CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

A stock also referred to as company's equity is a financial instrument that represents ownership in a company or corporation and represents a proportionate claim on its assets (what it owns) and earnings (what it generates in profits). There are different areas that people invest in but, one of the major areas shareholders invest in is the financial sector which is the bank stocks. Stock business just like any business has its own risks associated with it. People invest in stock as means of generating wealth (Abdullahi & Lawal, 2011). Stock Market has given investors opportunity to invest in securities of quoted companies and reward in form of monetary benefit has been the major objective of any investor. Returns on these investments are used as major indices to evaluate investment instead of prices. Reasons for this include, return on assets is a complete and scale- free summary of investment opportunity, returns series are easier to handle than price series because returns have more attractive statistical properties (Tsay, 2005).

The stock market is a well-regulated market that was created not only to act as a meeting point for highly liquid and insolvent (potential) investors, but also to aid in the growth and development of a country's economy. The stock market, according to current theories, thrives on knowledge. Long-term funds packaged in the form of securities such as shares, commodities, bonds, debentures, loan stocks, and derivatives are exchanged on the stock exchange, which is a segment of the financial market. Since the market is knowledge-driven, price indexes, returns, volatility, market capitalization, and other metrics are thought to be affected by information availability.

Claim on assets is one of the many possible advantages of owning stocks or shares in a business, a shareholder has a claim on the properties of the company of which they own

shares. The claims on properties, on the other hand, are only valid when the business is about to be liquidated. In that case, all of the company's assets and liabilities are counted, and the shareholders will say whatever is left after all creditors have been paid. Since creditors are compensated before equity holders, and if there are no assets left after the debt is paid, equity holders can receive nothing, equity investments are considered higher risk than debt (credit, loans, and bonds). Capital Gains and Dividends Earnings can also be distributed to stockholders in the form of dividends. The company can determine how much money it wants to pay out in dividends for a certain time span (such as a quarter or a year), or it can decide to keep all of the profits and use them to grow the business. Aside from dividends, stockholders will benefit from capital gains as the stock price rises. The ability to vote is another significant advantage of equity ownership is the ability of shareholders to vote for management changes if the business is mismanaged. Annual meetings of a company's management board will be held to report on the company's overall results. They reveal plans for future operations as well as management decisions. Investors and stockholders have the right to negotiate changes in management or corporate strategy if they disagree with the company's current operations or future plans. Finally, the nature of ownership is restricted when an individual owns shares in a corporation. Shareholders are not directly responsible for any losses if the corporation goes bankrupt.

Stock trading, like any other investment, carries some risk, such as capital loss because there is no guarantee that the stock's price will increase, resulting in a loss. There is also no liquidation preference, which means creditors are compensated before shareholders when a corporation is liquidated. Furthermore, while retail investors have voting rights in executive board meetings, they have no power to vote. Many factors affect the returns from stock investment, some of them include; from overall market volatility to company-specific events,

like a communications crisis or a product recall, also due to unforeseen circumstances like the COVID-19 global pandemic.

The Coronavirus disease widely known as COVID-19 was first identified in Wuhan, China in December 2019 but later spread to other parts of the world. The disease has been declared as pandemic by the World Health Organization (WHO) (Samson *et al.,* 2020). The COVID-19 pandemic started when multiple unexplained cases of pneumonia were reported in the area. It was discovered that there is a severed human to human transmission and the cause of this was unraveled. The epidemiological finding showed that this was caused by a novel Corona Virus. By early 2020, about 59 cases of COVID-19 were reported in Wuhan.

After this pandemic was confirmed in Wuhan, China, the pandemic has spread to other countries of the world. The first confirmed case of COVID-19 was reported in Nigeria by the Nigeria Centre for Disease Control on 27 February 2020. This first case was an Italian citizen who works in Nigeria and returned from Milan, Italy to Lagos, Nigeria on the 25th of February; 2020. The first index case was confirmed by the Virology Laboratory of the Lagos University Teaching Hospital (LUTH), Lagos. This Laboratory is part of the Laboratory Network of the Nigeria Centre for Disease Control (NCDC). As at 8 May, 2020, the total confirmed cases of COVID-19 in Nigeria were put at 3,9125. Given the fact that COVID-19 pandemic has affected virtually every aspect of human life, this study therefore intends to examine the impact of the COVID-19 on the returns of Nigerian bank stocks.

1.2 Statement of the Problem

COVID-19 pandemic has adversely affected the world economy with Nigeria inclusive. Virtually every sector of Nigeria economy including the banking sector has been affected by the global pandemic. Some studies have been carried out on COVID-19 pandemic. Notable among them is a study by Samson, Ogunlaran and Raimi (2020) on a predictive model for COVID-19 in Nigeria, Wu, Leung and Leung (2020) forecasted the domestic and

international spread of the COVID-19 outbreak, Sujath, Chatterjee and Hassanien (2020) adopted machine learning approach in forecasting COVID-19 pandemic in India among other works. These researchers have contributed immensely in the area of COVID-19 modelling and prediction, nevertheless these studies focused on COVID-19 modelling and prediction with no much attention on its impact on the Nigerian banking sector to the best of my knowledge which is an integral part of the Nigeria economy. Hence, this study intends to fill this gap by examining the impact of the COVID-19 pandemic on the returns of Nigerian bank stocks.

1.3 Aim and Objectives of Study

The aim of the study is to assess the impact of the COVID-19 pandemic on the returns of the Nigerian bank stocks. The specific objectives are:

1. To determine the impact of COVID-19 pandemic on the returns of Zenith bank stock.
2. To investigate the impact of COVID-19 pandemic on the returns of united Bank for Africa (UBA) stock.
3. To examine the impact of impact of COVID-19 pandemic on the returns of Guaranty Trust bank stock.

1.4 Research Questions

1. What is the impact of the COVID-19 pandemic on the returns of Zenith bank stock?
2. What is the impact of COVID-19 pandemic on the returns of United Bank for Africa (UBA) stock?
3. What is the impact of COVID-19 pandemic on the returns of Guaranty Trust bank stock?

1.5 Research Hypotheses

This study will be guided by the following null hypotheses

Ho_1: there is no significant impact of COVID-19 pandemic on the returns of Zenith bank stock.

Ho_2: There is no significant impact of COVID-19 pandemic on the returns of UBA stock.

Ho_3: There is no significant impact of COVID-19 pandemic on the returns of Guaranty Trust bank stock.

1.6 Scope of the Study

The scope of the study is limited to only the three most traded bank stocks in Nigeria. (Investing.com, 2021)

CHAPTER TWO

LITERATURE REVIEW

This Chapter provides an insight into various researches done by other researchers and explains the terminologies which have to do with a liquid measurement system that is based on sensors and microcontrollers. This review is broadly divided into two sections; conceptual framework and empirical review. The conceptual framework is an analytical tool that is used to get a comprehensive understanding of a phenomenon. Empirical review is based on observed and measured phenomena and derives knowledge from experience rather than from theory or belief. It states the method which was used, the way the method was approached, and the limitations.

2.1 Conceptual Framework

2.1.1 Review on COVID-19 Pandemic and its Impact on the Global Economy

The World Health Organization designated COVID-19, a new infectious respiratory illness that arose in Wuhan, Hubei Province, China, in December 2019. Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), a novel kind of corona virus, has been identified as the cause of this disease. There have been major outbreaks of illnesses caused by a variety of viruses throughout the history of human civilization. According to a World Health Organization study, the current COVID-19 outbreak has impacted over 2,164,111 individuals and killed over 146,198 people in over 200 countries throughout the world (Chakraborty & Maity, 2020). The COVID-19 pandemic has claimed many lives throughout the world and poses a threat to public health, food systems, and the workplace. Hundreds of millions of people are at risk of sliding into poverty, with approximately 690 million people suffering from malnutrition. Hundreds of millions of businesses are in danger of going out of business. Nearly half of the world's 3.3 billion workers are at danger of losing their jobs. Workers in the informal economy are particularly vulnerable because they lack social security and

adequate health care, as well as having lost access to productive assets. Many people are unable to feed themselves during lockdowns since they do not have the means to generate money.

Nigeria's financial system was quick to respond as COVID-19 spread across Africa, affecting lives and livelihoods. The Central Bank of Nigeria (CBN) acted quickly, implementing a stimulus package to address the pandemic's impacts on vital sectors, which included lowering the interest rate on its intervention facilities from 9% to 5%. However, Nigerian banking faces a difficult path ahead. Already under stress before the crisis due to a slow economy, a difficult operating environment, and increasing competitive intensity—the ongoing pandemic, currency depreciation, and other macro difficulties continue to obstruct the sector's progress.

2.1.2 Nigerian Stock Exchange

A stock is a financial instrument that symbolizes ownership of a portion of a company. This entitles the stockholder to a share of the corporation's assets and earnings according to the amount of stock they possess. "Shares" are the units of stock. Stocks are the cornerstone of many individual investors' portfolios and are purchased and sold mostly on stock exchanges, but private trades are possible. These deals must comply with federal rules designed to safeguard investors from deceptive tactics. They have historically outperformed most other assets throughout time. The majority of internet stock brokers sell these assets.

Stock is issued (sold) by corporations to raise cash to operate their companies. The stockholder (shareholder) has now purchased a piece of the corporation and may be entitled to a portion of its assets and earnings, depending on the type of shares acquired. To put it another way, a shareholder has become a shareholder of the issuing business. The number of shares a person holds in relation to the number of outstanding shares determines ownership. For example, if a business has 1,000 outstanding shares of stock and one individual owns 100

of them, that person owns and has a claim to 10% of the company's assets and earnings. Stock holders do not own corporations; instead, they own the shares that businesses issue. Corporations, on the other hand, are treated differently by the law since they are considered legal people. To put it another way, companies can file taxes, borrow money, own property, be sued, and so on. The concept of a company as a "person" implies that it owns its own assets. The corporation, not the stockholders, owns a corporate office with chairs and tables.

The stock exchange market is a regulated marketplace where stocks, bonds, and other securities are bought and traded. The market is split into two segments. There are numerous institutional actors on both sides of the demand and supply sides. These institutional investors pool money from a big number of people and invest it in the stock market. The capital market is made up of the stock exchange of the first among equals in institutions. It is the axis around which the capital market rotates, and it is pivotal to a country's economic progress.

By logical extension, the Nigerian capital market, like our political and economic lives, has an international and colonial significance. Following colonial masters' awareness that insufficient money or capital was a key stumbling block to industrial progress and economic development, they established the first commercial bank in Nigeria in 1892, the central bank of Nigeria in 1959, and the first merchant bank in 1960. These banks solely supplied short-term financing, i.e., they were money market institutions. The money market is a financial market for buying and selling short-term assets. This indicates that the securities will mature in less than a year. However, no substantial investment can be made if only short-term money is available. The capital market, on the other hand, is a financial market in which short-term securities are exchanged. As a result, the capital market has a maturity period of more than one year. Due to the money market's incapacity to satisfy the goals and objectives of investors, Nigeria's capital market was created to provide for medium and long-term funding.

2.2 Empirical Review

2.2.1 Review of Related Empirical Sturdies in Nigeria.

Babarinde (2020) explored the impact of positive, discharged, and deadly COVID – 19 instances on stock prices on the Nigerian Stock Exchange were investigated (NSE). This study used an event study research design using Granger causality and Vector Autoregression (VAR) techniques to analyze weekly time series data from the NSE and Nigeria Centre for Disease Control websites. This study lasted 30 weeks, starting on Monday, March 2, 2020, and ended on Friday, September 25, 2020. There is no indication of a link between coronavirus and stock prices in Nigeria. The study also discovered that COVID-19 discharged and fatal instances had a positive impact on Nigerian stock values.

Jelilov *et al,* (2020) examined the stock market returns-inflation nexus while accounting for the impact of the COVID-19 epidemic in Nigeria. Data were obtained between February 27, 2020 to April 30, 2020. The findings showed that COVID-19 increases volatility and distorts the positive relationship between inflation and stock market returns, which tends to negate Fisher's hypothesis, using estimation procedures based on generalized autoregressive conditional heteroskedasticity type models (GARCH (1,1), the GJR-GARCH, and accounting innovation tests.

Adenomon *et al,* (2020) examined the impact of the COVID-19 epidemic on the performance of the Nigeria stock exchange from March 2, 2015 to April 16, 2020. The results of this study compared the COVID-19 era in Nigeria to the usual time under investigation, and the results indicated a loss in stock returns and significant volatility in stock returns during the COVID-19 period. In addition, stock returns were subjected to Quadratic GARCH (QGARCH) and Exponential GARCH (EGARCH) models using dummy variables, revealing that the COVID-19 has had a detrimental impact on stock returns in Nigeria.

Olanrewaju *et al,* (2020) used the ARCH and GARCH models to investigate the volatility of the banking sector's return on stock in the Nigerian stock market. The BIC and AIC criteria were used by several commercial banks on the Nigerian stock exchange to assess model adequacy. The data on the stocks of Nigeria's five largest banks reveal various degrees of volatility persistence; nevertheless, the return on Union Bank assets does not exhibit strong evidence of volatility, implying that the stock of Union Bank is comparatively stable among the institutions studied. The return on UBA stock looks to be non-stationary, implying that First Bank shares are part of the IGARCH (1,1).

