ANALYSIS OF MACROECONOMIC DRIVERS OF STOCK MARKET PERFORMANCE PRE AND DURING THE COVID-19 PERIOD: THE CASE OF SOUTH AFRICA

MASTER OF COMMERCE IN ECONOMICS

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by

LOPANG KENNETH GALEHOSE

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SUPERVISOR: PROF IP MONGALE

CO-SUPERVISOR: Dr L TALA

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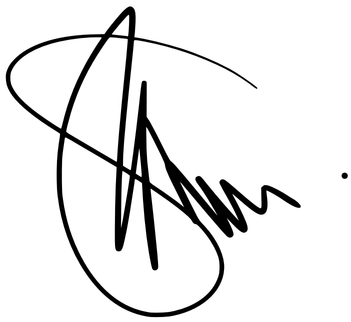
DECLARATION

I declare that "**ANALYSIS OF MACROECONOMIC DRIVERS OF STOCK MARKET PERFORMANCE PRE AND DURING THE COVID-19 PERIOD: THE CASE OF SOUTH AFRICA"** is my work and that all the sources that I have used or quoted have been indicated and acknowledged using complete references and that this work has not been submitted before for any other degree at any other institution.



Lopang Kenneth Galehose 19 December 2024

Full names **Date**

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ABSTRACT

The study analysed macroeconomic drivers of stock market performance for the pre-and during the COVID-19 period. The aim was attained by formulating two models, the pre-and during the COVID-19 models. The study used the Vector Error Correction Model (VECM) to determine how macroeconomic drivers such as, economic growth, exchange rate fluctuations, and stock market liquidity influenced the JSE stock price index during these two distinct time frames. The results revealed that the turnover ratio has a role, exchange rates have complex dynamics, and GDP sensitivity changes. During pre-COVID-19, positive short-term correlations between GDP growth and stock prices were evident, while exchange rate fluctuations exhibited transitory effects. In contrast, the COVID-19 period model unveiled a muted response to GDP, increased sensitivity to exchange rate shocks, and a heightened influence of the turnover ratio in sustaining market stability. This study adds to the understanding of the behaviour of the South African stock market and provides a methodological framework for future research on the intricate interactions between financial markets and macroeconomic drivers.

KEY CONCEPTS: South Africa, VECM, Macroeconomic drivers, stock price index, the COVID-19 pandemic.

TABLE OF CONTENTS

ACRONYMS

ADF	Augmented Dickey-Fuller test
APT	Arbitrage pricing theory
ARDL	Autoregressive Distributed Lag
CAPM	Capital Asset Pricing Model
CLRM	Classical linear regression model
CLRM	Classical linear regression model
COVID-19	Coronavirus Disease 2019.
CPI	Consumer price index
CUSUM	Cumulative sum
CUSUMSQ	Cumulative sum squares
DSGE	Dynamic Stochastic General Equilibrium
ECM	Error Correction model
ECT	Error correction term
EXCH	Exchange rate
FDI	Foreign direct investment
GDP	Gross Domestic Product
JSE	Johannesburg Stock Exchange
LQDT	Liquidity of the stock market (turnover)
OLS	Ordinary least squares
PP	Phillips Perron test
RGDP	proxy of economic growth

SARB	South African Reserve Bank
SPI	Stock Price Index
VAR	Vector Autoregression

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1 Introduction

The COVID-19 virus outbreak, declared a world pandemic (Sohrabi, Alsafi, O'Neill, Khan, Kerwan, Al-Jabir, Losifidis, Agha, 2020), had a wide spread negative effect on South Africa, similar to other world economies. The immediate, aggressive lockdowns by most nations to limit the spread of the transmission of the novel coronavirus immobilized economic activity and thwarted additional growth for the world economy. While most stock exchanges were open for business during the shutdown, the impact of COVID-19 on economic activity had many market investors nervous.

Mazur, Dang, and Vega (2020) highlight how many industries thrived while others took more impact due to massive structural changes in economic activity. Most businesses that thrived were technology and logistics, while businesses that saw the negative impact were the hospitality, travel, and tourism sectors. As a result, Rashid and Pitterle (2021) affirm the possibility that the pandemic generated a disconnection between asset values and the pricing of the financial market.

From individuals to large institutions, the stock market serves as a crucial allocator of capital within an economy because it encourages saving by offering opportunities to work or invest money. The opportunity is for individuals whose income exceeds their expenditures and who lack the time to devote to investment initiatives they want to launch or to large institutions with large amounts of money on hand seeking to hedge against the yearly erosion of buying power that comes with inflation. To encourage savers to enhance their savings by taking advantage of market possibilities and provide sufficient money for businesses to make investments and maintain their operations, investing in the stock market remains one of the best investment options available (Ho, 2019)

Agyemang-Badu (2022) highlights that since the early 1990s, the African capital markets have undergone significant growth. Only five stock markets existed in sub-Saharan Africa and three in North Africa before 1989. There are currently 29 stock exchanges in Africa, ranging from new ones like those in Uganda and Mozambique to established ones like those in Nigeria and Johannesburg, with the Johannesburg

Stock Exchange being the largest. Between 1992 and 2020, the capitalisation of most African stock markets, except South Africa, doubled. Throughout its 130-year existence, the JSE has been a marketplace for trading financial instruments, bringing together buyers and sellers in the equities, derivatives, and debt markets.

Mesagan (2021) denotes that excessive global volatility can affect economic growth, particularly in the African economy. A higher cost of borrowing capital is one such effect due to higher funding costs in a volatile economy. Others include higher precautionary savings, reduced or delayed investment (due to increasing uncertainty and worse demand expectations), and higher precautionary savings. Global volatility increased due to the COVID-19 outbreak, much like it had during prior periods of financial crisis (Cesa-Bianchi, Pesaran and Rebucci, 2020).

Furthermore, Mesagan, Vo, and Amadi (2021) and Akinmade et al. (2020) argue that Stock Markets in emerging economies have not optimally taken advantage of the opportunity to drive economic expansion. Such expansion is due to many difficulties, including dishonest and aggressive trading methods. As a result, the equity markets in emerging nations frequently struggle to take full advantage of this potential. Several studies have also shown that the global financial crisis, weak structure, governance, trade deception, and a shortage of market efficiency due to incomplete information have all contributed to the country's stock market's inefficiency. These factors include insider trading, illegal sales of stocks, and trade manipulations.

Kowalewski and Piewanowski (2020) indicate that stock markets were created to finance businesses using short-term financing because of technological advancements and by paying for government expenditures in the industrialised world's economy. In recent times, financial market systems have been classified into two categories. The alternative, by Germany, is a mix of the Anglo-Saxon market- and lender models, which have been capitalist economies and allow for private investment and private ownership, serve as additional examples of this split. It is the bank-based model that Eastern European nations have used most frequently. The Johannesburg Stock Exchange, much like the stock exchanges in the UK and USA, falls under the market-based system due to the comparable long-term growth rates (Masoud, 2013).

1.2 Statement of problem

Wealth protection amidst macroeconomic fluctuations remains the main target for individuals, wealth managers and businesses. The stock market is one of the institutions which measure and direct investments. As expected, the South African stock market was negatively affected by the COVID-19 pandemic and was accompanied by an economic decline. However, the sharp decline in the JSE All-share index performance did not last for a long. This is in line with Marfatia (2023) who argued that the stock market and economic performance often have a favourable link. This unconventional increase in performance of the stock market performance during a time of economic decline contradicted economic theory as noted by Mohtadi and Agarwal, (2004), Kurach (2010), Pradhan et al., (2014), Wongbangpo and Sharma (2002), Manasseh et al., (2017), Adjasi and Biekpe (2006). As a result, it warrants further investigation and analysis, particularly for the South African economy.

Figure 1.1: JSE All-share index performance pre- and during COVID-19

Source: JES (2022)

As depicted in Figure 1.1 the JSE All Share index followed a statistically normal trend between 55 000 and 60 000 points. However, with the advent of the COVID-19 pandemic in 2020, Figure 1.1 depicts that on the 21st of February, the trend fell sharply from 57 700 to 38 600 points on March 18th, 2020, signifying a 67% sharp decline. The observed behaviour of major financial indexes requires a thorough investigation of the underlying dynamics, especially during economic turmoil. The intricate nature of these patterns highlights the significance of conducting a comprehensive examination to understand the complexities of stock market behaviour during economic crises. Hence, there is a strong scholarly need to investigate these events, enabling a more comprehensive comprehension of the fundamental mechanisms that drive the dynamics of financial markets.

For the risk to be minimised, economic intelligence regarding the past behavioural patterns of the stock market needs to be analysed and understood to better hedge against risk. Studies by Ho (2017 and 2019) shed more light on this but, lack a direct link comparing the stock market performance for pre-and during the COVID-19 pandemic period.

1.3 Aim and objectives of the study

This subsection covers the purpose of the study.

1.3.1 Aim of the study

The study aims to investigate the relationship between the performance of the JSE stock price index and the macroeconomic drivers of the stock exchange pre and during the COVID-19 pandemic period.

1.3.2 Objectives of the study

For this study to achieve its aim, pre- and during the COVID-19 periods econometric models will be developed. Therefore, the objectives are presented as follows,

- To ascertain the impact of stock market liquidity on the JSE stock market price index.
- To assess how economic expansion affects the JSE stock market price index.

- To ascertain the exchange rate's impact on the JSE stock market price index.
- To examine the short-term impulse response of the Stock price index to a 10% shock in GDP growth, exchange rate and turnover volume over 10 periods (months).

1.4 Research questions

- How did the stock market's liquidity affect the JSE stock market price index?
- How does economic growth affect the JSE stock market price index?
- What is the influence of the exchange rate on the JSE stock market price index?
- What is the short-term impulse response of the Stock price index to a 10% shock in GDP growth, exchange rate and turnover volume over 10 periods (months)?

1.5 Definition of key concepts

- **JSE stock price index**

The primary index of the South African stock exchange is The Financial Times Stock Exchange/JSE All Share index. It includes the largest and most valuable firms listed on the JSE's main board, which accounts for nearly 99 percent of all JSE-listed companies by market capitalisation (JSE, 2022).

- **Liquidity of the stock market (turnover ratio)**

The turnover ratio is used to analyse the stock market liquidity. The value of domestic share trading on the domestic exchange divided by the value of domestically listed shares gives the turnover ratio formula. Several writers have used this proxy to gauge stock market liquidity, including Levine and Zervos (1996), Minier (2003), Ben Naceur et al., (2007), and Billmeier and Massa (2009).

- **Economic growth**

The economic expansion may be determined by looking at the real GDP growth. This measure has also been used to quantify the economic growth in various studies such as Levine and Zervos (1998), Deb and Mukherjee (2008), and Carp (2012).

- **Exchange rates**

The nominal effective exchange rate is used to calculate the real effective exchange rate index, which measures a currency's value concerning a weighted average of several distinct foreign currencies. The nominal effective exchange rate is obtained by multiplying the nominal effective exchange rate by a price deflator. The study of various academics, including Calvo et al., (1993), Abdalla and Murinde (1997), and Chou (2000), employed this measurement.

1.6 Ethical considerations

This study does not condone nor add to anything that may result in human harm or illegal activity. All sources have been cited as well as due credit accredited to other authors' contributions, as such there are no ethical concerns that have been applied to the proceedings of this study. This study used secondary data freely available for public consumption from the Johannesburg Security Exchange, Quantec Easy Data and South African Reserve. As per the requirement of the University of Limpopo, the researcher received permission to do research endorsement from the Turfloop Research Ethics Committee.

1.7 Significance of the study

The relationship between macroeconomic factors, stock performance and prices, has been the subject of extensive research using a variety of approaches for developed nations. However, the literature review has revealed limited research on this area in the South African context. The uniqueness of this study is its focus on economic drivers of stock market performance before and during the COVID-19 pandemic analysis. Unlike Ho (2017 and 2019), who focused on the macroeconomic drivers of the stock exchange, this study takes it further by analysing and comparing how macroeconomic factors impacted the stock exchange performance pre-and during the COVID-19 era by identifying the similarities as well as differences in behavioural patterns during the two periods. Also, unlike Ho (2017 and 2019) as well as Yusuf, Salaudeen and Agbonrofo (2021), this study utilises the JSE all-share index as the dependent variable which accurately reflects the state of the South African stock market since it accounts for more than 99% of the market capitalisation of all JSE-listed businesses (JSE, 2022)

The outcomes are intended to yield insights that can inform the development of national policies, provide guidance to businesses and investors during crises and contribute to academia.

1.8 Structure of the study

This study is organised into 6 chapters. Chapter 1 focuses on the introduction and background as well as addressing the statement of the problem and the overall aims and objectives of the study. Chapter 2 examines how the pandemic affected the financial markets of various countries and how those markets managed to survive it, which also includes the case of South Africa. Chapter 3 delves into the literature review by focusing on the core theoretical framework of the topic and some important empirical literature related to the study. Chapter 4 presents data and sources, model specification and estimation techniques utilised for analysis. Chapter 5 presents discussions and interpretations of the findings of the study. Lastly, Chapter 6 offers a summary of results, recommendations, and a conclusion of the study.

CHAPTER 2 OVERVIEW OF THE IMPACT AND RESPONSE TO COVID 19 BY VARIOUS COUNTRIES

2.1 Introduction

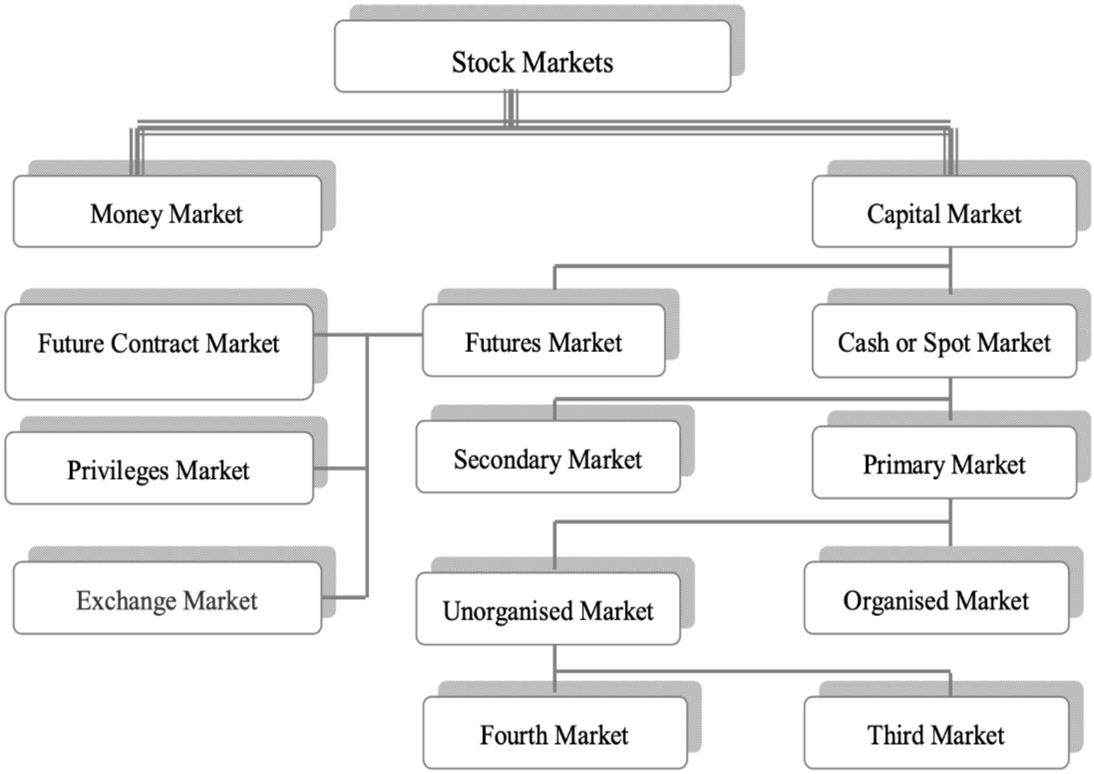
This chapter focuses on how countries' financial markets were impacted by the pandemic and, how they navigated through it.

2.2 The Structure of the Stock Market

Stapley (1986) indicated that a stock market is a sophisticated exchange where goods like stocks and shares are traded. Additionally, it is crucial for the growth and development of a robust and thriving economy. Every economy goes through fundamental changes, including replacing an antiquated, rigid banking system with one that is more flexible, secure, and able to withstand shocks, volatility, and a decline in investor confidence. On the other hand, Mishkin and Eakins (2003) viewed a stock as a type of trading tool representing a stake in a company's earnings and assets.

Gitman, Joehnk, Smart and Juchau (2015) maintained that the American economy's most frequently monitored market is the stock exchange, where shares of stock representing claims on firm earnings are traded. Figure 2.1 depicts different subcategories of stock markets, including cash or spot markets, futures markets, markets for short-term debt instruments (the money market), and markets for longer-maturity financial assets (the capital markets).

Figure 2.1: Structure of the Stock Market



Source: Handay (1997)

As indicated in Figure 2.1, stock is divided into two main categories, money and capital markets. Eldomiaty et. al (2020) argued that the money market has always been a bustling marketplace where new buyers and sellers present their wares daily. Given the substantial rise in interest rates after 1970, its significance has grown. These interest rates are typically rather fluid. Short-term rate hikes in the late 1970s and early 1980s, combined with a capped interest rate that banks could provide depositors, led to a dramatic reduction in the money held by financial institutions. To make matters worse, this situation led to the collapse of several financial institutions including savings and loans.

The capital markets are regarded as where equities are exchanged and financial securities with maturities of a year or more are bought and sold. Because they can estimate their potential flexibility precisely, banking institutions, insurance companies, and pension funds typically own assets in the market like stock and long-term bonds. In that sense, the financial instruments are classified as either offering participation in the future profitability of the company's chrematistics or a commitment to provide cash flow over time (Fama, 1990).

The stock market ought in principle to speed up growth in the economy by injecting personal savings and adding to the quanity and quality of investment (Singh, 1997). Goldsmith (1969), Shaw (1973) and King and Levine (1993) indicate that financial intermediation tends to have a positive influence on the efficiency of the economy. However, this previous study is grounded on aggregate information of the structure of the financial system. They have not addressed, in specific terms, the role that stock markets can play in pushing up economic growth.

2.3 Stock market in developed economies

This subsection provides an analysis of the impact of the COVID-19 pandemic on the stock markets in developed economies. Particular attention is paid to the measures implemented to mitigate the pandemic’s impact in the listed countries.

2.3.1 United States and Japan

The United States' stock markets, boasting the world's largest economy, experienced immense volatility during the COVID-19 pandemic (Park, 2023). Despite good economic fundamentals motivating initial confidence, the quick spread of the virus and accompanying lockdown measures led to extraordinary market volatility. To stabilise financial markets and aid with economic recovery, the Federal Reserve enacted aggressive monetary policies. These measures included lowering interest rates and engaging in quantitative easing (Rahman et al. 2020). Although the stock market in Japan experienced difficulties during the pandemic, these difficulties were not as severe as those experienced in other affluent countries (Cevik et al., 2022). The country's modern healthcare infrastructure and proactive containment measures contributed to reducing the virus's spread and minimising the disruptions to economic activity (Nguyen, 2023). However, Das (2020) underscores that a decline in global demand and disruptions in supply chain operations still impacted Japan's heavily export-dependent economy, leading to stock market volatility.

2.3.2 Germany and the United Kingdom

Germany as the sole European economy with the highest output, recorded massive shrinkage in economic output during the COVID 19 pandemic (Zhang and Hamori, 2021). A nation’s stock market, especially susceptible to disturbances in global commerce as it was built on its export-oriented manufacturing sector, was particularly susceptible to these disturbances (He et al., 2021). Government stimulus measures and European Central Bank monetary policy, however, stabilised the financial markets, but the uncertainty about how long and how much things would get bad kept investor mood from stabilising (Kacperska and Kraciuk, 2021).

