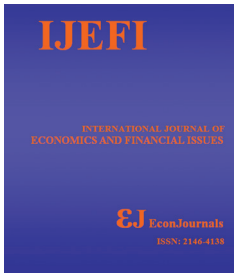

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COVID-19 Shock and Sectorial Index Response in South Africa: A Cross-sector Analysis

Edson Vengesai*

Department of Economics and Finance, Faculty of Economics and Management Sciences, University of the Free State, PO Box 339, Bloemfontein 9300, Republic of South Africa. *E-mail: vengesaie@ufs.ac.za

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ABSTRACT

The prime objective of this study was to examine the impact of COVID-19 shock on sector returns of the South African Stock market. The study employed the Autoregressive Distributed Lag (ARDL) model estimated with a Pooled Mean Group estimator on a sample of daily stock returns of 10 Johannesburg Stock Exchange (JSE) sectors. The results indicate a heterogeneous behaviour in sector stock return response to COVID-19 shock. The study shows that the Pandemic negatively impacted the majority of the sectors. However, some sectors were positively affected by the outbreak, while some were resilient to the shock. The pooled ARDL panel results show a negative relationship between COVID-19 and stock market returns in the short run. The study found an insignificant relationship between stock market returns and COVID-19 cases in the long run. The study also shows that sector and stock return response to different factors is time-varying. The results imply that COVID-19 shock is short-lived, the negative impact of the Pandemic is corrected in the long run. Stock market investors should thus focus on the long-run behaviour of stock returns. The results evidence the significance of diversification in different stock market sectors for investors.

Keywords: COVID-19, Stock Returns, ARDL, Stock Market, Sector
JEL Classifications: G0, G1, G2, G3

1. INTRODUCTION

Epidemics and contagious diseases have presented a significant threat to modern societies. Pandemics pause different costs to economies and societies; specific dimensions include direct costs such as medical expenses and hospitalisation and indirect costs such as loss of earnings and productivity costs. The first and most crucial part of an outbreak is a threat to human life. Nevertheless, epidemics pause significant economic implications by disrupting the international supply chain and trade (Delivorias and Scholz, 2020). The Coronavirus pandemic fashioned enormous economic uncertainty and caused severe consequences in all aspects across the world (Assous and Al-Najjar, 2021). Capano et al., (2020) notes that the novel nature of COVID-19 makes it a thorn policy problem because many aspects of the virus were unknown, which made policy responses uncertain and highly contested. In response to the Pandemic Regulatory bodies, Central banks and financial institutions employed various initiatives and radical measures, including lockdowns to contain the virus and save lives. However, such actions instigated devastating effects on economies, including production halt, supply chain disruption, closure of businesses, loss of income, the decline in global equity and asset prices and escalating unemployment levels. Raghavan et al., (2021) document that the Pandemic disrupted historical operational models and introduced new changes such as telework that may last beyond the Pandemic.

Most indices worldwide lost value, and significant market slumps were recorded, triggering panic selling among investors. Grima et al., (2021) showed that a 1% increase in COVID cases increased fear in the US market by 32.5%. For the 1st time in history, the US Crude oil futures crashed into negative territory

amid the Pandemic induced supply glut. The IMF projected a 3% shrinkage in the global economy's GDP, the worst since the great depression. Emerging equities and Forex markets felt the worst sting as trade shocks took hold as investors flocked to safe-havens. The South African Rand plummeted hastily against major currencies to new historic levels. In 2020 at the onset of the Pandemic, as lockdowns fraught the economy by disrupting output and trade, the South African economy contracted by 7%, the worst in 11 years since the economy contracted by 1,5% in 2009 following the world financial crisis.

To revive the economies post-COVID-19, the stability of capital markets will play a central stage in steering economic progression. Capital markets are an engine of any economy. They provide the means for efficient capital allocation by assisting firms in raising capital and diversifying their risks and investments, thereby stimulating economic development. The functioning and efficiency of capital markets are disrupted during pandemics, derailing economic productivity. Adverse events such as pandemics cause investors to overreact and withdraw their savings. The switch in positions induces shocks and panic, leading to an increase in the volatility of returns (Del Giudice and Paltrinieri, 2017). Due to pandemics' colossal economic cost, earlier studies report a strong association between macro-economic performance and pandemics (Bloom et al., 2018). Haacker (2004) notes that epidemics diminish government capacities as mortality increases while domestic revenues slow following increased demand for government services, imposing a significant financial burden on the government and private sector. Bloom et al., (2018) note that the fear and panics of epidemics prompt several economic risks, including disrupting production, overwhelming the health system, and limiting an economy's capacity. Assous and Al-Najjar (2021). Reported a significant decline in the banking index following lockdown and interest rate decrease announcements.

The COVID-19 Pandemic induced a fall in stock and asset prices across the world, following a panic by investors. A handful of studies examined the impact of COVID-19 on stock returns on the overall stock markets across the world. Raghavan et al., (2021) argue that among all the studies on COVID-19, there is no comprehensive view at meso and micro levels. Industries and different sectors of the economy were not affected in the same way. Some businesses transitioned to an online environment smoothly; for example, the increase in remote working and online transactions saw the upsurge in the relevance of telecommunications and tech firms which may lure investors into investing in tech stocks. Some firms blossomed during the Pandemic, whilst the detrimental effects of the Pandemic crushed others. Due to different industry structures and focus, economic sectors respond differently to shocks. Al-Nassar and Makram, (2022) found different characteristics and dynamics of volatility spillovers and shocks in both main and SME stock markets. It is vital for policymakers and investors to comprehend the extent and differences in the impact of the Pandemic on various sectors of the market to make informed policy and investment decisions. The main aim of this study was to examine the impact of COVID-19 Pandemic on the performance of different sectors of the South African stock market. The study contributes to the existing literature by first examining the effect of the Pandemic at the stock market sector/industry level instead of the aggregate market. Secondly, it presents evidence from a developing economy. Lastly, the study analyses stock returns on a risk-adjusted basis, which has not been done with previous studies that examine the Pandemic's effect on stock returns. The rest of the paper is organised as follows, section 2 reviews the literature and empirical studies, section 3 details the methodology adopted, section 4 presents the findings and discussions of the results, and section 5 concludes the study.

2. LITERATURE REVIEW

Ascertaining stock return drivers is a major concern for academic research and investment practitioners. Several asset pricing models have been put forth in financial theory that relates asset returns to a single or more variable signifying different sources of risk. The Capital Asset Pricing Model (CAPM) and the Arbitrage pricing model (APT) are the most popular pricing models in financial theory. The CAPM implies that returns are driven by one source of risk (market risk), and investors are only compensated for bearing this type of risk. Holding any non-systematic risk will not be rewarded by the market-hence a one risk source model. The significance of this theory in this study is that if the CAPM holds, then the COVID-19 shock should be embedded in the market risk of the asset and reflected in the systematic risk measure. The APT recognises that returns are driven by several sources of risk (Cauchie et al., 2004). Earlier versions of these models were established assuming that investors only have access to domestic securities. However, investors no longer operate in closed markets in the current globalised economies. Several anomalies have been reported in testing these models in financial literature. Two empirical versions of the APT have been implemented (factors are either pre-specified or pulled out from statistical techniques), given that economic theory does not explicitly specify the factors. Chen et al., (1986) found pre-specified macro variables to be priced in explaining stock returns in the US stock markets. Different studies have adopted the same approach in various markets.

