The Relationship between Stock Returns and Inflation in the Era of COVID-19 in Nigeria: A Test of Fisher's Hypothesis

Ibrahim Oladipupo SHITTU
Department of Accounting and Finance, Faculty of Management Sciences,
Abubakar Tafawa Balewa University, Bauchi, Nigeria.
+23480773223399; ibroprofessor@gmail.com

Anthony Olugbenga ADARAMOLA
Department of Finance
Ekiti State University, Ado-Ekiti
+2348033881329
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Abstract
The study examined the relationship between stock returns and inflation in Nigeria. It also put to test, the applicability of Fisher's hypothesis during COVID-19 pandemic. Weekly time series data that covered the period between 27th February, 2020 and 26th February, 2021 were used for the analyses. Unit root test was conducted and results revealed that the variables are of different orders of integration. This justified the use of ARDL estimation technique. The ARDL bound test confirmed the existence of a long run relationship among the variables. Findings revealed that despite COVID-19 pandemic in Nigeria, inflation has positive and significant relationship with stock returns in the long run. The import of this is that, inflation can be used as a hedge against stock returns in Nigeria; hence, the study affirmed the relevance of Fisher's hypothesis despite COVID-19 pandemic. It was therefore recommended that investors should put their investible funds in Nigerian stock market with or without COVID-19 pandemic.

Key words: *COVID-19 Pandemic, Stock Return, Inflation, Fisher's hypothesis*

1.0 Introduction

Amidst contradicting research outcomes on the relationship between stock returns and inflation, the world experience the upsurge of the novel coronavirus commonly called COVID-19. The outburst of the virus was first experienced in Wuhan, China around December 2019 and its spread was as low as around 50 till 20th of January, 2020 (Gurmeet & Muneer, 2021). This was not initially taken serious until when it started spreading to other countries and after a while across continents which makes World Health Organization (WHO) to declare it as a pandemic precisely on the 30th of January, 2020. In fact, the confirmed cases reached almost 16 million and more than 640,000 deaths were recorded by July 2020 (WHO, 2020). The virus affects the respiratory system and causes mild symptoms like headache, temperature and could be severe sickness in some cases which could lead to death in little time. As at 15th March 2021, the global confirmed cases were 119,220,681 while the global death cases stood at 2,642,826. This was about 45% increase of confirmed cases and 46% increase in death cases compared to 81,947,503 confirmed cases and 1,808,041 death cases on the 2nd of January, 2021.

The persistent increase in the number of cases arising from COVID-19 has caused lot of havoc to the global economy in which equity market is not an exception. In order to curb the severity of its impact, governments of several countries came up with various measures to cushion the negative effect. As described by Abu et al. (2021), some developed countries and blue-chip organizations supported the less privileged nations with aids and various assistance to minimize the spread of the virus as well as the economic hardship attached to it.

The implication of COVID-19 pandemic cut across every aspect of the economy. It affected the prices of commodities especially food (Ehsan, Deniz& Soledad, 2020), decrease pricing of assets, affect import, export, businesses and economic activities in general (Yousef, 2020). Consequently, the impact is generally felt on global demand and supply functions which in other word has led to economic recession and high inflation across the world.

The persistent increase in prices of goods and services caused by COVID-19 has been making investors to think otherwise about their investments as they are really scared of losing the value of their investment in the future. This has therefore been a topic of debate by various scholars like Jelilov, Iorember, Usman and Yua (2020) and Mukolu and Ilugbemi (2020) as whether equity return could help in hedging against inflation so that investors would still have an added value to their investment despite the recurring inflation.

Fisher (1930) opined that stock returns should be able to hedge against the recurring inflation and afterwards several research outcomes like that of Ang, Chua and Desai (1979); Fama (1981); Kaul (1987); Adrangi, Chatrath and Sanvicente (2000) and Berument and Jelassi (2002) have been conflicting on whether the relationship between stock returns and inflation is actually positive or otherwise. However, to ensure that investors funds are safe by ensuring that they invest in a more secure investment like stock, it is pertinent to confirm if the relationship between stock return and inflation is in line with Fisher's hypothesis during COVID-19 pandemic. The main objective of the study is therefore to examine the spillover effect of COVID-19 on the relationship between Stock Returns and Inflation and this will further affirm the applicability of Fisher's hypothesis during COVID-19.