Sharma *et al.,* (2021) used eigenvalue decomposition of Hankel matrix (EVDHM) along with the autoregressive integrated moving average (ARIMA) is applied to develop a forecasting model for nonstationary time series. The Phillips-Perron test (PPT) is used to determine if a time series is nonstationary. EVDHM is used to deconstruct a time series into its constituent subcomponents and decrease nonstationary. Each subcomponent's future values are forecasted using an ARIMA-based model. The final output values are calculated by adding the forecast values of each subcomponent. A genetic algorithm (GA) with lowest Akaike information criterion values is used to find the optimal ARIMA parameters for each subcomponent (AIC). The model's performance is assessed by projecting the daily new cases of the recent pandemic illness COVID-19 for India, the United States, and Brazil in the future. The results support the great effectiveness of the suggested technique.

Isenahd & Olubusoye (2014) carried out a study to forecast Nigerian stock market returns using ARIMA and artificial neural network models. The study reports empirical evidence that artificial neural network-based models are applicable to forecasting of stock market returns. The Hurst coefficient was used to evaluate the presence of memory in the Nigerian stock market logarithmic returns time series before the models were trained. The test revealed that the logarithmic returns process is not a random walk, and the Nigerian stock market is

inefficient. The study created two artificial neural network-based models. The out-of-sample forecast performance of these networks, TECH (4-3-1) and TECH (3-3-1), was compared to a baseline ARIMA (3,0,1) model. The results obtained in the study showed that in comparison to the based model, artificial neural network-based models are capable of closely imitating log-returns. The trained models' out-of-sample assessments were based on the RMSE, MAE, NMSE, and directional change metrics, respectively. The artificial neural network-based models beat the ARIMA-based model in anticipating future developments of the returns process, according to these measures. Another finding of the study is that, rather than relying on vast market data, basic technical indicators may be used to estimate future stock market returns given that the returns has memory of its past.

Emenike (2010) modelled and forecasted stock prices of the Nigerian Stock Exchange using the Autoregressive Integrated Moving Average (p, d, q) model. The fit sample was drawn from the NSE's monthly All-Share Indices from January 1985 to December 2008, while the out-of-sample prediction period is drawn from January 2009 to December 2009. Several diagnostic tests were run to determine which p, d, and q parameter best matched the index. The index points and growth rates predicted by the ARIMA (1, 1, 1) model differed from the actual indices and growth rates. During the predicted period, the projections did not match market performance. As a consequence, the model's adequacy was tested by generating one-period predictions for the next 12 periods, and the U statistics revealed that the ARIMA (1,1,1) model beat the nave Model. Hence, the deviations indicate that the global economic meltdown destroyed the correlation relationship existing between the NSE All-Share Index and its past.

2.2.2 Review of Related Empirical Sturdies in Other Countries.

Takyi & Bentum-Ennin (2021) examined and quantified the short-term impact of the coronavirus illness of 2019 (COVID-19) on stock market performance in thirteen (13) African nations. Using daily time series stock market data spanning 1st October 2019 to 30th June 2020. To assess the relative impacts of the COVID-19 pandemic on stock market performance in various nations, we use a unique Bayesian structural time series method (a state-space model). In general, our Bayesian posterior estimates suggest that stock market performance in Africa has deteriorated considerably during and after the COVID-19 outbreak.

Engelberg & Gao (2021) examined the financial implications for African stock markets of increased global investor attention or risk attitude connected to the COVID19 epidemic. Engelberg & Gao (2021) showed that investor attention is a key driver of stock returns using daily investor attention indices based on worldwide COVD19-related google search queries and stock return indices for 14 African stock markets. Result showed that a rise in investor attention regularly lowers stock returns in three stock markets: Botswana, Nigeria, and Zambia. In Ghana and Tanzania, on the other hand, increased investor interest may boost stock returns.

Allam *et al.,* (2020) carried out a study the effect of the Coronavirus on the trading behavior of both individual and institutional investors in the Egyptian Stock Exchange, as the virus spread was measured by indicators reveal the virus spread in the Arab Republic of Egypt by using (daily cases, total cases, daily deaths, total deaths) on a daily basis as independent variables, and the dependent variable represented in invest. From March 1, 2020, until June 30, 2020, it was used every day. Individual and institutional investors' trading behavior for Egyptians, Arabs, and foreigners appears to be sensitive to the spread of the Coronavirus, according to the findings. The daily deaths variable was more effective and sensitive for

individuals and institutions for Egyptian investors, and the daily cases variable was more sensitive to the trading behavior of Arab individual investors, as the results of (Beta Standardized Coefficients) were the most influential and sensitive independent variables in the dependent variable.

Ovidiu *et al*., (2020) used Auto-Regressive Integrated Moving Average (ARIMA) models to predict the epidemiological trend of COVID-19 in Ukraine, Romania, the Republic of Moldova, Serbia, Bulgaria, Hungary, the United States, Brazil, and India, the last three nations being the most afflicted at the moment. COVID-19 daily prevalence data from 10 March to 10 July 2020 were used to improve accuracy. Different ARIMA models were formulated with different ARIMA parameters. ARIMA (1, 1, 0), ARIMA (3, 2, 2), ARIMA (3, 2, 2), ARIMA (3, 1, 1), ARIMA (1, 0, 3), ARIMA (1, 2, 0), ARIMA (1, 1, 0), ARIMA (0, 2, 1), ARIMA (0, 2, 1), ARIMA (0, 2, 1), ARIMA (0, 2, 1), ARIMA (0, 2, 1), ARIMA (0, 2, 1), ARIMA (0, 2, 1), ARIMA (0, 2, (4.70244, 1.40016, 2.76751, 2.16733, 2.98154, 2.11239, 3.21569, 4.10596, 2.78051). This study shows that ARIMA models are useful for generating forecasts during the present crisis and provides an indication of these regions' epidemiological stage.

Haneen *et al.,* (2021) carried out a study to test how accurate the Auto-Regressive Integrated Moving Average (ARIMA) models best-fit model predictions were with the actual values reported after the entire time of the prediction had elapsed. The ARIMA best-fit model predictions were correct when compared to the actual values presented after the prediction period had ended. Using Kuwait as a case study, we explore and evaluate the correctness of an ARIMA model over a reasonably long period of time. We examined auto-correlation function and partial auto correlation function charts, as well as other accuracy metrics, to determine the best-fit parameters for our model. Throughout Kuwait's progressive preventative approach, the best-fit model was utilized to forecast confirmed and recovered

cases of COVID-19. The results showed that despite the disease's dynamic character and the Kuwaiti government's continuous adjustments, the actual values for the most of the time period studied were well within the boundaries of the selected ARIMA model prediction at 95 percent confidence range. The predicted points had a Pearson's correlation coefficient of 0.996 with the actual recorded data. This shows that the two sets are very closely linked. The accuracy of our ARIMA model's prediction is both adequate and satisfactory.

Perez *et al*., (2020) carried out a comparison of two statistical models for calculating and forecasting pandemic growth: the autoregressive integrated moving average (ARIMA) and the Gompertz function growth model. Austria, Switzerland, and Israel were chosen as the nations to test the effectiveness of these models since they had similar populations. The models' accuracy was tested using data on verified, non-asymptomatic cases, and confirmed fatalities from February 21 to May 19, 2020. To assess the correctness of the models, the study utilized Root Mean Squared Error (RMSE), Mean Absolute Percentage Error (MAPE), and the regression coefficient index R^2. The results showed that both models have promising adjustment errors (R^2>0.99), with the ARIMA model performing best for infections and the Gompertz model performing best for mortality. It has also been established those various nations are influenced in different ways, which might be attributable to external influences that are difficult to quantify statistically.

Jamir (2020) used ARIMA models to forecast potential impact of COVID-19 outbreak on India’s GDP. Modeling and forecasting India's GDP growth rate for the following 11 quarters, from Q2 2020 to Q4 2022. In the ARIMA (1, 1, 4) model, Box-Jenkins technique was used to anticipate short-term GDP using quarterly GDP data. Even with a controlled epidemic and various stimulus measures implemented by the government, the pandemic might have a substantial impact on India's economy in the medium term, with no indications of recovery, according to the predictions presented in this article. According to the findings,

India's GDP growth would continue to slow significantly until the fourth quarter of 2022. The forecast produced in this study, however, is merely suggestive and not conclusive.

Dash *et al*, (2019) used Random Walk Hypothesis (RWH) to test the Indian Stock Market using ARIMA modelling. Twenty significant equities in the Indian banking sector are examined in this study. The National Stock Exchange provided the stock price data. The research period was April 1, 2017 to March 31, 2018, a one-year timeframe. For the stock log-returns, the study used the runs test, the Augmented Dickey-Fuller (ADF) unit root test, and Auto-regressive integrated moving average (ARIMA) modeling. While the RWH is supported by the results of the runs test and the ADF test, the findings of the Auto-regressive moving average (ARMA) modeling give some evidence against it. However, because the ARMA models' R^2 was low, log-returns might be primarily attributable to random stock price changes. Although log-returns do not always follow a random walk, there is some room for unpredictability in log-returns series.

Dehesh *et al*. (2020) carried out a research to forecast COVID-19 confirmed cases in different countries. The study was based on daily verified COVID-19 cases obtained from Johns Hopkins University's official website between January 22nd and March 1st, 2020. The trend of confirmed cases was predicted using the Auto Regressive Integrated Moving Average (ARIMA) model. Stata version 12 was utilized in this study. ARIMA parameters were (2,1,0) for Mainland China, (2,2,2) for Italy, (1,0,0) for South Korea, (2,3,0) for Iran, and (3,1,0) for Thailand. The trend in mainland China and Thailand was virtually constant. South Korea's trend has been declining and is expected to stabilize in the near future. Iran's and Italy's tendencies were both in flux.

CHAPTER THREE

METHODOLOGY

3.1 Source of Data

This data on daily closing prices of the three selected banks (United Bank for Africa, Zenith bank and Guaranty Trust bank) from 27th February, 2020 to 31st May, 2021 which is also the period of COVID-19. There are 199 observations used in this research. This data was obtained from Cashcraft website (www.cashcraft.com). Similarly, data on daily new cases of COVID-19 within the same period was obtained from Nigeria Centre for Disease Control (NCDC).

3.2 Computations of Returns

Having observed P_t which denotes the daily closing price for day t, then the daily returns will be computed from daily prices using the formula:

$$R_t = \log\left(\frac{P_t}{P_{t-1}}\right), \text{ t = 2,…, n} \qquad \text{[Tsay, 2005].} \qquad (1)$$

Where, P_t is the closing price at the current day and P_{t-1} is the closing price of the stock in the previous day.

3.3 Test of Stationarity

In time series analysis, stationarity of the data is very important. It is when the mean and variance of the time series is constant independent of time**.** A formal test of stationarity was carried out using the Augmented Dickey Fuller (ADF) test.

The test statistic is: $\Delta R_t = \alpha R_{t-1} + \sum_{j=1}^{p} \delta_j \Delta R_{t-j} + \varepsilon_t \qquad (2)$

The null hypothesis is:

H_0: The data is non-stationary $\left(|\phi| = 1\right)$

versus the alternative hypothesis:

H_1: the data is stationary $\left(|\phi| < 1\right)$

Decision rule: We reject the null hypothesis if p-value is less than 0.05(p<0.05)

3.4 Model Identification

The study identified models by plotting the Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF). The ACF plot can help in identifying the appropriate model while the plot of PACF can help to identify the appropriate order of the identified model (tentative model).

$$\rho = \frac{COV(R_t, R_{t-1})}{Var(R_t)} \tag{3}$$

$$\rho = \frac{\frac{1}{n-k}\sum_{t=k+1}^{n}(R_t - \overline{R_t})(R_{t-k} - \overline{R_t})}{\sqrt{\frac{1}{n}\sum_{t=1}^{n}(R_t - \overline{R_t})^2}\sqrt{\frac{1}{n-k}\sum_{t=k+1}^{n}(R_{t-k} - \overline{R_t})^2}} \tag{4}$$

Where ρ is the Autocorrelation function (ACF)

3.5 Models used in the Study

The model used to be used in this study is an Autoregressive Moving Average (ARMA) model of the form

$$R_t = \varepsilon_t + \sum_{i=1}^{p}\phi_i R_{t-i} + \sum_{j=1}^{q}\theta_j \varepsilon_{t-j} + \alpha \log\left(COVID_t\right) \tag{5}$$

where, R_t and R_{t-1} are the present day and the previous day returns respectively, ϕ_i and θ_j are the autoregressive and moving average terms respectively while α captures the impact of the COVID-19 pandemic. For ARMA(p,q)

$$1-\phi_1 B-\phi_2 B^2-...-\phi_p B^p (1-B)^d R_t = \varepsilon_t (1-\theta_1 B-\theta_2 B^2-...-\theta_q B^q) \tag{6}$$

Since the series is stationary d=0

$$(1-\phi_1 B-\phi_2 B^2-...-\phi_p B^p) R_t = \varepsilon_t (1-\theta_1 B-\theta_2 B^2-...-\theta_q B^q) \tag{7}$$

$$R_t - \phi_1 BR_t - \phi_2 B^2 R_t - ... - \phi_p B^p R_t = \varepsilon_t - \theta_1 B\varepsilon_t - \theta_2 B^2 \varepsilon_t - ... - \theta_q B^q \varepsilon_t \quad (8)$$