The United Kingdom, one of the main financial centres, met its share of difficulties during the COVID 19 pandemic. In addition to the setting which the pandemic had created for the country’s economy, the decision of the country to withdraw from the European Union (popularly known as "Brexit") has increased the complexity of its economic environment, thus intensifying the destabilizing effect of COVID on its stock market performance (Rakha et al., 2021). The market was volatile as a result of lockdowns, as well interruptions to international trade and travel, and required unprecedented policy adjustments from the Bank of England and the government necessitating unprecedented policy actions from the Bank of England and the government (Jallow et al., 2021).

2.3.3 France and Italy

The COVID-19 pandemic could cause economic consequences of France, one of the largest countries in the European Union (Zeren and Hizarci, 2020). The country’s lockdown measures to stop the virus spreading have seen economic activity grind to a halt. It was especially true in hospitality and tourism. Despite having taken measures to stimulate the economy such as giving fiscal stimulus and guaranteeing loans, investor confidence remained weak. Namely, there was ambiguity on how long and how effective would those containment measures be (Ozkan, 2021).

The COVID-19 pandemic severely disrupted Italy's capital market, making it one of the hardest-hit countries in Europe. Delle, Emiliozzi, and Nobili (2021) reflect that the swift propagation of the virus and the subsequent implementation of stringent lockdown procedures had a devastating effect on economic activity, resulting in a decrease in the earnings of corporations and a loss of confidence among investors. Financial constraints and political uncertainty hindered the government's efforts to curb the virus's spread and assist enterprises, leading to heightened market volatility (Matuka, 2022).

2.3.4 Canada, Australia, and South Korea

During the COVID-19 pandemic, the stock market in Canada witnessed volatility. This reflected the country's tight economic links with the United States and its vulnerability to global commodity markets (Rahman, Rahman, and Abedin, 2020). The decrease in oil prices and disruptions to international trade negatively impacted investor sentiment, leading to changes in stock prices across all economic segments. According to Apergis, Mustafa, and Malik (2022), there was a continued lack of clarity over the length of time that the crisis would last, even though the government's support measures, which included income support programmes and liquidity injections, helped alleviate the impact on the economy.

The prohibition on travel and the closure of borders caused significant disruptions in important industries such as tourism and education, which in turn led to a decrease in consumer spending and investment in businesses during the COVID-19 in Australia (Gunay, Bakry, and Al-Mohamad, 2021). Even though the Reserve Bank of Australia took bold steps to ease monetary policy, investor confidence remained weak, reflecting economic recovery concern prospects (Brueckner and Vespignani, 2021). For the duration of the COVID-19 pandemic, the stock market in South Korea has shown remarkable resilience.

Hoshikawa and Yoshimi (2021) denote that this was largely down to the country's efficient containment efforts and robust healthcare infrastructure. Jiang, Park, and Park (2021) further highlight the government’s early response which included broad testing and tracking down contacts, which assisted in reducing the probability of the virus spreading further and minimising the impact it had on economic activities. Compared to other nations' stock markets in the region, South Korea's stock market has maintained a relatively stable level despite external headwinds such as weak global demand and disruptions in supply chain operations (Choi and Jung, 2022).

2.4 Stock Market in Developing Economies

This sub-section provides an in-depth analysis of the pandemic impact in developing countries and the strategies they adopted to minimise its effects.

2.4.1 China

Through tough containment measures and focused economic stimulus, China, the second-largest economy navigated the COVID-19 pandemic. During the COVID-19 pandemic, the stock market in China experienced substantial instability, first witnessing severe falls amid widespread uncertainty and dislocation in the economy (Najaf and Chin, 2024). However, Sansa (2020) denotes the rapid and comprehensive policy actions, which included fiscal stimulus measures, monetary easing, and targeted support for impacted sectors and played a vital role in stabilising the economy and restoring investor confidence. It was also possible for China to assist in a relatively speedy recovery because of its solid healthcare system and effective containment procedures, which helped to reduce the spread of the virus.

Liu, Huynh, and Dai (2021) attribute China's endurance and adaptation to the fact that certain industries, notably technology and healthcare, flourished despite the hurdles present throughout the pandemic. In the future, maintaining China's economic momentum and creating long-term stability in its stock market would require continuous policy support, structural reforms, and international cooperation, as this is the most important factor (Liu et al., 2020).

2.4.2 India and Brazil

During the COVID-19 pandemic, the stock market in India saw high volatility (Patel, Patel, and Patel, 2024), which reflects the country's big and diverse economy. The stringent lockdown to contain the virus caused disruptions in supply chains and consumer demand decrease, ultimately resulting in a slowdown in GDP expansion.

Despite efforts to stimulate the economy, the Reserve Bank of India's decision to ease monetary policy, investor confidence remained weak. Such concerns about growing inflation and federal deficits added to the sentiment (Khan, 2024).

One of the largest economies in Latin America went through difficult economic conditions (Costa, da Silva, and Matos, 2022). Consequently, variations in global demand and supply dynamics caused wide swings in the countries stock market that was heavily dictated by commodity pricing and investor emotions. In addition, da Silva (2023) points out that the impact of the crisis was even more damaging for Brazil, given that the country relied too much on outside financing so as also a highly vulnerable structure, triggered the outflow of capital and the devaluation of the country's currency.

2.4.3 Nigeria and Egypt

Volatility in the stock market in Nigeria during the era of the COVID 19 pandemic was tremendous (Yusuf, Salaudeen, and Agbonrofo, 2021). It was a reflection of the country's dependence on oil exports and vulnerability to shocks from the outside world. The oil prices steep drop combined with the introduced lockdown procedures and supply chain disruptions operations had a great effect on investor’s sentiments (Agunobi et al., 2024). @further, limited fiscal space and structural constraints (Osasogie and Joseph, 2024) made the virus difficult for the government to contain and revive the economy.

The stock market in Egypt was volatile during the pandemic (Allam, Abdelrhim, and Mohamed, 2020). The changes in the variables of domestic factors such as government action and global economic variables are responsible for these changes. Collectively, the nation’s attempts to curtail the spread of the virus and also those to aid businesses softened the impact the disease had on the performance of the stock market (Barakat, 2022). While Elgharib (2023) recognizes that tourism and investment profits from various countries still remain uncertain, this hindered the countries' efforts to recover the economy.

2.4.4 Kenya and Ghana

The Kenyan stock market experienced volatility during the COVID-19 pandemic (Takyi and Bentum-Ennin, 2021). This reflects the country's vulnerability to both domestic and international economic trends. Bayero, Safiyanu, and Bakabe (2021) noted that the lockdown implementation procedures and disruptions to essential industries like agriculture and tourism further contributed to the market's uncertainty. Initiatives by the government to assist people and companies helped mitigate the damage but concerns about budgetary sustainability and debt levels persisted (Insaidoo et al., 2024).

During the pandemic, internal and external factors caused oscillations in Ghana's stock market (Kuranchie-Pong and Forson, 2022). According to Askandir, Bondzie, and Tweneboah (2024), because of the country's extensive reliance on commodity exports and remittances, it was susceptible to fluctuations in the demand and supply dynamics of the global market. As affirmed by Nayo and Atsi (2022) international assistance supported the government's efforts to contain the pandemic and encourage economic recovery. However, structural difficulties such as high debt levels and inflation raise concerns about long-term stability.

2.4.5 Morocco and Botswana

It was during the COVID-19 pandemic that Morocco's stock market had difficulties (Bouhlal and Sedra, 2022). Morocco's high reliance on tourism and foreign investment exacerbated these difficulties. The travel restrictions and the closure of borders had impact on important economic sectors, which led to a decrease in the stock market's performance (Beraich, Fadali, and Bakir, 2021). Agouram and Lakhnati (2022) mention that although the negative impact on the economy was reduced because of government attempts to support enterprises and encourage domestic consumption, there was still a lack of clarity over the length of time the crisis would last.

Botswana's stock market faced unprecedented obstacles due to the COVID-19 pandemic. These challenges reflected the country's reliance on essential industries such as mining, tourism, and diamond exports (Bayero, Safiyanu, and Bakabe, 2021). Botswana's stock market saw tremendous volatility because of the severe impact that dramatic decrease in worldwide demand and disruptions to international travel had on economic activity. Bédi (2024) informs us that despite the attempts of the government to contain the infection and provide support to firms through fiscal stimulus measures and changes in monetary policy, investor confidence remained shaky. Furthermore, structural vulnerabilities like high unemployment and reliance on foreign markets exacerbated the economic impact of the crisis. Moving forward, it will be critical to diversify the economy, investments in healthcare infrastructure, and reform policies to strengthen Botswana's resilience to future crises and encourage sustainable economic growth (Owusu, 2020).

2.4.6 South Africa

The financial sector of the South Africa is one of the most valuable sectors of the country’s economy. It provides services in relation to financial flow, investment promotion, and enhancement of the economy. It is a key participant of the African market due to the progressive infrastructure, a wide range of services, and protection legislation.

JSE plays a significant role in South Africa financial market and act as a central place for the SA capital market. The JSE offers two avenues of accessing capital; these include secondary offers and IPOs. When floated it offers the companies a way to raise capital needed for expansion, new projects, or other goals. The South African capital markets also consist of the bond market along with the equity market The South African capital markets also consist of the bond market along with the equity market. The following allows for the flotation of bonds and for corporate and government securities or debt instruments to be traded Within this market: In addition, Zhou and Ridge (2023) affirm computerised trading platforms that have transformed the financial goods sector. Market liquidity or people participating are up since investors may engage capital markets from any part of the globe.

The capital markets in South Africa are fundamentally regulated. The market activities are regulated by the Financial Sector Conduct Authority (FSCA), and the JSE ensures that regulations and laws are observed. These institutions seek to encourage the right conduct and free access to trading, protect shareholders and investors, and maintain free, competitive, and transparent market systems (Khetsi, 2014).

The South African capital market generally presents an efficacious and vigorous setting for money raising, investments, and risk management. In this way, they contribute to the nation's welfare by enhancing capital availability, making people and organisations put their capital in financial instruments. The capital market growth will impact the financial structure and enhance the overall objective of the economic growth. The South African financial industry is an extravagant and affluential industry imperative for economic enhancement, executing financial-related processes and providing crucial services to consumers and companies. Due to various components, strict regulation, and adaptation of many segments of the South African Republic's financial sector, it remains in demand. It actively influences the further development of the country's economy (Adedokun and Olaniyi, 2021).

As the top stock exchange in South Africa, the JSE enjoys prominence in the domestic and international markets. As the largest and most liquid stock exchange on the African continent, the JSE is well-known internationally and serves as a point of entry for foreign investors to get exposure to the continent's markets. Due to its wide variety of investment options, JSE draws domestic and foreign participants eager to capitalise on the continent's potential for economic growth (Ho, 2019).

The Headline Category includes the Top 40 Index (J200), the Mid Cap Index (J201), the Small Cap Index (J202), the Fledgling Index (J204) and the All-Share Index (J203), of which are the five indices. They are comprised of JSE Main Board qualified instruments classified according to market capitalisation. The market capitalisation of eligible securities on the JSE Main Board is represented by All-Share Index to about 99% degree. It also breaks down the All-Share Index into the Top 40, Mid Cap and Small Cap Indices according to the size of the company. Not all markets are reflected in the JSE All-Share Index (ALSI). It consists of 164 top publicly traded businesses that between them account for all of the market’s size and liquidity.

Zalk (2021) indicates that the JSE is crucial in assisting local businesses with capital raising and advancing their expansion goals. Companies can access a large pool of investors and raise money for purposes like organic expansion, acquisitions, and strategic initiatives by listing on such a market. The JSE's equity market gives businesses opportunities to increase their visibility, draw in institutional and individual investors, and unleash hidden value.

Agyemang-Badu (2022) opined that the African markets for capital have seen tremendous growth over the early 1990s. Only five stock markets existed in sub–Saharan Africa and three in North Africa before 1989. All in all, there are 29 stock exchanges in Africa, with the JSE the biggest. The spectrum on which these exchanges exist ranges from Uganda and Mozambique, brand new, to Nigeria and

Johannesburg, older. With the exception of South Africa, market capitalisation more than doubled for most African stock markets between 1992 to 2020. In its 130 years of existence, the JSE has been a place for the trading of financial instruments (‘trading’ coalescing buyers and sellers) in the equities, derivatives and debt markets.

Mesagan (2021) denotes that excessive global volatility can affect economic growth, particularly in Africa. One of these stems from greater funding costs in an unstable economy, which raises the cost of capital borrowing. Other factors include increased savings as a precaution, decreased or postponed investment (due to growing unpredictability and worsening demand projections), and increased savings as a precaution. The widespread COVID-19 pandemic caused a spike in global volatility, much like it had during prior periods of the financial crisis (Cesa-Bianchi, Pesaran and Rebucci, 2020).

Furthermore, Mesagan, Vo and Amadi (2021), and Akinmade et al., (2020), argue that Stock Markets in emerging economies have not optimally taken advantage of the opportunity of driving economic expansion. This is a result of many difficulties, including dishonest and aggressive trading methods. As a result, the equity markets in emerging nations frequently struggle to take full advantage of this potential. Additionally, Mesagan, et al (2021) have shown that the global financial crisis, weak structure and governance, trade deception, and a shortage of market efficiency brought on by incomplete information have all contributed to the country's stock market's inefficiency. These factors include insider trading; illegal sales of stocks; and trade manipulations.

Kowalewski and Piewanowski (2020) indicate that stock markets were created to finance businesses using short-term financing because of technology advancements and to pay for government expenditures in the industrialised world's economy. In recent times, financial market systems can be classified into two categories, the alternative, mostly shown by Germany, is a mix of the Anglo-Saxon market- and lender models, which have been capitalist economies and allow for private investment and private ownership, serve as additional examples of this split. It is the bank-based model that Eastern European nations have used more frequently. The JSE, much like the UK and USA stock exchanges, fall under the market-based system due to the comparable long-term growth rates (Masoud, 2013).

The COVID-19 pandemic influenced the South African economy, causing interruptions and difficulties in several sectors. The decline in economic activity has been one of the most obvious results. Lockdown procedures, travel restrictions, and social segregation policies resulted in decreased consumer spending, company closures, and supply chain disruptions. As a result, South Africa saw its biggest economic recession in decades and a steep decrease in GDP growth (Sohrabi, Alsafi, O'Neill, Khan, Kerwan, Al-Jabir, Losifidis, Agha. 2020).

The pandemic caused serious damage to employment as well. Many businesses had to reduce employee salaries or lay off staff to survive the economic downturn. This caused the unemployment rate to soar, worsening the nation's poverty. Most of the effects were felt by vulnerable populations, such as unorganised employees and people working in the tourism and hospitality industries. The South African economy's fundamental vulnerabilities, including high levels of economic inequality and restricted access to healthcare services, were made apparent by these difficulties. The crisis made it clear that these issues require more attention. An important segment of the workforce, the informal sector, experienced unique challenges since its employees frequently had trouble accessing social safety programs (Zalk 2021).

Mazur, Dang and Vega (2020) highlighted that some industries thrived while others took more impact due to massive structural changes in economic activities. Most of the businesses that thrived were from technology and logistics while businesses that saw the negative impact were hospitality, travel and tourism sectors. As a result, Rashid and Pitterle (2021) affirm the possibility that the pandemic generated a disconnection between asset values and the pricing of the financial market

In conclusion, the COVID-19 pandemic had a major effect on the South African economy, causing a decline in economic activity, rising unemployment, and exposing pre-existing structural flaws. Lockdown procedures and other limitations led to sectoral disruptions, decreased consumer spending, and firm closures. Increased wealth inequality and restricted access to healthcare services became more obvious, while the unemployment rate increased, particularly impacting vulnerable groups. A durable recovery will depend on addressing these issues and enhancing the economy's resilience.

2.5 Summary

The market, in general, and the stock exchanges have been among the areas most affected by the COVID-19 pandemic. The crisis has been ever more unique, causing significant fluctuations and unpredictable changes in the stock market, differing in each country.

The outbreak of COVID-19 brought into focus the shifts that occurred in the interconnected international financial system as well as proved that macroeconomic factors significantly affect the operations of the stock markets across the world. That is why in the process of the crisis it was revealed that even in the framework of pre-existing financial systems there were the existing of such vulnerabilities when anyway the nations were facing challenges starting from instability up to the recovery one. Policymakers and investors should do the same in the future and should keep the eye on the macroeconomic indicators so that they can adopt right strategy amidst such unfamiliar conditions. Being as such, the specifics of building material and human capital as well as global cooperation and support are imperative to the journey of resilience and recovery. The enhanced comprehension of the flexibility of the investment options available together with the respect for the differing socioeconomic states will help the stakeholders counter the challenges that post pandemic world poses.

CHAPTER 3

LITERATURE REVIEW

3.1 Introduction

Macroeconomic factors are explained and the theoretical and empirical analysis of their effect on the stock market returns is presented in this chapter.

3.2 Theoretical Framework

This section explores theories on principles of stock market performance. They include theories such as the market efficiency theory, McKinnon's (1973) and Shaw's (1973) theories and The Capital Asset Pricing Model (CAPM) by Sharpe (1958).

3.2.1 Market Efficiency Theory

According to the principle of market efficiency, a market is logical and offers accurate pricing. That is, due to the buy-and-sell activity of arbitragers or sensible investors buying and selling under-priced or overstocked equities, the present prices of assets are relatively near to their underlying values. On the other hand, this claim is contested by observable market anomalies. Fama (2000) defined an efficient market as one in which prices accurately represent all the information. This includes past pricing, publicly accessible information, and all knowledge, including private information. If the three sets of information above are available, the efficient market hypothesis is separated into three stages, namely, the weak, semi-strongand strong forms.

The weak form of efficiency states that past market statistics, like prior prices and trading volumes, are virtually completely reflected in current stock prices (Bodie et al., 2007). Given that price changes from one period to the next are independent, the assumption of the weak form of efficiency is extremely compatible with studies on the random walk hypothesis (Adam and Tweneboah, 2008). The semi-strong form of efficiency claims, and fundamental information should all be completely represented in security prices. The strong forms of efficiency contend that market prices accurately reflect all information, including historical prices, all publicly available information, and all private information. Prices in such a market would always be equitable, and any investor or trader outperform it.

3.2.2 McKinnon and Shaw's theory

McKinnon (1973) and Shaw (1973) suggested that real interest rates may raise investment demand without increasing investment if held under the market equilibrium. If substitution effects outweigh the income effect for families, low interest rates might lower savings. Low interest rates, however, boost the projected profitability of investment projects by raising the project's net present value of future earnings. According to the theory, investing reduces as a function of the real loan interest rate and grows as a function of the growth rate. On the other hand, saving increases as a function of the real growth rate in output and the real interest rate on deposits. According to this view, policymakers should set a permanent ceiling on the nominal interest rate. They argue that since developing economies are so dispersed, investments are more likely to be inefficient.

A substantial inflation rate makes the nominal interest rate extremely low, and the real interest rate may even be negative. This discourages the accumulation of capital. For investment projects, people come up with the money or turn to the unregulated informal sector, which often has usurious interest rates. The reason is that the banking industry's capital supply is constrained, and banks only engage in specialised loan operations.

3.2.3 The Capital Asset Pricing Model (CAPM)

According to Perold (2004), it is the CAPM a popular financial theory linking an asset's expected return to system risk. CAPM gives an understanding on asset pricing and portfolio employing. It was developed in the mid-1960s by William Sharpe, John Lintner and Jan Mossin. The main points of the CAPM theory, the presuppositions, and the implication for the financial world.

Sharpe (1964) highlights that the CAPM offers a structured way to evaluate the expected asset returns by risk and reward balancing. The CAPM postulates that investors ought to be compensated for taking on risk over and beyond the rate of return on risk-free investments. The risk premium, also referred to as compensation, changes according to the beta of an asset and the market risk premium.