2.0 Literature Review

The major aim of investors is to maximize return on their investment which is said to be jeopardized by COVID-19 pandemic as it reduces the value of investment (Yousef, 2020). However, stock has been identified by researchers as a hedging instrument against stock. In order words, if this is maintained during COVID-19, it will be a reliable investment during this period.

Stock returns which are the return on investment in shares of companies have been fluctuating over time and especially during the COVID-19 period. In the same vein, the pandemic has also lead to persistent increase in prices of goods and services which is referred to as Inflation.

Moreover, stock return has not been stable since the inception of COVID-19. It had an All Share Index point of 26,808.24 on the 27th of February when coronavirus was first discovered in Nigeria and this drop to 26,216.46 point the following day and this keep fluctuating till date. The weekly average of the return increase to 25287.18 points by week 15 (31st May, 2020 to 6th June, 2020) but remain unstable till it reached its peak by week 50 (24th January, 2021 to 30th January, 2021) with 41979.32 points as revealed in figure 1 (Nigerian Stock Exchange, 2021). On the other hand, inflation as shown in figure 2 has as well not been stable and in fact increasing at an increasing rate since February 2020 when the first COVID-19 case was recorded in Nigeria. It started with 12.13% in January 2020 which moved a little bit higher to 12.2% in February. The increased

change in inflation continued and rise to 13.22 in August, 2020. The impact of this was seriously felt as the cost of goods and services increases but the real value worth lesser. Inflation rate increased to 13.72% in September and even to 14.23 and 14.89 in October and November respectively. As the second wave of COVID was identified, the inflation rate keeps increasing. 15.75%, was recorded in December 2020 which moved to 16.47% and 17.33% in January and February, 2021 respectively. In fact, Nigeria experience 42% increase in inflation rate between February 2020 and February 2021, that is, inflation rate had increased by 42% within COVID-19 period (CBN, 2021).

Consequently, the rate of COVID-19 cases has been increasing since February, 2020 when it was first discovered in Nigeria. it started with 1 on the first week and nothing was recorded in the second and third week until 4th week when 15 was recorded and keeps increasing as revealed in Figure 3. On a 7-day average, it increased to an average of 610 in week 19 (28th June, 2020 to 4th July, 2020) which later dropped to 363 in week 24 (2nd August, 2020 to 8th August, 2020). The figure keeps fluctuating till it drops to weekly average of 99 in week 35 (11th October, 2020 to 17th October, 2020). The number of recorded cases during this period was minima until when it increased to 1,267 in week 46 (27th December 2020 to 2nd January, 2021) which was associated to the second wave of the virus. The increase persists and the peak was reached at week 48 (10th January, 2021 to 16th January, 2021) with confirmed cases of 1,661 daily for that week and this has been unstable since then. The total confirmed cases in Nigeria as at 16th March 2021 is 161,074 while 2,018 deaths have been recorded as at that date. As revealed in figure 4, the first five states with highest number of cases are Lagos, FCT, Plateau, Kaduna and Rivers state with 57,081, 19,490, 8,995, 8,825 and 6,831 respectively (Nigeria Centre for Disease Control, 2021). It is however important to study how the spread of COVID-19 has affected the relationship between stock returns and inflation in Nigeria.

Fisher hypothesis and Fama proxy hypothesis are the major theories of stock returns and inflation relationship. Fisher (1930) opined that the relationship between interest rate and expected inflation rate is positive, and as such, the nominal rate of interest is a combination of real interest rate and the expected inflation rate which makes the nominal interest rate to differ from the real interest rate by the expected rate of inflation (Humphrey, 1983; Cooray, 2002; Omotor, 2010 & Uwubanmwen & Egbosa, 2015). In other word, Fisher proposed that stock returns could hedge against inflation. on the other hand, Fama (1981) explained that the negative relationship that exists between equity returns and inflation are actually induced by an existing negative relationship between inflation and real activity which is also explained as a result of money demand theory and the quantity theory of money. However, Fama stand is that, the relationship between stock return and inflation is negative and therefore cannot be used to hedge against inflation. Several researchers like that of Emenike and Nwankwegu (2013), Manasseh and Omeje (2016), Gurmeet and Muneer (2021) among others