Following the perfect integration of financial markets and the presence of abitrageous that engage in international stock trades, the domestic models have been extended to several international models such as different versions of the International CAPM and the International APT. In the International APT, numerous global factors are considered to impact stock prices (Ferson and Harvey, 1994), whereas, in the International CAPM, foreign exchange risk and the world market portfolio are hypothesised as global sources of risk (Korajczyk and Viallet, 1989). Hence the inclusion of Crude oil, the world market proxied by the S&P500 and the exchange rate as explanatory variables in this study. The home-bias anomaly suggests that investors' portfolios are not internationally diversified as proposed by the portfolio theory, providing evidence of market imperfections that prevent optimal portfolio diversification (Lewis, 1999). Several studies have employed different global and local variables in the pricing equations, given that the pricing models do not provide a general equilibrium relationship on stock return determination. This paper following up on these previous studies explicitly assumes that stock returns can be explained by global, local or a combination of both factors.

Fama (1965) proposed the Efficient Market hypothesis (EMH), which has been the backbone of financial markets. The EMH believes that stock prices are very sensitive to and are driven by information. Any new information is instantly reflected in the security price. The EMH assumes that investors are very sensitive to information while investing in stock markets and possess the same information. This is one of the main foundations of the contention; given the existence of heterogenous expectations, buyers expect a rise, and sellers expect a fall in stock prices hence bulls and bears in the market. The significance of this theory to this study is that if markets are efficient, as suggested by the EMH, then the increase in COVID-19 shock should be reflected in the stock's price immediately and thus, investors would not beat the market.

Recently there has been a growing body of literature examining the impact of COVID-19 on stock markets. Akinola et al., (2021) suggest that the Pandemic's influence can be characterised by a demand and supply shock. The decline in aggregate demand was induced by lockdowns following the decline in consumption of durable goods and services, the uncertainty surrounding the future virus caused households and firms to restrain consumption and increase precautionary savings. The uncertainty caused many to lose income, reducing consumption, affecting firms' liquidity and accelerating a drop in investment. On the other hand, aggregate supply was disturbed by the disruption of the global supply chain as drastic lockdowns were implemented worldwide to save lives. Liu et al., (2020) argues that the coronavirus pandemic affects the expectation of investors leading to a fall in stock returns. From the Real options theory perspective, they document that investors can choose to delay their investments, plummeting stock market activity and eventually reducing stock returns.

From an empirical perspective, numerous studies examined the impact of different factors on the aggregate economy, stock markets and commodity prices and stock returns across the world. Pertaining to studies that examined the influence of commodities on returns, Kilian and Park (2009) show that a 22% variation in stock returns is due to the increase in oil prices in the USA. Antonakakis and Filis, (2013) also indicate that increases in oil prices negatively impact stock returns. They argue that an increase in oil price increases the daily production costs, decreasing a normal investor's investment ability due to a lower saving rate. However, Khan et al., (2019) found a negative and non-significant impact of increasing oil prices on stock returns on the Shanghai stock exchange. Regarding the influence of macro variables, Jumah (2013) argues that the movement of exchange rates affects the expected cash flows of firms and, therefore, stock returns through altering home currency foreign currency-denominated revenues and costs and competition terms for companies with international operations.

Focusing on the impact of pandemics, Bloom et al. (2018) document that epidemics, fear and panic associated with outbreaks induce anxiety and create pessimism among investors and cause stock market instability. Burns et al. (2006) note that during stock market downtrends, investors suspend investments until the stock market begins to recover. Investors turn to safe havens during stock market downturns to mitigate risk during volatile periods. As such, market performance dips and returns fall. Evidence from previous studies shows a significant reaction of financial markets to epidemics. During the 2013-2014 Ebola outbreak, Liberia suffered a whopping 8% decline in GDP (Bloom et al., 2018). Del Giudice and Paltrinieri (2017) found that Ebola had a huge impact on mutual funds flows in Africa. They indicate that a surge in Ebola cases led to an increase in investment withdrawal from mutual funds as investors and pundits overreacted to the news. Ichev and Marinč (2018) document a positive impact of the Ebola outbreak on the Pharmaceutical, food and beverage, healthcare supplies sectors, while other sectors showed a negative effect in the US and West Africa on companies located in areas hit by the outbreak. In Taiwan, Chen et al. (2009) report a negative relationship between the SARS outbreak and returns in the retail, tourism, and hotel sectors. Travel and tourism hit the most experiencing the most significant drop in value, while the biotechnology sector was positively impacted. This demonstrates that sectors are never affected the same by any pandemic or economic shock.

Various econometric models have been used to examine the effect of the recent coronavirus pandemic on stock markets in several countries. Hung et al., (2021) used a panel random-effect model to show that an increase in COVID-19 cases negatively affected stock returns in Vietnam. Al-Awadhi et al. (2020) found a negative response of all stock returns to confirmed infections and deaths per day in China. Baker et al. (2020) reiterate that COVID-19 has had a more significant impact on the US stock returns than the Spanish Flu. In addition, Yilmazkuday (2021) also analysed the US stock market using Structural Vector Autoregressive Model (SVAR) and found that a 1% increase in COVID-19 cases led to a 0.01% decline in the S&P500 index after a day and 0.03% decline after a month. Similarly, He et al., (2020) found a negative and short-term impact of COVID-19 on China, Italy, South Korea, France, Spain, Germany, Japan and the USA stock markets. Also, Liu et al., (2020) document that the coronavirus led to negative abnormal stock returns in Singapore, Japan, Korea, Germany, Italy, the UK and the USA.

Using Bayesian posterior estimates, Takyi and Bentum-Ennin (2021) showed that African stock markets performance reduced significantly between −2.7% and −21 per cent during the COVID-19 Pandemic. At the heterogenous level, they indicate that 10 African countries were negatively affected by the Pandemic, whereas 5 other countries including South Africa, Mauritius, Namibia Uganda and Cote D'Ivore had their stock markets not significantly impacted by COVID-19 or experienced a short lived negative impact. They argue that although the COVID-19 occurrence negatively affected the performance of the stock markets in these countries, considering the post-COVID-19 shock as a whole, the impact is not statistically significant. The authors suggest that the insignificant effect could be due to the stock market resilience of these countries or individual economy-level policy interventions. Ngwakwe (2020) discloses that the Pandemic had different impacts on stocks across the globe. Using a balancing *t*-test, they reported a substantial decrease in the Dow Jones Industrial Average value throughout the Pandemic. In contrast, the Chinese Stock market's composite index indicated an upsurge in average stock prices that were more sustainable than before the Pandemic, which is contrary to other Chinese findings.

Yan and Qian (2020) argued that the coronavirus' negative impact on the US stock markets is short term. The market's invisible hand will normalise the adverse effect in the long run. The authors reveal that the fall in prices induced by the outbreak will be eventually brought back in the long run. Falato et al. (2021), on the other hand, submitted that the Federal reserve actions, through funds transmission to the primary market, helped to reduce the adverse effect caused by the Pandemic in the long run. Contrary to short term claims, Hatmanu and Cautisanu (2021), using an ARDL cointegration test, reported a significant long-term impact of the Pandemic on the Romanian index and a positive impact on the European economy. Erdem (2020) reveals that COVID-19's adverse effects on stock markets are more pronounced in lower financial freedom countries. For a given increase in COVID-19 cases, stock returns are correlated with a smaller decrease in returns in financially freer countries (Erdem, 2020). Phan and Narayan (2020) argued that as the market becomes awash with fake and unexpected news, markets tend to overreact and then correct themselves as financial market players become acquainted with the available information.

Czech and Wielechowski (2021) indicate that the pandemics' impact on stock returns varied across industries. The authors document that transport, petroleum & gas, machinery, garment, automobile and hospitality were heavily influenced by the Pandemic. Goodell (2020) adds the financial sector as one of the hardest-hit sectors following heavy cash withdrawals by depositors due to uncertainty and an increase in non-performing loans owing to depletion of the borrower's income. However, the Pandemic did not hurt all industries. Ali et al. (2020) report that COVID-19 has had a positive impact on stock returns of the Technology and Telecommunications sectors in Australia due to the increase in demand for these sectors' services as people work from home. Al-Awadhi et al. (2020) noted that Pharmaceutical and IT stocks in the Chinese stock market recorded higher returns outperforming all other sectors. Based on the review of literature and empirical studies the study hypothesises that COVID-19 Pandemic resulted in the reduction in stock market returns and the impact of the Pandemic was different across industries and countries owing to heterogeneous economic structures and country conditions and capacity.