Recall that $BR_t = R_{t-1}$

$$R_t - \phi_1 R_{t-1} - \phi_2 R_{t-2} - ... - \phi_p R_{t-p} = \varepsilon_t - \theta_1 \varepsilon_{t-1} - \theta_2 \varepsilon_{t-2} ... - \theta_q \varepsilon_{t-q} \quad (9)$$

$$R_t = \phi_1 R_{t-1} + \phi_2 R_{t-2} + ... + \phi_p R_{t-p} + \varepsilon_t - \theta_1 \varepsilon_{t-1} - \theta_2 \varepsilon_{t-2} ... - \theta_q \varepsilon_{t-q} + \alpha \log COVID_t \quad (10)$$

The expected value is

$$E(R_t) = E(\phi_1 R_{t-1} + \phi_2 R_{t-2} + ... + \phi_p R_{t-p} + \varepsilon_t - \theta_1 \varepsilon_{t-1} - \theta_2 \varepsilon_{t-2} ... - \theta_q \varepsilon_{t-q}) \quad (11)$$

$$E(R_t) = \phi_1 E(R_{t-1}) + \phi_2 E(R_{t-2}) + ... + \phi_p E(R_{t-p}) + E(\varepsilon_t) - \theta_1 E(\varepsilon_{t-1}) - \theta_2 E(\varepsilon_{t-2}) ... - \theta_q E(\varepsilon_{t-q}) \quad (12)$$

Recall that $E(\varepsilon) = 0$

$$E(R_t) = \phi_1 E(R_{t-1}) + \phi_2 E(R_{t-2}) + ... + \phi_p E(R_{t-p}) \quad (13)$$

$$E(R_t) - \phi_1 E(R_{t-1}) - \phi_2 E(R_{t-2}) - ... - \phi_p E(R_{t-p}) = 0 \quad (14)$$

Assuming strict stationarity, $E(R_t) = E(R_{t-1}) = E(R_{t-2})$

$$E(R_t)(1 - \phi_1 - \phi_2 - ... - \phi_p) = 0 \quad (15)$$

Therefore, $E(R_t) = 0$ (16)

The variance is

$$Var(R_t) = Var(\phi_1 R_{t-1} + \phi_2 R_{t-2} + ... + \phi_p R_{t-p} + \varepsilon_t - \theta_1 \varepsilon_{t-1} - \theta_2 \varepsilon_{t-2} ... - \theta_q \varepsilon_{t-q}) \quad (17)$$

$$Var(R_t) = \phi_1^2 Var(R_{t-1}) + \phi_2^2 Var(R_{t-2}) + ... + \phi_p^2 Var(R_{t-p}) + Var(\varepsilon_t) - \theta_1^2 Var(\varepsilon_{t-1}) - \theta_2^2 Var(\varepsilon_{t-2}) ... - \theta_q^2 Var(\varepsilon_{t-q})$$

Since $Var(R_t) = Var(R_{t-1}) = Var(R_{t-2}) = ... = Var(R_{t-p}) = \sigma_e^2$

$$\sigma_t^2 - \phi_1^2 \sigma_t^2 - \phi_2^2 \sigma_t^2 - ... - \phi_p^2 \sigma_t^2 = \sigma_e^2 - \theta_1^2 \sigma_e^2 - \theta_2^2 \sigma_e^2 ... - \theta_q^2 \sigma_e^2 \quad (18)$$

$$\sigma_t^2 (1 - \phi_1^2 - \phi_2^2 - ... - \phi_p^2) = \sigma_e^2 (1 - \theta_1^2 - \theta_2^2 - ... - \theta_q^2) \quad (19)$$

$$Var(R_t) = \sigma_t^2 = \frac{\sigma_e^2 (1 - \theta_1^2 - \theta_2^2 - ... - \theta_q^2)}{(1 - \phi_1^2 - \phi_2^2 - ... - \phi_p^2)} \quad (20)$$

The variance of all the tentative models can be obtained from equation (20) as follows:

For ARMA (1,1)

$$\sigma^2 = \frac{\sigma_e^2(1-\theta_1^2)}{(1-\phi_1^2)} \tag{21}$$

For ARMA (1,2)

$$\sigma^2 = \frac{\sigma_e^2(1-\theta_1^2-\theta_2^2)}{(1-\phi_1^2)} \tag{22}$$

For ARMA (2,1)

$$\sigma^2 = \frac{\sigma_e^2(1-\theta_1^2)}{(1-\phi_1^2-\phi_2^2)} \tag{23}$$

For ARMA (2,2)

$$\sigma^2 = \frac{\sigma_e^2(1-\theta_1^2-\theta_2^2)}{(1-\phi_1^2-\phi_2^2)} \tag{24}$$

For ARMA (3,0)

$$\sigma^2 = \frac{\sigma_e^2}{(1-\phi_1^2-\phi_2^2-\phi_3^2)} \tag{25}$$

For ARMA (3,1)

$$\sigma^2 = \frac{\sigma_e^2(1-\theta_1^2)}{(1-\phi_1^2-\phi_2^2-\phi_3^2)} \tag{26}$$

For ARMA (3,2)

$$\sigma^2 = \frac{\sigma_e^2(1-\theta_1^2-\theta_2^2)}{(1-\phi_1^2-\phi_2^2-\phi_3^2)} \tag{27}$$

To examine the impact of COVID-19 on ARMA (1,1), equation (5) becomes

$$R_t = \varepsilon_t + \phi_1 R_{t-1} + \theta_1 \varepsilon_{t-1} + \alpha \log\left(COVID_t\right) \tag{28}$$

To examine the impact of COVID-19 on ARMA (1,2), equation (5) becomes

$$R_t = \varepsilon_t + \phi_1 R_{t-1} + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \alpha \log\left(COVID_t\right) \tag{29}$$

To examine the impact of COVID-19 on ARMA (2,1), equation (5) becomes

$$R_t = \varepsilon_t + \phi_1 R_{t-1} + \phi_2 R_{t-2} + \theta_1 \varepsilon_{t-1} + \alpha \log\left(COVID_t\right) \tag{30}$$

To examine the impact of COVID-19 on ARMA (2,2), equation (5) becomes

$$R_t = \varepsilon_t + \phi_1 R_{t-1} + \phi_2 R_{t-2} + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \alpha \log\left(COVID_t\right) \quad (31)$$

To examine the impact of COVID-19 on ARMA (3,0), equation (5) becomes

$$R_t = \varepsilon_t + \phi_1 R_{t-1} + \phi_2 R_{t-2} + \phi_3 R_{t-3} + \alpha \log\left(COVID_t\right) \quad (32)$$

To examine the impact of COVID-19 on ARMA (3,1), equation (5) becomes

$$R_t = \varepsilon_t + \phi_1 R_{t-1} + \phi_2 R_{t-2} + \phi_3 R_{t-3} + \theta_1 \varepsilon_{t-1} + \alpha \log\left(COVID_t\right) \quad (33)$$

To examine the impact of COVID-19 on ARMA (3,2), equation (5) becomes

$$R_t = \varepsilon_t + \phi_1 R_{t-1} + \phi_2 R_{t-2} + \phi_3 R_{t-3} + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \alpha \log\left(COVID_t\right) \quad (34)$$

The appropriate order of autoregression (p) and moving average (q) will be determined using the plot of the Partial Autocorrelation Function (PACF) while tentative models will be determined using the Autocorrelation Function (ACF) plot.

3.6 Model Estimation

The estimation of the parameters of these ARIMA models was carried out using the Statistical Package for Social Sciences (SPSS version 20.0). Excel package was used for the log transformation of the raw data. E-views package was used to test the unit root of the data (ADF test).

3.7 Model Diagnostic Checking

The diagnostic check is a procedure that is used to check residuals. In this study; the Ljung-Box test statistic was used. The Ljung-Box test statistic was used for testing the independency of the residuals.

The null hypothesis is:

H_0: the model does not exhibit lack of fit.

versus the alternative hypothesis:

H_1: the model exhibits lack of fit.

$$Q(m) = \frac{n(n+2)\sum_{k=1}^{m} r_k^2}{n-k} \tag{35}$$

where, n = length of the time series, r_k is the estimated autocorrelation of the series at lag k and m is the number of lags tested. The null hypothesis is rejected if

$$Q(m) > \chi^2_{1-\alpha,h} \tag{36}$$

where, $\chi^2_{1-\alpha,h}$ is the Chi-square distribution table value with h degrees of freedom and α level of significance. The summary of the methodology in fitting the model is summarized graphically below:

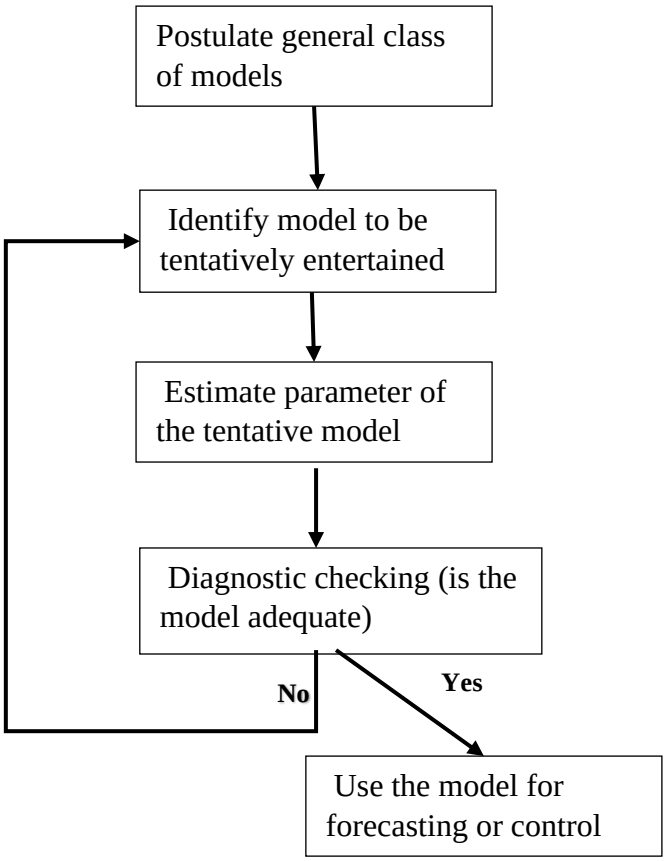

Figure 3.1: Stages in the iterative approach to model building

3.8 Model Selection Criteria

Among these proposed ARMA models, the selection of the best fitting models was based on the Akaike Info Criteria (AIC), Schwarz Information Criteria (SIC), Root Mean Square Error (RMSE). The AIC and SIC were used to assess the performance of the ARMA models in terms of fitness while Root Mean Square Error (RMSE) assesses the forecasting accuracy of the models.

$$AIC = 2k - 2\ln(\hat{L}) \tag{37}$$

$$SIC = -2\log(L) + k\{\log(n)\} \tag{38}$$

$$RMSE = \sqrt{\frac{\sum_{t=2}^{n}\left(R_t - \hat{R}_t\right)^2}{n-1}} \tag{39}$$

where R_t is the actual returns, $\hat{R}_t$ is the estimated returns, n is the number of observations, L is the likelihood, and k is the number of parameters in the model and p is the number of parameters in the model excluding the constant term. The model with the least AIC and SIC is the best model in terms of fitness while model with the least RMSE is the best model in terms of forecasting accuracy.

CHAPTER FOUR

RESULTS AND DISCUSSION

This Chapter presents the results of data analysis and the discussion of the results.

4.1 Descriptive Statistics and Test of Stationarity of the Series

Result in Table 4.1 shows that the returns were positive for the three bank stocks indicating that investors do not incur loss as a result of the COVID-19 pandemic. Zenith bank stock reported the highest mean daily returns compared with UBA and GTB bank stocks which indicate that Zenith bank stock gained higher returns than the other two bank stocks. The skewness were positive for the stocks indicating that despite the COVID-19 pandemic, the returns increased more than it decreased in values.

Table 4.1: Descriptive Statistics for returns of the selected bank stocks and new cases of COVID-19

Variables	n	Mean	Min	Max	STD	Kurtosis	Skewness
ZENITH BANK STOCK	199	1.000430	0.907613	1.138768	0.016844	31.44936	1.443356
UBA STOCK	199	1.000289	0.891512	1.163016	0.021839	21.78140	1.229141
GTB STOCK	199	1.000193	0.930165	1.094251	0.012902	21.61514	0.932615
COVID-19 NEW CASES	199	2.2349	0.0000	1964	412.5045	5.857726	1.734894

Table 4.2: Summary result of Stationarity using Augmented Dickey Fuller (ADF) test

Bank	ADF t-statistic	P-value	Test critical value at 5%	Remarks
Zenith Bank	-11.55205	0.0000	-2.87620	Stationary
UBA	-15.19799	0.0000	-2.875972	Stationary
GTB	-14.69734	0.0000	-2.875972	Stationary

The p-values were all less than 0.05 (P<0.05) which indicates that the returns are stationary.

4.2: Impact of COVID-19 pandemic on the returns of Zenith bank stock

Table 4.3 below presents the result of the model selection for Zenith bank stock.

Table 4.3: Model Selection Criteria for Zenith Bank Stock Returns

SN	Models	AIC	SIC	Ljung-box statistics	P-value of Ljung-box	RMSE
1	ARMA (1,1)	**-5.2309**	**-5.1808**	8.504	0.932	0.073
2	ARMA (1,2)	-4.7995	-4.7500	7.960	0.925	0.073
3	ARMA (2,0)	-4.4005	-4.3671	9.438	0.894	0.074
4	ARMA (3,0)	-4.3416	-4.3083	9.258	0.864	0.074
5	ARMA (3,1)	-4.4259	-4.3759	9.884	0.771	0.074
6	ARMA (3,2)	-4.3791	-4.3291	9.668	0.721	0.075

AIC- Akaike Info Criteria, SIC- Schwarz Information Criteria, RMSE- Root Mean Square Error, Bolded values are the least AIC and SIC.