The question; does stock returns protect investors against inflation in Nigeria was evaluated by Emenike and Nwankwegu (2013). The study was analysed with the use of the Engle and Granger two steps cointegration model while monthly data of All-share Index (proxy of stock returns) and monthly consumer price index (proxy of inflation) between January 1985 and March 2011. Though low speed of adjustment was found but there is an evidence of long run relationship between stock returns and inflation. It was therefore concluded that stock cold hedge against inflation in Nigeria. Kumari (2011) conducted an empirical analysis of stock returns and inflation in India between the last quarter of 1991 and third quarter of 2009. The study deployed Granger causality test and

regression analysis while Vector Autoregressive (VAR) was used to test for results robustness. As confirmed by the Granger causality test, no relationship was found between stock returns and inflation in India. This was also ascertained from the regression result. Hence in the case of India, stock returns cannot serve as a hedge against inflation. Moores-Pitt and Strydom (2017) as well empirically examined equities as a hedge against inflation in South Africa. The extracted data on stock returns from the Johannesburg Stock Exchange between 1980 and 2015 and analyze the data with Autoregressive Distributed Lag Model (ARDL) and Vector Error Correction Model (VECM). They therefore found a strong and positive relationship between equity returns and inflation which however means that equity returns do act as a hedge against inflation in South Africa.

The short term impact of COVID-19 on global stock market indices was investigated by Gurmeet and Muneer (2021). The study which covers between January 2020 and March 2020 adopted two categories of data. The data used are the daily closing prices of the indices of the healthcare, Pharma, Hotel and Leisure, Information Technology and Airline as well as the daily closing price of the Morgan Stanley Capital International All Country World Index (MSCI ACWI), Morgan Stanley Capital International (MSCI) and Morgan Stanley Capital International Emerging Market Index. They also consider daily closing price and volume of stock market indices of 23 developed and 26 developing economies and the adopted event study analysis revealed that there is a significant effect of COVID-19 on global stock market indices and this was said to varies for developed and developing economies. Abu et al. (2021) employed Autoregressive Distributed Lag (ARDL), Canonical Co-Integration Regression (CCR), Dynamic Ordinary Least Square (DOLS) and Fully Modified Ordinary Least Square (FMOLS) to examined how COVID-19 confirmed cases and deaths affected stock markets in Nigeria. The study extracted data that range from 23rd of March to 11th September, 2020. The ARDL bound tests found a long run relationship between COVID-19 and Nigeria Stock market. COVID-19 cases are revealed to be negative and significant to stock market performance. However, COVID-19 death is positive and significant to stock market performance while oil price and exchange rate have a significant effect on stock market performance in the long run. Consequently, Yousef (2020) also assessed the spillover of COVID-19: impact on stock market volatility for G7 countries. The period of study was from 2000 to 2020 with emphasis on COVID-19 daily new cases, cases growth rate and stock market volatility. The adopted GARCH technique revealed that COVID-19 represented by dummy variable, number of new cases of COVID-19 as well as its growth rate had positive and significant effect on the volatility of G7 stock market.

The nexus between stock market returns and inflation in Nigeria was tested by Jelilov et al. (2020) with the aim to confirm if the effect of COVID-19 pandemic matter. In order to achieve this, they make use of daily data of COVID-19 and stock return between 27th February, 2020 and 30th April, 2020. The deployed GARCH model identified that COVID-19 has actually increase the volatility of the stock market and not only that, it has also distorted the existing positive relationship between inflation and stock market returns. In order words, a negative stock return and inflation relationship was established.

Taking cognizance of the empirical literatures reviewed, it is glaring that some literatures have focused on the relationship between stock returns and COVID-19 while some dwell on the relationship between stock returns and inflation. Meanwhile, the literature on the effect of COVID-19 on the relationship between stock return and inflation is rarely available which is the gap this study tends to fill.