The analysis of the empirical studies presented shows conflicting and inconclusive results on the impact of COVID-19 on stock markets. Although many studies suggest that the Pandemic has harmed stock markets, some suggest otherwise. Hence, there is no consensus in the literature about the actual impact of the Pandemic over the short and long term. Furthermore, many studies agree that the Pandemic's effect is heterogeneous across countries and industries. However, most of these studies are concentrated in developed economies and mainly analysed broad market indices. Little is known about the response of different sectors, especially in developing economies. This study sought to cover this gap. Understanding the influence of the Pandemic at the sector level helps investors make better future asset allocation and security selection decisions. Furthermore, such an analysis informs policymakers of the most hit sectors, and they can make informed precautionary policy interventions in the current and future pandemics. The present study contributes to the literature in the following ways. Firstly, it examines the effect of the Pandemic on different sectors of the stock market as opposed to the aggregate market. Secondly, it presents evidence from a developing economy. Lastly, the study analysed returns on a risk-adjusted basis, which has not been done with previous studies that examine the Pandemic's effect on stock returns.

3. METHODOLOGY

3.1. Data and the Variables

To ascertain the impact of COVID-19 on index returns, the study used daily observation data of all the ten sectors of the JSE from March 2020 to February 2022. The study included the All Share (ALSHI) index to capture the overall market effect. The 10 sectors include the Industrials (IND), Precious metals & Mining (PMM), Basic material (BM), Consumer goods (CG), Oil & Gas (OG), Consumer Services (CS), Financials (FIN), Health care (HLT), Technology (TECH) and Telecommunications (TELCO). The final sample constituted of 6371 Observations. The daily stock index price data were obtained from the IRESS database. Price data were converted into continuous returns estimated as follows:

$$R_t = ln\frac{P_t}{P_{t-1}}$$

Where: R_t *is return at time t,* P_t *and* P_{t-1} *are respectively closing prices at times t and t-1.*

The daily COVID-19 positive rate (number of positive cases as a ratio of total tests) was used to capture coronavirus cases. COVID-19 data (daily new infections) were obtained from the South African department of health COVID-19 updates and the WHO websites. Consistent with the International APT and International CAPM as discussed in the literature, the daily Rand/USD Exchange rate (dollar terms); the US stock market (S&P-500); Oil price shocks (Brent crude oil prices in USD) were included to explain stock returns. The dividend yield (dividend/stock price) was also used as a control variable.

3.2. Model Specification

Index returns were expressed as a function of COVID-19 cases, overall market movement, and control variables: daily Rand/USD Exchange rate movement, Oil price shocks, US stock market proxied by the S&P 500, and the dividend-adjusted stock price.

$$Index\,return_{i,t} = f(COVID-19\ ,overall\ market\ movement, \sum_i^n Control\ \text{var}iables)$$

To examine the long and short-run dynamics of the impact of COVID-19 on sector performance, the study estimated a Panel Auto-Regressive Distributed Lag (ARDL) model. The ARDL model is appropriate because the study sample is a heterogeneous panel with a time series dimension greater than the cross-sectional dimension. This study augments prior studies by employing a panel ARDL model which enables an analysis of the short-run cross-

sectional relationships (Pesaran et al., 1999). The cross-sectional relationship (the main focus of this study) enables an analysis of the effect of COVID-19 on individual sectors. The ARDL models perform well irrespective of whether the variables are stationary at the first difference I (1), at level (I(0), or mutually cointegrated (Pesaran et al., 1999). The data were examined for unit root using the first generation (Fisher type) and second-generation (Bai and Ng; Pesaran (2007) CADF) unit root tests. The results show a mixture of I (0) and I (1) variables which justify the ARDL as an appropriate model for this analysis.

In dealing with heterogeneous bias in dynamic panels, Pesaran et al. (1999) suggested the Mean Group (MG) model. In the MG, long-run parameters are obtained through averaging long-run parameters in the ARDL model for individual observations. For an ARDL model specified as follows:

$$Y_{i,t} = \alpha_i + \gamma_i Y_{i,t-1} + \beta_i X_{i,t} + \varepsilon_{i,t} \quad (1)$$

Such that i=1,2…N. The long parameter θ_i would be given by: $\theta_i = \frac{\beta_i}{1-\gamma_i}$; For the entire panel, the Mean Group estimators will be given by: $\hat{\theta} = \frac{1}{N}\sum_{i-1}^{N}\theta_i$; $\hat{\alpha} = \frac{1}{N}\sum_{i-1}^{N}\alpha_i$

In this way, separate regressions are estimated for each index, and the coefficients are calculated as an unweighted mean of the estimated coefficients for the individual indexes. Hence, no restrictions are imposed in this setup and coefficients can be heterogeneous and vary in the long and short run (Elsalih et al., 2021). Pesaran et al. (1999) notes that an error correction form of the ARDL (p, q) model estimated with MG or PMG is the appropriate technique to analyse dynamic panels in such conditions.

A basic ARDL model can be specified as follows:

$$y_{it} = \sum_{j=1}^{p}\lambda_{ij}^{*} y_{i,t-j} + \sum_{j=0}^{q}\delta_{ij}^{*} x_{i,t-j} + \mu_i + \varepsilon_{i,t} \quad (2)$$

Where: λ_{ij} is the coefficients scalar of all lagged dependent variables; y_{it} is a vector (Kx1) of explanatory variables; δ_{ij}^{*} is a (k x 1) vector of coefficients; i=cross section (1,2…,N); t=1.2…,T classifies the estimation period; μ_i is the fixed effect term;

Any short-run disequilibrium is observed as the correction progression towards the long-run equilibrium. The adjustments are achieved through the Error Correction Form (ECM).

Reparametrizing equation 2, we can obtain the ECM model specified as:

$$\Delta(y)_{it} = \varnothing_i (y)_{i,t-1} + \beta_i x_{it} + \sum_{j=1}^{p}\lambda_{ij}^{*}\Delta(y)_{i,t-j} + \sum_{j=0}^{q}\delta_{j=0}^{*'}\Delta(x)_{i,t-j} + \mu_i + \varepsilon_{i,t} \quad (3)$$

Where $\varnothing_i = -(1-\sum_{j=1}^{p}\lambda_{ij})$ is the *ith* group error correction parameter; $\beta_i = \sum_{j=1}^{p}\delta_{ij}$ is the ith group long-run parameter; $\lambda_{ij}^{*} = -\sum_{m=j+1}^{p}\lambda_{im}$, j = 1 , 2 … , p - 1 ; and $\delta_{ij}^{*} = -\sum_{m=j+1}^{q}\lambda_{im}$ *for* $j = 1,2\ldots q-1$. Ø Presents the coefficient of the long run status speed of adjustment.

Dependent variable: Log of index return:

$$\Delta lnR_{i,t} = \mu + \beta_1 (lnR)_{it-1} + \beta_2 lnCOVID_{it-1} + \beta_3 lnM_{it-1} + \beta_4 lnEx_{it-1} + \beta_5 lnS\,\&\,P_{it-1} + \beta_6 lnOil_{it-1} + \sum_{j=0}^{p}\beta_7\Delta(lnR)_{it-1} + \sum_{j=0}^{q}\beta_8\Delta COVID_{it-1} + \sum_{j=0}^{r}\beta_9\Delta(\mathrm{M})_{it-1} + \sum_{j=0}^{s}\beta_{10}\Delta lnEx_{it-1} + \sum_{j=0}^{u}\beta_{11}\Delta \mathrm{S\,\&\,P}_{it-1} + \sum_{j=0}^{v}\beta_{12}\Delta \mathrm{Oil}_{it-1} + v_t \quad (4)$$

Where $ln\,R_{i,t}$ is the continuous index return lnM_{it-1}, is the continuous JSE market return; Ex is the Rand/USD exchange rate. Oil is the oil price shock; S&P the US stock market; μ is a constant.