All the six tentative models were found to be good fit as revealed by the Ljung-box statistic (P>0.05). Hence, the fitness of these models were compared using the AIC and SIC and ARMA (1,1) was adjudged as the best model among the competing models. Result in Table 4.4 shows positive coefficient of 0.008 for COVID-19 with p-value of 0.006 (P<0.01) which indicates that the COVID-19 pandemic has a significant positive impact on the returns of Zenith bank stock. The null hypothesis is rejected and hence there is a significant positive impact of COVID-19 on

the returns of Zenith bank stock. The AR (1) term was significant (P=0.000, P<0.01) meaning that yesterday's returns have a significant positive effect on today's returns.

Table 4.4: Estimation Result for Zenith Bank Returns

Bank	**Parameters**	**Estimate**	**Standard error**	**t-value**	**P-value**
Zenith bank	AR (1)	1.000	0.00002.77	36072.527	0.000
	MA (1)	0.886	0.047	18.869	0.000
	New cases of COVID-19	0.008	0.003	2.769	0.006

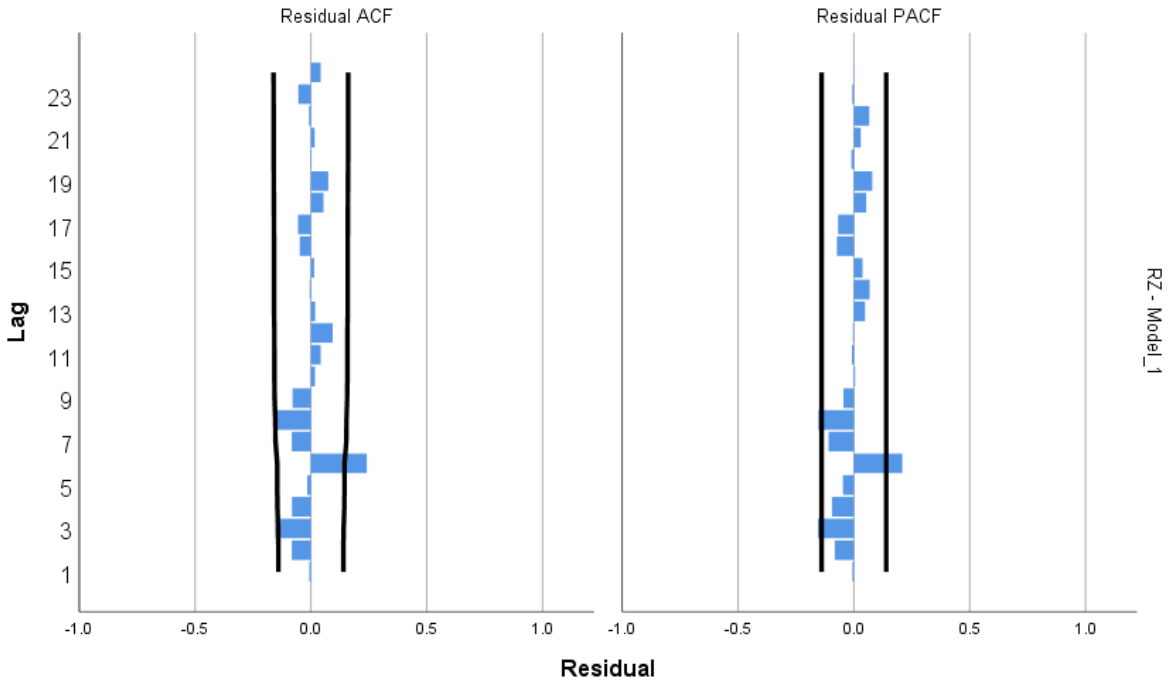

Figure 4.1: Residual ACF and PACF Plots of ARMA (1,1) for Zenith Bank Returns

The ACF plot is within the confidence limit which shows that the model is a good fit.

4.3: Impact of COVID-19 pandemic on the returns of united Bank for Africa (UBA) stock

Result as presented in Table 4.5 reveals that all the seven tentative models were found to be good fit as revealed by the Ljung-box statistic since the p-value for Ljung-box were all greater than 0.05 (p-value>0.05). Therefore, the fitness of these models was compared in terms of AIC and SIC, the model with the least value of AIC and SIC was found to be the best model for UBA stock returns as highlighted above is ARMA (1,1). The summary result of parameter estimation for UBA stock is presented in Table 4.6.

Table 4.5: Model Selection Criteria for UBA Stock Returns

SN	Models	AIC	SIC	Ljung-box statistics	P-value of Ljung-box	RMSE
1	ARIMA (1,1)	**-4.7150**	**-4.6654**	12.337	0.720	0.074
2	ARIMA (1,2)	-3.9854	-3.9375	12.399	0.649	0.074
3	ARIMA (2,0)	-3.9152	-3.8821	16.425	0.424	0.075
4	ARIMA (2,1)	-4.0216	-3.9719	12.799	0.618	0.075
5	ARIMA (2,2)	-4.6750	-4.6254	12.140	0.595	0.074
6	ARIMA (3,1)	-4.0514	-4.0017	16.529	0.282	0.075
7	ARIMA (3,2)	-4.0556	-4.0060	17.455	0.179	0.076

AIC- Akaike Info Criteria, SIC- Schwarz Information Criteria, RMSE- Root Mean Square Error, Bolded values are the least AIC and SIC.

Table 4.6: Estimation Result for UBA Returns

Bank	**Parameters**	**Estimate**	**Standard error**	**t-value**	**P-value**
UBA	AR (1)	1.000	7.068E-5	14148.121	0.000
	MA (1)	0.848	0.054	15.733	0.000
	New cases of COVID-19	0.010	0.004	2.472	0.014

Result in Table 4.6 reveals that COVID-19 has a positive effect on the returns meaning that as the number of COVID-19 new cases were increasing, there was a corresponding increase in the

returns of UBA stocks and this was significant with p-value=0.014 (P<0.05). Therefore, there is a significant positive impact of COVID-19 pandemic on the returns of UBA stock.

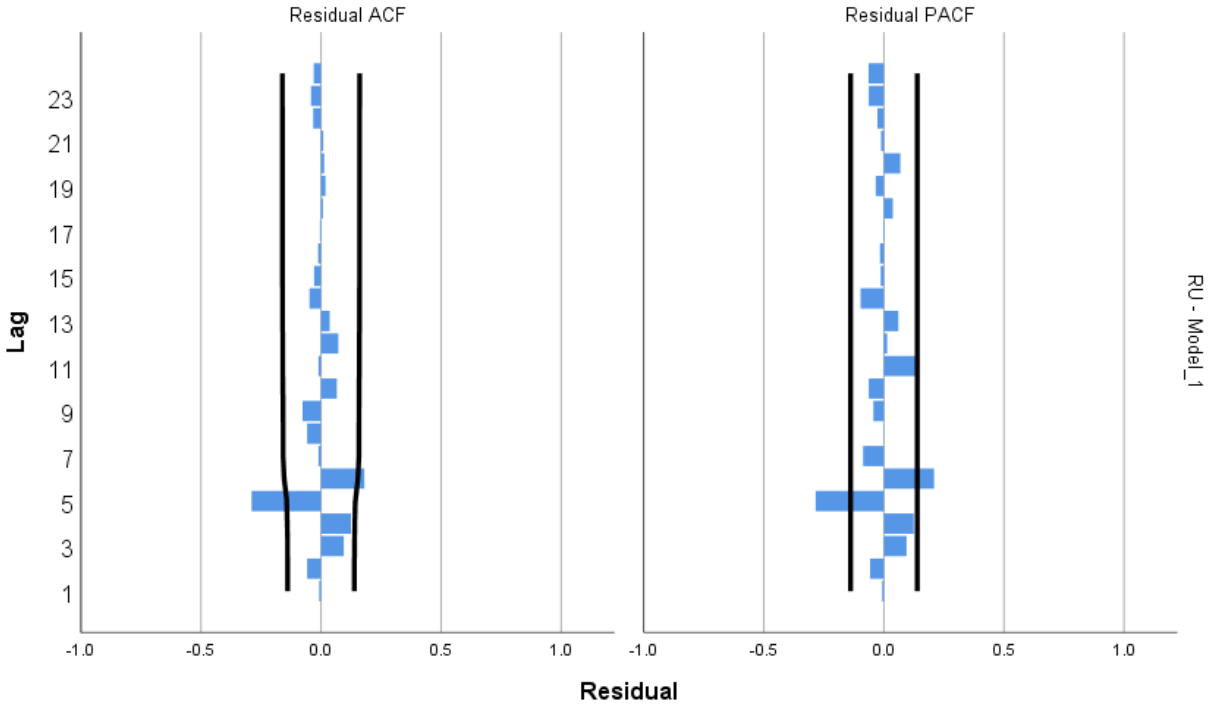

Figure 4.2: Residual ACF and PACF Plots of ARMA (1,1) for UBA Returns

The ACF plot in Figures 4.2 is within the confidence limit which shows that the model is a good fit. The only spike can be adjudged to be due to chance and hence does not invalidate the fitness of the model.

4.4: Impact of COVID-19 pandemic on the returns of Guaranty Trust bank (GTB) stock

Result presented in Table 4.7 reveals that all the eight tentative models were found to be good fit as revealed by the Ljung-box statistic since the p-value for Ljung-box were all greater than 0.05 (p-value>0.05). The fitness of these models was compared and ARMA (1,1) was found to be best model among the competing models. The parameter estimate for ARMA (1,1) for Guaranty Trust bank is presented in Table 4.8.

Table 4.7: Model Selection Criteria for GTB Stock Returns

SN	Models	AIC	SIC	Ljung-box statistics	P-value of Ljung-box	RMSE
1	ARMA (1,1)	**-5.7624**	**-5.7127**	5.093	0.995	0.071
2	ARIMA (1,2)	-5.0862	-5.0366	4.944	0.993	0.071
3	ARIMA (2,0)	-4.9619	-4.9290	6.614	0.980	0.071
4	ARIMA (2,1)	-5.0999	-5.0503	5.058	0.992	0.071
5	ARIMA (2,2)	-5.6980	-5.6484	4.891	0.987	0.071
6	ARIMA (3,0)	-4.9927	-4.9596	6.551	0.969	0.071
7	ARIMA (3,1)	-4.9856	-4.9360	7.118	0.930	0.071
8	ARIMA (3,2)	-4.9902	-4.9405	7.360	0.883	0.072

Table 4.8: Estimation Result for GTB bank stock

Bank	Parameters	Estimate	Standard error	t-value	P-value
GTB	AR (1)	1.000	8.013E-5	12478.760	0.000
	MA (1)	0.760	0.066	11.486	0.000
	New cases of COVID-19	0.008	0.003	2.628	0.009

Result in Table 4.8 reveals that COVID-19 has a significant positive impact on the returns of GTB bank stock (P= 0.000, P<0.01). The null hypothesis is rejected. Hence, there is a significant positive impact of COVID-19 on returns of GTB bank stock.

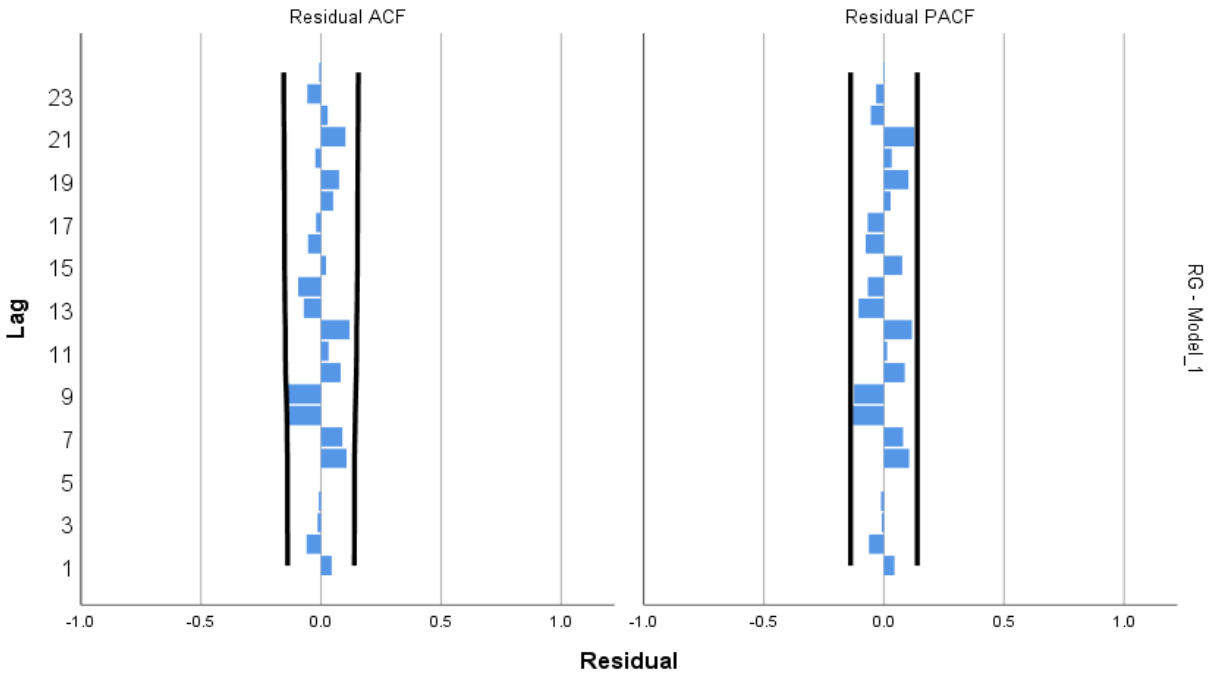

Figure 4.3: Residual ACF and PACF Plots of ARMA (1,1) for GTB Returns

The ACF plot is within the confidence limit which shows that the model is a good fit.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter presents summary as well as conclusion and recommendations based on the findings.