3.0 Data and Methodology

The variables considered in the study are stock returns, inflation and COVID-19. The stock return is measured with the Nigeria Stock Exchange (NSE) All Share Index (ASI) as used in the work of Adegboyega, Odusanya, and Popoola (2013); Owolabi, and Adegbite (2013); Akani, and Uzobor (2015) as well Jelilov et al. (2020). Inflation is proxied by inflation rate (INF) as adopted in the study of Yaya and Shittu (2010); Uwubanmwen and Egbosa (2015); Sokpo, Iorember and Usar (2017) as well as Raghutla, Sampath and Vadivel (2019) while COVID-19 is measured with coronavirus confirmed cases (CVD) as used by Ashraf (2020) and Abu et al. (2021). The study is a time series study as data collected and used for analysis are weekly data of ASI, INF and COVID-19 which range from 27th February, 2020 to 26th February, 2021 making 53 weeks in total. 27th February, 2020 was taken being the first day COVID-19 case was recorded in Nigeria and the data collection stopped at 26th February because of availability of data.

The Nigerian Stock Exchange do trade for five days in a week excluding weekends and public holidays. So, the study adopted a 5-day weekly average of ASI collected from NSE. The weekly data was calculated by dividing all ASI values between Monday and Friday by the number of the trading period in a week (that is, 5) and this is done for all the weeks under study. Inflation rate data used is a weekly inflation rate decomposed from the monthly inflation rate published by CBN as used in the work of Jelilov et al. (2020). The COVID-19 (CVD) index was calculated from the daily data published by the Nigeria Centre for Disease Control (NCDC). The weekly data used for analysis was calculated using a 7-day weekly data. The confirmed cases were collected from Sunday to Monday divided by 7 and this was done for all the weeks under study.

Model as revealed in equation 1 was built to examine the relationship between stock returns and inflation during COVID-19 in Nigeria. The model is adapted from the hypothesis of Fisher (1930) in order to confirm if the theory still hold with the pandemic of COVID-19 intervening the relationship of stock returns and inflation. Fisher's hypothesis considered only inflation and stock returns while this study includes COVID-19 as an intervening variable. However, the Ordinary Least Square (OLS) model in equation 1 serves as basis for Autoregressive Distributed Lag (ARDL) used for estimation as shown in equation 2 below. ARDL model is developed by Pesaran and Shin (1999). ARDL is adopted because it aids disentanglement between short run relationship and long run effect of the variables, enhance selection of optimal lag length and it helps to avoid spurious regression issues that could be caused by non-stationarity (Ghouse, Khan &Rehman, 2018).

$$SR = f(INF, CVD)$$

$$SR = \alpha + \beta_1 INF + \beta_2 CVD + e \quad \text{.....1}$$

ARDL for Bound Test

$$\Delta SR = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta SR_{t-1} + \sum_{i=1}^{n} \beta_2 \Delta INF_{t-1} + \sum_{i=1}^{n} \beta_3 \Delta CVD_{t-1} + \delta_1 SR_{t-1} + \delta_2 INF_{t-1} + \delta_3 CVD_{t-1} + e_t \quad \text{.....equation 2}$$

Where:

SR = Stock returns

INF = Inflation rate

CV = Corona Virus index

α = Constant Parameter

β_1 = Parameter to be estimated

e = Error Term

4.0 Empirical Results and Discussion

4.1 Unit Root Tests

Methodological technique(s) to be adopted for time series research analysis especially regression depends on the level of stationarity of the variables involved. This makes it essential to first consider the unit root test of each variables. As explained by Datta and Kumar (2011) as well as Iskenderoglu and Akdag (2020), variables that are using for regression must be stationary, that is, they must not have a unit root in order to avoid spurious results. However, to ensure that the variables are stationary and suitable for regression analysis, unit root tests are carried out and the results of both Augmented Dickey-Fuller and Phillips-Perron as well as their order of integration are revealed in table 1 below.