Fama and French (2004) indicate the CAPM inhibits the following assumptions:

- Efficient Markets: In the CAPM framework, it is assumed that markets function effectively, which implies that asset prices absorb all available information promptly and accurately. As a result, the theory contends that discovering mispriced assets and consistently generating excess returns are not realistic.
- Investors who are logical and risk-averse: The CAPM assumes that investors are logical and work to maximise their utility. As a result of their risk aversion, they expect payment for taking on greater risk. When making investing decisions, investors consider the potential returns and dangers various assets. The CAPM consider a single investment term x, which works under the assumption that all investors use the same amount of time to evaluate their investment options.

The following equation can be used to represent the CAPM:

$$E(R_i) = Rf + \beta i(E(Rm) - Rf) \quad \text{............} \quad 3.1$$

Where,

E(Ri) = the expected return of asset I,

Rf = risk-free rate of return,

i = asset

I's = beta, and

E(Rm) = for the market portfolio's projected return.

According to Equation 3.1, the expected return on an asset equal to the risk-free rate plus a risk premium based on the asset's beta and the market risk premium (Sharpe, 1958).

Fama and French (2004), Perold (2004) and Merton (1973) have highlighted the following criticism and limitation of the CAPM:

- Simplified Hypotheses: It was developed based on assumptions like efficient markets, rationality, and information effusion to investors. These presumptions, however, may only sometimes be true, significantly when distorting behavioural biases and market anomalies impact asset valuation.
- Single-component Model: The CAPM focuses on systemic risk captured by beta and posits that the senior market element defines how much an asset will earn. This also rules out other influential factors, such as macroeconomic factors or factors unique to a particular firm that may affect the prices of these assets.
- Issues with Input Estimation: The expectation, as discovered in the CAPM, is influenced by the precision in determining some parameters, such as beta, projected market return, and the risk-free rate. The estimation of these variables may not always be accurate and may involve a high level of errors, and as such, the model's projections may not be satisfactory.
- Limited Applicability to Diversified Portfolios: However, the CAPM has many more restrictions when applied to a diversified portfolio than to individual assets. This is because the analysis assumes that investors hold one risky asset and a risk-free asset and thus need to take into account the most prominent resource, which is diversification. However, investors often hold diversified portfolios, and thus, the CAPM's forecasts can be off the mark.
- Neglects Non-Market Risks: Since the CAPM only focuses on systematic risk, it does not expressly account for idiosyncratic factors or company-specific occurrences. These non-market risks offer new sources of risk that the CAPM misses and have a major impact on asset returns.
- Limitations of previous Data: The CAPM uses previous data to calculate predicted returns and betas. However, historical data may not correctly reflect future market conditions, particularly in periods of considerable economic or financial change.
- Alternative Asset Pricing Models: In contrast to the CAPM, other models of asset pricing, such as the Fama-French three-factor model and the APT, include other factors and covariates to explain return on assets.

3.3 Empirical literature

This subsection specifically deals with the empirical literature on stock market performance by connecting each macroeconomic variable of the stock market to stock performance.

3.3.1 The stock market liquidity influence on the stock market price index

Liu (2015) studied the relationship between time-series fluctuations in stock market liquidity and investor sentiment. The study used Amihud's (2002) liquidity measure in conjunction with two survey-based investor sentiment indices, the research indicates a positive association between market liquidity and rising sentiment indices, showing more liquidity when investors are more bullish. Granger causality tests show that investor sentiment drives market liquidity. Additionally, Uhunmwango and Omorokunwa (2022) analysis shows that market trading volume is increasing in tandem with rising investor mood. Notably, enhanced market liquidity in response to stronger investor sentiment persists even after accounting for market trade volume. These data support the theoretical assumptions that investor sentiment improves stock market liquidity.

Debata and Mahakud (2018) concluded that economic policy uncertainty has a moderate effect on the stock market liquidity during a normal market. Debata and Mahakud (2018) concluded that economic policy uncertainty has a moderate effect on the stock market liquidity during normal market conditions. However, it is also important to point out that it rises significantly as it is a pointer to the period when one organization or country is under serious financial stress. Likewise, the flouting of this policy considerably affects the amount of funds in the stock market regarding the level of economic policy uncertainty. Furthermore, the authors have quantified that a large portion of the variations in stock market liquidity during financial crises are due to the moods of investors. These results underline the importance of the influence of investor's feelings as the main driver of liquidity within the stocks during the financial crisis. According to Chiang and Zheng (2015), the engagement of the EPCC in the research helps to explain the sentiments of investment in the market. They show that economic policy uncertainty affects the market in a way that is stable during normal market conditions; however, it fluctuates and becomes the single most influential force working in tandem with investor sentiment during turbulent periods. From this, policymakers should understand that the mood of investors ought to be taken into account when handling economic policy uncertainties during a crisis.

Gofran, Gregoriou and Haar (2022) examined the volatility and the effect of COVID-19 during the developed, developing and emerging stages of the US, UK, Brazil, China, Germany and Spain concerning equities market liquidity. The study evidence supports the hypothesis that bid-ask spreads increased temporarily due to the pandemic, and there was a reduced availability of liquid assets. For the purpose of assessing long-term profitability, the study utilized price impact ratios, which showed that only the Chinese market had been vulnerable to COVID-19 in the long run. Furthermore, the spread decomposition analysis by Nguyen, Hai and Nguyen (2021) shows that asymmetric information increases in virtually all of the observed capital markets contributing to the spread and is incompatible with a decrease in trading costs linked to the news of the pandemic. This pattern is, in fact, apparent across all examined markets, albeit to an even lesser extent than the Chinese market. The study shows that COVID-19 affected all components of short-term solvency, while the changes in long-term solvency were not significant. Moreover, adverse selection was the key factor contributing to shifts in the liquidity levels in most markets during the pandemic.

Naik and Reddy (2021) aimed to categorize the identified research elements for stock market liquidity determinants, consolidate their important findings and propose a quantitative taxonomy of the reviewed literature for future reference. The study delineates four primary domains of emphasis in the extant literature: definitions of liquidity and measures of it, characteristics affecting liquidity, and the relation between stock market liquidity and expected returns or between market liquidity risk and expected returns. The case studies of Alsufy et al. (2020), Amihud (2002), Debata & Mahakud (2018), and Chiang & Zheng (2015) hypothesize that many factors affect the stock market liquidity, of which some of the key factors include regulatory policy announcements, different investor trading activity, trading update systems in the stock exchange, and company releases. Furthermore, Alsufy, Afifa and Zakaria (2020) assert that influential factors include corporate governance structure, market fluctuations and factors related to the organization alone. Such an argument provides a comprehensive understanding of the mechanisms and determinants and the backward and forward reference points for research in this field.

3.3.2 Effects of economic growth on the stock market price index

Manasseh et al. (2017) conducted a comparative study on Nigeria using the Autoregressive Distributed Lag (ARDL) model to analyse data from 1986 to 2013. Empirical results suggest a significant long-run relation between institutional quality and stock market performance, which in turn drives economic growth (Manasseh et al 2017). On this basis, Tsaurai (2018) furthered the study by including 23 developing economies using data from 1994 to 2014. They give evidence that macroeconomic indicators, including economic growth, savings, trade openness, stock market liquidity, infrastructural development, foreign direct investment (FDI), exchange rates and inflation, have a direct relation to stock market performance. Consequently, these studies emphasize the role of institutional quality and macroeconomic factors as determining factors for stock market success and, therefore, influencing economic growth. Their results validate some key determinants of stock market performance and should be of interest to policymakers and researchers studying emerging market dynamics. Igoni et al. (2020) also found a favourable and statistically significant association between GDP and the Market Value of Nigerian stocks with data periodically assembled between 1985 and 2014.

Ncanywa and Ralarala (2019) analyzed the relationship between stock market prices and exchange rates for South Africa by using monthly data from 2006 to 2016. An analysis using the Johansen cointegration test showed that the relationship between exchange rates and stock market values was persistent. The relationship study is connected to Ho's (2019) macroeconomic research that shows how various macroeconomic variables influence developing and developed markets. These factors have an external influence on stock market prices and market dynamics further determined beyond market mechanics. Adedokun and Olaniyi (2021) further bolster the substantial effect of macroeconomic variables on stock market performance and are in line with worldwide patterns, as evidenced by the correlation between external economic conditions and market behaviour in South Africa.

Monthly data ranging from June 2002 to September 2017 was used by Adedokun and Olaniyi (2021) to study the correlations between the exchange rate and the stock price index in South Africa. These interactions were tested using cointegration and Granger causality tests. The results showed a long-term equilibrium relationship between the stock price index and exchange rate through co-integration. Results of the Granger causality test indicated that there is a two-way causality between the JSE All Share Index and Rand/US dollar exchange rates in the short term. Therefore, fluctuations in the stock price index forecast fluctuations in the exchange rate and vice versa. Furthermore, Javangwe and Takawira (2022) stress that the stock markets and exchange rate changes are positively related and vice versa, stressing the need to include the two factors in the analysis to comprehend the indirect effect each has on the other.

3.3.3 The influence of the exchange rate on the stock market price index

Empirical data shows that exchange rates and stock market price indexes have a complex, situation-dependent relationship. Many of the studies found different correlation values, which vary according to the external economic conditions, the composition of the stock index, and the economic framework in consideration. However, a 2019 study by Lee and Brahmasrene on the South Korean market found that the Korean won and the stock price index showed a strong positive link. However, the reason why this connection exists is primarily due to the fact that South Korean businesses are dependent heavily on export revenue. When the won's value drops, Korean products become more affordable in the world market, raising stock prices and making enormous profits for exporters. The result is consistent with rationalizing the export-driven development model in many Asian nations (Jo et al., 2018).

On the other hand, research conducted in the US market by Bhargava and Konku (2023) exhibits a uniqueness. Its conclusions were, on the whole, that the US dollar and the S&P 500 stock index bore a largely negative correlation: when the dollar is strong, the S&P 500 index tends to go down. This may explain a relationship between a strong dollar and multinational firms that earn significant sales from overseas markets in terms of a relationship between a strong dollar and their impaired financial performance. A more excellent dollar value hurts the dollars that American businesses bring back to the US and hinders the capacity of American goods to compete in foreign markets. This negatively affects stock values (Bhargava and Konku, 2023). This inverse relationship shows how currency value fluctuations will affect the stock market for countries deeply involved in global trade and investment. In addition, the findings from empirical data suggest that the link between exchange rates and the stock market is affected by investor emotion and market expectations.

Suriani et al. (2015) identified that changing the exchange rate could generate more market volatility supervised unsuitably and suddenly. That happens when investors adjust their investment portfolios as needed and relook at the risk tolerance they can take. This most clearly appears when economic uncertainty and currency value fluctuations result from interpretations of broader economic shifts. During the European sovereign debt crisis, the euro lost significantly relative value to the US dollar. Stock indices in Europe were smashed down as investors expressed fears over the economy's stability and default risks. These results call for studying behavioral and psychological factors when an exchange rate affects stock markets (Krishnan and Dagar, 2022).

3.4 Summary

This chapter presents an overview of the stock market, its functions, various theories, and the determinants of stock market performance. These factors include liquidity, economic development, and exchange rate. This stock market overview section discusses market efficiency theory, McKinnon and Shaw's theory, and CAPM. It explores the relationship between Stock Market Liquidity and Stock Market Price Index, looks at the effects of Economic Growth on the Stock Market Price Index, and lastly, looks at the effects of Exchange Rates on the Stock Market Price Index. Overall, these discussions offer a broad understanding of the workings of the stock market, market efficiency, and economic growth models, and factors that influence the stock market's performance.

Ross (2013) asserted that the CAPM remains relevant and is still taught as one of the foundational models in finance because of its simplicity and practicality. This paper aims to enhance the understanding of the limitations of asset pricing and investment decision-making and increase its accuracy through the use of other models and factors.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

This chapter outlines the research design used to analyse the relationships between the macroeconomic factors that determine stock market performance and the South African stock market performance. The chapter also defines data sources, estimation models, and statistics.

4.2 Data

This study used a monthly data time series of three years before the pandemic and three years during the pandemic periods. The Stock price index data was obtained from the JSE, exchange rate data was obtained from Quantec and the GDP and Liquidity of the stock market (turnover) data were obtained from the South African Reserve Bank.

4.3 Model specification

Modelling of this study follows Yusuf, Salaudeen and Agbonrofo (2021) and Ho (2019) who used the stock market performance as a dependent variable of the key macroeconomic drivers' model. The two proposed models are presented as follows,

- Pre-COVID-19 period model (Model 1)

$$SPI = \alpha + \beta_1 LQDT + \beta_2 RGDP + \beta_3 EXCH + \mu \quad (4.1)$$

- COVID-19-period model (Model 2)

$$SPI = \gamma + \delta_1 LQDT + \delta_2 RGDP + \delta_3 EXCH + \epsilon \quad (4.2)$$

Where,

SPI= stock price index of publicly traded South African Companies listed in the JSE

LQDT= Liquidity of the stock market (turnover)

RGDP= is the proxy of economic growth

EXCH= Exchange rate

4.4 Estimation Techniques

This section presents the econometric techniques utilised in this study. They include the stationarity/unit root tests, cointegration analysis, vector error correction model, diagnostic and stability testing, Impulse Response Function and variance decomposition analyses.

4.4.1 Stationarity/Unit Root Test

The stationarity test, which evaluates data for the presence of a unit root (or "non-stationarity"), is the first step of the analysis. Data is non-stationary (has a unit root) if its mean and variance fluctuate with time, while stationary data has a constant mean and variance. When making predictions, it is best to avoid using data that is not stationary (has a unit root) because it tends to follow a certain pattern and might thus lead to inaccurate predictions. Cointegration occurs when the combination of two series (stationary or non-stationary) in a statistical equation yields a stationary error term (Gonzalo, 1994). In the long term, if two variables are cointegrated, their connection has reached equilibrium. This connection is analysed by Johansen's (1991) vector error correction model. The expression for a non-stationary series, commonly known as a random walk is presented as follows,

$$y_t = y_{t-1} + E_r \quad (4.3)$$

The equation depicts a random walk with an error term (Et), the random disturbance term. This model posits that the present value (y_t) is equivalent to the preceding value (y_{t-1}) plus a stochastic error factor (Et). As a result of the accumulation of unpredictable errors, the series demonstrates a growing level of variability with time, rendering it non-stationary. The following equation describes the process of differencing a series to transform the data into a stationary distribution:

$$y_t - y_{t-1} = (1 - l)y_t + E_r \quad (4.4)$$

When a series is differentiated an infinite number of times, it ceases to evolve and assumes an order of integration represented by the symbol I(d), where the order of integration is determined by the differences between terms. To carry out Johansen's (1991) method, non-stationary variables with a unit root must be used. Integration of order form might happen at either the first or second difference. The Augmented Dickey-Fuller and Phillip-Perron tests will identify a unit root on a series.

4.4.1.1 ADF unit root test

Dickey and Fuller (1981) attest that the ADF test employs a negative static, and the greater the static, the more likely it becomes to reject the hypothesis of data possessing a unit root at a specific level of confidence. This is because the probability of rejecting the null hypothesis increases in direct relation to the magnitude of the test statistic. The validity of the examination is supported by three regression equations in the form of "no constant and trend," "just constant," and "constant and trend," respectively. The following is a full explanation of the regression equations:

- $\Delta Y_t = \delta Y_{t-1} + u_t$ (4.5)
- $\Delta \mathrm{Y}_\mathrm{t} = \alpha + \delta Y_{t-1} + u_t$ (4.6)
- $\Delta Y_t = \alpha + BT + \delta Y_{t-1} + u_t$ (4.7)

Where Equation 4.5 stands for "without constant," Equation 6 for "constant," and Equation 4.7 for "constant and trend." The following is the approximated standard equation used in calculating the ADF test:

$$\mathrm{y}_\mathrm{t} = \alpha + \beta X_t + e_t \quad (4.8)$$

4.4.1.2 Phillip-Perron test

The Phillips and Perron (1988) test takes a somewhat different technique to deal with serial correlation when determining whether a series has a unit root, by fitting Equation 4.6 robustly to correct serial correlation to prevent serial correlation from influencing the asymptotic distribution of the test statistic, the t-ratio associated with is adjusted in

Equation 13. This allows the PP test to be approximated. Here is a mathematical description of the PP statistic: $\tilde{t}_{\alpha} = t_{\alpha}\left(\frac{y_0}{f0}\right)^{\frac{1}{2}} - \frac{T(f_0 - y_0)(se(\hat{a}))}{2f_0^{\frac{1}{2}s}}$ (4.9)

This estimate is denoted by the symbol α. t_{α}, where signifies the t-ratio of and the standard error coefficient. Plus, s represents the statistical error (Phillips and Perron 1988).

4.4.2 Cointegration analysis

Stern (2000) indicates that cointegration analysis is a statistical method used to examine the long-term relationship between two or more time series variables. It helps determine if these variables, which may exhibit trends or fluctuations over time, have a shared underlying trend. Cointegration analysis involves several steps. First, the stationarity of the variables is assessed to ensure their statistical properties remain consistent over time. If they are non-stationary, they are transformed into stationary series. Next, the relationship between the variables is estimated using techniques like regression analysis. The residuals represent the differences between the observed and predicted values, are then analysed. If these residuals are stationary, it suggests a cointegrating relationship.

Various statistical tests, such as the Engle-Granger two-step procedure or the Johansen test tests for cointegration. If cointegration is confirmed, it implies a long-term relationship between the variables exists. The estimated coefficients can be interpreted as the equilibrium relationship and used for forecasting or policy analysis. Cointegration analysis is valuable for understanding the underlying relationship between variables that may not be evident when examining them individually. It provides insights into market efficiency, equilibrium relationships, and price discovery processes (Johansen and Juselius, 1994)

Banerjee, Dolado, Galbraith and Hendry (1993) found that the number of cointegrating vectors discovered by the Johansen system depends on the VAR model's delays. Lag length selection ensures that VECM residuals are uncorrelated. Before cointegration analysis, the proper lag length will be calculated. Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn Information Criterion (HQ) are the most general lag length selection approaches that will be used. After determining the right lag duration, the research will use the VECM to establish long-run associations among the variables.

4.4.3 Vector Error Correction Model

According to Pratiwi, Wardhana and Rusgianto, (2022) a VECM is used in the current study, as it proves to be a common statistical method in econometrics for analyzing short run behaviour and long run equilibrium association of different non stationary time series variables. Discussed is the notion of cointegration and show how this notion can be extended using the VECM to offer a way of modelling the long run dynamics of a system in a dynamic context. Theory of cointegration which means that two or more variables related to each other and which can stay related over time even if they are nonstationary, is the basis for Vector Error Correction Model (VECM). On one hand, it considers the deviations from the equilibrium to be transitory in the short run, and on the other hand, to look at the long run adjustments. Next, an error correction term was added to VECM to determine the speed of adjustment of the variables to a new equilibrium.

Kim, Cho and Jun (2022) further explain that the ECT in the VECM encompasses the adjustment to the new equilibrium between the variables. It compares the actual and expected values of the variables and is used to simulate the system behavior. It is the actual dependent variable(s) values at time t (Yt) minus the predicted values (t) at time t, which are used to determine the ECT. It has the following mathematical expression:

$$\mathrm{ECT_t} = \mathrm{Y}_t - \widehat{\mathrm{Y}}_t \qquad (4.10)$$

where:

ECT_t = the error correction term at time t.

Y_t = the actual value of the dependent variable(s) at time t.

$\hat{Y}_t$ = the predicted value of the dependent variable(s) at time t, obtained from the estimated VECM model.