To estimate model 4, a PMG or an MG can be used, computed by the maximum like-hood estimations. The PMG permits the coefficients of the short-run equation, the long-run values adjustment speed, and error variances to be heterogeneous across indices while restricting the coefficients of the long-run equation to be homogeneous across indices (Rafindadi and Yosuf, 2013). The adjustment coefficient must be negative and lower than -2 for the existence of the long-run relationship. Following Elsalih et al., (2021), the study estimated a panel ARDL model using the PMG estimation. The appropriate lag length and the best model was selected based on the modified Akaike Information Criteria (AIC). Lombardini et al. (2006) reports a theoretical advantage of the AIC over other information criteria. The model with the lowest AIC was taken as the best model.

4. EMPIRICAL RESULTS

4.1. Descriptive Statistics

The descriptive statistics shown in Table 1 depict that the Energy sector had the highest average daily returns at 0.34% over the sample period, which was more than double the S&P500 (0.14%) and more than quadruple the JSE-ALSHI (0.07%). The S&P500 outperformed all other sectors, including the ALSHI. The sector performances as measured by daily average returns, from the second-best to the last, were as follows respectively TELCO, CD, PMM, CS, ALSHI, HLT, IND, FI and TECH. The JSE-ALSHI was outperformed by the ENG, TELCO, CD, and CS. The Technology sector experienced the lowest return, which is negative over the sample period. The Energy sector also exhibited the highest risk, as shown by the higher standard deviation (4.65%) compared to other sectors. All sectors show very high-risk levels compared

Table 1 : Descriptive statistics

Variable	Mean	SD	Min	Max	Variable	Mean	SD	Min	Max
	Alshi					Consumer discretionary (CD)			
Returns	0.07%	1.50%	−10.23%	7.26%	Returns	0.09%	1.70%	−9.31%	7.36%
DY	3.45	0.67	2.33	5.59	DY	2.37	1.31	0.73	4.35
	Financials (FI)					Industrials (IND)			
Returns	0.04%	2.10%	−13.10%	7.49%	Returns	0.04%	1.80%	−9.72%	7.64%
DY	5.41	2.79	0.00	10.65	DY	3.63	1.13	2.03	5.73
	Consumer services (CS)					Precious metals and mining (PMM)			
Returns	0.08%	1.45%	−10.04%	7.24%	Returns	0.09%	2.56%	−15.89%	13.46%
DY	3.21	0.63	2.10	4.25	DY	4.34	1.37	2.48	8.17
	Health (HLT)					Technology (TECH)			
Returns	0.04%	1.84%	−11.11%	5.46%	Returns	−0.02%	2.44%	−8.96%	9.93%
DY	1.86	1.60	0.04	4.66	DY	0.18	0.05	0.01	0.33
	Telecommunications (TELCO)					Energy (ENG)			
Returns	0.12%	2.46%	−11.74%	10.46%	Returns	0.34%	4.65%	−30.17%	32.70%
DY	5.47	2.92	1.41	11.68	DY	5.64	5.25	0.00	15.37
S&P Return	0.14%	1.23%	−6%	9%	Exchange Rate	15.67	1.32	13.42	19.25
Crude Oil	0.29%	3.43%	−28%	19%	New Cases	5176	5621	0.00	26389
Positive rate	13%	8.81%	1%	33%					

to their means, more than 20 times the mean for the majority of the sectors, indicating very high levels of return volatility during the COVID-19 period. Not surprisingly, the S&P500 index and the ALSHI Index had lower standard deviations showing the importance of diversification in these indices.

The CS sector had a lower standard deviation than the ALSHI, implying less return volatility in this sector during the sample period, indicating that investors had higher expectations of the industry and kept their positions. In the same period, the Energy, TELCO and FIN sectors had the highest dividend yield 5.64, 5.47 and 5.41, respectively. The higher dividend yield of the energy sector may explain higher returns in this sector, possibly as investors valued current cash flows more than future cash flows due to the Pandemic's uncertainty. Technology which had the lowest returns, also exhibits the lowest dividend yield (0.18), suggesting investor flight to current income (dividends), which saw the Technology sector retain negative returns during the Pandemic.

The study also analysed the risk-adjusted returns (risk premium per unit of standard deviation) of the JSE sectors. The results in Table 2 show that the Energy sector outperformed all other sectors in terms of the risk-adjusted returns, followed by the TELCO, CD, CS, ALSHI, PMM, HLT, IND, and FI. On a risk-adjusted basis, the Energy outshined all the sectors, and the ALSHI was also outperformed by TELCO, CD and CS sectors, respectively. The FI sector had the highest (56.11) coefficient of variation (mean return divided by the standard deviation), indicating the highest risk compared to all other sectors. This could be due to an increase in non-performing loans owing to depletion of the borrower's income and rapid cash withdrawals due to increased uncertainty. The highest variations in sectors were recorded as follows; IND, HLT, PMM, ALSHI, TELCO, CS, CD and ENG, respectively. Thus the Energy sector was better in terms of risk-return tradeoff, as shown by the lower coefficient of variation. CD, CS and TELCO also had lower variation than the ALSHI index over the sample period. Using the ALSHI as the benchmark, the results indicate that the Energy, TELCO, CD, CS were the best performers during the Pandemic, as shown by high risk-adjusted returns above the benchmark and lower coefficients of variation.

Table 2: Risk adjusted returns (RaR) and coefficient of variation

Index	RaR	CV	Index	RaR	CV
ALSHI	0.030792	20.20	Health	0.00805	42.95
FIN	0.004458	56.11	PMM	0.02363	28.98
CD	0.038851	18.08	TEL	0.03938	19.69
CS	0.033316	18.98	IND	0.00639	45.66
Energy	0.066821	13.73	TECH	−0.01772	−159.75

Table 3 shows the correlation analysis of JSE sectors and other explanatory variables. The correlations between the independent variables (ALSHI, S&P500, Crude Oil and the Exchange rate) are very low, <3%, indicating that multicollinearity is not a problem in this analysis.

4.2. Correlation Analysis

The correlations pre indicate a negative association between COVID-19 and pooled returns. The returns positively correlate with the ALSHI index and S&P 500 index and negatively relate to dividend yield, oil prices, and exchange rate.

4.3. Unit Root Tests

Before the models were estimated, the panels were examined for unit root. The study employed the first (Fisher type) and second-generation (Bai and Ng; Pesaran (2007) CADF) unit root tests. The first generation(traditional) tests assume cross-sectional independence, whereas the second generation tests consider cross-section dynamics by assuming that cross-sections are dependent. The Bai and Ng Panic test is motivated by the fact that non-stationarity can arise due to common factors, idiosyncratic components or both. Idiosyncratic components are tested for non-stationarity by ADF progressions. From the first generation tests, as indicated in Table 4, all the variables (except dividend yield) are stationary at level. From the second generation tests, all variables are also stationary at levels, except the COVID-19, Dividend yield, ALSHI S&P500 and the Exchange rate variables, which became

Table 3: Correlation

	Returns	COVID-19	DY	ALSHI	SP	CrudeOil	Exch
Returns	1						
COVID-19	−0.0199	1					
DY	−0.0339*	−0.0795*	1				
ALSHI	0.5227*	0.0191	−0.0023	1			
SP	0.1554*	0.0023	0.0182	0.2699*	1		
CrudeOil	−0.1173*	0.0302*	−0.0114	0.1817*	0.2369*	1	
Exch	−0.0101	0.0053	−0.002	0.0299*	−0.076*	0.0152	1