Table 1: **Unit Root Tests Results**

	Augmented Dickey-Fuller		**Phillips-Perron**		**Order of Integration**
Variables	Level	First Diff.	Level	First Diff.	
SR	-2.92	-2.92**	-2.92	-2.92**	*I* (1)
INF	-3.51	-3.50**	-3.50	-3.50**	*I* (1)
CVD	-2.92**	N/A	-2.92**	N/A	*I* (0)

Note: ** connotes that the variable is significant at not more than 5%
Source: Extracted from E-view version 10

Augmented Dickey-Fuller and Phillips-Perron results as shown in table 1 revealed that both stock returns and inflation have unit root at level but are stationary at first difference. COVID-19 confirmed cases however have no unit root and in other word, the variable (CVD) is stationary at level using Augmented Dickey-Fuller and this is confirmed by Phillips-Perron technique. Therefore, stock returns and inflation are stationary at first difference (*I* (1)) while COVID-19 case is stationary at level (*I* (1)). Having found that the variables are stationary at both level and first difference (mixture of order of integration), no variable is stationary at order 2 and specifically the dependent variable (stock returns) is stationary at first difference; the requirements of ARDL are thereby satisfied and can therefore be used for estimation.

4.2 Lag Length Selection

The optimum lag length for ARDL estimation was selected using the various lag length criteria of the lag structure. Table 2 showed that only Schwarz information (SC) criterion selected lag 1 as the best lag length while all other criteria (LR, FPE, AIC and HQ) adopted lag 4 as the best lag length. Considering the majority of the selection criteria, lag 4 is therefore selected as the optimum lag length for ARDL estimation.

Table 2: Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	172.24	N/A	2.01e-07	-6.91	-6.79	-6.86
1	364.86	353.78	1.12e-10	-14.40	-13.94*	-14.23
2	375.01	17.40	1.07e-10	-14.45	-13.64	-14.14
3	382.02	11.5	1.18e-10	-14.37	-13.21	-13.93
4	405.39	34.35*	6.68e-11*	-14.95*	-13.45	-14.38*

Note: * denotes the order of lag selected by criterion
Source: Extracted from E-view version 10

LR: sequential modified Likelihood Ratio test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

4.3 ARDL Bounds Test

Having revealed that the series data adopted are stationary at both level *I* (0) and first difference *I* (1), ARDL is suitable for the study estimation. However, as described by Pesaran and Shin (1999) and strengthened by Peseran et al. (2001), one of the justifications of choosing ARDL is its ability to determine both short run and long run estimates of the model which is achievable through ARDL bounds test. The bound test hypothesis stated that H_o: $\beta_{1i}= \beta_{2i} = \beta_{3i}= 0$ while H_1: $\beta_{1i}= \beta_{2i} = \beta_{3i} \neq 0$. In other word, the null hypothesis emphasized that there is no long run relationship between the variables while the alternate hypothesis stated otherwise.

ARDL bounds test was conducted to determine if co-integration exist in the long run or not. The result has shown in table 3 revealed that the F- statistics value of 4.29 is above both the lower bound and upper value of 3.1 and 3.87 respectively at 5% significance level. The null hypothesis of no existence of co-integration is thereby rejected which implied that there is an indication of the existence of long run relationship among the variables. This therefore justify the use of ARDL method for long run and short run dynamics estimation.

Table 3: ARDL Bounds Test

Test Statistics	Value	k
F-Statistics	4.292201	2
Critical Value Bounds		
Significance level	I (0) Bound	I(1) Bound
10%	2.63	3.35
5%	3.1	3.87
2.5%	3.55	4.38
1%	4.13	5

Source: Extracted from E-view version 10

4.4 ARDL Co-Integration Test and Long Run Result

Having confirmed the existence of long run relationship between the variables within the model, the estimation of the short run dynamics as well as long run relationship of the variables were carried out using the ARDL model estimated in equation 2 above. The result as shown in table 4a explains if COVID-19 has effect on the relationship between stock returns and inflation in Nigeria in the long run while 'b' part of table 4 described the effect of COVID-19 on the relationship between stock returns and inflation in Nigeria within a short period of time. The fact that the value of the Error Correction Mechanism's (ECM) coefficient is negative and significance, clearly depict an indication of co-integration among the studied variables. The ECM's coefficient of -0.28 explained that about 28% of the prior year disequilibrium is adjusted in the present year which therefore indicates the level at which ECM is rapidly adjusted to changes in the long run.