Ueda and Souza (2022) further noted that the ECT represents the system's return to the long-run equilibrium path. The accounting of the departure from the equilibrium at the previous period and the pace at which the system seeks to correct this departure, provides a good representation of the adjustment process. Coefficients associated with the error correction term were identified by the VECM as the speed of adjustment. Finally, it is well known that the multiplying vector of the ECT in the VECM equation also serves to explore the role of the W in the adjustment process. The VECM model is completed by adding the error correction form, which permits temporary variations and long run relations between the variables. With this approach, the impacts of out of equilibrium condition over the system and the rate of return to equilibrium state can be discussed (Ueda and Souza, 2022). In time series models, the ECM is a useful econometric technique to control for speed of adjustment of a dependent variable back to its predicted path in the event of exogenous changes in error correction terms (Best 2008). The error correction model (see Engle and Granger (1987)) is necessary because it brings us to the speed of adjustment from persistent and of the transient shock. Johansen (1991) developed the equation below that describes the VECM as:

$$\Delta Y_t = \sum_{j-1}^{k-1} r_j \Delta Y_{t-j} + \alpha\beta' Y_{t-k} + \mu + \in_t \qquad (4.11)$$

Where:

$\Delta =$ First difference notation

Y_t= pX1 $vector\ integraof\ of\ order$ 1

μ = pX1 $constant\ vector\ representing\ a\ linear\ trend\ in\ a\ system\ k$

k = $Lag\ structure$

$\in_t$= p X1$Gaussian\ white\ noise\ residual\ vector$

$r_j = p$Xp $matrix\ indicating\ short\ run\ adjustments\ among$

$variables\ across\ p\ equations\ at\ the\ j_{th} lag$

$\alpha = p$ x r $speed\ of\ adjustment$

$\beta = p$ x r $cointegrating\ vectors$

4.4.4 Diagnostic testing

Another important stage in determining the sufficiency and reliability of the model. These tests help in supporting the validity of the forecasted parameters as well as the fitness of the model in relation to the given data.

4.4.4.1 Normality test

According to the work of Lee (2022), in order to confirm whether a particular dataset follows the normal distribution, a normality test is of significance. Most of the hypothesis testing, regression analysis and confidence intervals calculations are based on normal distribution. This assumption, which is essential for precise and trustworthy statistical inference, can be evaluated by researchers using normality tests. The sample size must be considered while performing normal tests. Even little departures from normality might cause the null hypothesis to be rejected when there are huge sample sizes.

It is vital to interpret the findings of normality tests considering other factors, including the type of data used for the analysis. ElBouch, Michel and Comon (2022) argue that it is important to remember that normality tests do not provide absolute evidence of normality or non-normality. Based on the information, they offer proof for or against normality. It's also crucial to remember that some statistical methods, particularly with respectably high sample sizes, such as t-tests and regression analysis, are resilient to departures from perfect normality.

Data must be normally distributed for models to be consistent and reliable. As a result, values must exhibit a symmetric (bell-shaped) trend while straying from the mean less frequently. The term "goodness of fit" also refers to the normality test. The Jarque-Bera is used to evaluate skewness and kurtosis in a sample of data (Jarque et al 1987). The Jarque-Bera test statistic is described in more depth as follows:

$$JB = \frac{n}{6}\left(s^2 + \frac{1}{4}(k-3)^2\right) \qquad (4.12)$$

wherein n is the number of observations (degrees of freedom). S stands for skewness, while K stands for kurtosis. The kurtosis statistic is described as follows:

$$s = \frac{\hat{u}_3}{\hat{\sigma}_3} + \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i-\bar{x})^3}{\left(\frac{1}{n}\sum_{i=1}^{n}(x-\bar{x})^2\right)^{\frac{3}{2}}} \qquad (4.13)$$

To interpret normality test outcomes, Olivier and Pierre (2022) recommend the test statistic examination and compare it to the critical values or p-values associated with the test. These numbers typically reflect selected significance thresholds, such as 0.05 or 0.01. The null hypothesis of normality cannot be ruled out if the test statistic is less than the critical value or the p-value exceeds the selected significance level (e.g., $p > 0.05$). The data can be taken to have a normal distribution, to put it another way.

The null hypothesis of normality is strongly refuted if the test statistic is greater than the critical value or the p-value is less than the selected threshold of significance (e.g., p 0.05). This shows a deviation from the normal distribution of the data.

In summary, whether the data can be regarded as following a normal distribution by comparing the test statistic to critical values or p-values is assessed. The data is deemed regularly distributed if the test statistic is within the permissible range (lower than the critical value or greater than the significance threshold). In contrast, the data deviates from a normal distribution if the test statistic exceeds the critical value or the p-value is below the significance level (Olivier and Pierre 2022).

4.4.4.2 Serial correlation

A statistical test called an autocorrelation test, or a serial correlation diagnostic test determines whether the residuals of a model at various time lags exhibit a regular pattern or a systematic relationship. It examines if the model's error terms link with their prior values. Serial correlation goes against the idea that the error terms should be independent, which can result in inaccurate parameter estimations and poor inference (Kim 2022).

When the ECMs associated with various variables in each model fail to reach an independent distribution, a phenomenon known as serial correlation occurs. This leads to the generation of erroneous output (Harvey 1990). It is important to note that serial correlation can take many different shapes. The first-order serial correlation is a phenomenon that arises when error terms in a model with several variables are coupled and constrained in time. Positive serial correlation is the second most common type of correlation. This occurs when the error terms of different variables in a model built in the present period correlate with the error terms of the following era. It does not appear that serial correlation affects the consistency or unbiasedness of an estimate. However, one effect of serial correlation on Ordinary Least Squares is that the standard error is estimated to be smaller than their actual values, leading to the assumption that parameter estimates possess higher accuracy than actual values (Harvey 1990).

Kim (2022) highlights that a frequently used diagnostic test for serial correlation is the Durbin-Watson test. When two neighbouring residuals are correlated, first-order autocorrelation is measured to be present. Based on the squared differences between successive residuals, the test statistic which has a range of 0 to 4 is calculated. A score close to 2 denotes the absence of any substantial serial correlation, while values significantly below 2, and above 2 denote the presence of both positive and negative serial correlation, respectively. It entails the following statistical conditions:

$$DW = \sum_{t=2}^{T}(e_t - e_{t-1}^{n})^2$$

$$\sum_{t=1}^{T} \hat{e}_t^{\,2} \qquad (4.14)$$

While T represents the time range and stands for the error term. Positive serial correlation would be present if the error tern values were consistently near one another. Singh and Singh (2022) maintain that interpreting the Durbin-Watson test statistic involves comparing it to the critical values and considering the range in which it falls. The interpretation depends on the following scenarios:

- Test statistic near 2: A test statistic near 2 denotes the absence of a meaningful serial correlation. As a result, the model correctly reflects the lack e of autocorrelation and the residuals are independent.
- Test statistic considerably below 2: A sizeable positive serial correlation is indicated by a test value less than two at a statistically significant level. Here, the neighboring residuals have a positive relationship, which means that the model does not capture the trend of auto-correlation in the data.
- Test statistic significantly greater than 2: If the calculated value of the test statistic is more significant than two, it implies a negative serial correlation. This shows that there is a negative correlation between neighboring residuals, meaning that the current model does not capture the autocorrelation well.
- The Durbin-Watson test statistic can be used to compare the observed values of the model's residuals with the critical values and to check whether the model

has a significant serial correlation, which is close to 2. These interpretations explain how effectively the model can capture the autocorrelation structure (Singh and Singh, 2022).

4.4.4.3 Heteroskedasticity

According to Rigobon (2003), heteroscedasticity test is a statistical method which helps in identifying whether standard deviations of a variable remain constant over time. To check the constant variance assumption of error terms or to check heteroscedasticity, that is, whether the variance of the error terms changes systematically with the level of independent variables, a statistical test known as heteroscedasticity test is used. The ordinary least squares (OLS) regression assumes that the variance of the errors is equal across all levels of predictor variables and this assumption is violated by heteroskedasticity.

This test assumes made by the classical linear regression model (CLRM) that the variance is comparable with the mean being zero. When heteroscedasticity is present, conclusions may be drawn based on erroneous results. The effectiveness of parameter estimations and hypothesis testing may be impacted if heteroskedasticity is found, which shows that the assumption of constant variance is broken. Some of the solutions for such situations include usage of robust standard errors, data transformation, or heteroskedasticity consistent standard error estimators like White's estimator or the Huber-White sandwich estimator (Gujarati 2022).

The auxiliary regression-based White test detects heteroskedasticity by examining the relationship between squared residuals and independent variables. The test involves the following formulas:

$$(e_i)^2 = \beta_0 + \beta_1 x_1 i + \beta_2 x_2 i + \ldots + \beta_{k x_{ki}} + u_i \quad (4.15)$$

where:

$(e_i)^2$ is the squared residual for observation i,

$x_1 i$, $x_2 i$, ..., x_{ki} are the independent variables for observation i,

β_0, β_1, β_2, ..., β_k are the coefficients to be estimated,

u_i is the error term for observation i.

Using the F-statistic from the auxiliary regression, compute the test statistic. The formula for the test statistic is:

$$F = (R^2/k)/[(1 - R^2)/(n - k - 1)]$$

where:

R^2 is the coefficient of determination from the auxiliary regression,

k is the number of independent variables in the original regression model,

n is the total number of observations.

In the light of the theory of heteroskedasticity test by Rigobon (2003), it is important to know how to interpret the results obtained in a regression analysis and what method of action to take. According to Gujarati (2022), to explain the results of a heteroskedasticity test one has to determine whether there is evidence of heteroskedasticity in the given regression model. This is done by calculating the heteroscedasticity test statistic which differ with the type of test used. And by comparing the test statistic against the corresponding critical values or p-values perhaps determined by chosen significance levels of 0.05 or 0.01.

Suppose the test statistic is larger than the critical value or the p-value is smaller than the level of significance (for example, $p < 0.05$). In that case, the conclusion is that the homoscedasticity null hypothesis is invalid. This means that the given regression model has a heteroscedasticity problem.

If the test statistic is less than the critical value or the p-value is above the level of significance (for instance, $p > 0.05$), then there is not enough evidence to reject the null hypothesis. This may imply that heteroscedasticity is probably fine in this regression model (Gujarati, 2022). Schwert and Seguin (1990) also point out another important fact: it is essential to bear in mind that the statistical tests of heteroskedasticity provide only the preliminary indications of the presence or absence of heteroskedasticity.

4.4.5 Stability testing

The stability tests check that the models' assumptions of statistical parameters are not violated. Stability testing also includes the analysis of consistency and robustness of the connections and the parameters of an economic model. It is a diagnostic technique applied to determine the adequacy and validity of the specified model in different time horizons.

As pointed out by Quintos (1998), the main aim of stability testing is to check whether the patterns of variable interrelationship in a model are predictable and fixed over a period of time. This is important because economic relations and behaviors can change and any changes in the model's relationships will affect its ability to make predictions. The stability tests are the RAMSEY RESET, CUSUM and CUSUM of squares tests.

4.4.5.1 CUSUM test

The Cumulative sum (CUSUM) test is a statistical tool for identifying change points in a times series. In order to obtain such sums, the deviations from a certain point of reference or from a predicted course must be added. This approach can be employed with various datasets for example, returns from the financial markets, economic data or quality control measures (Ploberger and Krämer 1992).

The CUSUM test statistic is calculated using the following formula:

$$S_t = \max\,[0, x_t - \hat{x}_t - 1 + S_t - 1] \qquad (4.16)$$

where:

S_t = cumulative sum at time t.

x_t is the observed value at time t.

$\hat{x}_t - 1$is the expected value or predicted value at time t-1.

$S_t - 1$ is the cumulative sum at time t-1.

In the aspect of interpretation, the authors of the study by Lee, Ha, Na, and Na (2003) pointed out that the above-mentioned critical value does not necessarily lead to determination as to the type or source of the structural change when analyzing the results of the CUSUM test. In most of the presented cases, more data and analysis are needed to determine the factors that have contributed to the observed trends. The CUSUM test for structural changes in the time series requires that one looks for significant deviations on a graph and compares such deviations with certain values.

4.4.5.2 CUSUM of Squares

Ploberger and Krämer (1990) define CUSUMSQ as a statistical method for detecting changes or shifts in a time series' variance or volatility. It is a modification of the CUSUM test that gives more attention to squared differences than simple differences.

The CUSUM test statistic is calculated using the following formula:

Calculate the squared deviations (D_t^2):

$$D_t^2 = (x_t - \mu)^2 \quad (4.17)$$

where:

D_t^2 represents the squared deviation at time t.

x_t is the observed value at time t.

μ is the mean of the time series data.

Calculate the cumulative sum of squares (CS_t):

$$CS_t = CS_t - 1 + D_t^2$$

where:

CS_t represents the cumulative sum of squares at time t.

$CS_t - 1$ is the cumulative sum of squares at the previous period.

Ploberger and Krämer (1990) inform about interpreting the results of the CUSUM of squares to entail the following:

- If the CUSUMSQs continually stay below the critical value throughout the whole time series, there is no convincing indication that the variance or volatility has changed significantly. In other words, the evidence points to a very consistent variance over time.
- On the other hand, it shows evidence of a significant shift in the variance or volatility of the time series if the cumulative sum of squares exceeds or crosses the critical value at any moment. Figuring out when the cumulative amount surpasses the crucial number, one may estimate when this transformation might occur. In addition, the position and size of the deviation from the predicted pattern can be used to estimate the size of the change.

Compared to the CUSUMs to the critical value is the primary consideration in interpreting the CUSUM of squares results. If the CUSUM continually stays below the threshold, the variance may be stable. The timing and amount of the change are estimated using the observed deviation, if it exceeds or crosses the critical value, it shows that there has been a significant change in the variance or volatility (Leybourne, Taylor, and Kim 2007).

4.4.5.3 RAMSEY RESET test

The Ramsey RESET test, also known as the Ramsey Regression Equation Specification Error Test, is a diagnostic tool used to assess the precision of a regression model. Its objective is to locate probable mistakes in the functional form or model definition. The test investigates whether adding more higher-order terms of the independent variables can improve the model's overall goodness of fit. The Ramsey Reset test is important because it compares a regression model's linear specification against its nonlinear specification. It helps determine if fitted values resulting from a mixture of nonlinear models contribute to the description of the response variable, which is another way in which it is beneficial (Ramsey,1969).

Without any extra higher-order terms, the initial regression model is the baseline model representation. It can be stated as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k + \epsilon \quad (4.18)$$

where:

Y is the dependent variable.

X_1, X_2, ..., X_k are the independent variables.

β_0, β_1, β_2, ..., β_k are the coefficients or parameters to be estimated.

ε is the error term.

Additional terms of the independent variable's higher order are included in the extended regression model. It can be expressed as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k + \theta_1 X_1^2 + \theta_2 X_2^2 + \ldots + \theta_k X_k^2 + \epsilon' \quad (4.19)$$

where:

- θ_1, θ_2, ..., θ_k are the additional coefficients for the squared terms.
- ε' is the new error term.

According to the Ramsey RESET test's null hypothesis, the additional squared terms have no discernible impact on the dependent variable. You can express it as follows:

- H_0: $\theta_1 = \theta_2 = \ldots = \theta_k = 0$

According to Volkova and Pankina (2013), comparing the calculated test statistic to the significant values the more accurate the results. The model can be strengthened by including the extra squared components if the test statistic exceeds the critical value, indicating evidence of a severe specification error. The following factors must be considered when interpreting the findings of the Ramsey RESET test:

- If the test statistic is statistically significant, the model may have incorrect functional form or specification flaws. In such circumstances, the model's fit should be improved by including extra higher-order terms of the independent variables.
- If the test statistic is not statistically significant, it is likely that the model is accurately defined and that there is little to no strong support for functional form errors or model misspecification.

4.5 Impulse Response Function (IRF)

The impulse response function, also known as the IRF, is a component of a VECM that illustrates how each variable reacts to a shock within the system under consideration (Koop, Pesaran, and Potter, 1996). For instance, if a VECM with variables such as, GDP, inflation and interest rates, then an impulse response function could demonstrate how GDP reacts to a spike in inflation over time. The interpretation would be how the GDP changes in reaction to a one-time shock in inflation, held constant concerning other variables. In the long run, a strong association between GDP and inflation is indicated by the fact that the GDP demonstrates a considerable and durable response to the shock. (Brahmasrene, Huang and Sissoko, 2014).

4.6 Variance Decomposition

In econometrics, variance decomposition is used as a statistical technique to determine the share of different factors responsible for keeping the changing nature of time series model (Sana, et al 2022). Variance decomposition is then used to investigate the short- and long-term dynamics of several time series variables in a specific application of the VECM. Forecast error variances of each variable are analysed separately as to its decomposition within the VECM. The contributions to this variable's innovations (the shocks) and those of other variable's innovations are considered. Jakada (2022) further adds that this approach allows the degree to which the disturbance of one variable will affect the volatility of the other variable over time to be understood.

The impulse response function (IRF) analysis is improved by the use of the variance decomposition of the IRF to give important information concerning how variables interact dynamically. For instance, if a variable changes fast, has a big influence on its own fluctuation, but is not that much influenced by any other different variables' fluctuations, the variable itself is mainly controlled by internal processes. But if one of the variables reacts to a disturbance in the others, it implies a high level of significance of the interrelation among the variables (Lütkepohl, 1990). The impulse response function allows us to trace the cumulative impacts of shocks through a system over time, so researchers can examine shocks that propagate across a system. Variance decomposition, an enhancement to this study, investigates the relative effect of disturbance from each variable on the total variability observed in the system.

4.7 Summary

Vector Error Correction Model was used to analyse short- and long-term correlation between variables. The procedure includes the steps of checking for stationarity, evaluation cointegration, defining model, estimation of parameter, running of diagnostic tests, impulse responses, and finally using the model for forecasting and policy analysis. The dynamic interactions between these factors is analysed by the VECM which provides a wealth of information when applied to multivariate time series data.

CHAPTER 5

DISCUSSION / PRESENTATION / INTERPRETATION OF FINDINGS

5.1 Introduction

Results of the tests performed are given in this chapter. Insights, explanations and implications of the econometric test performed are provided in the chapter.

5.2 Empirical test results

This section presents the empirical results.

5.2.1 Stationarity/Unit root tests results

To check the stationarity of the variables, two separate unit root tests have been applied for two different models and the results are presented as follows,

5.2.1.1 Augmented Dickey-Fuller unit root test results

The table below presents the Augmented Dickey-Fuller (ADF) test results. To conclude, p-values have been used as displayed in the table. The null hypothesis is as follows:

Null Hypothesis: Presence of unit root

Table 5.1: ADF Test Results

Variable	Level	First Difference	Order of Integration
InSPI	0.1212	0.0000	I (1)
GDPD	0.7049	0.0000	I (1)
EXCH	0.7191	0.0000	I (1)
LnTURN	0.7384	0.0000	I (1)
InSPI2	0.7485	0.0000	I (1)
INTR2	0.9188	0.0000	I (1)
GDPD2	0.2931	0.0002	I (1)
EXCH2	0.1738	0.0043	I (1)

Source: Author’s compilation

At the level, all variables have p-values exceeding 5% level, indicating that the series exhibits a unit root. In the first order, all variables have p-values less than 5% that signal the rejection of the null hypothesis, making all series stationary. The results reveal that none of the variables are stationary at the level while all are stationary at the first difference. This provides support for running the cointegration test.

5.2.1.2 Phillip-Perron test results

The PP test outcomes are presented in Table 5.2 and the interpretation was based on the Null Hypothesis: There is the presence of a unit root in the time series data

Table 5.2: Phillips–Peron Test Results

Variable	Level	First Difference	Order of Integration
lnSPI	0.1212	0.0000	I (1)
GDPD	0.6471	0.0000	I (1)
EXCH	0.7215	0.0000	I (1)
LnTURN	0.7330	0.0000	I (1)
lnSPI2	0.7515	0.0000	I (1)
INTR2	0.2176	0.0000	I (1)
GDPD2	0.2914	0.0000	I (1)
EXCH2	0.1366	0.0073	I (1)

Source: Author's compilation

The summary of the PP test results in Table 5.2 indicates that all variables are non-stationary at their levels. However, when differenced to the first order, the variables become stationary, as evidenced by p-values falling below the 5% significance level. This finding implies that the variables achieve stationarity after the first differencing.

