

## **BOUNDS TESTING APPROACH TO THE ANALYSIS OF LEVELS RELATIONSHIP AMONG STOCK MARKET SIZE, STOCK RETURNS AND CORONAVIRUS DISEASE USING NIGERIA'S DATA**

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### **ABSTRACT**

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The kernel of this research is to re-examine the implications of the size-returns characteristics of Nigerian stock market in the face of the coronavirus pandemic. The study is based on secondary data, obtained on weekly basis, from the websites of the Nigerian Stock Exchange and the Nigeria Centre for Disease Control. In a period of 33 weeks, stretching from 29th February, 2020 to 18th October, 2020, this study explores the dynamics of stock market size, coronavirus and stock returns in Nigeria using Autoregressive Distributed Lag (ARDL) model. Empirical findings indicate that in the short run, stock market size has positive significant effect on stock returns in Nigeria whereas in the long run, the position is reversed to negative and statistically significant. However, coronavirus does not have a significant influence on stock returns in Nigeria in the study period. It can therefore be concluded that coronavirus disease does not distort the negative connection between stock market size and stock market returns in Nigeria as stated by stock market size-returns hypothesis. It is therefore recommended that policies that ensure positivity of market size-returns nexus in the short-run should be elongated to the long-run to reverse the negative long-run implications of stock market size on stock returns in Nigeria.

## **1. INTRODUCTION**

Risk and returns are Siamese twins of investment decisions, such that the duo go hand in hand. Thus, behind every investment decision is the desire to earn high returns while

minimizing attendant risks. Besides macroeconomic variables, stock returns being the gain accruable to an investor proportional to share-holding in the organization (Kayode *et al.*, 2020), are perceived to be influenced by the market fundamentals such as market risk, liquidity, size, concentration, etc.

As an indicator of market size, market capitalization refers to the aggregate market value of all securities. Babarinde (2020) argues that stock market size signals the capacity of the market to absorb endogenous and exogenous risks/shocks. A cursory look at the market capitalization in the Nigerian Stock Exchange (NSE) on 28th February, 2020 stood at ₦13.657trillion. From this date even up till end of 28th August, 2020, there has been decline in market capitalization (MCAP) to have the estimate stood at ₦13.203trillion. The loss in the Nigerian capital market in terms of market capitalization, has been attributed to the panic-driven selling syndrome and desire for safe haven for investment in other markets considered to be safer and resilient against shocks of coronavirus disease (COVID-19) pandemic (Babarinde *et al.*, 2020). However, beginning from September, 2020, when the cases of coronavirus were reducing in terms of daily confirmed cases and death cases in Nigeria, the stock market started showing some signs of recovery in terms of appreciation in market capitalisation. For instance, as at Friday, 16th October, 2020, the MCAP appreciated by 0.86% relative the previous week's figure to close the week at ₦14.980 trillion. However, in comparison with the 28th February 2020's figure (₦13.657trillion), this represents an appreciation of about 9.69% (Nigerian Stock Exchange [NSE], 2020).

Coronavirus has been described as zoonotic disease, believed to be caused by a new strain of coronavirus (SARS-CoV-2) that has not been previously identified in humans. The symptoms of the disease include: cough, fever, shivering, body pains, headache, sore throat, recent loss of taste or smell, difficulty in breathing/shortness of breath, diarrhea/abnormal pain, running nose/catarrh, fatigue(tiredness). The disease was discovered in Wuhan city of China in late December, 2019 with the first confirmed case in January 2020. The viral disease has since then spread to 216 countries of the world including Nigeria. Specifically, the first Nigerian case was confirmed on 27th February, 2020. Statistics on COVID-19 as at October 18, 2020 shows that cumulatively, there have been 61440 confirmed cases, 56611 recoveries and 1,125 deaths reported with a case fatality rate of 1.8% in Nigeria. In Africa, the count for confirmed COVID-19 cases is 1,605,581 with 38,837 resulting in a case fatality rate of 2.4%. Globally, the count for confirmed COVID-19 cases is 9,596,858 with 1,107,374 deaths resulting in a case fatality rate of 2.8% (Nigeria Centre for Disease Control [NCDC], 2020).

Empirically, the association between firms' market capitalization (size) and stock returns have investigated beginning from the 1980s. The relationship between firm size and stock returns as documented by Banz (1981) was shown to be negative, hence the small firm

effect or size effect hypothesis- described as the propensity of small firms' stocks to earn higher returns than large firms' stocks. The 'small firm effect' hypothesis is one of the market anomalies which results in small market capitalization firms perform better than large market capitalization firms in terms of returns from investment thereof. In a recent study in Nigeria, Babarinde (2020) also established a negative association between market capitalization and market returns in Nigeria. This suggests that the 'bigger the better' view of the investors, most especially, self-directed investors, does not hold in the Nigerian capital market. The advent of the coronavirus disease is believed to be a potential factor of consideration in capital market driven by information in line with the market efficiency postulate. Hence, re-examining the stock market size-returns nexus becomes necessary so to see whether coronavirus disease matter or not in the Nigerian capital market; as most studies (Al-Awadhi *et al.* (2020), Liu *et al.* (2020), Ngwakwe (2020) confirm the existence of a significant negative effect of coronavirus pandemic on stock market returns.