*Indicates significant coefficients

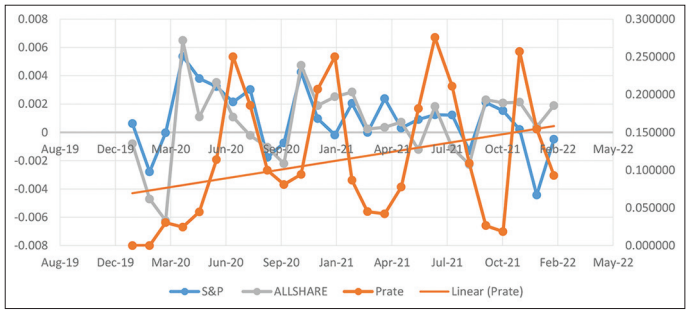
Table 4: Unit root test

Variable	Fisher		Bai and Ng Panic		Pesarn CADF test	
	Statistic (chi)	Prob	Statistic	Probability	Z[t-bar]	P-value
Index return	126.352	0.0000	+/−inf	0.0000	−17.627	0.0000
COVID19	2.0480	0.0203	6.0493	0.0000	17.627	1.0000
Div_Yield	0.0168	0.4933	4.094	0.0000	2.946	0.9980
ALSHI	126.352	0.0000	−0.7547	0.4504	17.627	1.0000
S&P	126.352	0.0000	1.3229	0.1859	−14.915	0.0000
RaR	120.236	0.0000	+/−inf	0.0000	−17.627	0.0000
Ex_return	126.352	0.0000	−2.9527	0.0032	17.627	1.0000
Crud_oil	126.352	0.0000	+/−inf	0.0000	−14.915	0.0000
	Fist-Diff				Fist-Diff	
ALSHI	−40.4963	0.0000			−17.620	0.0100
COVID19	−14.0869	0.0000			−3.113	0.0100
Div_Yield	−30.2243	0.0000			−17.627	0.0000
Ex_return	−41.9578	0.0000			−17.620	0.0000

stationary at first differences. The estimation technique used allows a mix of I (0) and I(1) variables.

Figure 1 shows the monthly average trend of COVID-19 (Prate) and JSE All share returns over the sample period. The trend indicates that when the first cases were reported in March 2020, the average monthly returns of the JSE were just above 0.6%. As the number of cases continued to rise, there was a notable decline in returns of the JSE All-share index to as low as-0.02% mid-year 2020 (which suggests a negative relationship between the number of cases and the market returns).

Figure 1: COVID 19 and JSE All share returns trend



COVID-19 and JSE stock returns trend analysis

In September 2020, when the number of cases reached the lowest for that period, the monthly index returns increased to just above 0.4%, followed by a gradual decrease in returns in the subsequent periods. It can be noted that periods of lowest COVID cases are associated with higher index returns- for example, October 2020, March 2021, and October 2021. It is worth noting that since the start of the Pandemic, the index returns are yet to return to the high (0.6%) reported in early 2020. Also, from January 2021 to Feb 2021, the returns became less volatile or less responsive to changes in COVID 19 cases compared to the period when the Pandemic started. Appendix Figures 1 and 2 in the also shows high spikes (volatility) in index returns in early 2020 at the onset of the Pandemic and less return volatility thereafter. The trend supports the ARDL results, which showed a significant negative impact of COVID-19 on stock returns over the short term and a non-significant impact over the long run. This suggests that the Pandemic severely impacted the stock market over the short term as investors overreacted. Over the long run, there is a less significant impact associated with market corrections. This is consistent with Yan and Qian's (2020) findings that the virus' adverse impact on the US stock markets is short term. Figure 3 shows the trend of COVID-19 cases and JSE sector returns. The majority of the sectors show the same trend- a general decline in returns from March 2020 to mid-2020 and a sharp increase in returns in September 2020, when the COVID-cases were at the lowest. However, consistent with the ARDL regression results, the Pandemic did not impact the energy sector returns (the top performer during the period), as shown by high returns even at the peak of the four waves.

4.4. Regression Results

4.4.1. Cross-sector short-run analysis

The study aimed to analyse the cross-sector impact of COVID-19 on sector returns across JSE industries; hence the focus is on the cross-section short-run results shown in Table 5. The increase in COVID-19 daily cases was found to negatively impact most of the South African stock market sectors (Financials, Consumer discretionary, Consumer services, Industrials, Health

Figure 2: Akaike information criteria

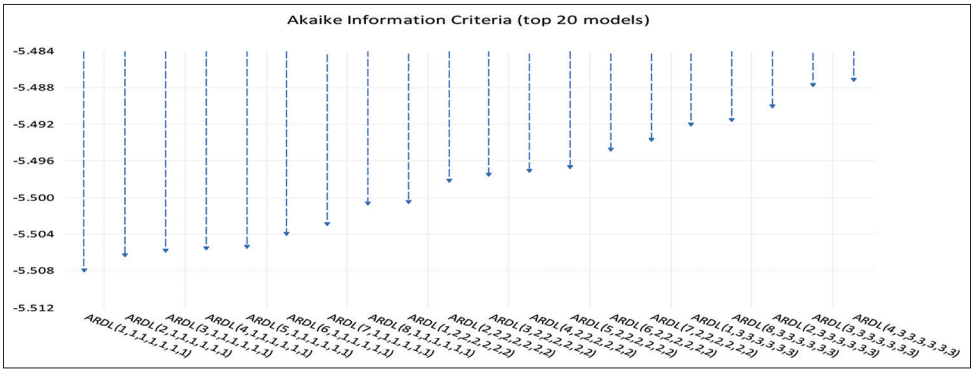
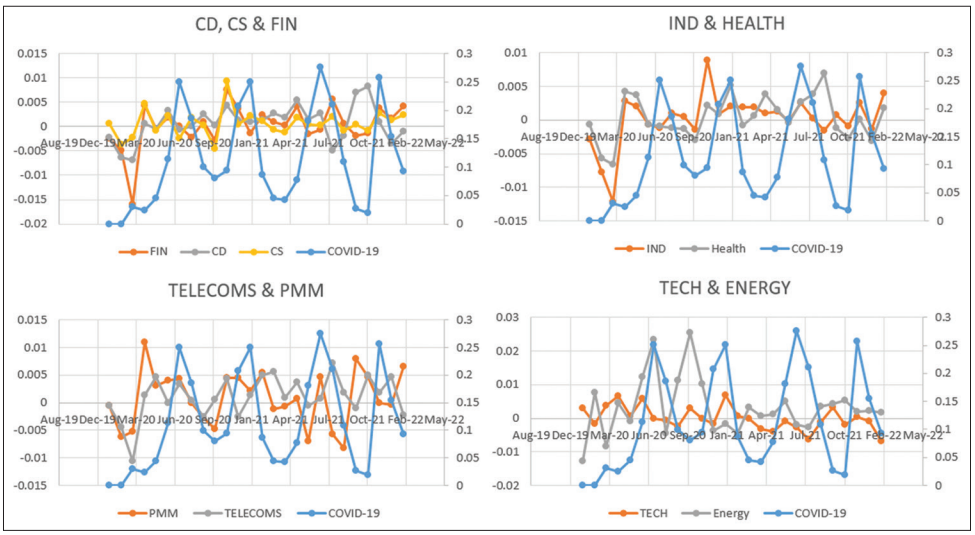