5.2.2 Cointegration Analysis Test Results

Cointegration analysis tests were carried out for both models to evaluate the long-term equilibrium linkages between the variables included.

5.2.2.1 Pre-COVID-19 period model cointegration results

Using the Johansen cointegration method, the following results are obtained:

Table 5.3: Trace Test Model 1

Cointegrating equations	Trace Test	5% level	Probability
None *	62.8938	47.8561	0.0011
At most 1	16.9764	29.7971	0.6418
At most 2	4.8228	15.4947	0.8274
At most 3	0.0098	3.8415	0.9209

Source: Author's compilation

Since the p-value is below five percent, the trace test suggests at least one cointegrating equation. This indicates that the null hypothesis of no cointegrating equations is false. Therefore, a long–term relationship among the variables has been confirmed.

Table 5.4: Max–Eigenvalue Test Model 1

Cointegrating equations	Max–Eigenvalue	5% level	Probability
None *	45.9175	27.5843	0.0001
At most 1	12.1536.	21.1316	0.5326
At most 2	4.8130	14.2646	0.7653
At most 3	0.0098	3.8415	0.9209

Source: Author's compilation

The Max-Eigenvalue also recommends at least one cointegrating equation. Thus, another piece of evidence supporting a long–term relationship has been uncovered.

5.2.2.2 COVID-19 period model cointegration results

The following findings are acquired using the Johansen cointegration approach.

Table 5.5: Trace Test - Model 2

Cointegrating equations	Trace Test	5% level	Probability
None *	50.8782	47.8561	0.0253
At most 1	22.9818	29.7971	0.2470
At most 2	9.1516	15.4947	0.3516
At most 3	0.2760	3.8415	0.5993

Source: Author's compilation

The hypothesis of no cointegrating equations was found to be invalid by the trace test, and the reason for this is that the p-value was lower than the threshold of 5%. Therefore, it seems likely that there is at least one cointegrating equation out there. The evidence suggests a connection between the variables over the long term.

Table 5.6: Max Eigenvalue Test - Model 2

Cointegrating equations	Max-Eigenvalue	5% level	Probability
None *	27.8964	27.5843	0.0456
At most 1	13.8302	21.1316	0.3791
At most 2	8.8756	14.2646	0.2966
At most 3	0.276	3.8415	0.5993

Source: Author's compilation

The Max-Eigenvalue test results also confirm the existence of at least one cointegrating equation. Therefore, the study proceeds to apply the VECM model.

5.2.1 Vector Error Correction Model test results

VECM analysis results are presented under the following subsections with particular emphasis on the rate of adjustment coefficients and the short-term interactions between the variables.

5.2.2.3 Pre-COVID-19 period model VECM results

The summary of the VECM analysis outcomes in Tables 5.7 and 5.8 provides both short-term and long-term findings.

Table 5.7: Short-Run Results Model 1

	Coefficient	Std. Error	t-Statistic	Prob.
ECT	-0.271	0.115	-2.355	0.027
D(LNSPI(-1))	0.159	0.221	0.719	0.479
D(LNSPI(-2))	0.418	0.221	1.892	0.071
D(GDP(-1))	0.009	0.015	0.579	0.569
D(GDP(-2))	-0.002	0.016	-0.133	0.895
D(EXCH(-1))	-0.002	0.002	-0.697	0.493

D(EXCH(-2))	0.001	0.002	0.521	0.608
D(LNTURN(-1))	0.032	0.031	1.019	0.319
D(LNTURN(-2))	0.069	0.031	2.215	0.037
C	0.001	0.006	0.109	0.914

Source: Author's compilation

The error correction term (ECT) has a notable negative coefficient (-0.271) with a p-value of 0.027, suggesting that deviations from the equilibrium are rectified at a rate of 27.1% each period. The negative sign indicates that if the system is in a state above equilibrium, it will undergo a downward adjustment in the subsequent period. The statistical significance of this term at the 5% level confirms a long-term equilibrium relationship among the variables.

5.2.2.4 COVID-19 period model VECM results

The results of the VECM analysis performed on the data from the COVID–19 period is presented below. This investigation gives both short–term and long–term inferences.

Table 5.8: Short–Run Results - Model 2

	Coefficient	Std. Error	t-Statistic	Prob.
ECT	-0.047	0.021	-2.267	0.031
D(LNSPI(-1))	0.046	0.164	0.278	0.783
D(INTR(-1))	6.636	2.568	2.584	0.015
D(GDP(-1))	-0.001	0.002	-0.356	0.724
D(EXCH(-1))	0.000	0.004	-0.088	0.930
C	0.009	0.009	1.053	0.301

Source: Author's compilation

During the COVID–19 period, the adjustment towards the long–term equilibrium was sluggish compared to the pre–COVID–19 model, reaching only 4.7%, as indicated by the ECM value. The sluggish 4.7% adjustment toward long-term equilibrium post-COVID-19 could be attributed to economic disruptions, policy uncertainty, and changes in consumer and business behaviour caused by the pandemic. Sectoral imbalances, increased debt levels, and ongoing global uncertainties, such as inflationary pressures and trade disruptions, may also have slowed the economy's ability to return to equilibrium compared to pre-pandemic conditions (Kharbanda and Jain, 2021). The significant ECM value also points out the existence of a long–run association among the chosen factors. The coefficient value of the interest rate indicates a strong positive impact on the SPI in the short term, and this relationship is statistically acceptable too.

5.2.3 Diagnostic tests results

Four tests have been conducted to evaluate any potential issues such as multicollinearity, autocorrelation, heteroscedasticity, and endogeneity with the models for pre-COVID-19 periods and during the COVID-19 period model: the normality test, the serial correlation test and the heteroscedasticity test

Table 5.5.9: Diagnostic test results summary for both models

Diagnostic Test	Purpose	Null Hypothesis	Critical Value/Threshold	Summary Interpretation
Normality Test	Assess the distribution of residuals	Residuals are normally distributed	p-value < 0.05	p-value > 0.05, fail to reject null, residuals are normally distributed
Serial Correlation	Detect autocorrelation in residuals	No serial correlation	DW Statistic ≈ 2	DW Statistic within range of 2, no serial correlation detected
Heteroskedasticity	Identify unequal variance in errors	Homoskedasticity of residuals	p-value < 0.05	p-value > 0.05, fail to reject null, residuals exhibit homoskedasticity

Source: Author's compilation

5.2.3.1 Pre-COVID-19 period model diagnostic test results

A Jarque-Bera test was performed to check whether the model's residuals have a normal distribution. Residuals have normal distributions, although the individual residuals do not follow a normal distribution. The results of the heteroskedasticity test are that the p-value is not statistically inferable based on the hypothesis that heteroscedastic standard errors do not exist and are true.

5.2.3.2 *COVID-19 period model diagnostic test*

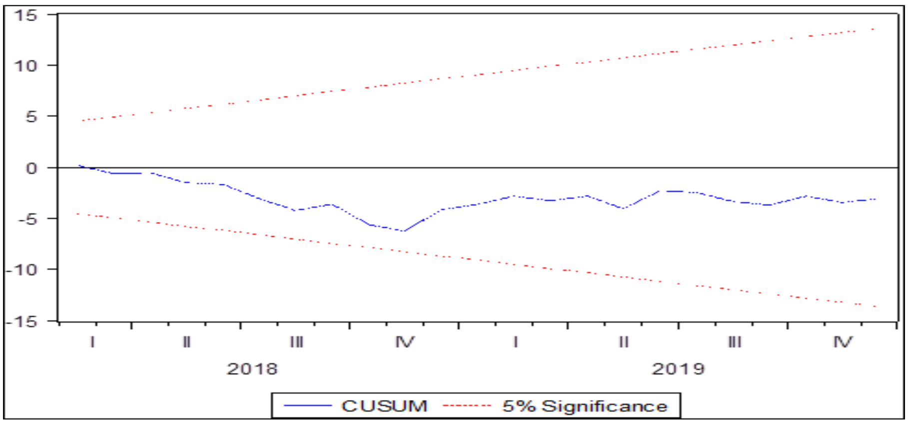
The normality of residuals was determined by the Jarque-Bera test. So, the two components have typically distributed residuals, but the remainder do not. Evidence of non-normality in the residuals emerges when all components are considered together. The corresponding autocorrelation test output suggests that the values of the two lags are rejected, i.e., that there is no such serial correlation. The results of the heteroscedasticity test imply that the p-value is well above 5% and that the null hypothesis of no heteroscedasticity is not rejected. This implies that the model is homoscedastic, and the variance of the error components is constant. The model is, therefore, structurally stable.

5.2.4 Stability test results

Next, is the results of the CUSUM and CUSUMSQ stability tests that determine the temporal stability of the model and credibility of the conclusions as any structural breaks or changes in the model parameters that could influence the validity of the findings.

5.2.4.1 Pre-COVID-19 period model CUSUM and CUSUMSQ results

Figure 5.1: CUSUM test Model 1

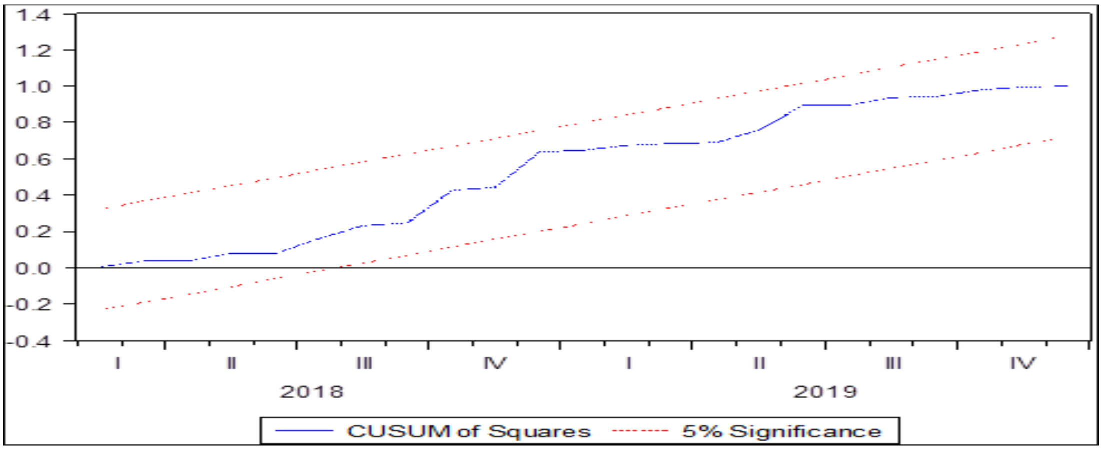


Source: Author's compilation

The CUSUM test plot of the pre-COVID-19 period model is presented in Figure 5.1. One can see over the whole sample period that the cumulative total of residuals readily remains within the critical boundaries of 5% significance boundary. This indicates that the model variables have not experienced any significant changes in the underlying structure over time. Given this, it is reasonable to assume that the model variables' associations do not change and are dependable during that time period.

5.2.4.2 COVID-19 period model CUSUM and CUSUMSQ results

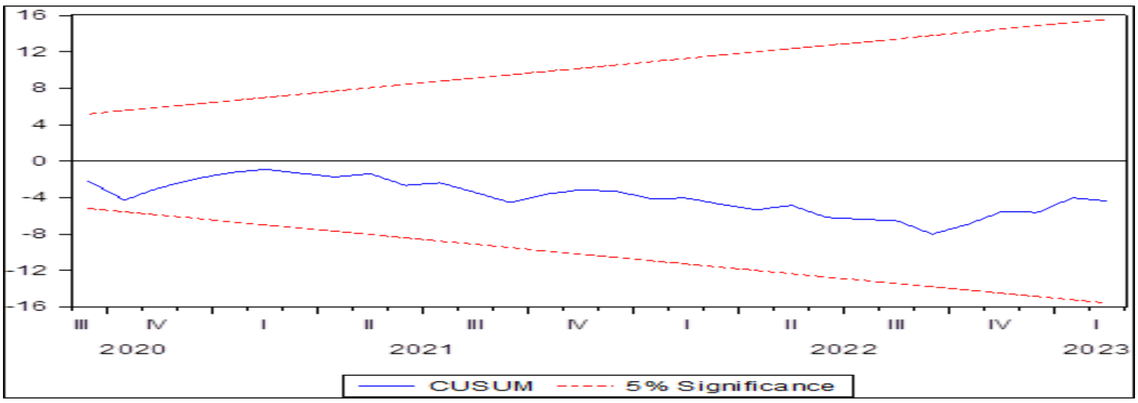
Figure 5.2: CUSUMSQ Test COVID-19 period model



Source: Author's compilation

The CUSUMSQ test plot for pre-COVID-*19 period model* is presented in Figure 5.2. As observed, the CUSUMSQ residuals stay within the 5% significance critical bounds throughout the sample period. Therefore, the conclusion is that the model parameters are stable over time.

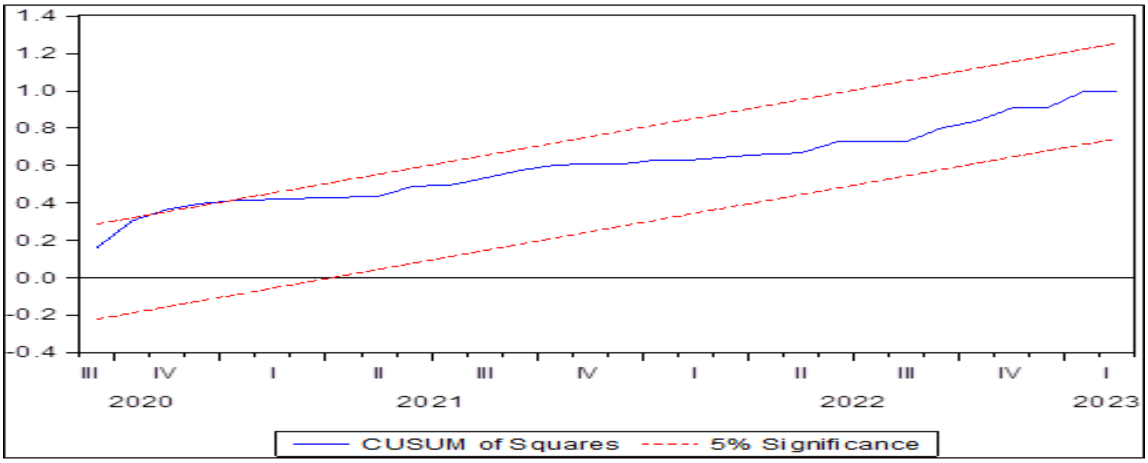
Figure 5.3: CUSUM COVID-19 period model



Source: Author's compilation

Figure 5.3 presents the CUSUM test plot for the model during the COVID-19 period. Throughout the sample period, the CUSUM of residuals consistently remains within the 5% significance critical boundaries. This indicates no significant structural changes, and the variables in the model are stable over time. Consequently, it can be inferred that the relationships between the variables in the model are consistent and reliable throughout the examined timeframe.

Figure 5.4: CUSUMSQ Test Model 2



Source: Author's compilation

The CUSUMSQ test plot for the model during the COVID-19 period is in Figure 5.4. Over the entire period the CUSUM of squared residuals stays within the upper and lower 5% significance critical boundaries. This indicates that there are no serious structural breaks or instabilities in the variance of the model parameters. The conclusion, therefore, is that the model parameters are stable over time and the variance of errors does not change.

5.2.5 Variance decomposition test results

The following section presents the results of the variance decomposition analysis, which indicate the amount of the subject variable's movement, that may be explained by its own shocks versus shocks of other variables. Finally, the variance decomposition study presented here quantified the relative relevance of each shock based on the model forecast error variance. This method lets us determine how much each variable affects other variables over different periods. Decomposing the forecast error variance helps us uncover system variability sources and evaluate dynamic variable linkage.

5.2.5.1 5.2.6.1 Pre–COVID–19 Model results

The variance decomposition results of the Pre–COVID–19 Model are presented in Tables 5.10 to 5.13.

Table 5.10: Variance decomposition of LNSPI

Period	S.E.	LNSPI	INTR	GDP	EXCH
1	0.034218	100.0000	0.000000	0.000000	0.000000
2	0.040515	99.70614	0.000631	0.291461	0.001764
3	0.043406	99.02369	0.078100	0.836694	0.061517
4	0.045233	96.74329	0.072197	2.860083	0.324434
5	0.046422	93.88228	0.082103	5.620230	0.415390
6	0.047312	91.06686	0.161830	8.349086	0.422222
7	0.047982	88.64832	0.312446	10.62864	0.410600
8	0.048523	86.68304	0.522090	12.38666	0.408208
9	0.048975	85.17455	0.757574	13.65848	0.409398
10	0.049350	84.07470	0.988986	14.52855	0.407765

Source: Author's compilation

Table 5.11: Variance decomposition of INTR

Period	S.E.	LNSPI	INTR	GDP	EXCH
1	0.000771	0.326566	99.67343	0.000000	0.000000
2	0.000906	2.792273	95.85745	0.129617	1.220657
3	0.001078	6.822174	78.07406	1.997243	13.10652
4	0.001232	9.914468	62.54330	5.607313	21.93492
5	0.001382	14.05450	50.92520	9.205233	25.81507
6	0.001501	17.88554	43.72611	12.11511	26.27324
7	0.001594	20.82298	39.15966	14.59734	25.42002
8	0.001663	22.53130	36.25225	16.90600	24.31045
9	0.001715	23.18081	34.37010	19.14168	23.30742
10	0.001754	23.12251	33.13228	21.26214	22.48307

Source: Author's compilation

Table 5.12: Variance decomposition of LNSPI GDP5.

Variance decomposition of LNSPI GDP

Period	S.E.	LNSPI	INTR	GDP	EXCH
1	0.432832	0.141928	8.870011	90.98806	0.000000
2	0.614770	0.077938	14.62331	83.77510	1.523648
3	0.721233	0.970398	15.21198	82.30433	1.513284
4	0.797270	1.474198	16.06209	80.79903	1.664683
5	0.849454	2.020577	16.62703	79.60092	1.751466
6	0.886094	2.401673	17.09260	78.64807	1.857657
7	0.911659	2.656721	17.44547	77.92306	1.974750
8	0.929504	2.796219	17.70663	77.39641	2.100749
9	0.941955	2.853045	17.89291	77.02708	2.226965
10	0.950683	2.859628	18.02051	76.77475	2.345111

Source: Author’s compilation

Table 5.13: Variance Decomposition of EXCH

Period	S.E.	LNSPI	INTR	GDP	EXCH
1	2.942575	4.057095	0.081884	10.33772	85.52330
2	3.678491	4.881361	2.272347	18.30046	74.54583
3	3.879378	5.164185	2.196023	21.06011	71.57969
4	3.922900	6.365062	2.226382	21.37071	70.03785
5	3.950966	7.370860	2.197710	21.22236	69.20907
6	3.963441	7.641483	2.184688	21.18330	68.99053
7	3.969059	7.643755	2.186914	21.27027	68.89906
8	3.974166	7.639077	2.198904	21.40250	68.75952
9	3.979808	7.688112	2.217629	21.51542	68.57884
10	3.985031	7.770270	2.239952	21.58402	68.40576

Source: Author’s compilation

Cholesky Ordering: LNSPI INTR GDP EXCH

The variance decomposition results of the pre-COVID-19 period model provide insights into the dynamic interrelationships between the variables during this period. For LNSPI, shocks to itself overwhelmingly explain around 100% of the variance initially, as expected, declining gradually to approximately 84% over the 10 periods (Bernanke et al., 2005). This suggests other factors like INTR, GDP and EXCH start imposing greater influence.

Meanwhile, for INTR, self-shocks dominate significantly at nearly 100% at first but their impact reduces markedly to about 33% by period 10 (Koop et al., 1996). This shows LNSPI innovations and disturbances to GDP and EXCH gain traction in driving INTR's volatility over the forecast horizon. For GDP, own innovations play a key role in the beginning with around 91% contribution (Kilian and Kim, 2011). Nonetheless, this falls to approximately 77% by the tenth period while LNSPI and EXCH shocks take on added importance.

