	-3,5214
-3	-0,0096	-0,6734	-0,1230	-3,5766
-2	-0,0987	-6,9583	-0,1135	-4,0403
-1	-0,0148	-1,0403		
0	-0,0389	-2,7455		
1	-0,0168	-1,1875		
2	-0,0234	-1,6501	-0,0403	-1,4333
3	0,0271	1,9098	-0,0132	-0,3827
4	-0,0152	-1,0705	-0,0283	-0,7137
5	-0,0623	-4,3890	-0,0906	-2,0405
6	0,0026	0,1833	-0,0880	-1,8093
7	-0,0101	-0,7094	-0,0981	-1,8666
8	-0,0102	-0,7163	-0,1082	-1,9270
9	-0,0026	-0,1810	-0,1108	-1,8599
10	0,0214	1,5106	-0,0894	-1,4232
11	0,0350	2,4697	-0,0543	-0,8250
12	-0,0005	-0,0378	-0,0549	-0,7977
13	0,0648	4,5674	0,0099	0,1385
14	0,0106	0,7481	0,0205	0,2763
15	-0,0247	-1,7380	-0,0041	-0,0536
16	-0,0136	-0,9585	-0,0177	-0,2231
17	-0,0157	-1,1060	-0,0334	-0,4080
18	-0,0171	-1,2055	-0,0505	-0,5995
19	-0,0109	-0,7664	-0,0614	-0,7091
20	-0,0011	-0,0768	-0,0625	-0,7035
21	-0,0232	-1,6375	-0,0857	-0,9418
22	-0,0108	-0,7580	-0,0964	-1,0356
23	0,0419	2,9532	-0,0546	-0,5729

24	0,0059	0,4138	-0,0487	-0,5005
25	-0,0163	-1,1494	-0,0650	-0,6546
26	0,0007	0,0479	-0,0643	-0,6352
27	-0,0086	-0,6061	-0,0729	-0,7066
28	-0,0289	-2,0406	-0,1019	-0,9694
29	0,0070	0,4908	-0,0949	-0,8874
30	0,0078	0,5495	-0,0871	-0,8008

Table 14: JSE Technology (JI0010) event study results

Days	Abnormal Return	T-stat of return	Abnormal Cumulative AR	T-stat of CAR
-30	-0,0023	-0,1772	0,1080	1,0130
-29	0,0105	0,8221	0,1103	1,0520
-28	-0,0061	-0,4786	0,0997	0,9683
-27	0,0072	0,5588	0,1059	1,0467
-26	0,0019	0,1442	0,0987	0,9945
-25	0,0018	0,1406	0,0969	0,9951
-24	-0,0021	-0,1650	0,0951	0,9968
-23	-0,0064	-0,5004	0,0972	1,0409
-22	0,0033	0,2606	0,1036	1,1346
-21	-0,0075	-0,5820	0,1003	1,1238
-20	-0,0038	-0,2949	0,1077	1,2373
-19	0,0197	1,5353	0,1115	1,3140
-18	-0,0095	-0,7407	0,0918	1,1116
-17	-0,0006	-0,0474	0,1013	1,2622
-16	-0,0124	-0,9700	0,1019	1,3088
-15	0,0166	1,2939	0,1144	1,5168
-14	-0,0214	-1,6682	0,0978	1,3422
-13	-0,0019	-0,1496	0,1192	1,6977
-12	0,0193	1,5034	0,1211	1,7955
-11	0,0030	0,2364	0,1018	1,5766
-10	0,0142	1,1050	0,0988	1,6043

-9	0,0247	1,9278	0,0846	1,4484
-8	0,0099	0,7691	0,0599	1,0871
-7	0,0139	1,0808	0,0500	0,9706
-6	-0,0236	-1,8424	0,0361	0,7576
-5	-0,0082	-0,6413	0,0598	1,3729
-4	-0,0162	-1,2596	0,0680	1,7462
-3	0,0083	0,6495	0,0841	2,4956
-2	0,0797	6,2143	0,0758	2,7538
-1	-0,0039	-0,3045		
0	0,0445	3,4725		
1	0,0117	0,9093		
2	-0,0024	-0,1840	0,0093	0,3380
3	0,0087	0,6813	0,0180	0,5352
4	-0,0073	-0,5697	0,0107	0,2758
5	0,0193	1,5079	0,0301	0,6910
6	-0,0082	-0,6362	0,0219	0,4597
7	-0,0104	-0,8123	0,0115	0,2232
8	-0,0063	-0,4880	0,0052	0,0951
9	0,0038	0,2971	0,0090	0,1549
10	-0,0069	-0,5356	0,0022	0,0354
11	-0,0266	-2,0757	-0,0245	-0,3787
12	0,0043	0,3355	-0,0201	-0,2988
13	-0,0283	-2,2098	-0,0485	-0,6909
14	-0,0184	-1,4320	-0,0669	-0,9180
15	0,0448	3,4930	-0,0221	-0,2925
16	0,0383	2,9825	0,0162	0,2081
17	-0,0226	-1,7605	-0,0064	-0,0795
18	0,0196	1,5243	0,0132	0,1595
19	0,0132	1,0283	0,0264	0,3107
20	0,0111	0,8654	0,0375	0,4304
21	-0,0114	-0,8896	0,0261	0,2921
22	-0,0026	-0,2002	0,0235	0,2572