5.1 Summary of the Findings

The aim of the study is to assess the impact of the COVID-19 pandemic on the returns of three selected Nigerian bank stocks. The selected banks are Zenith bank, United Bank for Africa (UBA) and Guaranty Trust bank. The data on daily stock returns were obtained from Cashcraft website (www.cashcraft.com) from 27th February, 2020 to 31st May, 2021. Similarly, data on daily new cases of COVID-19 within the same period were obtained from Nigeria Centre for Disease Control (NCDC). The natural log of COVID-19 new cases was transformed to make the variance stationary. The data was tested for stationarity using the Augmented Dickey Fuller (ADF) test which showed that they are all stationary. The Autocorrelation function (ACF) and Partial Autocorrelation function (PACF) plots, seven Autoregressive Moving Average (ARMA) tentative models were identified [ARMA (1,1), ARMA (1,2), ARMA (2,1), ARMA (2,2), ARMA (3,0), ARMA (3,1), ARMA (3,2)]. All the seven tentative models were found to be good fit as revealed by the Ljung-box statistic ($P>0.05$). Hence, the fitness of these models were compared using the Akaike Info Criteria (AIC) and Schwarz Information Criteria (SIC) and ARMA (1,1) was adjudged as the best model among the competing models for all the selected bank stock returns. The ARMA (1,1) model was also found to have the best forecasting accuracy having the least Root Mean Square Error (RMSE). The ACF and PACF residual plots were examined and the model was within the confidence limits meaning that the model is a good fit.

ARMA (1,1) parameters were estimated for each of the bank stock returns and the result revealed that COVID-19 has a significant positive impact on the returns of all three selected bank stock.

5.2 Conclusion

This study has examined the impact of COVID-19 pandemic on the returns of three selected bank stocks in Nigeria. Result reveals that COVID-19 pandemic has a significant positive impact on the returns of these selected bank stocks. This implies that investors have nothing to worry about the impact of the COVID-19 on these selected stocks.

5.3 Recommendation

Based on the findings the following were recommended**:**

1. Investors should not panic about losing their investment on these stocks as a result of the global pandemic.
2. Intending investors are encouraged to invest in stocks markets particularly these selected stocks even in this period of COVID-19.

5.4 Suggestions for Further Study

The study suggests that this study should be extended to stocks in other sectors other the banking sector. Study can also be carried out on the impact of COVID-19 on the volatility of returns of these stocks instead of returns.

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APPENDIX 1: Data

Data on Zenith bank stock daily returns and COVID-19 new cases

SN	DATE	ZENITH	RETURNS	new cases
1	2/27/2020	19		1
2	2/28/2020	18.5	0.990942843	0
3	3/2/2020	18.05	0.991560321	0
4	3/3/2020	19.6	1.028475539	0
5	3/4/2020	19.6	1	0
6	3/5/2020	19.85	1.004259558	0
7	3/9/2020	16.95	0.94714679	0
8	3/10/2020	13.05	0.90761309	0
9	3/12/2020	10.85	0.928128345	0
10	3/13/2020	11.9	1.038744515	0
11	3/16/2020	12.8	1.029438983	0
12	3/17/2020	13.5	1.020884746	1
13	3/18/2020	13.5	1	5
14	3/19/2020	12.15	0.959518603	4
15	3/20/2020	11.85	0.989988784	1
16	6/4/2020	16.7	1.138768347	350
17	6/5/2020	16.75	1.001061849	328
18	6/8/2020	16.9	1.003163273	315
19	6/9/2020	16.9	1	663
20	6/10/2020	16.6	0.993665037	409
21	6/15/2020	16.2	0.991317922	573
22	6/16/2020	16.1	0.99777668	490
23	6/17/2020	16.15	1.001115862	587
24	6/18/2020	16.15	1	745
25	6/19/2020	16.15	1	667
26	6/22/2020	16.15	1	675
27	6/24/2020	16.4	1.005521828	649
28	6/25/2020	16.15	0.994508495	594
29	6/26/2020	16.2	1.001111172	684
30	6/29/2020	16.2	1	566
31	6/30/2020	16.1	0.99777668	561
32	7/1/2020	15.7	0.990946313	790
33	7/2/2020	14.8	0.978561799	626
34	7/3/2020	15.25	1.011115572	454
35	7/6/2020	16.05	1.018765959	575
36	7/7/2020	16.35	1.006671826	503
37	7/9/2020	16.75	1.008650104	499
38	7/10/2020	16.7	0.998939277	575
39	7/13/2020	16.2	0.989203174	595
40	7/14/2020	15.6	0.98644877	463
41	7/15/2020	15.55	0.998831467	643
42	7/16/2020	15.75	1.004657232	595

43	7/17/2020	15.75	1	600
44	7/20/2020	15.65	0.997689584	562
45	7/21/2020	15.55	0.997669389	576
46	7/22/2020	15.55	1	543
47	7/23/2020	15.55	1	604
48	7/24/2020	15.5	0.998826333	591
49	7/27/2020	15.9	1.009296086	648
50	7/28/2020	16.35	1.010088781	624
51	7/29/2020	16.3	0.998903887	404
52	8/3/2020	16.35	1.001097316	288
53	8/4/2020	16.95	1.012897995	304
54	8/5/2020	16.5	0.990492966	457
55	8/6/2020	16.7	1.00429782	354
56	8/7/2020	16.9	1.004228481	443
57	8/10/2020	16.8	0.997900928	290
58	8/11/2020	16.85	1.001053304	423
59	8/12/2020	16.75	0.997892472	453
60	8/13/2020	16.75	1	373
61	8/14/2020	16.7	0.998939277	329
62	8/17/2020	16.7	1	417
63	8/18/2020	16.75	1.001061849	410
64	8/20/2020	16.9	1.003163273	476
65	8/21/2020	16.8	0.997900928	340
66	8/24/2020	16.85	1.001053304	321
67	8/25/2020	16.95	1.002095058	252
68	8/26/2020	16.95	1	221
69	8/27/2020	16.85	0.997909323	296
70	8/28/2020	16.85	1	160
71	8/31/2020	16.75	0.997892472	143
72	9/1/2020	16.85	1.002111979	239
73	9/2/2020	16.95	1.002095058	216
74	9/3/2020	17.2	1.005173203	125
75	9/7/2020	17.3	1.002037716	155
76	9/8/2020	16.9	0.991794006	296
77	9/14/2020	17.25	1.007250176	132
78	9/15/2020	17.2	0.998980705	90
79	9/16/2020	17	0.995888783	126
80	9/17/2020	16.7	0.993715749	131
81	9/18/2020	16.7	1	221
82	9/21/2020	16.7	1	195
83	9/23/2020	17	1.006323993	111
84	9/24/2020	17.1	1.00207013	125
85	9/25/2020	17.3	1.004095709	213
86	9/28/2020	17.3	1	136
87	9/29/2020	17.5	1.004032116	187
88	10/2/2020	18.05	1.010811542	126

89	10/5/2020	19	1.017729247	120
90	10/6/2020	20.8	1.030740663	118
91	10/7/2020	19.55	0.979578695	155
92	10/8/2020	20.1	1.009332243	103
93	10/14/2020	20	0.998337885	179
94	10/16/2020	21.55	1.024916627	212
95	10/19/2020	21	0.991579735	118
96	10/20/2020	21.05	1.000781115	72
97	10/21/2020	20.8	0.996078778	37
98	10/22/2020	20.65	0.997615229	138
99	10/23/2020	21	1.005551089	77
100	10/26/2020	21.15	1.002337794	119
101	10/27/2020	21.45	1.004615466	113
102	10/28/2020	21.5	1.000759458	147
103	10/30/2020	22.1	1.008971382	170
104	11/3/2020	21.85	0.996324858	137
105	11/4/2020	21.85	1	155
106	11/5/2020	21.9	1.000741105	180
107	11/9/2020	23.95	1.028991438	94
108	11/10/2020	24.5	1.007148936	152
109	11/11/2020	25.6	1.013730454	180
110	11/12/2020	28.15	1.02928367	212
111	11/13/2020	27.15	0.989162608	156
112	11/16/2020	26	0.986890165	157
113	11/17/2020	25.9	0.998817233	152
114	11/20/2020	25.6	0.996419869	143
115	11/23/2020	24.15	0.9820181	56
116	11/24/2020	24.1	0.999349135	168
117	11/25/2020	24.5	1.005172904	198
118	11/26/2020	24.5	1	169
119	12/1/2020	24.4	0.998721349	281
120	12/2/2020	24	0.994825834	122
121	12/3/2020	23.55	0.994044151	343
122	12/4/2020	23.95	1.005331381	324
123	12/7/2020	23.7	0.996696039	390
124	12/8/2020	23.4	0.995975635	550
125	12/9/2020	23.45	1.000677022	474
126	12/11/2020	22.7	0.989696702	796
127	12/14/2020	22.6	0.998586002	199
128	12/16/2020	24.1	1.020610316	930
129	12/18/2020	24.8	1.008997457	806
130	12/21/2020	24.3	0.993656713	356
131	12/23/2020	24.5	1.002569136	1133
132	12/29/2020	0	#NUM!	749
133	12/30/2020	24.95	#NUM!	1016
134	12/31/2020	24.8	0.998125457	934

135	1/5/2021	24.6	0.997478167	1354
136	1/7/2021	25.3	1.008760591	1565
137	1/11/2021	25.85	1.00665661	1244
138	1/13/2021	25.9	1.000594152	1398
139	1/14/2021	26.4	1.005875726	1479
140	1/15/2021	26.3	0.998840621	1867
141	1/18/2021	26.15	0.998250611	1617
142	1/19/2021	26.2	1.000585266	1301
143	1/21/2021	26.45	1.002907975	1964
144	1/26/2021	26.45	1	1303
145	1/27/2021	26.4	0.99942229	1861
146	1/29/2021	27.2	1.009119964	1650
147	2/1/2021	27.15	0.999442989	676
148	2/4/2021	26.75	0.995504127	1340
149	2/8/2021	26	0.991347136	643
150	2/9/2021	25.8	0.99762989	1056
151	2/10/2021	25	0.990309219	1131
152	2/11/2021	24.8	0.997504666	938
153	2/16/2021	25	1.002501577	1572
154	2/18/2021	24.1	0.988609693	877
155	2/23/2021	26	1.023846526	571
156	3/1/2021	26	1	360
157	3/2/2021	25.65	0.99584022	479
158	3/3/2021	25.55	0.998796054	467
159	3/9/2021	21.75	0.950311145	346
160	3/10/2021	21.75	1	394
161	3/15/2021	21.2	0.991683186	238
162	3/16/2021	20.3	0.985795586	179
163	3/17/2021	20.5	1.003256471	200
164	3/19/2021	22.5	1.030820307	130
165	3/22/2021	22.5	1	131
166	3/24/2021	22	0.99278216	102
167	3/29/2021	22.05	1.000734428	48
168	3/30/2021	22.6	1.007964699	121
169	4/9/2021	21.95	0.990640399	71
170	4/12/2021	22	1.000736641	44
171	4/15/2021	22	1	80
172	4/16/2021	21.5	0.992562536	67
173	4/19/2021	21.65	1.002266101	70
174	4/20/2021	22.25	1.008889921	120
175	4/21/2021	22.3	1.00072354	65
176	4/22/2021	22	0.99563735	100
177	4/23/2021	22.3	1.004381766	45
178	4/26/2021	22.2	0.998552339	37
179	4/27/2021	22.1	0.998543695	156
180	4/28/2021	22.1	1	81

181	4/29/2021	22.15	1.000730038	62
182	4/30/2021	22.25	1.001454083	55
183	5/4/2021	22	0.996357734	34
184	5/5/2021	21.3	0.989539005	40
185	5/6/2021	21.95	1.009827704	28
186	5/7/2021	22.2	1.00366656	39
187	5/10/2021	23	1.011419636	49
188	5/11/2021	23.25	1.003447915	47
189	5/14/2021	23.7	1.006092834	49
190	5/17/2021	23.7	1	69
191	5/18/2021	23.5	0.997322795	31
192	5/19/2021	23	0.993187772	19
193	5/20/2021	23	1	49
194	5/21/2021	23	1	43
195	5/24/2021	23.05	1.000692571	42
196	5/25/2021	23.05	1	37
197	5/26/2021	22.8	0.996524412	48
198	5/27/2021	22.9	1.001399651	45
199	5/28/2021	23	1.001391605	63
200	5/31/2021	23	1	203