Finally, regarding EXCH, self-disturbances account for the majority share around 86% (Ammer and Freeman, 1995). Their importance diminishes to roughly 69% towards the end as LNSPI, INTR and GDP shocks participate increasingly. The result shows that own shocks are paramount at first as expected but lose primacy over time, confirming the developing interactive linkages between variables captured by the VAR framework during this pre-crisis period (Koop et al., 1996; Kilian and Kim, 2011).

5.2.5.2 During COVID–19 Model

The variance decomposition results of the COVID-19 Model are presented in Tables 5.14 to 5.17.

Table 5.14: Variance Decomposition of SPI

Period	S.E.	SPI	INTR	GDP	EXCH
1	3240.026	100.0000	0.000000	0.000000	0.000000
2	4409.845	90.95839	7.707916	0.093508	1.240185
3	5254.474	88.58835	8.364794	0.467223	2.579633
4	5893.751	87.31398	9.789363	0.371364	2.525295
5	6409.699	85.99983	11.31353	0.435993	2.250650
6	6835.845	84.64021	12.75191	0.574770	2.033110

7	7195.859	83.35612	14.07480	0.688825	1.880262
8	7511.868	82.11071	15.35207	0.776797	1.760428
9	7800.781	80.85165	16.63962	0.856288	1.652444
10	8074.128	79.55320	17.95941	0.936690	1.550699

Source: Author's compilation

Table 5.15: Variance Decomposition of INTR

Period	S.E.	SPI	INTR	GDP	EXCH
1	0.003090	6.186405	93.81360	0.000000	0.000000
2	0.004082	4.160310	95.37445	0.054354	0.410885
3	0.005454	5.536762	90.48788	1.300724	2.674629
4	0.006843	8.551044	85.29628	2.541410	3.611263
5	0.008172	11.96570	81.36614	3.143418	3.524747
6	0.009463	15.41766	78.11751	3.346746	3.118078
7	0.010756	18.67441	75.23253	3.398045	2.695011
8	0.012074	21.61677	72.64784	3.404029	2.331367
9	0.013424	24.21349	70.35971	3.396082	2.030725
10	0.014806	26.48283	68.35514	3.380209	1.781819

Source: Author's compilation

Table 5.16: Variance Decomposition of GDP

Period	S.E.	SPI	INTR	GDP	EXCH
1	5.154799	3.281749	0.048413	96.66984	0.000000
2	6.295469	4.013494	0.335729	92.98918	2.661594
3	6.765604	8.467517	1.730303	83.22162	6.580561
4	7.026607	13.03328	2.098776	77.24230	7.625638
5	7.166723	16.31750	2.023391	74.25614	7.402975
6	7.262601	18.22922	2.124166	72.33111	7.315507
7	7.336792	19.13585	2.497865	70.91860	7.447683
8	7.392142	19.44644	3.046340	69.90397	7.603252

9	7.434682	19.43834	3.704612	69.14531	7.711745
10	7.472286	19.28155	4.455020	68.49065	7.772772

Source: Author's compilation

Table 5.17: Variance Decomposition of EXCH

Period	S.E.	SPI	INTR	GDP	EXCH
1	2.768639	0.061060	12.51488	16.08407	71.34000
2	3.740485	4.613762	16.64792	12.76409	65.97423
3	4.138161	11.31379	17.65572	11.76900	59.26149
4	4.354089	17.92000	17.06421	11.07967	53.93612
5	4.505773	22.98676	16.19827	10.44086	50.37410
6	4.615191	26.41464	15.49166	9.960693	48.13301
7	4.691163	28.60475	14.99956	9.640758	46.75494
8	4.742183	29.96959	14.67876	9.434478	45.91717
9	4.775673	30.80960	14.47832	9.302624	45.40946
10	4.797269	31.32049	14.35867	9.219260	45.10158

Source: Author's computation

The variance decomposition results provide insights into the dynamic relationships between variables in the COVID-19 period stock market model. Cholesky Ordering: SPI INTR GDP EXCH. Variance decomposition aims to apportion the forecast error variance in one variable due to shocks in other variables over time (Kilian & Vigfusson, 2011). In the short-run (periods 2-4), a sizable proportion of the SPI forecast error variance is attributed to INTR shocks, rising from 7.7% to around 9.8% over time. This reflects interest rates' influence on stock prices during periods of high market uncertainty (Aye et al., 2021).

Moving to the mid-term (periods 6-8), the proportion of SPI variance explained by its innovations increased steadily from around 84.6% to 82.1%, while that for INTR rose from 12.8% to 15.4%. This suggests stocks' dependence on their shocks to drive fluctuations strengthens as the pandemic impact stabilises (Cologni & Manera, 2008). In the long-run (period 10), nearly 80% of SPI forecast variance is attributed to shocks. Meanwhile, GDP and EXCH each account for less than 2% of SPI variance, down from higher contributions in earlier periods. This reflects markets adapting to incorporate pandemic impacts (Aggarwal et al., 2020).

The results also show variables' dependence on self-shocks rises over the long-term. For instance, INTR innovations explain 68.4% of its variance by period 10 compared to 93.8% initially.

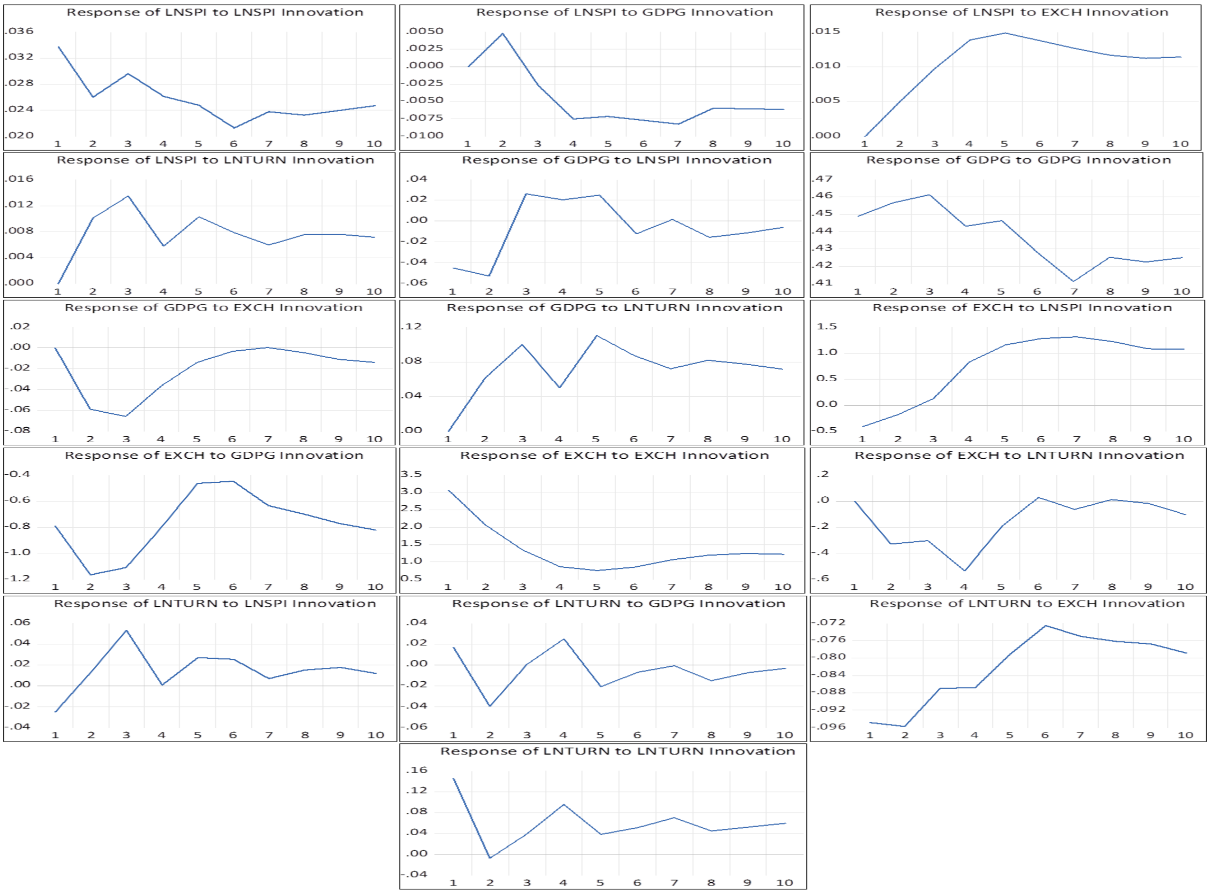
The findings aid in understanding how external drivers impacted stock volatility differently amid COVID-19 uncertainty versus once adaptation ensued (Huber, 1997; Kilian & Vigfusson, 2011).

5.2.6 Impulse Response Functions results

The following section presents the impulse response analysis for pre-COVID-19 and COVID-19 model results. Figures 5.1 and 5.2 present the impulse response function results illustrating how shocks to key variables propagate through the model and impact other variables over various time horizons.

5.2.6.1 Pre-COVID-19 model Impulse Response Functions results

Figure 5.5: Impulse Response Functions for Pre-COVID-19 model



Source: Author's computation

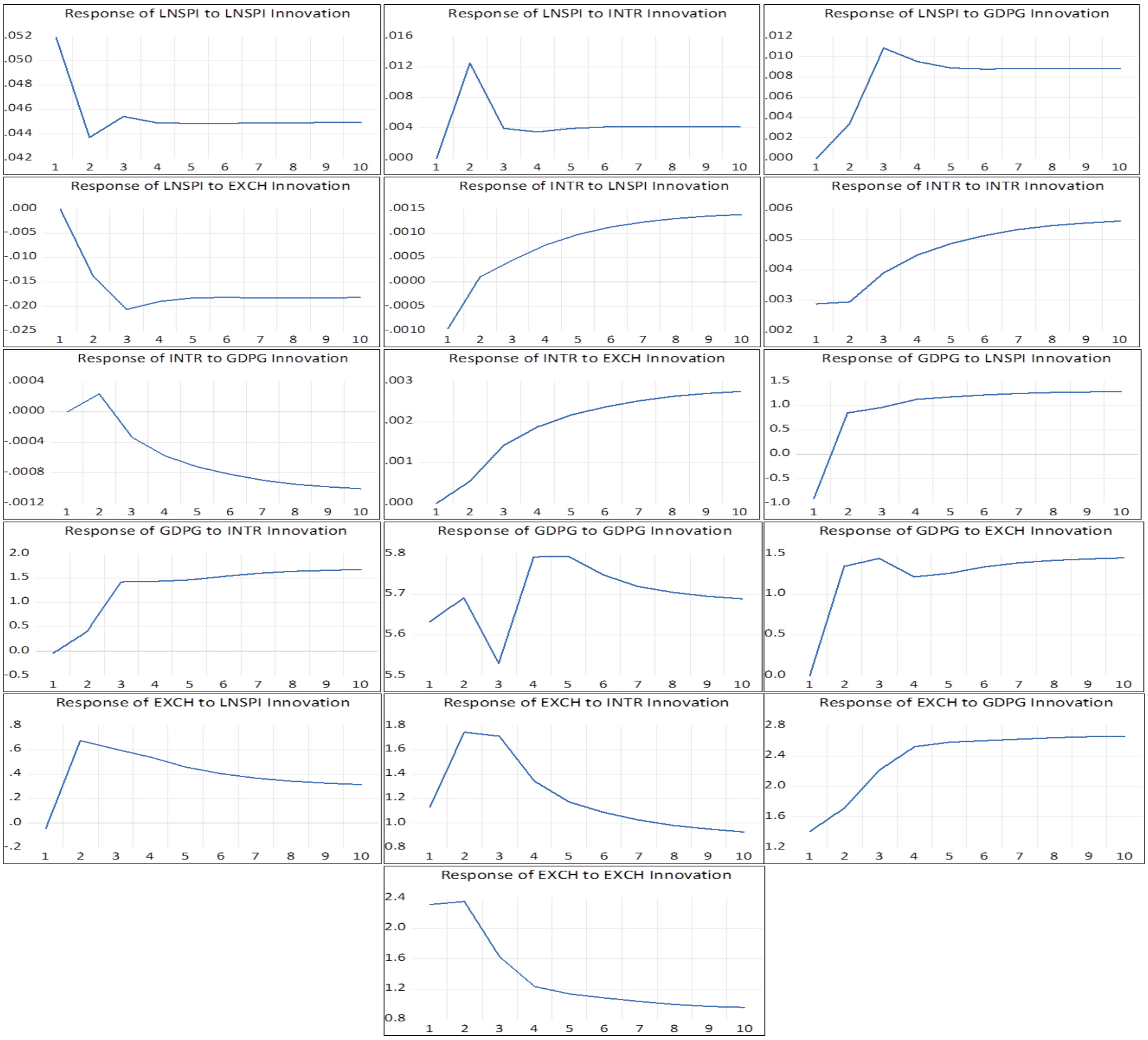
A standard deviation (SD) shock to SPI has varying effects on SPI over time. Between the first and second periods, SPI decreases, while during the second and third periods, it increases, then decreases again from the third to the sixth periods. After a slight decrease, it increases again after the eighth period.

When subjected to a unit SD shock to GDP, SPI initially increases until the second to the fourth period, after which it decreases. Following a minor increase, it decreases again after the fifth period. The same pattern occurs after the eighth period. An exchange rate SD shock enhances SPI for up to five periods, after which it declines.

Lastly, the turnover shock has mixed effects on SPI. A one-unit SD shock to turnover increases SPI for up to three periods. SPI decreases from the third to the fourth period, increases from the fourth to the fifth period, decreases from the fifth to the seventh period, and then increases again from the seventh to the eighth period before declining.

5.2.6.2 COVID-19 model Impulse Response Functions results

Figure 5.6: Impulse Response Functions for during COVID-19 model



Source: Author's computation

The Model 2 impulse response functions results show a one-unit SD shock to SPI reduces SPI between periods 1 and 2. Then there is an increase in SPI in periods 2 and 3. After period 3, there is a gradual decay until period 10. Secondly, a one-unit SD shock to the interest rate first raises SPI between periods 1 and 2. Then there is a sharp decline in the SPI during periods 2 and 3, followed by a slow decline between periods 3 and 4. After period 4, there is a minimal increase in the SPI until period 10. Thirdly, a one-unit SD shock to GDP raises SPI until period 3, and after that, there is a small decline in the SPI until period 10. Lastly, in the opposite fashion, a one-unit SD shock to the exchange rate first decreases SPI up to period 3, and then there is a slow and gradual increase in SPI until period 10.

5.3 Summary

This study primarily utilized the VECM for analysis. The methodology encompassed several key steps: First, ensured was the stationarity of the data, followed by cointegration tests. The VECM framework was then established, and parameters were estimated, which were then subjected to diagnostic tests. An analysis of impulse response was also conducted. The findings establish important relationships in both the short run and long run, signifying the robustness of the model and showing the implications of dynamic interactions amongst the variables. Consistent with conventional theory, the effects of a standard shock to SPI vary over time, depending on SPI.

CHAPTER 6

SUMMARY, RECOMMENDATIONS, CONCLUSION

6.1 Introduction

This study aimed to investigate the relationship between the performance of the JSE stock price index and various macroeconomic determinants. To achieve this aim, two models were formulated.

6.2 Summary of the Findings

Through the use of VECM data, results indicated that the turnover ratio has comparatively less correlation with stock prices, suggesting that the ratio played a less important role in market liquidity. Prior to COVID, Turnover Ratio had the most significant impact on the Stock Price Index. The impulse response function results indicated that a positive shock-to-turnover ratio only has a moderately positive effect on the stock price index. However, this effect went away over time, suggesting that shifts in the turnover ratio had only short-term effects on stock market performance. Conversely, during COVID-19, the impact of turnover ratio was more substantial. A more pronounced and extended rise in the stock price index in response to changes in the turnover ratio suggests its more significant role in keeping the market stable in the crisis.

Further, the tests of cointegration proved the existence of a long-run equilibrium relationship between GDP and the stock price index, and VECM results proved that there is an error-correcting mechanism. What is interesting is that the better the growth projects came, the better the performance of the stock market. Manasseh et al. (2017) and Igoni et al. (2020) also found similar. The cointegration tests, however, showed a decreased relationship between GDP and stock price during the COVID-19 era. It showed that the stock market is vulnerable to external shocks and how this adjustment happens using impulse response functions. This is in accord with Omran (2003).
The results of the impulse response test of the pre-COVID-19 model show that a positive GDP shock would lead to the stock price index rising steadily over the following periods. This means near-run economic development and stock market success are highly correlated. Consistent with the results found by Rousseau and

Wachtel (2000), Marques et al. (2013), and Ake (2010), these results indicate that. Also found is that the stock price index is less sensitive to a positive GDP shock in the pandemic era research than in the pre-COVID-19 research. Overall, however, the pandemic's volatility and uncertainty have moderated the short-run response of stock prices to GDP fluctuations.

The cointegration and impulse response function results show that exchange rate fluctuations became more noticeable during the crisis. This proves how unpredictable world business has become and how currency rate swings affect foreign investments. Cointegration tests showed a long-term relationship between GDP and the stock price index, and the VECM results showed the existence of an error-correcting mechanism. Interestingly, as the GDP rose, growth projections were connected with better stock market performance. Similar findings were made by Manasseh et al. (2017) and Igoni et al. (2020). However, the cointegration tests showed a declining relationship between GDP and stock prices when COVID-19 hit. This showed the stock market's vulnerability to shocks from outside the stock market, and the impulse response functions clearly depicted how the adjustment took place. These findings confirm Omran (2003).

The impulse response test from the pre-COVID-19 model test results showed that, following a positive GDP shock, the stock price index gradually rose. This implies that economic development and stock market success are positively correlated in the near run. These results are consistent with those of Rousseau and Wachtel (2000), Marques et al. (2013), and Ake (2010). The pandemic-era research showed that a positive GDP shock had a less pronounced effect on the stock price index than before the COVID-19 pandemic. The short-term response of stock prices to fluctuations in GDP has been moderated by the pandemic's enhanced volatility and uncertainty.

According to the results of the cointegration and impulse response functions, exchange rate fluctuations became more noticeable during the crisis. This demonstrated how unpredictable the global economy has become and how currency rate swings affect foreign investments.

The pre-COVID-19 period analysis revealed that an initial short-term increase in stock prices was reflected in the stock price index, which was slightly impacted by a positive shock to the exchange rate. Over the ensuing periods, though, this positive effect was reversed, and stock values started to rise again. This implies that changes in exchange rates have a brief impact on investor mood. Similar results are indicated by Adjasi and Biekpe (2006) and Jefferis and Okeahalam (2000), one of the main reasons for this was because the JSE has the highest number of foreign investors in the African continent tended to increase their position amidst a fluctuating domestic currency (JSE 2022). During the COVID-19 period, a positive exchange rate shock initially had a more pronounced negative effect on the stock price index. Nevertheless, this effect faded with time, indicating that swings in exchange rates had a transient negative impact on stock values, probably due to the heightened volatility in the global economy.

6.3 Recommendations

Based on the findings of this study, several recommendations are proposed to enhance the JSE's stability and performance amidst varying macroeconomic conditions. First and foremost, it is crucial to enhance market liquidity. To maintain consistent liquidity, in line with Bayero, Safiyanu and Bakabe (2021) authorities could improve trading infrastructure and promote increased investor engagement, considering the temporary influence of the turnover ratio on stock prices. It is essential to diversify the economic growth drivers to decrease susceptibility to external shocks. Developing industries less susceptible to international market changes can help maintain stable economic growth and support a robust stock market (Barakat et al., 2022). To properly manage volatility during times of crisis, it is important to deploy certain measures such as circuit breakers and liquidity support mechanisms to ensure market stability (Bouhlal and Sedra, 2022).