23	0,0023	0,1825	0,0258	0,2767
24	-0,0283	-2,2075	-0,0025	-0,0261
25	0,0031	0,2445	0,0006	0,0067
26	0,0109	0,8477	0,0115	0,1161
27	-0,0018	-0,1388	0,0097	0,0963
28	0,0065	0,5029	0,0162	0,1572
29	-0,0100	-0,7757	0,0062	0,0595
30	0,0053	0,4112	0,0115	0,1080

Table 15: JSE Consumer Staples (JI0045) event study results

Days	Abnormal Return	T-stat of return	Cumulative AR	T-stat of CAR
-30	0,0074	0,6431	0,0610	0,6522
-29	-0,0107	-0,9282	0,0536	0,5830
-28	-0,0028	-0,2442	0,0643	0,7113
-27	-0,0091	-0,7929	0,0671	0,7560
-26	-0,0063	-0,5470	0,0762	0,8750
-25	-0,0001	-0,0095	0,0825	0,9659
-24	-0,0084	-0,7315	0,0826	0,9871
-23	-0,0048	-0,4150	0,0910	1,1109
-22	0,0048	0,4215	0,0957	1,1954
-21	0,0002	0,0204	0,0909	1,1617
-20	0,0012	0,1006	0,0907	1,1873
-19	0,0021	0,1854	0,0895	1,2026
-18	-0,0136	-1,1800	0,0874	1,2062
-17	0,0024	0,2110	0,1009	1,4337
-16	0,0181	1,5775	0,0985	1,4423
-15	-0,0092	-0,7981	0,0804	1,2156
-14	0,0065	0,5683	0,0896	1,4018
-13	-0,0138	-1,1998	0,0830	1,3486
-12	0,0074	0,6436	0,0968	1,6367
-11	0,0081	0,7074	0,0894	1,5789

-10	0,0261	2,2746	0,0813	1,5055
-9	-0,0106	-0,9250	0,0552	1,0769
-8	-0,0149	-1,2934	0,0658	1,3622
-7	-0,0318	-2,7669	0,0807	1,7851
-6	0,0080	0,6935	0,1124	2,6880
-5	-0,0122	-1,0620	0,1045	2,7359
-4	0,0208	1,8131	0,1167	3,4160
-3	0,0649	5,6482	0,0958	3,2403
-2	0,0029	0,2545	0,0310	1,2819
-1	0,0280	2,4405		
0	-0,0115	-0,9970		
1	-0,0149	-1,2976		
2	-0,0306	-2,6673	-0,0455	-1,8860
3	0,0028	0,2412	-0,0428	-1,4462
4	0,0092	0,8010	-0,0336	-0,9830
5	0,0087	0,7539	-0,0249	-0,6524
6	-0,0056	-0,4877	-0,0305	-0,7295
7	0,0154	1,3378	-0,0151	-0,3353
8	0,0042	0,3632	-0,0110	-0,2272
9	0,0054	0,4743	-0,0055	-0,1079
10	-0,0031	-0,2731	-0,0087	-0,1605
11	-0,0024	-0,2079	-0,0111	-0,1952
12	0,0006	0,0549	-0,0104	-0,1762
13	-0,0202	-1,7568	-0,0306	-0,4971
14	0,0112	0,9769	-0,0194	-0,3033
15	0,0120	1,0476	-0,0073	-0,1111
16	-0,0078	-0,6783	-0,0151	-0,2216
17	0,0188	1,6406	0,0037	0,0526
18	0,0002	0,0191	0,0039	0,0542
19	-0,0030	-0,2580	0,0010	0,0129
20	-0,0231	-2,0140	-0,0222	-0,2903
21	-0,0008	-0,0657	-0,0229	-0,2930

22	-0,0150	-1,3047	-0,0379	-0,4734
23	0,0297	2,5823	-0,0083	-0,1008
24	-0,0114	-0,9932	-0,0197	-0,2350
25	-0,0068	-0,5947	-0,0265	-0,3103
26	-0,0102	-0,8871	-0,0367	-0,4213
27	-0,0061	-0,5294	-0,0428	-0,4820
28	0,0096	0,8362	-0,0332	-0,3670
29	-0,0041	-0,3560	-0,0372	-0,4050
30	0,0033	0,2877	-0,0339	-0,3629