Figure 3: COVID 19 and JSE sector returns trend



and Technology) over the short run. Implying that there was a significant decrease in daily returns for these sectors following an increase in reported COVID-19 cases/positive rate in the short term in South Africa. Indicating that these sectors suffered the most blow in returns from the Pandemic's effect. The Pandemic affected the expectation of investors leading to a fall in returns (Liu et al., 2020). Panic and the fear of the epidemic induced anxiety and created pessimism among investors, and caused stock market instability (Bloom et al., 2018). From the real options theory perspective, investors can choose to delay their investments which disrupts stock market activity and eventually dips stock returns. The results are consistent with several studies that found a negative relationship between the COVID-19 surge and stock returns. For example, Czech and Wielechowski (2021) indicate that the Pandemic heavily influenced the transport, petroleum & gas, machinery, garment, automobile, and hospitality sectors. Goodell (2020) adds the financial industry as one of the hardest-hit sectors following an increase in non-performing loans due to the borrower's income depletion and a reluctance to invest because of the uncertainty. The Health sector was overwhelmed with claims and costs in medical services for the infected population. Halt in production and supply chain disruption brought a standstill to the industrial and other discretionary services as more focus was placed on the survival needs. Hung et al., (2020), Al-Awadhi et al. (2020), Alfaro et al. (2020), Baker et al. (2020) also found COVID-19 to negatively affect stock returns in Vietnam, China, Nigeria and the USA, respectively Yilmazkuday (2021) using an SVAR model also found that a 1% increase in COVID-19 cases led to a 0.01% decline in the S&P500 index after a day and 0.03% decline after a month. Using Bayesian posterior estimates, Takyi and Bentum-Ennin (2021) found that among a few African stock Markets, the aggregate South African stock market was not significantly impacted by the spread of the Pandemic. However, our results reveal that some sectors were indeed significantly affected by the Pandemic from a cross-sector analysis.

Nevertheless, for Precious Metals and Mining and Telecommunications, the results show a significant positive relationship between COVID-19 and the daily returns of these sectors over the sample period in South Africa. Indicating that the returns of these sectors (TELCO and PMM), as opposed to the general expectations, essentially increased as COVID-19 infections were going up. The positive association between COVID-19 cases and Precious Metals and Mining could be explained by investors turning to safe havens during market downturns to mitigate risk during such volatile periods (Burns et al., 2006). Precious metals such as Gold are deemed as a store of value in financial markets. Hence investors could have switched their investments to such havens. Telecommunications could be explained by the increase in demand for the services of this sector as people work from home, for example, more internet usage to enable workers to work from home, more calls and remote connections.

Table 5: Cross section short run

Variable	Coefficient	t-Statistic	Prob*	Variable	Coefficient	t-Statistic	Prob*
	Financials (FI)				Consumer discretionary (CD)		
COINTEQ01	−0.8807	−453.33	0.0000	COINTEQ01	−0.9697	−562.73	0.0000
D (COVID19)	−0.0551	−13.438	0.0009	D (COVID19)	−0.0589	−22.354	0.0002
D (ALSHI)	0.1617	60.535	0.0000	D (ALSHI)	0.0003	0.1898	0.8616
D (D_Yield)	−0.0134	−4655.0	0.0000	D (D_Yield)	−0.0562	−1565.2	0.0000
D (Ex_rate)	−0.2325	−1.6265	0.2023	D (Ex_rate)	0.2394	2.4845	0.0889
D (S&P)	0.0397	40.983	0.0000	D (S&P)	0.0028	4.0391	0.0273
D (Crude_oil)	0.0107	53.762	0.0000	D (Crude_oil)	0.0209	158.68	0.0000
C	0.0015	1753.999	0.0000	C	0.0012	2548.61	0.0000
	Consumer Staples (CS)				Industrials (IND)		
COINTEQ01	−1.0651	−570.47	0.0000	COINTEQ01	−0.9660	−684.26	0.0000
D (COVID19)	−0.0318	−13.956	0.0008	D (COVID19)	−0.0422	−17.620	0.0004
D (ALSHI)	−0.1018	−68.851	0.0000	D (ALSHI)	−0.0704	−43.084	0.0000
D (D_Yield)	−0.0338	−1431.3	0.0000	D (D_Yield)	−0.0780	−3376.5	0.0000
D (Ex_rate)	−0.2492	−2.8776	0.0437	D (Ex_rate)	0.0219	0.2469	0.8209
D (S&P)	0.0204	31.115	0.0001	D (S&P)	0.0309	47.899	0.0000
D (Crude_oil)	0.0010	8.1501	0.0039	D (Crude_oil)	−0.0021	−17.3972	0.0004
C	0.0016	2990.5	0.0000	C	0.0010	1817.19	0.0000
	Health (HLT)				Precious Metals & Mining (PMM)		
COINTEQ01	−1.0860	−610.38	0.0000	COINTEQ01	−0.9912	−1003.2	0.0000
D (COVID19)	−0.0151	−3.3335	0.0446	D (COVID19)	0.0815	27.785	0.0001
D (ALSHI)	−0.1591	−83.314	0.0000	D (ALSHI)	0.0798	37.919	0.0000
D (D_Yield)	−0.0482	−1370.7	0.0000	D (D_Yield)	−0.0915	−5389.3	0.0000
D (Ex_rate)	−0.1921	−1.2022	0.3155	D (Ex_rate)	0.2392	2.2596	0.1090
D (S&P)	0.0076	6.7957	0.0065	D (S&P)	−0.0071	−9.3433	0.0026
D (Crude_oil)	−0.0016	−7.3143	0.0053	D (Crude_oil)	−0.0211	−144.64	0.0000
C	0.0005	848.35	0.0000	C	0.0022	3135.2	0.0000
	Telecommunications (TELCO)				Technology (TECH)		
COINTEQ01	−1.0269	−980.407	0.0000	COINTEQ01	−0.9697	−562.73	0.000
D (COVID19)	0.0290	6.441718	0.0076	D (COVID19)	−0.0589	−22.354	0.000
D (ALSHI)	−0.1545	−83.0152	0.0000	D (ALSHI)	0.0003	0.1898	0.862
D (D_Yield)	−0.0653	−6685.06	0.0000	D (D_Yield)	−0.0562	−1565.2	0.000
D (Ex_rate)	−0.7955	5.010278	0.0153	D (Ex_rate)	0.2394	2.4845	0.089
D (S&P)	−0.0095	−8.69996	0.0032	D (S&P)	0.0028	4.0391	0.027
D (Crude_oil)	0.0133	60.75494	0.0000	D (Crude_oil)	0.0209	158.68	0.000
C	0.0020	1892.669	0.0000	C	0.0012	2548.6	0.000
	Energy (ENG)						
COINTEQ01	−1.1286	−583.22	0.0000				
D (COVID19)	−0.1558	−2.4313	0.0932				
D (ALSHI)	−0.3462	−24.156	0.0002				
D (D_Yield)	−0.0213	−1170.4	0.0000				
D (Ex_rate)	0.2851	0.2097	0.8473				
D (S&P)	−0.0651	−4.9116	0.0162				
D (Crude_oil)	−0.0515	−22.635	0.0002				
C	0.0055	1107.5	0.0000				

These findings are consistent with Alam et al. (2020), who report that COVID-19 has positively impacted stock returns of the Technology and Telecommunications sectors in Australia due to the increase in demand for these sectors' services. Likewise, Ngwakwe (2020) showed that the Chinese Stock market's composite index indicated an upsurge in average stock prices that were more sustainable than before the Pandemic levels. In the same vein, Hatmanu and Cautisanu (2021), using an ARDL cointegration test, reported a significant positive impact of the Pandemic on the European economy. Furthermore, Al-Awadhi et al. (2020) noted that Pharmaceutical and IT stocks in the Chinese stock market recorded higher returns outperforming all other sectors. Phan and Narayan (2020) argued that markets tend to overreact and then correct themselves as financial market players become acquainted with the available information. Thus, the increase in returns in such sectors could be due to investors adjusting to the prevailing situation and reducing fear and panic in holdings in these sectors. For investors in South Africa, our findings imply that the TELCO and the PMM sectors can provide a diversification and profit benefit to investments in all other sectors during such pandemics since they reacted differently to the COVID shock.