It is crucial to monitor and manage exchange rate fluctuations as their influence on stock prices became increasingly noticeable during the pandemic. The foreign exchange reserve maintenance, and hedging mechanism utilisation strategies can help alleviate the negative consequences (Bhargava and Konku, 2023). Stability during economic uncertainty can be ensured through transparent implementation of the regulation and investor protection measures to make investors trust (Aggarwal et al., 2020). To support stock market performance, maintain stock market performance even in bad times, encourage foreign investment by creating a stable macroeconomic environment, and start offering incentives (Elgharib, 2023).

6.4 Conclusions

Before the COVID-19 pandemic, stock prices were impacted in the short term by turnover ratio, but the GDP growth had a positive correlation. On the other hand, currency movements had a stable but short-lived market impact resulting from temporary effects on stock prices.

These dynamics were also changed by the COVID-19 epidemic. The stock market was less sensitive to economic growth during the epidemic: its relationship with GDP deteriorated. It mirrors the way Ho (2017) shows how the epidemic affects economic stability and financial markets. However, the stock market became more sensitive to exchange rate shocks under economic uncertainty, meaning that currency swings mattered more. In the context of the crisis, the turnover ratio enabled market stability and contributed to the protection of liquidity and the reduction of the degree of market volatility. The findings provide a methodological foundation for future study on financial markets and macroeconomic causes in contexts of global economic disruptions.

6.5 Limitations of the Study

The limitations of the study are sample size coverage and data accessibility. Because the study is based on a small sample size, it cannot adequately represent the broader complexity and diversity of the whole sector. However, research that focuses on just one country or region may not apply to a broader global context. The quality and availability of financial data might have affected the correctness and dependability of the study. Restricted access to specific financial datasets may undermine the robustness of the analysis or may even result from data mistakes. The duration and timeframe of the study may also not cover long-run financial market trends and cyclical trends. A more extended observation period would have allowed the investigated elements to be better understood.

Certain presumptions or simplifications may be used to model complex financial processes in the study. These analytical tools can be helpful but might oversimplify the real dynamics of the real world and reduce the accuracy of the findings. Unexpected external factors such as changes in governmental policy, geopolitical events, or other events or global economic shocks can affect financial markets independently. However, these uncontrollable variables may make it hard to precisely identify the impacts of the researched parameters.

REFERENCES

Abdalla, I. and Murinde, V. (1997) ‘Exchange rate and stock price interactions in emerging financial markets: Evidence on India, Korea, Pakistan and the Philippines’. *Applied Financial Economics*, 7(1), pp.25-35.

Adam, A.M. and Tweneboah, G. (2008) ‘Macroeconomic factors and stock market movement: Evidence from Ghana’. *SSRN*. Available at: https://ssrn.com/abstract=1289842 (Accessed: 15 August 2024).

Adedokun, M.W. and Olaniyi, T.A. (2021) ‘Interactions between stock prices and exchange rates in South Africa’, *International Journal of Economics, Commerce and Management*, 9(2), pp. 1-16.

Adjasi, C.K. and Biekpe, N.B. (2006) ‘Stock market development and economic growth: The case of selected African countries’, *African Development Review*, 18(1), pp. 144-161.

Adler, M. and Dumas, B. (1983) ‘International portfolio choice and corporation finance: A synthesis’, *Journal of Finance*, 38(3), pp. 925-984.

Aggarwal, R., Erel, I., Ferreira, M. and Matos, P. (2020) ‘Intergenerational effects of pandemic investing’, *The Review of Financial Studies*, 34(6), pp. 2683-2729.

Agouram, J. and Lakhnati, G. (2022) ‘Impact of COVID-19 pandemic on Moroccan sectoral stocks indices’, *Scientific African*, 17, pp. e01321.

Agunobi, C., Okoli, E., Haruna, B. and Madi, Y.A. (2024) ‘Relationship between COVID-19 Pandemic and the performance of the Nigerian stock market’, *AFIT Journal of Marketing Research*, 3(1), pp. 56-59.

Agyemang-Badu, A., Osei, M., Mensah, K., Nketia, P. and Boakye, J. (2022) ‘Overview of Africa’s financial sector: Long-term financing and capital markets’, *Economic Bulletin from ICE*, (3143), pp. 46-50.

Ake, B. (2010) ‘The role of stock market development in economic growth: Evidence from some Euronext countries’, *International Journal of Financial Research*, 1(1), pp. 14-20.

Akinmade, B., Adedoyin, F.F. and Bekun, F.V. (2020) 'The impact of stock market manipulation on Nigeria's economic performance', *Journal of Economic Structures*, 9(1), pp. 1-28.

Al-Abbadi, H.A. and Abdul-Khaliq, S. (2017) 'The relationship between inflation and stock market performance in Jordan', *European Journal of Business and Management*, 9(29), pp. 142-150.

Al-Awadhi, A.M., Alsaifi, K., Al-Awadhi, A. and Alhammadi, S. (2020) 'Death and contagious infectious diseases: Impact of the COVID-19 virus on stock market returns', *Journal of Behavioural and Experimental Finance*, 27, p. 10-24

Alam, M.M., Wei, H. and Wahid, A.N. (2021) 'COVID-19 outbreak and sectoral performance of the Australian stock market: An event study analysis', *Australian Economic Papers*, 60(3), pp. 482-495.

Allam, S., Abdelrhim, M. and Mohamed, M. (2020). 'Determinants of herding behaviour in the time of COVID-19: The case of Egyptian stock market sectors', *SSRN*. Available at: https://ssrn.com/abstract=3717995 (Accessed: 15 June 2024).

Alsufy, F., Afifa, M.A. and Zakaria, M. (2020) 'Mediating effects of liquidity in the relationship between earnings quality and market value of the share price: Evidence from Jordan', *Review of Applied Socio-Economic Research*, 19(1), pp. 17-32.

Amihud, Y. (2002) 'Illiquidity and stock returns: Cross-section and time-series effects', *Journal of Financial Markets*, 5(1), pp. 31-56.

Ammer, J. and Freeman, R.T. (1995) 'The international role of U.S. monetary policy', *Journal of Money, Credit and Banking*, 27(4), pp. 1049-1071.

Apergis, N., Mustafa, G. and Malik, S. (2022) 'COVID-19 pandemic, stock returns, and volatility: The role of the vaccination program in Canada', *Applied Economics*, 54(42), pp. 4825-4838.

Arjoon, R., Botes, M., Chesang, L.K. and Gupta, R. (2012) 'The long-run relationship between inflation and real stock prices: Empirical evidence from South Africa', *Journal of Business Economics and Management*, 13(4), pp. 1611-1699.

Askandir, I., Bondzie, E.A. and Tweneboah, G. (2024) ‘Government interventions and stock market performance during COVID-19 pandemic: Empirical evidence from Ghana’, *Cogent Social Sciences*, 10(1), pp. 23.

Asteriou, D. and Hall, S.G. (2011) *Applied Econometrics*. New York: Palgrave McMillan.

Aye, G.C., Balcilar, M., Gupta, R. and Pierdzioch, C. (2021) ‘COVID-19 pandemic and stock markets: Empirical evidence from India’, *International Review of Financial Analysis*, 72, pp. 101.

Banerjee, A., Dolado, J.J., Galbraith, J.W. and Hendry, D. (1993) *Co-integration, error correction, and the econometric analysis of non-stationary data*. Oxford: Oxford University Press.

Barakat, H.A., El-Zayat, A.M., Mohamed, H.E., El-Naggar, I.K., Mohamed, N.A. and Mounir, N.H. (2022) ‘The Impact of COVID-19 Spread on Egyptian Stock Market Return’, *Corporate Governance and Organizational Behavior Review*, 6(4), pp. 338-348.

Bayar, Y. (2016) ‘Macroeconomic determinants of stock market development: Evidence from Borsa Istanbul’, *Financial Studies*, 20(1), pp. 31-39

Bayero, S.A., Safiyanu, B.D. and Bakabe, Z.S. (2021) ‘Impact of COVID-19 on the stock market in sub-Saharan Africa’, *International Journal of Entrepreneurship and Sustainability Studies*, 1(2), pp. 51-69.

Bédi, H.D. (2024) ‘Assessing volatility in Southern African stock markets: Implementations of global economic policy uncertainty and oil shocks using a Garch-Midas framework’, *Top Journal of Economics and Finance*, 9(1), pp. 1-19.

Ben Naceur, S., Ghazouani, S. and Omran, M. (2007) ‘The determinants of stock market development in the Middle Eastern and North African region’, *Managerial Finance*, 33(7), pp. 477-489.

Beraich, M., Fadali, M.A. and Bakir, Y. (2021) ‘Impact of the COVID-19 crisis on the Moroccan stock market’, *International Journal of Accounting, Finance, Auditing, Management and Economics*, 2(1), pp. 100-108.

Bernanke, B.S., Boivin, J. and Eliasz, P. (2005) ‘Measuring the effects of monetary policy: A factor-augmented vector autoregressive (FAVAR) approach’, *The Quarterly Journal of Economics*, 120(1), pp. 387-422.

Bernstein, P.L. (2011) *Capital ideas evolving*. John Wiley & Sons.

Bhargava, V. and Konku, D. (2023) ‘Impact of exchange rate fluctuations on US stock market returns’, *Managerial Finance*, 49(10), pp. 1535-1557.

Billmeier, A. and Massa, I. (2009) ‘What drives stock market development in emerging markets: Institutions, remittances, or natural resources?’, *Emerging Markets Review*, 10(1), pp. 23-35.

Blume, M.E. and Friend, I. (1973) ‘A new look at the capital asset pricing model’, *The Journal of Finance*, 28(1), pp. 19-33.

Bodie, Z., Kane, A. and Marcus, A.J. (2007) *Essentials of Investments*. 6th ed. McGraw-Hill/Irwin.

Booth, G.G., Martikainen, T., Virtanen, I. and Yli-Olli, P. (1993) ‘On the existence of common factors in the Arbitrage Pricing Model: International evidence from US and Scandinavian stock markets’, *Applied Financial Economics*, 3(3), pp. 189-200.

Bouhlal, F. and Sedra, M.B. (2022) ‘The impact of COVID-19 on the topological properties of the Moroccan stock market network’, *Investment Management and Financial Innovations*, 19(2), pp. 40-55.

Brahmasrene, T., Huang, J.C. and Sissoko, Y. (2014) ‘Crude oil prices and exchange rates: Causality, variance decomposition and impulse response’, *Energy Economics*, 44, pp. 407-412.

Brown, S.J. and Otsuki, T. (1989) ‘Macroeconomic factors and the Japanese equity markets: The CAPMD project’, *Salomon Bros. Centre for the Study of Financial Institutions*, Graduate School of Business Administration, New York University.

Brueckner, M. and Vespignani, J. (2021) ‘COVID-19 infections and the performance of the stock market: An empirical analysis for Australia’, *Economic Papers: A journal of applied economics and policy*, 40(3), pp. 173-193.

Calvo, G.A., Leiderman, L. and Reinhart, C.M. (1993) 'Capital inflows and real exchange rate appreciation in Latin America', *IMF Staff Papers*, 40(1), pp. 108-151.

Carp, L. (2012) 'Can stock market development boost economic growth? Empirical evidence from emerging markets in Central and Eastern Europe', *Procedia Economics and Finance*, 3, pp. 438-444.

Cesa-Bianchi, A., Pesaran, M.H. and Rebucci, A. (2020) 'Uncertainty and economic activity: A multi-country perspective'. *The Review of Financial Studies*, 33(8), pp. 3393-3445.

Cevik, E., Kirci Altinkeski, B., Cevik, E.I. and Dibooglu, S. (2022) 'Investor sentiments and stock markets during the COVID-19 pandemic'. *Financial Innovation*, 8(1), pp. 18-20.

Chen, N.F., Roll, R. and Ross, S.A. (1986) 'Economic forces and the stock market'. *Journal of Business*, 59(3), pp. 383-403.

Cheng, S.Y. (2012) 'Substitution or complementary effects between banking and stock markets: Evidence from financial openness in Taiwan'. *Journal of International Financial Markets, Institutions and Money*, 22(3), pp. 508-520.

Chiang, T.C. and Zheng, D. (2015). Liquidity and stock returns: Evidence from international markets. *Global Finance Journal*, 27, pp. 73-97.

Choi, C. and Jung, H. (2022) 'COVID-19's impacts on the Korean stock market'. *Applied Economics Letters*, 29(11), pp. 974-978.

Chou, W.L. (2000) 'Exchange rate variability and China's exports'. *Journal of Comparative Economics*, 28, pp. 61-79.

Clare, A.D. and Thomas, S.H. (1994) 'Macroeconomic factors, the APT and the UK stock market'. *Journal of Business Finance and Accounting*, 21(3), pp. 309-330.

Cologni, A. and Manera, M. (2008) 'Oil prices, inflation and interest rates in a structural cointegrated VAR model for the G-7 countries'. *Energy Economics*, 30(3), pp. 856-888.

Cooray, A. (2010) ‘Do stock markets lead to economic growth?’. *Journal of Policy*, 32, pp. 448-460.

Costa, A., da Silva, C. and Matos, P. (2022) ‘The Brazilian financial market reaction to COVID-19: A wavelet analysis’. *International Review of Economics & Finance*, 82, pp. 13-29.

da Silva, L.S., Gutierrez, M., Gouvea, R. and Moraes, C. (2023) ‘Effectiveness of foreign exchange derivatives usage from non-financial companies: A Brazilian perspective’. *Modern Economy*, 14(11), pp. 1550-1565.

Das, P.K. and Das, A. (2023) ‘Prediction, risk assessment and comparison of selected emerging markets’ stock indices during COVID-19 pandemic using the coherent measure’. *The Journal of Prediction Markets*, 16(3), pp. 81-97.

Deb, S.G. and Mukherjee, J. (2008) ‘Does stock market development cause economic growth? A time-series analysis of the Indian economy’. *International Research Journal of Finance and Economics*, 21, pp. 142-149.

Debata, B. and Mahakud, J. (2018) ‘Economic policy uncertainty and stock market liquidity: Does financial crisis make any difference?’. *Journal of Financial Economic Policy*, 10(1), pp. 112-135.

Delle Monache, D., Emiliozzi, S. and Nobili, A. (2021) ‘Tracking economic growth during the COVID-19: A weekly indicator for Italy’. *Bank of Italy Note Covid-19*, January.

Dickey, D.A. and Fuller, W.A. (1981) ‘Likelihood ratio statistics for autoregressive time series with a unit root’. *Econometrica: Journal of the Econometric Society*, 49(4), pp. 1057-1072.

Dornbusch, R. and Fisher, S. (1980) ‘Exchange rates and the current account’. *American Economic Review*, 70, pp. 960-971.

ElBouch, S., Michel, O.J. and Comon, P. (2022) ‘Joint normality test via two-dimensional projection’. In *ICASSP 2022-2022 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pp. 5802-5806.

Elgharib, W.A. (2023) ‘The effect of the COVID-19 announcement on stock returns: Evidence from Egypt’. *African Journal of Economic and Management Studies*, 14(3), pp. 420-431.

Engle, R.F. and Granger, C.W. (1987) ‘Co-integration and error correction: Representation, estimation, and testing’. *Econometrica: Journal of the Econometric Society*, 55(2), pp. 251-276.

Enisan, A.A. and Olufisayo, A.O. (2009) ‘Stock market development and economic growth: Evidence from seven sub-Sahara African countries’. *Journal of Economics and Business*, 61(2), pp. 162-171.

Fama, E.F. (1990) ‘Stock returns, expected returns, and real activity’. *The Journal of Finance*, 45(2), pp. 1089-1108.

Fama, E.F. (2000) *Short-term interest rates as predictors of inflation; the debt market*. Cheltenham: Elgar.

Fama, E.F. and French, K.R. (2004) ‘The capital asset pricing model: Theory and evidence’. *Journal of Economic Perspectives*, 18(3), pp. 25-46.

Garza-Garcia, J.G. and Yue, Y. (2010) ‘International determinants of stock market performance in China: A cointegration approach’. *University of West of England: Working Paper*, 3(10).

Geske, R. and Roll, R. (1983) ‘The fiscal and monetary linkage between stock returns and inflation’. *The Journal of Finance*, 38(1), pp. 1-33.

Gitman, L.J., Joehnk, M.D., Smart, S. and Juchau, R.H. (2015) *Fundamentals of investing*. Pearson Higher Education AU.

Gofran, R.Z., Gregoriou, A. and Haar, L. (2022) ‘Impact of Coronavirus on liquidity in financial markets’. *Journal of International Financial Markets, Institutions and Money*, 78, p. 101561.

Goldsmith, R.W. (1969) *Financial structure and development*. London: Yale University Press.

Gonzalo, J. (1994) ‘Five alternative methods of estimating long-run equilibrium relationships’. *Journal of Econometrics*, 6(1), pp. 203-233.

Gujarati, D.N. (2021) *Essentials of econometrics*. SAGE Publications.

Gunay, S., Bakry, W. and Al-Mohamad, S. (2021) ‘The Australian stock market’s reaction to the first wave of the COVID-19 pandemic and black summer bushfires: A sectoral analysis’. *Journal of Risk and Financial Management*, 14(4), pp. 175.

Hajilee, M. and Al Nasser, O.M. (2014) ‘Exchange rate volatility and stock market development in emerging economies’. *Journal of Post Keynesian Economics*, 37(1), pp. 163-180.

Handay, E.M. (1997) *Securities and capital market*. Alexandria: Monshat Almarf.

He, Q., Liu, J., Wang, S. and Yu, J. (2020) ‘The impact of COVID-19 on stock markets’. *Economic and Political Studies*, 8(3), pp. 275-288.

Ho, S.Y. (2017) ‘The macroeconomic determinants of stock market development: Evidence from South Africa’. Germany: University Library of Munich.

Ho, S.Y. (2018) ‘Macroeconomic determinants of stock market development in South Africa’. *International Journal of Emerging Markets*, 14(2), pp. 322-342.

Ho, S.Y. and Odhiambo, N.M. (2018) ‘Analysing the macroeconomic drivers of stock market development in the Philippines’. *Cogent Economics and Finance*, 6(1), pp, 12

Ho, S.Y. and Odhiambo, N.M. (2019) ‘The macroeconomic drivers of stock market development: Evidence from Hong Kong’. *Journal of Financial Economic Policy*, 12(2), pp. 185-207.

Hoshikawa, T. and Yoshimi, T. (2021) ‘The effect of the COVID-19 pandemic on South Korea's stock market and exchange rate’. *The Developing Economies*, 59(2), pp. 206-222.

Huber, P.J. (1997) ‘Tutorial on robust estimation of location and scale parameters’. In *Robust Statistics* (pp. 45-78). Birkhäuser, Basel.

Humpe, A. and Macmillan, P. (2009) ‘Can macroeconomic variables explain long term stock market movements? A comparison of the US and Japan’. *Applied Financial Economics*, 19(2), pp. 111-119.

Ibrahim, M. and Musah, A. (2014) ‘An econometric analysis of the impact of macroeconomic fundamentals on stock market returns in Ghana’. *Research in Applied Econometrics*, 6(2), pp. 1-12.

Igoni, S., Ogiri, I.H. and Orlu, L. (2020) ‘Perceived macroeconomic factors and stock market capitalization: Experience from the Nigerian economy perspective’. *Asian Journal of Economics and Empirical Research*, 7(1), pp. 105-114.

Insaidoo, M., Ullah, A., Dziwornu, R.K., Amoako, S. and Abdul-Mumuni, A. (2023) ‘COVID-19 pandemic and stock market performance: A comparative study of emerging economies’. *Heliyon*, 9(5), pp. 1-10.

Jahur, M.S., Quadir, S.N. and Khan, M.A. (2014) ‘Determinants of stock market performance: Bangladesh’. *Indonesian Management and Accounting Research*, 13(1), pp. 16-28.