Considering the values and signs of the variables' coefficients, the result in table 4b revealed that stock returns lagged by one year is positive and significant to itself, and its coefficient of 0.42 indicated that a unit increase in stock returns will lead to 0.42 unit of itself in the short run. Moreover, COVID-19 which is measured with number of confirmed cases of COVID-19 revealed a positive and significant relationship with stock returns. Its' coefficient of 0.019 indicated a low impact as it implies that a unit increase in COVID-19 will yield 0.02 increase in stock returns in the short run while in the long run the effect of COVID-19 is also positive but not significant with stock returns with coefficient value of 0.022. the implication of this is that stock returns will also increase by 0.02 with a unit increase in COVID-19 but not significant. This is confirmed by the study of Bhagavatula and Acharya (2020) and Yousef (2020) but in contrary with the work of Abu et al. (2020) and Jelilov, Iorember, Usman and Yua (2020). Bhagavatula and Acharya (2020) revealed that there is a positive relationship between stock returns and COVID-19 but only in the short run while Yousef (2020) also supported that the COVID-19 has positive effect on the variance of stock indices studied. Abu et al. (2020) on the other hand, argued that though COVID-19 is significant to stock returns in the long run but negatively while Jelilov et al. (2020) and Abu et al. (2021) also found a negative impact of COVID-19 on stock returns while Jelilov et al. (2020) could only confirm it in the short run Abu et al. argued that the relationship extends to the long run.

The result in table 4 also affirm the existence of a positive relationship between inflation and stock returns in Nigeria even in the presence of COVID-19. Though the relationship is not significant in the short run unlike in the long run. In the short run, inflation has a coefficient of 0.20 which implies that in the short run, a unit increase in inflation will increase stock return by 20% while amazingly, a unit increase in inflation will resulted into about 174% increase in stock return in the long run as shown by its coefficient value of 1.736 in the long run revealed in table 4a. This is supported by the study of Omotor (2010); Akinlo (2013) as well as Lawal (2016) while otherwise, it contradicts the result of Owolabi and Adegbite (2013), Akani and Uzobor (2015), Uwubanmwen and Egbosa (2015) as well as Manasseh and Omeje (2016).

Table 4: ARDL Long run and short run relationship

Variables	Coefficient	t-statistics	Prob.
(a) Long-run Relationship			
INF	1.736810	11.665530	0.0000
CVD	0.022631	1.772963	0.0829
C	2.422446	15.328874	0.0000
(b) Short-run Relationship			
D(SR(-1))	0.423802	3.971557	0.0002
D(CVD)	0.019982	2.239784	0.0300
D(INF)	0.204110	0.966062	0.3391
CointEq (-1)	-0.282878	-4.906782	0.0000

Source: Extracted from E-view version 10

5.0 Conclusion and Recommendation

The study examined the relationship between stock returns and inflation in Nigeria in order to confirm if Fisher's Hypothesis still hold despite COVID-19 pandemic. The study which is time series was carried out with the aid of weekly data of inflation rate, All Share Index and COVID-19 number of confirmed cases in Nigeria between 27th February, 2020 and 26th February, 2021. Trend analysis of inflation rate, stock returns and COVID-19 cases within the study period was carried and the used data were subjected to unit root test. ARDL was adopted for estimation after the unit root, lag length selection criteria and bound test requirements have been met and followed by post estimation and stability tests which are all in favor of the estimated model.

However, the study found that there is a positive and significant relationship between stock return and its lag 1 period in the short run and that the relationship between COVID-19 and stock return is though positive and significant but weak in the short run. It was also revealed that COVID-19 has a weak and positive relationship with stock return in the long run but not significant while inflation is though not significant but has a positive relationship with stock return in the short run. At the same time, inflation was found to be positively and significantly related with stock return in the long run. The study therefore concluded that despite COVID-19, inflation has positive and significant relationship with stock return. That is, inflation could hedge against stock return, hence, the study upholds Fisher's hypothesis despite COVID-19. The study therefore recommended that investors should put their investible funds in stock with or without COVID-19 in Nigeria.

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