The coefficient of COVID-19 for the energy sector (the higher performer among all industries-in terms of risk-adjusted returns and coefficient of variation) is negative and statistically insignificant. Indicating that the Pandemic did not significantly decrease the daily returns of the energy sector. The results demonstrate the resilience of the energy sector to the pandemic shock. Suggesting that this could be a good target to hedge

and diversify investments during such economic shocks. The ALSHI was used to gauge the impact of the broad market on sector returns. The study found a significant positive relationship between the ALSHI index and FI, CD, and PMM in the short run. Indicating that as the broad market short term returns increased, the returns of FI, CD and PMM also increased. Inconsistent with expectations, we found a significant negative relationship between the ALSHI Index and the other sectors (ENG, CS, IND, HLT, TELCO). Implying that the returns of these sectors moved in the opposite direction as the broad market. However, this can explain the essence of diversification in the overall market index; as other sectors go up, some go down and offset each other in the market index. The study found no significant relationship with the ALSHI Index during the Pandemic for the TECH sector over the short run. The study included the daily S&P500 index to capture the world market effect. The results show a significant positive relationship between the majority of the sectors (FI, CD, CS, IND, HLT, TECH) and the S&P500 index returns. Indicating that these sectors decreased and increased with the world market. The PMM and TELCO sectors had a significant negative relationship with the S&P500. The dividend yield (D_Yield) was used as one of the control variables that explain stock returns. The results show a significant negative relationship between the dividend yield and all JSE sectors. Indicating that stocks with higher dividend yields during the Pandemic earned lower returns over the short run and stocks with lower yields earned higher returns.

The study found a significant negative relationship between Crude oil price increases and IND, HLT, PMM, and ENG sectors. The rise in oil prices significantly led to lower returns in these sectors. The results are consistent with Kilian and Park (2009), who report a 22% variation in stock returns due to increased oil prices in the USA. Jones and Kaul (2013) also indicate that increases in oil prices negatively impact stock returns. They argue that an increase in oil price increases the daily production costs, decreasing an average investor's investment ability due to a lower saving rate. However, we found a significant positive relationship between daily returns and crude oil prices for the FI, CD, CS, and TELCO. Suggesting that the increase in oil prices boosted the returns of these sectors during the Pandemic.

The exchange rate was found to impact the TELCO and CS sectors negatively. Jumah (2013) argues that the movement of exchange rates affects the expected cash flows of firms and, therefore, stock returns through altering home currency foreign currency-denominated revenues and costs and competition terms for internationally operating companies. However, no significant relationship was found for other sectors following a change in the exchange rate during the COVID-19 Pandemic. The results imply that stock returns' response to various industries and factors are time-varying. Thus, investors and policymakers must constantly evaluate the evolution of stock returns in different markets to make informed investments and policy interventions.

4.5. Panel Pooled ARDL regression results

Table 6 displays the ARDL long and short-run panel pooled regression results. The results depict a negative and statistically significant relationship between COVID-19 and index returns over the short run in South Africa. Indicating that COVID-19 negatively impacted JSE index returns. The surge in COVID-19 cases reduced the returns of JSE sectors over the short run. The results imply that when all sectors are pulled together, the negative impact on the majority of the sectors overwhelms the positive impact experienced in other sectors and hence an overall negative effect on the entire market. Over the long run, the coefficient of COVID-19 is still negative but insignificant. Implying that the COVID-19 shock does not significantly reduce the JSE index returns in the long run. The results are in line with Takyi and Bentum-Ennin (2021), who showed that some African stock markets, including South Africa, Mauritius, Namibia, Uganda and Cote D'Ivore, had their stock markets not significantly impacted by COVID-19 or experienced a short-lived negative impact. They argued that although the Pandemic adversely affected stock market performance in these countries, the impact is not statistically significant considering the post-pandemic shock as a whole. The insignificant effect could be the stock market resilience or economy-level policy interventions (Takyi and Bentum-Ennin 2021). The results also support Yan and Qian (2020) claim that the coronavirus' adverse impact on the US stock markets is short term. The results indicate that the market's invisible hand normalises the adverse effect caused by the Pandemic in the long run. The authors reveal that the fall in prices induced by the outbreak will be eventually brought back in the long run. The results suggest that due to evident market correction in the longer term, investors in stock markets should be more focused on the long run and avoid premature exiting of positions when a short term shock destabilises markets.

The dividend yield had a negative and significant impact on stock returns over the long and short run for South African stock market sectors. The effect is more significant over the short run, as shown by a higher coefficient. The results also show a positive and significant impact of the ALSHI on the sector pooled returns over the long run and a non-significant effect over the short run.

Table 6: Panel ARDL model

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
COVID19	−0.0014	0.0023	−0.5948	0.5520
ALSHI	0.6278***	0.0227	27.676	0.0000
D_Yield	−0.0003***	0.0001	−2.5859	0.0098
Ex_rate	−0.0537**	0.0204	−2.6354	0.0004
S&P	0.0041	0.0252	−0.1617	0.8715
Crude_oil	0.0038	0.0075	0.5148	0.6067
Short run equation				
COINTEQ01	−0.9701***	0.0262	−37.030	0.0000
D (COVID19)	−0.0554**	0.0218	−2.5476	0.0412
D (ALSHI)	−0.0473	0.0557	−0.8489	0.3960
D (D_Yield)	−0.0931**	0.0429	−2.1659	0.0304
D (Ex_rate)	0.0944	0.1121	0.8416	0.4001
D (S&P)	0.0289**	0.0105	2.7536	0.0301
D (Crude_oil)	−0.0172*	0.0072	−2.3917	0.0483
C	0.0017***	0.0005	3.0643	0.0022
Akaike info criterion	−5.489298			
Schwarz criterion	−5.376183			
Log likelihood	12173.67			

***represent significance at 1% P<1%; **significance at 5% P<5%; *significance at 10% P<10%

For the JSE ALSHI return, there is a change in sign to a positive in the long run from negative in the long run, indicating that the market return produces a positive and significant impact on sector returns in the long run and a negative effect on the short run. The results imply that sector returns respond more to the overall market activity in the long run than in the short run. Hence investors in stock markets should pay more attention to long-run dynamics in their security and asset allocation decisions. During the COVID-19 Pandemic, the overall market was not a significant determinant of sector returns over the short run in South Africa. The results also show a shift in the nature of the relationship between stock returns and exchange rate from the short term to the long run. The exchange rate volatility exerts a significant and negative effect on sector returns over the long run. Implying that the South African currency depreciation significantly decreases stock returns in the long run. The findings are consistent with Jumah (2013), who reveals that exchange rate movements alter foreign currency-denominated revenues and costs for firms with international operations, thereby affecting expected cash flows of firms and, therefore, stock returns. However, the exchange rate coefficient is positive and insignificant in the short run, suggesting that the South African rand exchange rate did not drive returns of JSE sectors during the Pandemic. Crude oil also shows a shift in its relationship with stock returns over the short and long run. The results show a significant negative relationship between stock returns and crude oil in the short run. Indicating that an increase in oil prices reduces South African stock returns in the short run. The results are consistent with Jones and Kaul's (2013) finding that stock returns are negatively impacted by the increases in oil prices in the USA. They argue that oil price upsurge increases the daily production costs, decreasing a normal investor's investment ability due to a lower saving rate. However, the sign turned positive and insignificant in the long run, implying that Oil prices do not significantly impact sector returns on the JSE over the long term. This is consistent with Khan et al., (2019), who found a non-significant impact of increasing oil prices on the Shanghai stock exchange stock returns.