Jakada, A.H., Mahmood, S., Ahmad, A.U., Muhammad, I.G., Danmaraya, I.A. and Yahaya, N.S. (2022) ‘Driving forces of CO2 emissions based on impulse response function and variance decomposition: A case of the main African countries’. *Environmental Health Engineering and Management Journal*, 9(3), pp. 223-232.

Jallow, H., Renukappa, S. and Suresh, S. (2021) ‘The impact of COVID-19 outbreak on United Kingdom infrastructure sector’. *Smart and Sustainable Built Environment*, 10(4), pp. 581-593.

Jarque, C.M. and Bera, A.K. (1987) ‘A test for normality of observations and regression residuals’. *International Statistical Review/Revue Internationale de Statistique*, 55(2), pp. 163-172.

Javangwe, K.Z. and Takawira, O. (2022) ‘Exchange rate movement and stock market performance: An application of the ARDL model’. *Cogent Economics & Finance*, 10(1), p. 2075520.

Jefferis, K.R. and Okeahalam, C.C. (2000) 'The impact of economic fundamentals on stock markets in Southern Africa'. *Development Southern Africa*, 17(1), pp. 23-51.

Jiang, J., Park, E.M. and Park, S.T. (2021) 'The impact of COVID-19 on economic sustainability: A case study of fluctuation in stock prices for China and South Korea'. *Sustainability*, 13(12), p. 6642.

Jo, S.K., Kim, M.J., Lim, K. and Kim, S.Y. (2018) 'Correlation analysis of the Korean stock market: Revisited to consider the influence of foreign exchange rate'. *Physica A: Statistical Mechanics and its Applications*, 491, pp. 852-868.

Johannesburg Stock Exchange (2022) 'JSE'. [Online] Available at: https://www.jse.co.za/learn-how-to-invest/accessing-market/share-indices [Accessed 2 November 2022].

Johansen, S. (1991) 'Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models'. *Econometrica*, 59(6), pp. 1551-1580.

Johansen, S. and Juselius, K. (1994) 'Identification of the long-run and the short-run structure: An application to the ISLM model'. *Journal of Econometrics*, 63(1), pp. 7-36.

Jorion, P. (1991) 'The pricing of exchange rate risk in the stock market'. *Journal of Financial and Quantitative Analysis*, 26(3), pp. 361-376.

Kacperska, E. and Kraciuk, J. (2021) 'Changes in the stock market of food industry companies during the COVID-19 pandemic—A comparative analysis of Poland and Germany'. *Energies*, 14(23), pp. 7886.

Khan, A., Sindhwani, R., Atif, M. and Varma, A. (2024) 'Supply chain driven herding behavior during COVID-19: Evidence of interdependence from India'. *Journal of Business & Industrial Marketing*, 39(3), pp. 456-478.

Kharbanda, V. and Jain, R. (2021) 'Impact of COVID on the stock market: A study of BRIC countries'. *International Journal of Financial Markets and Derivatives*, 8(2), pp. 169-184.

Khetsi, Q.S. (2014) 'The impact of capital markets on economic growth in South Africa'. (Doctoral dissertation, North-West University).

Kilian, L. and Kim, Y.J. (2011) 'How reliable are local projection estimators of impulse responses?' *Review of Economics and Statistics*, 93(4), pp. 1460-1466.

Kilian, L. and Vigfusson, R.J. (2011) 'Are the responses of the US economy asymmetric in energy price increases and decreases?' *Quantitative Economics*, 2(3), pp. 419-453.

Kim, H. (2022) 'A finite sample correction for the panel Durbin–Watson test'. *Applied Economics*, 54(28), pp. 3197-3205.

Kim, J.M., Cho, C. and Jun, C. (2022) 'Forecasting the price of cryptocurrency using linear and nonlinear error correction model'. *Journal of Risk and Financial Management*, 15(2), p. 74.

King, R.G. and Levine, R. (1993) 'Financial intermediation and economic development'. *Capital Markets and Financial Intermediation*, pp. 156-189.

Koop, G., Pesaran, M.H. and Potter, S.M. (1996) 'Impulse response analysis in nonlinear multivariate models'. *Journal of Econometrics*, 74(1), pp. 119-147.

Kowalewski, O. and Piewanowski, P. (2020) 'Stock market response to potash mine disasters'. *Journal of Commodity Markets*, 18, pp. 100124.

Krishnan, D. and Dagar, V. (2022) 'Exchange rate and stock markets during trade conflicts in the USA, China, and India'. *Global Journal of Emerging Market Economies*, 14(2), pp. 185-203.

Kurach, R. (2010) 'Stock market development in CEE countries – the panel data analysis'. *Ekonomika*, 89(3), pp. 20-29.

Kuranchie-Pong, R. and Forson, J.A. (2022) 'Overconfidence bias and stock market volatility in Ghana: Testing the rationality of investors in the COVID-19 era'. *African Journal of Economic and Management Studies*, 13(1), pp. 147-161.

Lee, J.W. and Brahmasrene, T. (2019) 'Long-run and short-run causality from exchange rates to the Korea composite stock price index'. *The Journal of Asian Finance, Economics and Business*, 6(2), pp. 257-267.

Lee, S., Ha, J., Na, O. and Na, S. (2003) ‘The CUSUM test for parameter change in time series models’. *Scandinavian Journal of Statistics*, 30(4), pp. 781-796.

Lee, S.W. (2022) ‘Methods for testing statistical differences between groups in medical research: Statistical standard and guideline of Life Cycle Committee’. *Life Cycle*, 2, pp. 16-26.

Levine, R. and Zervos, S. (1996) ‘Stock market development and long-run growth’. *World Bank Economic Review*, 10(2), pp. 323-340.

Leybourne, S., Taylor, R. and Kim, T.H. (2007) ‘CUSUM of squares-based tests for a change in persistence’. *Journal of Time Series Analysis*, 28(3), pp. 408-433.

Liu, H., Wang, Y., He, D. and Wang, C. (2020) ‘Short-term response of Chinese stock markets to the outbreak of COVID-19’. *Applied Economics*, 52(53), pp. 5859-5872.

Liu, S. (2015) ‘Investor sentiment and stock market liquidity’. *Journal of Behavioral Finance*, 16(1), pp. 51-67.

Liu, Z., Huynh, T.L.D. and Dai, P.F. (2021) ‘The impact of COVID-19 on the stock market crash risk in China’. *Research in International Business and Finance*, 57, pp. 101419.

Lütkepohl, H. (1990) ‘Asymptotic distributions of impulse response functions and forecast error variance decompositions of vector autoregressive models’. *The Review of Economics and Statistics*, 72(1), pp. 116-125.

Manasseh, C.O., Mathew, T.E. and Ogbuabor, J.E. (2017) ‘Investigating the nexus between institutional quality and stock market development in Nigeria: An Autoregressive Distributed Lag (ARDL) approach’. *African Development Review*, 29(2), pp. 272-292.

Marfatia, H. (2023) ‘The financial market's ability to forecast economic growth: Information from sectoral movements’. *Journal of Economic Studies*, (ahead-of-print).

Marques, L.M., Fuinhas, J.A. and Marques, A. (2013) ‘Does the stock market cause economic growth? Portuguese evidence of economic regime change’. *Economic Modelling*, 32, pp. 316-324.

Martikainen, T., Yli-Olli, P. and Gunasekaran, A. (1991) ‘The Finnish stock market: An investigation for empirical research and future research directions’. *Finnish Journal of Business Economics*, 40, pp. 253-284.

Masoud, N.M.H. (2013) ‘The impact of stock market performance upon economic growth’. *International Journal of Economics and Financial Issues*, 3(4), pp. 788-798.

Matuka, A., Asafo, S.S., Eweke, G.O., Mishra, P., Ray, S., Abotaleb, M., Makarovskikh, T., Alhussan, A.A., Abdelhamid, A.A., El-Kenawy, E.M. and Dutta, P. (2022) ‘Analysing the impact of COVID-19 outbreak and economic policy uncertainty on stock markets in major affected economies’. *IET. In 6th Smart Cities Symposium (SCS 2022) 2022*, pp. 372-378.

Mazur, M., Dang, M. and Vega, M. (2020) ‘COVID-19 and the March 2020 stock market crash: Evidence from S&P500’. *Finance Research Letters*, 38, pp. 1-7.

McKinnon, R. (1973) *Money and Capital in Economic Development*. Washington D.C.: Brookings Institution.

Merton, R.C. (1973) ‘An intertemporal capital asset pricing model’. *Econometrica: Journal of the Econometric Society*, 41(5), pp. 867-887.

Mesagan, E.P. (2021) ‘Efficiency of financial integration, foreign direct investment and output growth: Policy options for pollution abatement in Africa’. *Economic Issues*, 26(1), pp. 1-19.

Mesagan, E.P., Vo, X.V. and Amadi, I.P. (2021) ‘Symmetric and asymmetric effects of exchange rate: Evidence from the capital market and financial sector in Nigeria’. *Journal of Public Affairs*, 21(4), pp. e2776.

Minier, J. (2003) ‘Are small stock markets different?’. *Journal of Monetary Economics*, 50, pp. 1593-1602.

Mishkin, F.S. and Eakins, S.G. (2003) *Financial Markets and Institutions*. 4th ed. New York: Boston San Francisco.

Mohtadi, H. and Agarwal, S. (2004) *Stock Market Development and Economic Growth: Evidence from Developing Countries*. New York: Oxford University Press.

Moolman, E. and du Toit, C. (2005) ‘An econometric model of the South African stock market’. *South African Journal of Economics*, 73(1), pp. 77-91.

Mukherjee, T.K. and Naka, A. (1995) ‘Dynamic relations between macroeconomic variables and the Japanese stock market: An application of a vector error correction model’. *The Journal of Financial Research*, 18(2), pp. 223-237.

Naceur, S.B. and Ghazouani, S. (2007) ‘Stock markets, banks, and economic growth: Empirical evidence from the MENA region’. *Research in International Business and Finance*, 21(2), pp. 297-315.

Naik, P. and Reddy, Y.V. (2021) ‘Stock market liquidity: A literature review’. *SAGE Open*, 11(1), pp. 1-19.

Najaf, K. and Chin, A. (2024) ‘The impact of the China stock market on global financial markets during COVID-19’. *International Journal of Public Sector Performance Management*, 13(1), pp. 100-114.

Nayo, D. and Atsi, E.R. (2022) ‘The impact of the landscape of COVID-19 on the Ghana stock market’. *International Journal of Information, Business and Management*, 14(2), pp. 24-36.

Ncanywa, T. and Ralarala, O. (2019) ‘Effects of exchange rate movements on stock market prices in South Africa’. *International Conference on Public Administration and Development Alternatives (IPADA)*. pp. 150-158.

Nguyen, C.T., Hai, P.T. and Nguyen, H.K. (2021) ‘Stock market returns and liquidity during the COVID-19 outbreak: Evidence from the financial services sector in Vietnam’. *Asian Journal of Economics and Banking*, 5(3), pp. 324-342.

Olivier, M.J. and Pierre, C. (2022) ‘Multivariate normality test for coloured data’. In: *2022 August 30th European Signal Processing Conference (EUSIPCO)*, IEEE, pp. 2096-2100.

Olokoyo, F.O., Ibhagui, O.W. and Babajide, A. (2020) ‘Macroeconomic indicators and capital market performance: Are the links sustainable?’. *Cogent Business & Management*, 7(1), p. 1792258.

Omran, M.M. (2003) ‘Time series analysis of the impact of real interest rates on stock market activity and liquidity in Egypt: Co-integration and error correction model approach’. *International Journal of Business*, 8(3), pp. 45-68.

Osasogie, E.O. and Joseph, I.E. (2024) ‘COVID-19 pandemic and stock market returns in Nigeria’. *Strategic Management Practices & Sustainable Development in a Global Economy*, 12, pp. 296-310.

Osisanwo, B.G. and Atanda, A.A. (2012) ‘Determinants of stock market returns in Nigeria: A time series analysis’. *African Journal of Scientific Research*, 9(1), pp. 63-84.

Owusu, E.L. (2020) ‘Does stock market development promote economic growth in Botswana?’. *Journal of Economics & Management Research*, 1–6. https://doi.org/10.47363/jesmr/2020(1)111

Ozkan, O. (2021) ‘Impact of COVID-19 on stock market efficiency: Evidence from developed countries’. *Research in International Business and Finance*, 58, p. 101445.

Park, E.Y. (2023) ‘Analyzing the transition of volatility in stock markets and oil prices pre- and post-COVID-19 pandemic: Korea and the United States stock markets’. *Journal of Industrial Economics and Business*, 36(1), pp. 167-185.

Patel, N., Patel, A. and Patel, B. (2024) ‘The role of institutional investors in the Indian stock markets during the pandemic’. *Capital Markets Review*, p. 75.

Perold, A.F. (2004) ‘The capital asset pricing model’. *Journal of Economic Perspectives*, 18(3), pp. 3-24.

Phillips, P.C.B. and Perron, P. (1988) ‘Testing for the unit root in time series regression’. *Biometrika*, 75(2), pp. 335-346.

Ploberger, W. and Krämer, W. (1990) ‘The local power of the CUSUM and CUSUM of squares tests’. *Econometric Theory*, 6(3), pp. 335-347.

Ploberger, W. and Krämer, W. (1992) ‘The CUSUM test with OLS residuals’. *Econometrica: Journal of the Econometric Society*, 60(2), pp. 271-285.

Pradhan, R.P., Arvin, M.B., Hall, J.H. and Bahmani, S. (2014) ‘Causal nexus between economic growth, banking sector development, stock market development, and other macroeconomic variables: The case of ASEAN countries’. *Review of Financial Economics*, 23(4), pp. 235-248.

Pratiwi, A.C., Wardhana, A.K. and Rusgianto, S. (2022) ‘Application of vector error correction model on macroeconomic variables toward changes in the composite stock price index’. *Daengku: Journal of Humanities and Social Sciences Innovation*, 2(2), pp. 219-229.

Quintos, C.E. (1998) ‘Stability tests in error correction models’. *Journal of Econometrics*, 82(2), pp. 289-315.

Rahman, M.M., Rahman, M.M. and Abedin, M.Z. (2020) ‘Macroeconomic variables and stock market indices during the COVID-19 pandemic: Evidence from USA and Canada’. *Available at SSRN* [online]. Available at: https://ssrn.com/abstract=3712419 [Accessed 4 September 2024].

Rakha, A., Hettiarachchi, H., Rady, D., Gaber, M.M., Rakha, E. and Abdelsamea, M.M. (2021) ‘Predicting the economic impact of the COVID-19 pandemic in the United Kingdom using time-series mining’. *Economies*, 9(4), pp. 137.

Ramsey, J.B. (1969) ‘Tests for specification errors in classical linear least-squares regression analysis’. *Journal of the Royal Statistical Society: Series B (Methodological)*, 31(2), pp. 350-371.

Rashid, H. and Pitterle, I. (2021) ‘The monetary policy response to COVID-19: The role of asset purchase programmes’. *UN Policy Brief* No. 129.

Rigobon, R. (2003) ‘Identification through heteroskedasticity’. *Review of Economics and Statistics*, 85(4), pp. 777-792.

Ross, S.A. (2013) ‘The arbitrage theory of capital asset pricing’. In: *Handbook of the Fundamentals of Financial Decision Making: Part I*. pp. 11-30.

Rousseau, P.L. and Wachtel, P. (2000) ‘Banks, stock markets and China's Great Leap’. *Emerging Markets Review*, 8, pp. 206-217.

Sana, S., Malik, S. and Sheikh, M.R. (2022) 'Investigating the effectiveness of channels of monetary transmission mechanism in Pakistan: An application of VAR model, impulse response function and variance decomposition'. *Bulletin of Business and Economics (BBE)*, 11(2), pp. 160-183.

Sansa, N.A. (2020) 'The impact of COVID-19 on the financial markets: Evidence from China and USA'. *Electronic Research Journal of Social Sciences and Humanities*, 2.

Schwert, G.W. and Seguin, P.J. (1990) 'Heteroskedasticity in stock returns'. *The Journal of Finance*, 45(4), pp. 1129-1155.

Sharma, S.C. and Wongbangpo, P. (2002) 'Long-term trends and cycles in ASEAN stock markets'. *Review of Financial Economics*, 11(4), pp. 299-315.

Sharpe, W.F. (1958) 'Capital asset prices: A theory of market equilibrium under conditions of risk'. *Economic Studies*, 25, pp. 65-86.

Sharpe, W.F. (1964) 'Capital asset prices: A theory of market equilibrium under conditions of risk'. *The Journal of Finance*, 19(3), pp. 425-442.

Shaw, E. (1973) *Financial Deepening in Economic Development*. Washington D.C.: Brookings Institution.

Singh, A. (1997) 'Financial liberalization, stock markets, and economic development'. *The Economic Journal*, 107, pp. 771-782.

Singh, P. and Singh, S. (2022) 'Autocorrelation of an econometric model'. In: *Smart Trends in Computing and Communications: Proceedings of SmartCom*. Singapore: Springer Nature Singapore, pp. 289-297.

Sohrabi, C. et al. (2020) 'World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19)'. *International Journal of Surgery*, 76, pp. 71-76.

Stapley, N.F. (1986) *The Stock Market: A Guide for the Private Investor*. London: Woodhead-Faulkner in association with Laing and Cruickshank Investment Management Services.

Stern, D.I. (2000) 'A multivariate cointegration analysis of the role of energy in the US macroeconomy'. *Energy Economics*, 22(2), pp. 267-283.

Suriani, S., Kumar, M.D., Jamil, F. and Muneer, S. (2015) 'Impact of exchange rate on stock market'. *International Journal of Economics and Financial Issues*, 5(1), pp. 385-388.

Takyi, P.O. and Bentum-Ennin, I. (2021) 'The impact of COVID-19 on stock market performance in Africa: A Bayesian structural time series approach'. *Journal of Economics and Business*, 115, pp. 105968.

Nguyen, M. (2023) 'Examining contagion effects between global crude oil prices and the Southeast Asian stock markets during the COVID-19 pandemic'. *Investment Management and Financial Innovations*, 20(1), pp. 77-87.

Tsaurai, K. (2018) 'What are the determinants of stock market development in emerging markets?'. *Academy of Accounting and Financial Studies Journal*, 22(2), pp. 1-11.

Ueda, R.M. and Souza, A.M. (2022) 'An effective approach to detect the source(s) of out-of-control signals in productive processes by vector error correction (VEC) residual and Hotelling's T2 decomposition techniques'. *Expert Systems with Applications*, 187, pp. 115979.

Uhunmwango, M. and Omorokunwa, O.G. (2022) 'Volatility, liquidity and stock market returns'. *Journal of Academic Research in Economics*, 14(2), pp. 1-14.

Volkova, V.M. and Pankina, V.L. (2013) 'The research of the distribution of the Ramsey RESET-test statistic'. In: *Boris Lemeshko, Mikhail Nikulin, Narayanaswamy Balakrishnan (eds)*. pp. 265.

Yusuf, I.A., Salaudeen, M.B. and Agbonrofo, H. (2021) 'Social and economic drivers of stock market performance in Nigeria'. *Journal of Economic Impact*, 3(3), pp. 137-143.

Zalk, N. (2021) 'Structural change in South Africa: Structural transformation in South Africa: The challenges of inclusive industrial development in a middle-income country'. In: *Structural Transformation in South Africa*. 4(2), pp. 28-52.

Zeren, F. and Hizarci, A. (2020) 'The impact of COVID-19 coronavirus on stock markets: Evidence from selected countries'. *Muhasebe ve Finans İncelemeleri Dergisi*, 3(1), pp. 78-84.

Zhang, W. and Hamori, S. (2021) 'Crude oil market and stock markets during the COVID-19 pandemic: Evidence from the US, Japan, and Germany'. *International Review of Financial Analysis*, 74, pp. 101-121

Zhou, E.Y. and Ridge, M. (2023) 'Advances in machine learning methods to contextualize economic sustainability in South African capital markets within the COVID-19 era'. *College of Economic and Management Sciences, University of South Africa*, Pretoria. 12(3), pp. 45–67.