Data on United Bank of Africa (UBA) stock daily returns and COVID-19 new cases

SN	DATE	UBA	RETURNS	new cases
1	2/27/2020	7		1
2	2/28/2020	6.7	0.977489905	0
3	3/2/2020	6.45	0.980007757	0
4	3/3/2020	6.85	1.032277862	0
5	3/4/2020	6.9	1.003779532	0
6	3/5/2020	7.4	1.036219422	0
7	3/9/2020	6.25	0.915613178	0
8	3/10/2020	5.65	0.944926913	0
9	3/12/2020	5.6	0.994866792	0
10	3/13/2020	6.15	1.054380834	0
11	3/16/2020	5.05	0.891511678	0
12	3/17/2020	5.3	1.02983755	1
13	3/18/2020	5.35	1.00563033	5
14	3/19/2020	5	0.959657273	4
15	3/20/2020	5	1	1
16	6/4/2020	6.5	1.163016083	350
17	6/5/2020	6.65	1.012188616	328
18	6/8/2020	6.75	1.007877925	315
19	6/9/2020	6.8	1.003864856	663
20	6/10/2020	6.8	1	409
21	6/15/2020	6.4	0.968373986	573
22	6/16/2020	6.45	1.004192291	490

23	6/17/2020	6.4	0.995825211	587
24	6/18/2020	6.4	1	745
25	6/19/2020	6.4	1	667
26	6/22/2020	6.35	0.995774828	675
27	6/24/2020	6.3	0.995723358	649
28	6/25/2020	6.3	1	594
29	6/26/2020	6.4	1.008556334	684
30	6/29/2020	6.25	0.98722375	566
31	6/30/2020	6.25	1	561
32	7/1/2020	6.2	0.995617018	790
33	7/2/2020	6.15	0.995562076	626
34	7/3/2020	6.05	0.990974818	454
35	7/6/2020	6.05	1	575
36	7/7/2020	6.2	1.013605682	503
37	7/9/2020	6.4	1.017400844	499
38	7/10/2020	6.25	0.98722375	575
39	7/13/2020	6.2	0.995617018	595
40	7/14/2020	6.05	0.986576948	463
41	7/15/2020	6.05	1	643
42	7/16/2020	6.2	1.013605682	595
43	7/17/2020	6.15	0.995562076	600
44	7/20/2020	6.15	1	562
45	7/21/2020	6.15	1	576
46	7/22/2020	6.15	1	543
47	7/23/2020	6.1	0.995505904	604
48	7/24/2020	6	0.990859147	591
49	7/27/2020	6.15	1.013781209	648
50	7/28/2020	6.15	1	624
51	7/29/2020	6.2	1.004457706	404
52	8/3/2020	6.3	1.008769476	288
53	8/4/2020	6.3	1	304
54	8/5/2020	6.3	1	457
55	8/6/2020	6.45	1.012784495	354
56	8/7/2020	6.55	1.008253357	443
57	8/10/2020	6.45	0.991814203	290
58	8/11/2020	6.5	1.004142551	423
59	8/12/2020	6.5	1	453
60	8/13/2020	6.5	1	373
61	8/14/2020	6.5	1	329
62	8/17/2020	6.5	1	417
63	8/18/2020	6.65	1.012188616	410
64	8/20/2020	6.65	1	476
65	8/21/2020	6.6	0.9960165	340
66	8/24/2020	6.5	0.991909428	321
67	8/25/2020	6.55	1.004093848	252
68	8/26/2020	6.45	0.991814203	221

69	8/27/2020	6.4	0.995825211	296
70	8/28/2020	6.35	0.995774828	160
71	8/31/2020	6.25	0.991412639	143
72	9/1/2020	6.55	1.025583357	239
73	9/2/2020	6.45	0.991814203	216
74	9/3/2020	6.5	1.004142551	125
75	9/7/2020	6.3	0.983303501	155
76	9/8/2020	6.3	1	296
77	9/14/2020	6.2	0.991306759	132
78	9/15/2020	6.15	0.995562076	90
79	9/16/2020	5.95	0.98179921	126
80	9/17/2020	6	1.004692324	131
81	9/18/2020	6	1	221
82	9/21/2020	6	1	195
83	9/23/2020	6.05	1.00463165	111
84	9/24/2020	6.1	1.004572351	125
85	9/25/2020	6.1	1	213
86	9/28/2020	6.1	1	136
87	9/29/2020	6.05	0.99544846	187
88	10/2/2020	6.25	1.018067855	126
89	10/5/2020	6.45	1.01718814	120
90	10/6/2020	7.05	1.047716557	118
91	10/7/2020	6.85	0.985264435	155
92	10/8/2020	6.9	1.003779532	103
93	10/14/2020	6.6	0.97698614	179
94	10/16/2020	7.2	1.046109256	212
95	10/19/2020	7.1	0.992915062	118
96	10/20/2020	6.9	0.985422454	72
97	10/21/2020	6.6	0.97698614	37
98	10/22/2020	6.8	1.015819746	138
99	10/23/2020	7.05	1.018834879	77
100	10/26/2020	7.2	1.010779883	119
101	10/27/2020	7.2	1	113
102	10/28/2020	7.4	1.013879356	147
103	10/30/2020	7.7	1.019855471	170
104	11/3/2020	7.6	0.993595948	137
105	11/4/2020	7.6	1	155
106	11/5/2020	7.7	1.006445328	180
107	11/9/2020	8.8	1.065417432	94
108	11/10/2020	8.8	1	152
109	11/11/2020	9.1	1.015414492	180
110	11/12/2020	9.75	1.031242889	212
111	11/13/2020	9.2	0.974502861	156
112	11/16/2020	8.4	0.959007014	157
113	11/17/2020	8.4	1	152
114	11/20/2020	8.2	0.988677195	143

115	11/23/2020	7.7	0.970099898	56
116	11/24/2020	8.2	1.030821673	168
117	11/25/2020	8.5	1.017076862	198
118	11/26/2020	8.25	0.986050449	169
119	12/1/2020	8.2	0.997119227	281
120	12/2/2020	8.65	1.025390571	122
121	12/3/2020	8.2	0.975238147	343
122	12/4/2020	8.2	1	324
123	12/7/2020	8.25	1.002889096	390
124	12/8/2020	8.25	1	550
125	12/9/2020	8.2	0.997119227	474
126	12/11/2020	8	0.988264716	796
127	12/14/2020	7.95	0.996984953	199
128	12/16/2020	8.15	1.011984534	930
129	12/18/2020	8.3	1.00869277	806
130	12/21/2020	8.2	0.99427226	356
131	12/23/2020	8.5	1.017076862	1133
132	12/29/2020	8.5	1	749
133	12/30/2020	8.55	1.002740625	1016
134	12/31/2020	8.65	1.005418644	934
135	1/5/2021	8.4	0.986407041	1354
136	1/7/2021	8.6	1.011056361	1565
137	1/11/2021	8.9	1.015935345	1244
138	1/13/2021	8.8	0.994831066	1398
139	1/14/2021	9.05	1.012881027	1479
140	1/15/2021	9.25	1.009923345	1867
141	1/18/2021	9.1	0.992650829	1617
142	1/19/2021	8.9	0.989936424	1301
143	1/21/2021	8.95	1.002562728	1964
144	1/26/2021	8.95	1	1303
145	1/27/2021	9	1.002541937	1861
146	1/29/2021	9.05	1.002521445	1650
147	2/1/2021	9.1	1.002501246	676
148	2/4/2021	8.75	0.982239203	1340
149	2/8/2021	8.8	1.002626962	643
150	2/9/2021	8.7	0.994744827	1056
151	2/10/2021	8.1	0.966967964	1131
152	2/11/2021	8.1	1	938
153	2/16/2021	8.45	1.020222337	1572
154	2/18/2021	8	0.974357717	877
155	2/23/2021	8.5	1.02915428	571
156	3/1/2021	8.5	1	360
157	3/2/2021	8.2	0.983209861	479
158	3/3/2021	8.25	1.002889096	467
159	3/9/2021	7.2	0.9354889	346
160	3/10/2021	7	0.985729625	394

161	3/15/2021	7.2	1.014476967	238
162	3/16/2021	7	0.985729625	179
163	3/17/2021	7	1	200
164	3/19/2021	7.15	1.010895779	130
165	3/22/2021	6.9	0.98190701	131
166	3/24/2021	6.9	1	102
167	3/29/2021	6.9	1	48
168	3/30/2021	7.2	1.022034244	121
169	4/9/2021	7	0.985729625	71
170	4/12/2021	6.95	0.996316125	44
171	4/15/2021	6.8	0.988745769	80
172	4/16/2021	6.95	1.011382331	67
173	4/19/2021	7.05	1.007368675	70
174	4/20/2021	7.1	1.00361857	120
175	4/21/2021	7.25	1.01066616	65
176	4/22/2021	7.4	1.010337464	100
177	4/23/2021	7.5	1.006706547	45
178	4/26/2021	7.5	1	37
179	4/27/2021	7.4	0.993338131	156
180	4/28/2021	7.4	1	81
181	4/29/2021	7.35	0.996612663	62
182	4/30/2021	7.3	0.99657795	55
183	5/4/2021	7.2	0.993061271	34
184	5/5/2021	7.2	1	40
185	5/6/2021	7.2	1	28
186	5/7/2021	7.15	0.996469917	39
187	5/10/2021	7.25	1.00706066	49
188	5/11/2021	7.3	1.003469396	47
189	5/14/2021	7.3	1	49
190	5/17/2021	7.35	1.003433801	69
191	5/18/2021	7.35	1	31
192	5/19/2021	7.35	1	19
193	5/20/2021	7.25	0.99313238	49
194	5/21/2021	7.25	1	43
195	5/24/2021	7.15	0.992988843	42
196	5/25/2021	7.15	1	37
197	5/26/2021	7.1	0.996432551	48
198	5/27/2021	7.1	1	45
199	5/28/2021	7.15	1.003580221	63
200	5/31/2021	7.15	1	203

Data on Guaranty Trust bank stock daily returns and COVID-19 new cases

SN	DATE	GTB	RETURNS	new cases
1	2/27/2020	26.4		1
2	2/28/2020	23.8	0.968326642	0

3	3/2/2020	22.7	0.985070867	0
4	3/3/2020	24.5	1.02443923	0
5	3/4/2020	24.6	1.001273442	0
6	3/5/2020	27.95	1.039862899	0
7	3/9/2020	22.15	0.930164995	0
8	3/10/2020	19.95	0.966231814	0
9	3/12/2020	18.1	0.967487553	0
10	3/13/2020	19	1.016757084	0
11	3/16/2020	19	1	0
12	3/17/2020	19.6	1.010559087	1
13	3/18/2020	20.9	1.021582576	5
14	3/19/2020	18.3	0.956296361	4
15	3/20/2020	18.6	1.005593765	1
16	6/4/2020	24.5	1.094251217	350
17	6/5/2020	23.9	0.992248455	328
18	6/8/2020	24.1	1.002625615	315
19	6/9/2020	24.05	0.999347358	663
20	6/10/2020	24.2	1.001955149	409
21	6/15/2020	23.6	0.992120796	573
22	6/16/2020	23.6	1	490
23	6/17/2020	23	0.99185369	587
24	6/18/2020	23.1	1.001383642	745
25	6/19/2020	23.15	1.000688624	667
26	6/22/2020	22.75	0.994452685	675
27	6/24/2020	22.7	0.999295831	649
28	6/25/2020	22.7	1	594
29	6/26/2020	22.7	1	684
30	6/29/2020	22.35	0.995023451	566
31	6/30/2020	22.05	0.995650314	561
32	7/1/2020	21.85	0.997054394	790
33	7/2/2020	20.7	0.982469618	626
34	7/3/2020	20.8	1.001590453	454
35	7/6/2020	21	1.00315308	575
36	7/7/2020	21.05	1.000781115	503
37	7/9/2020	22.75	1.025489701	499
38	7/10/2020	22.45	0.995751559	575
39	7/13/2020	22	0.993492038	595
40	7/14/2020	21.3	0.989539005	463
41	7/15/2020	21.5	1.003055494	643
42	7/16/2020	22	1.007493195	595
43	7/17/2020	21.5	0.992562536	600
44	7/20/2020	21.5	1	562
45	7/21/2020	21.5	1	576
46	7/22/2020	21.55	1.000757119	543
47	7/23/2020	21.5	0.999243454	604
48	7/24/2020	21.65	1.002266101	591

49	7/27/2020	23.3	1.023885456	648
50	7/28/2020	22.6	0.990311607	624
51	7/29/2020	22.5	0.99857772	404
52	8/3/2020	22.85	1.004957679	288
53	8/4/2020	23.15	1.004168701	304
54	8/5/2020	23.6	1.006127296	457
55	8/6/2020	23.75	1.002004215	354
56	8/7/2020	24.35	1.007876454	443
57	8/10/2020	24.55	1.002562231	290
58	8/11/2020	24.8	1.003165483	423
59	8/12/2020	24.85	1.00062728	453
60	8/13/2020	24.8	0.999373113	373
61	8/14/2020	24.9	1.0012533	329
62	8/17/2020	24.85	0.999374764	417
63	8/18/2020	24.9	1.000625627	410
64	8/20/2020	25.25	1.004341812	476
65	8/21/2020	25.1	0.998154651	340
66	8/24/2020	25.2	1.00123373	321
67	8/25/2020	25	0.997530662	252
68	8/26/2020	25.05	1.000620714	221
69	8/27/2020	25.2	1.001853586	296
70	8/28/2020	25.4	1.002449818	160
71	8/31/2020	25.5	1.001214709	143
72	9/1/2020	25.6	1.001208487	239
73	9/2/2020	25.65	1.000601747	216
74	9/3/2020	25.7	1.000600214	125
75	9/7/2020	25.9	1.002387802	155
76	9/8/2020	24.3	0.980405084	296
77	9/14/2020	25.1	1.010152558	132
78	9/15/2020	25.15	1.000617478	90
79	9/16/2020	24.95	0.997524209	126
80	9/17/2020	25	1.000622344	131
81	9/18/2020	25.35	1.00431918	221
82	9/21/2020	25.4	1.00060952	195
83	9/23/2020	25.5	1.001214709	111
84	9/24/2020	26	1.005995682	125
85	9/25/2020	27	1.011583551	213
86	9/28/2020	27	1	136
87	9/29/2020	27.05	1.000561356	187
88	10/2/2020	29	1.021108378	126
89	10/5/2020	29.7	1.007083196	120
90	10/6/2020	31.5	1.017351209	118
91	10/7/2020	31	0.995362203	155
92	10/8/2020	32	1.009245433	103
93	10/14/2020	30	0.981378119	179
94	10/16/2020	30.35	1.00341031	212