The cointegration term has a negative and statistically significant coefficient for the pooled short-run equation and all cross-sector equations. This result indicates that the panel is cointegrated, and any discrepancies between the actual and equilibrium index returns are corrected daily across the sectors used in the sample. Short-run deviations are corrected in the long run. The pooled model's high error correction term coefficient (−0.9701) indicates a speedy daily return adjustment to discrepancies.

Figure 1 shows the Akaike information criteria on model selection. The chart indicates that model 1 ARDL (1,1,1,1,1,1,1,1) with the lowest information criteria was selected as the best model.

5. SUMMARY AND CONCLUSION

The study aimed to analyse the impact of the COVID-19 Pandemic on the returns of all ten sectors of the JSE using a panel ARDL model estimated with the PMG technique. The short-run results indicate that the COVID-19 shock impacted the JSE sectors' returns differently. Although the Pandemic hurt the majority of the sectors, some sectors show a positive response, and some no effect on the pandemic shock. The results show a significant negative relationship between COVID-19 and the returns of the Financials, Consumer discretionary, Consumer services, Industrials, Health and Technology sectors. The results Imply that these sectors experienced the most significant heat from the Pandemic. Investors felt anxious and frightened hearing the news regarding the increasing number of coronavirus cases and deaths, thereby delaying their investments until the capital market returned to normal. Policymakers and governments should attempt to suppress the circulation of negative news in the market to reduce investor anxiety and promote confidence in the market by ensuring policy intervention and protection of markets and businesses. In addition, the lesson for policymakers is to identify the sectors hardly hit by different pandemics and engage in appropriate intervention to save such sectors of the economy. However, for Precious Metals and Mining and Telecommunications, the study found a significant positive relationship between COVID-19 and the daily returns of these sectors over the sample period. This indicates that these sectors' returns essentially increased as COVID-19 infections went up. The energy sector was found to be resilient to the COVID-19 Pandemic's detrimental effects. The implication of these results to investors is the ability of these sectors (PMM, TELCO and ENG) to provide diversification and hedging abilities in security selection and asset allocation in other industries that experienced the detrimental effect of the Pandemic during such market shocks. Thus investors can look into adding securities from such sectors to hedge their portfolios during pandemic shocks. For literature, our findings show the extent of heterogeneity among industries and countries. Different industries are affected differently by the shock and also same industries in different countries may respond differently to the same shock.

The pooled ARDL results show a significant negative relationship between COVID-19 and pooled sector returns over the short run, indicating that the negative effect is dominant on a pooled basis across all sectors. This finding suggests that during extreme market shocks like pandemics, investors' portfolios should be heavily weighted towards resistant sectors to withstand the negative impact from other sectors. The study found an insignificant relationship between COVID-19 and sector returns in the long run, implying that the pandemic shock is short-lived and the market normalises the pandemics' negative effect in the long run. Thus stock market investors should worry more about the long-run dynamics of the stock market. Short-term discrepancies are short-lived and will be corrected over the long term. The study also found a significant negative relationship between exchange rate and stock returns over the long run. Thus, the local currency depreciation negatively affects JSE sector returns over the long run. However, no significant impact was found over the short run during the sample period.

Regarding crude oil, a negative and statistically significant relationship is reported in the short run, whereas in the long run, the relationship is insignificant. The dividend yield was found to negatively correlate with sector returns both in the long and short run. The international market proxied by the S&P500 had a significant positive relationship with the sector returns in the

short term and an insignificant relationship in the long run. In contrast, the local market (JSE-ALSHI) positively impacts sector returns in the long run, and a significant effect was found in the short run. This implies that JSE sector returns increase as the international markets surge in the short run and the local market does well in the long run. The long-run performance of the global stock market and the short-run activity of the overall market did not show any significant influence on the JSE sector returns over the sample period. This study also comes with its own limitations, the analysis focused only on the South African stock market, and the results cannot be generalised to other stock markets, even in developing countries, due to different economic settings, capacity and national responses to the pandemics which influences investors to react differently in different markets. In addition, the study used aggregate sector returns and ignored individual firm heterogeneity within each factor.

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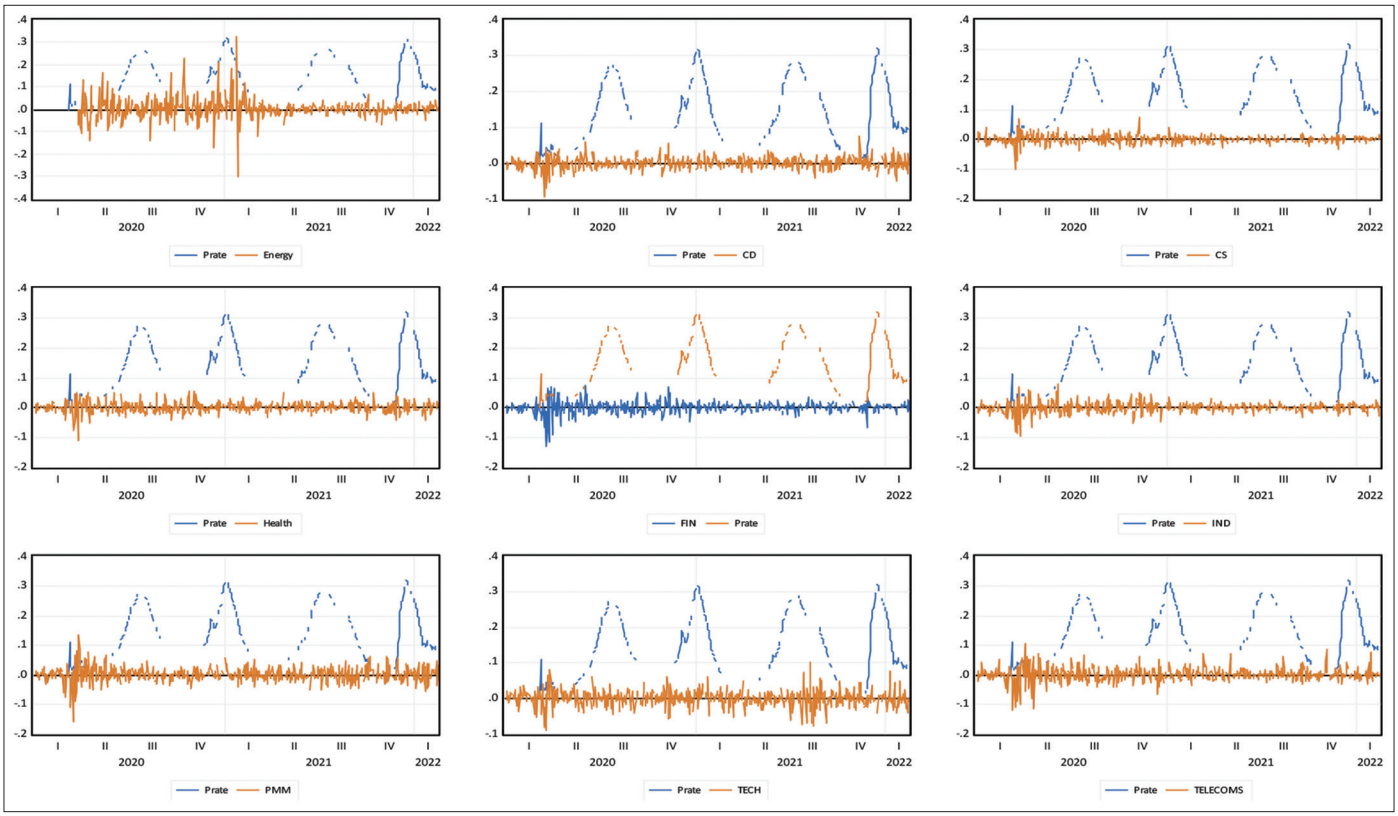
APPENDIX

Appendix Figure 1: Daily index returns and COVID 19 cases



Appendix Figure 2: Daily index returns and COVID 19 cases