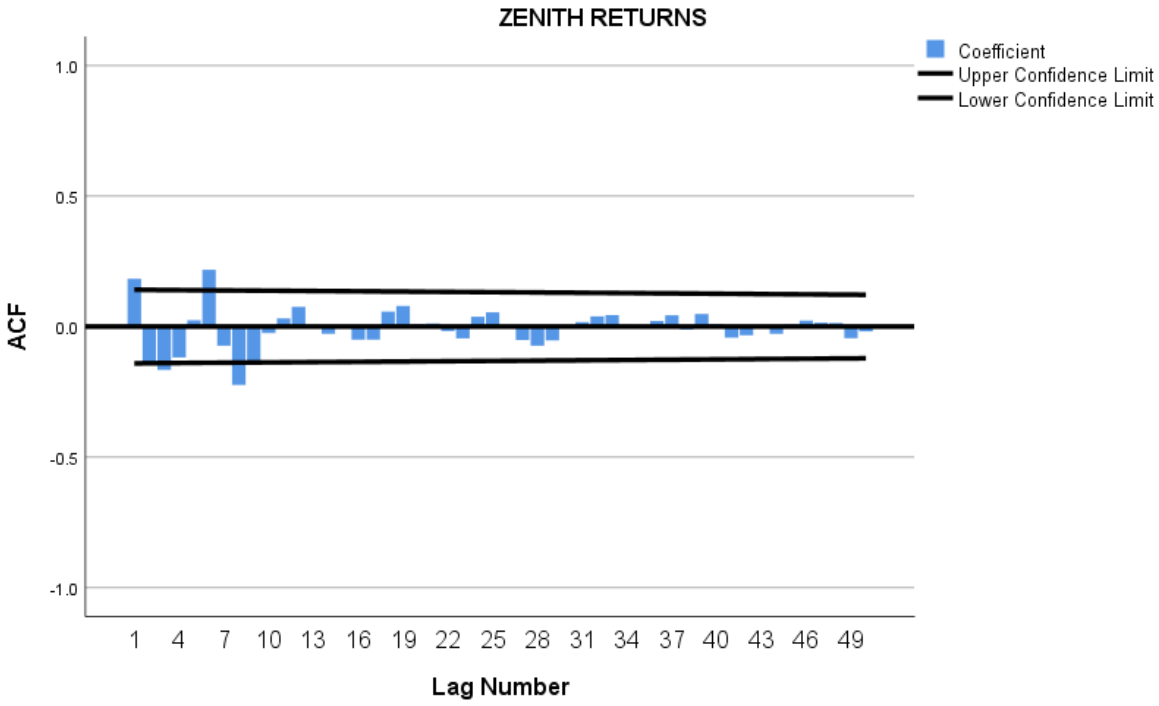
95	10/19/2020	30.8	1.004312643	118
96	10/20/2020	30.4	0.996186134	72
97	10/21/2020	30	0.996120823	37
98	10/22/2020	30	1	138
99	10/23/2020	30.45	1.004377462	77
100	10/26/2020	30.65	1.001916424	119
101	10/27/2020	31.25	1.00566427	113
102	10/28/2020	31.25	1	147
103	10/30/2020	32.5	1.011394681	170
104	11/3/2020	32	0.995546361	137
105	11/4/2020	32.1	1.000900278	155
106	11/5/2020	32.3	1.001790562	180
107	11/9/2020	35.25	1.025150103	94
108	11/10/2020	35	0.998002095	152
109	11/11/2020	36	1.007923522	180
110	11/12/2020	38.2	1.016552606	212
111	11/13/2020	36.4	0.986750228	156
112	11/16/2020	36	0.996925963	157
113	11/17/2020	37	1.007645829	152
114	11/20/2020	35.35	0.987366226	143
115	11/23/2020	34.05	0.989490821	56
116	11/24/2020	34.1	1.000415936	168
117	11/25/2020	34.5	1.003304323	198
118	11/26/2020	35.4	1.007272746	169
119	12/1/2020	35	0.99681394	281
120	12/2/2020	34.1	0.992672819	122
121	12/3/2020	33.6	0.995814658	343
122	12/4/2020	33.25	0.997020566	324
123	12/7/2020	33.15	0.99914041	390
124	12/8/2020	33.15	1	550
125	12/9/2020	33.15	1	474
126	12/11/2020	32.9	0.99783777	796
127	12/14/2020	33	1.000868735	199
128	12/16/2020	33.95	1.00811704	930
129	12/18/2020	33.75	0.998323795	806
130	12/21/2020	33.5	0.997887178	356
131	12/23/2020	33	0.99571759	1133
132	12/29/2020	33	1	749
133	12/30/2020	32.5	0.995633508	1016
134	12/31/2020	32.35	0.998671144	934
135	1/5/2021	32.55	1.001772802	1354
136	1/7/2021	33	1.003942311	1565
137	1/11/2021	32.85	0.998697038	1244
138	1/13/2021	32.4	0.996049968	1398
139	1/14/2021	33	1.005275533	1479
140	1/15/2021	33.05	1.000433005	1867

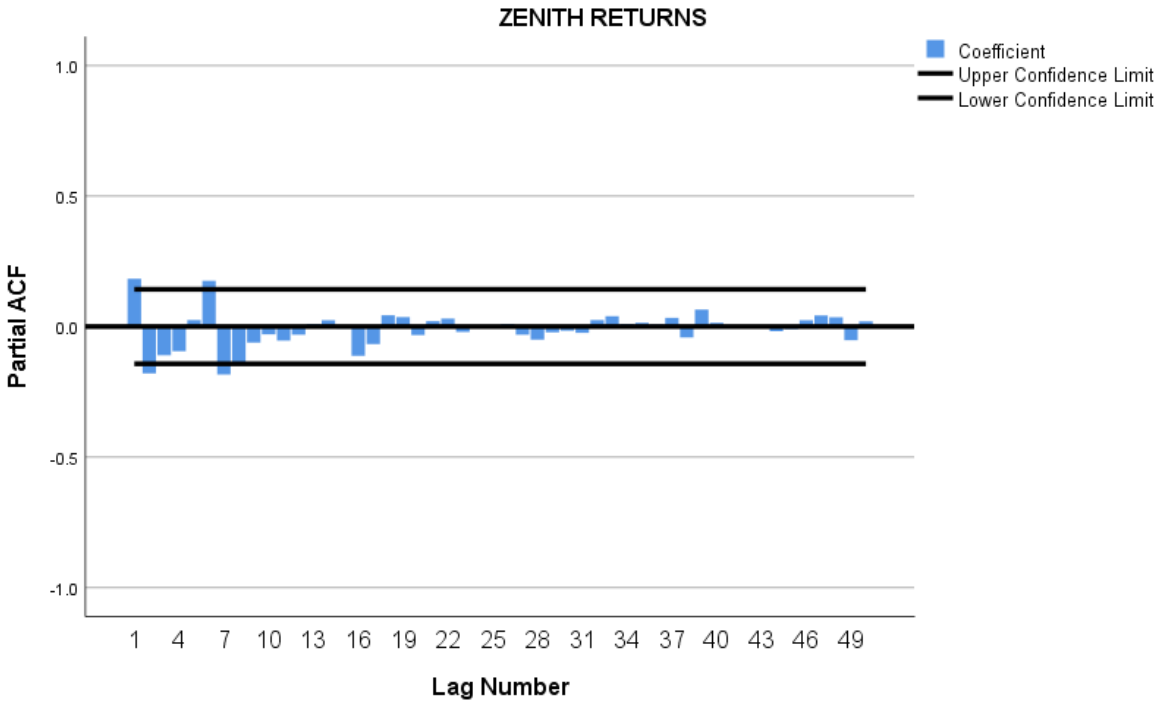
141	1/18/2021	33.65	1.005143333	1617
142	1/19/2021	33.75	1.000843956	1301
143	1/21/2021	33	0.993613816	1964
144	1/26/2021	33	1	1303
145	1/27/2021	33.2	1.0017281	1861
146	1/29/2021	34.5	1.010966139	1650
147	2/1/2021	34.5	1	676
148	2/4/2021	33	0.987446407	1340
149	2/8/2021	32.85	0.998697038	643
150	2/9/2021	32.7	0.998689367	1056
151	2/10/2021	32.2	0.995581598	1131
152	2/11/2021	30.55	0.984849575	938
153	2/16/2021	30.9	1.003331466	1572
154	2/18/2021	30.3	0.994284505	877
155	2/23/2021	30.75	1.004321795	571
156	3/1/2021	30.75	1	360
157	3/2/2021	31.5	1.007033954	479
158	3/3/2021	31.7	1.001834539	467
159	3/9/2021	31	0.993539517	346
160	3/10/2021	30.7	0.997168146	394
161	3/15/2021	29.95	0.992777035	238
162	3/16/2021	28.5	0.985402321	179
163	3/17/2021	28	0.994716393	200
164	3/19/2021	31	1.030545152	130
165	3/22/2021	31	1	131
166	3/24/2021	31	1	102
167	3/29/2021	32.9	1.017322561	48
168	3/30/2021	33	1.000868735	121
169	4/9/2021	28.9	0.962057578	71
170	4/12/2021	28.9	1	44
171	4/15/2021	28.75	0.99845301	80
172	4/16/2021	29.15	1.004113914	67
173	4/19/2021	29.5	1.003539069	70
174	4/20/2021	30	1.00496607	120
175	4/21/2021	31.25	1.012002242	65
176	4/22/2021	31.3	1.000464472	100
177	4/23/2021	31.2	0.999070744	45
178	4/26/2021	31.3	1.00093012	37
179	4/27/2021	31.15	0.998604999	156
180	4/28/2021	31	0.998596307	81
181	4/29/2021	30.05	0.990936325	62
182	4/30/2021	30.1	1.000488562	55
183	5/4/2021	30.1	1	34
184	5/5/2021	29	0.989064748	40
185	5/6/2021	29	1	28
186	5/7/2021	29.25	1.00254915	39

187	5/10/2021	30	1.007499618	49
188	5/11/2021	29.55	0.995556377	47
189	5/14/2021	30	1.004463457	49
190	5/17/2021	29.5	0.99505847	69
191	5/18/2021	29.5	1	31
192	5/19/2021	29.35	0.998493756	19
193	5/20/2021	29.5	1.001508516	49
194	5/21/2021	29.25	0.997485311	43
195	5/24/2021	29	0.997457331	42
196	5/25/2021	28.65	0.996394024	37
197	5/26/2021	28.45	0.997912083	48
198	5/27/2021	28.1	0.996302856	45
199	5/28/2021	28	0.998931261	63
200	5/31/2021	28.4	1.004256832	203

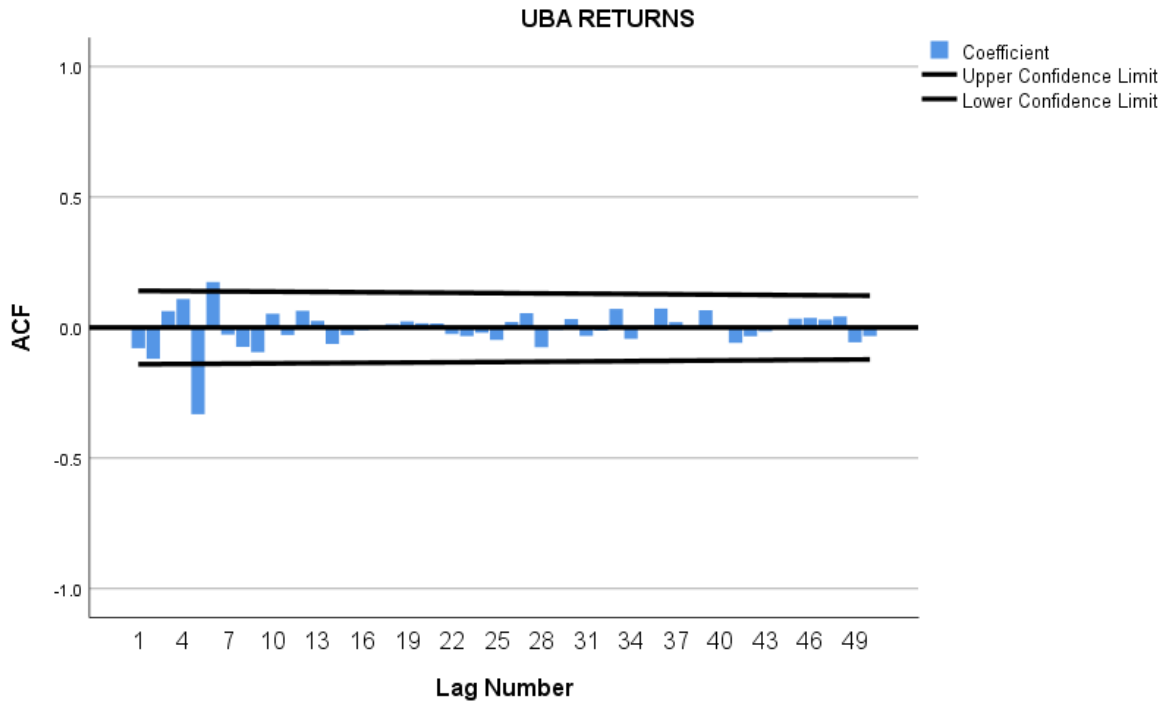
Appendix II: Results

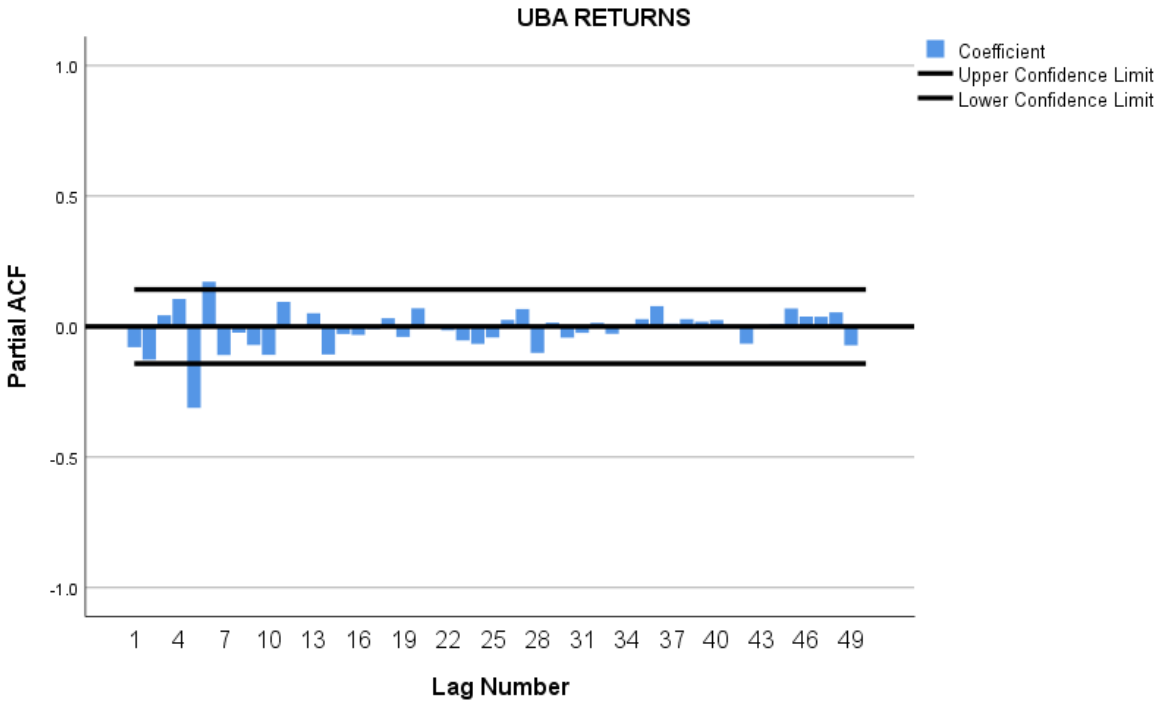
Autocorrelation (ACF) and Partial Autocorrelation (PACF) plots for Zenith bank returns



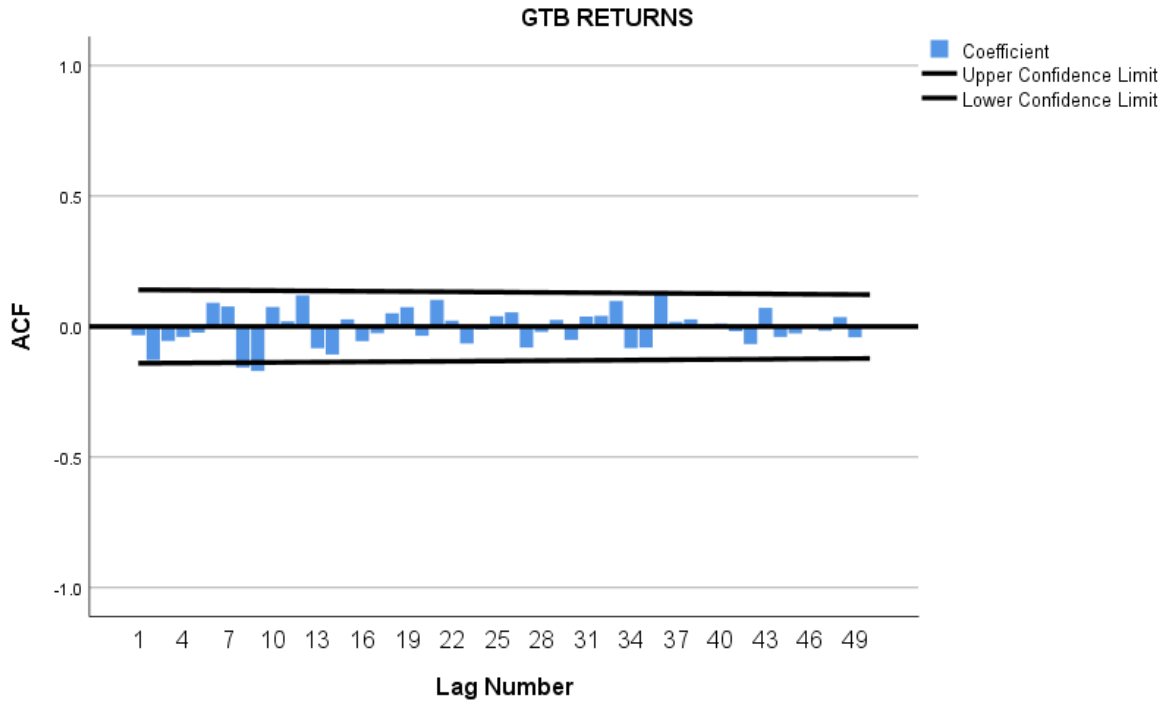


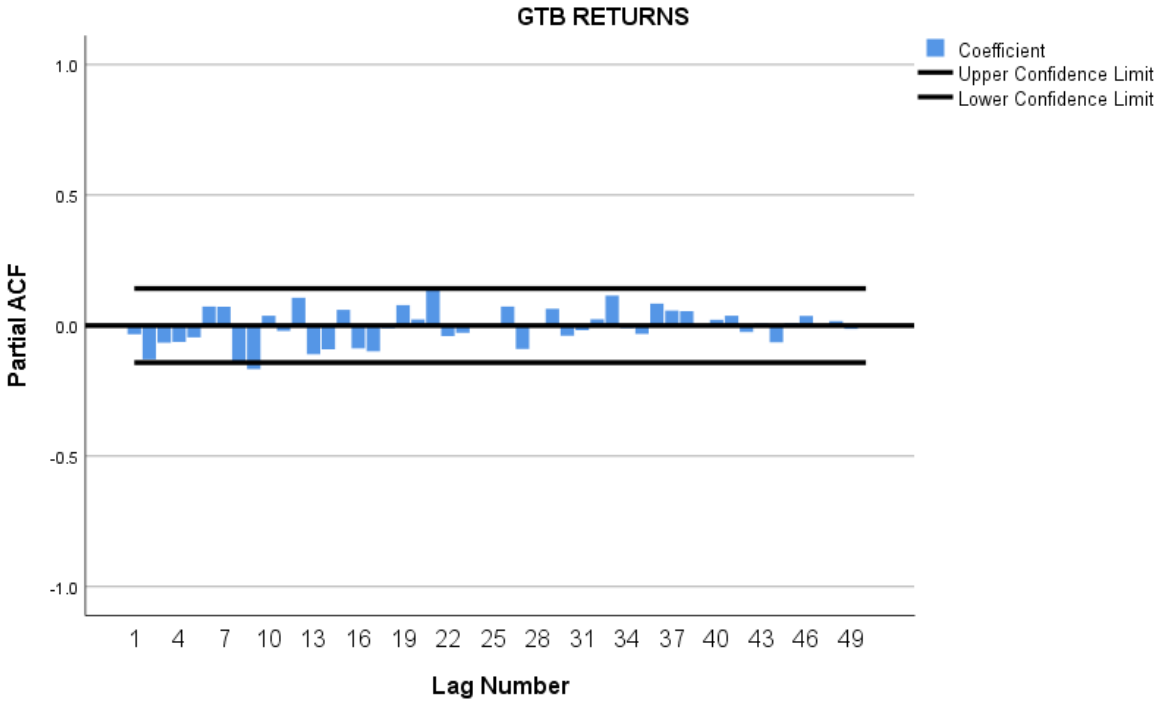
Autocorrelation (ACF) and Partial Autocorrelation (PACF) plots for United Bank of Africa (UBA) returns





Autocorrelation (ACF) and Partial Autocorrelation (PACF) plots for Guaranty Trust bank returns





Stationarity Test Using Augmented Dickey Fuller test

Test of Stationarity for Zenith bank returns

Null Hypothesis: RZ has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.55205	0.0000
Test critical values:	1% level	-3.463924	
	5% level	-2.876200	
	10% level	-2.574663	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RZ)
Method: Least Squares
Date: 06/04/21 Time: 16:42
Sample (adjusted): 2 199
Included observations: 195 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RZ(-1)	-0.816761	0.070703	-11.55205	0.0000
C	0.817174	0.070743	11.55138	0.0000

R-squared	0.408791	Mean dependent var	6.92E-05
Adjusted R-squared	0.405728	S.D. dependent var	0.021628
S.E. of regression	0.016673	Akaike info criterion	-5.339901
Sum squared resid	0.053649	Schwarz criterion	-5.306332
Log likelihood	522.6404	Hannan-Quinn criter.	-5.326309
F-statistic	133.4498	Durbin-Watson stat	1.945553
Prob(F-statistic)	0.000000		

Zenith bank returns are stationary since p-value<0.05

Test of Stationarity for United Bank of Africa returns

Null Hypothesis: RU has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-15.19799	0.0000
Test critical values:	1% level	-3.463405	
	5% level	-2.875972	
	10% level	-2.574541	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RU)
Method: Least Squares
Date: 06/04/21 Time: 16:44
Sample (adjusted): 2 199
Included observations: 198 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RU(-1)	-1.079149	0.071006	-15.19799	0.0000
C	1.079576	0.071044	15.19597	0.0000

R-squared	0.540961	Mean dependent var	0.000114
Adjusted R-squared	0.538619	S.D. dependent var	0.032125
S.E. of regression	0.021821	Akaike info criterion	-4.801864
Sum squared resid	0.093324	Schwarz criterion	-4.768650
Log likelihood	477.3846	Hannan-Quinn criter.	-4.788420
F-statistic	230.9788	Durbin-Watson stat	2.025769
Prob(F-statistic)	0.000000		

UBA returns are stationary since p-value<0.05

Test of Stationarity for Guaranty Trust bank returns

Null Hypothesis: RG has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-14.69734	0.0000
Test critical values:	1% level	-3.463405	
	5% level	-2.875972	
	10% level	-2.574541	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RG)
Method: Least Squares
Date: 06/04/21 Time: 16:39
Sample (adjusted): 2 199
Included observations: 198 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RG(-1)	-1.033105	0.070292	-14.69734	0.0000
C	1.033464	0.070310	14.69870	0.0000

R-squared	0.524286	Mean dependent var	0.000181
Adjusted R-squared	0.521858	S.D. dependent var	0.018451
S.E. of regression	0.012758	Akaike info criterion	-5.875227
Sum squared resid	0.031904	Schwarz criterion	-5.842012
Log likelihood	583.6474	Hannan-Quinn criter.	-5.861782

F-statistic	216.0118	Durbin-Watson stat	2.032816
Prob(F-statistic)	0.000000		

GTB returns are stationary since p-value<0.05

Test of Stationarity for COVID-19 new cases

Null Hypothesis: LOG_CO_ has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.231613	0.0196
Test critical values:	1% level	-3.463576	
	5% level	-2.876047	
	10% level	-2.574581	

Dependent Variable: D(LOG_CO_)
Method: Least Squares
Date: 06/18/21 Time: 11:02
Sample (adjusted): 3 199
Included observations: 197 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG_CO_(-1)	-0.080315	0.024853	-3.231613	0.0014
D(LOG_CO_(-1))	-0.302052	0.067200	-4.494828	0.0000
C	0.194846	0.058552	3.327719	0.0010

R-squared	0.151772	Mean dependent var	0.011713
Adjusted R-squared	0.143027	S.D. dependent var	0.271650
S.E. of regression	0.251474	Akaike info criterion	0.092156
Sum squared resid	12.26839	Schwarz criterion	0.142154
Log likelihood	-6.077357	Hannan-Quinn criter.	0.112395
F-statistic	17.35604	Durbin-Watson stat	2.097940
Prob(F-statistic)	0.000000		

New cases of COVID-19 are stationary since p-value<0.05