Therefore, this study re-evaluates the stock market size-returns hypothesis in the face of the currently ravaging COVID-19 pandemic. The study aims to provide answer to this question: Will the behavior of market in terms of market capitalization and market returns relationship be the same or different under the current novel coronavirus disease?

The rest of this paper is organized thus. The review of related empirical literature is contained in Section 2. The presentation of the methodology employed in this study follows in Section 3. The empirical results as well as discussion of findings are presented in Section 4 while Section 5 accommodates conclusions and recommendations of the study.

## 2. EMPIRICAL REVIEW

In a pioneer study, Banz (1981) investigated the relationship between the return and market capitalization of common stocks listed on the New York Stock Exchange. The study found that shares of firms with small market capitalizations had higher returns than large market capitalization firms. Wairimu (2017) tested the firm size effect on stock market returns at the Nairobi Securities Exchange and established that small firms have positive and significant effect on market stock returns in Nairobi. Similarly, In Nairobi, Kaburu (2012) established that there exists a strong positive relationship between market capitalization and the market indices. However, De Villiers *et al.* (1986) found no evidence of small firm effect-small firms having superior investment compared to large firms on Johannesburg Stock Exchange. Moreover, Abdullah, *et al.* (2015) indicate the relationship between size and stock returns to be significantly positive in Dhaka Stock Exchange. In another study, Abdullahi *et al.* (2011) reveal that the size of firm or sector has non-significant effect on firm or sectoral return in the Nigerian stock market. In another study, Kayode *et al.* (2020) indicate that market capitalization does not have significant effect on banks

stock returns in Nigeria. However, in the manufacturing sector, market capitalization was found to exert positive and significant effect on stock return in Nigeria. In a recent study, Babarinde (2020) explores the link between stock market size and stock market investment returns in Nigeria. Findings indicate that stock market size has significant negative and positive effect on stock market returns in Nigeria in the long run and short run respectively.

Findings on the relationship between coronavirus and stock market returns have been reported by some studies, among whom is Liu *et al.* (2020) who show that COVID-19 outbreak has negative and significant impact on the stock market returns of 21 major countries including Japan, Korea, the USA, the UK and others. Al-Awadhi *et al.* (2020)'s findings indicate that daily growth in total confirmed cases and total fatal cases of COVID-19 have significant negative effects on stock returns in Chinese stock market. Ngwakwe (2020) reveals the effect of coronavirus on Chinese stock market to be positive while on stock markets of Europe and USA to be negative. In Nigeria, Ikwuagwu *et al.* (2020) argue that coronavirus has positive but non-significant effect on health firms' stocks in Nigeria.

From the review we found that most studies confirm the significant negative effect of coronavirus pandemic on stock market returns. This does not portray a consensus, though, as the peculiarity of each capital market determine its reaction to the pandemic. Moreover, the size effect theorem confirmed by Banzi (1981) is negated by other findings (such as Abdullah, *et al.* (2015), Wairimu (2017), Kaburu (2012)) which reveal a positive significant association between market capitalization and market index. The potency of coronavirus disease in influencing stock returns and mixed findings on market size and stock returns nexus provide the motivation for this re-examination.

### 3. METHODOLOGY

The study adopts ex-post facto research design, whereby historical data are used to determine the relationship among stock market size, coronavirus disease and stock market returns in Nigeria. The study is based on secondary data, in the form of weekly data covering a period of 33 weeks, beginning from 29th February, 2020 to 18th October, 2020. Sources of the data are the Nigerian Stock Exchange's and Nigeria Centre for Disease Control's websites.

The procedure for estimation begins with descriptive statistics, then followed by stationarity test. Thereafter, cointegration test was carried out before model estimation using autoregressive distributed lag (ARDL) bounds testing approach. Partially following Abdullahi *et al.* (2020), Kayode *et al.* (2020) and Babarinde (2020), this study examines the impact of stock market size and coronavirus on stock returns in Nigeria.

The ARDL model for this study is specified in equation (1) below:

$$\Delta SMR_t = \beta_0 + \sum_{i=1}^n \beta_{1i} \Delta SMR_{t-1} + \sum_{i=0}^n \beta_{2i} \Delta \ln SMS_{t-i} + \sum_{i=0}^n \beta_{3i} \Delta \ln CNNP_{t-i} + \alpha_{1i} SMR_{t-1} + \alpha_{2i} \ln SMS_{t-1} + \alpha_{3i} \ln CNNP_{t-1} + \Psi ECT_t + \mu_t \quad (1)$$

Where;  $\Delta$  denotes first difference operator,

$\ln$  represents natural logarithm,

$\beta_0$  = the drift component,

$\mu_t$  = the error term,

$\beta_1 - \beta_3$  = the parameters of the short-run dynamics of the model,

$\alpha_1 - \alpha_3$  corresponds to parameters of the long-run relationship,

$\Psi$  is the coefficient of the error correction term (ECT),

$SMS$  denotes stock market size in Nigeria, measured as  $\ln$  (MCAP)

$SMS$  represents stock market returns in Nigeria, measured as  $\ln \left[ \frac{ASI_t}{ASI_{t-1}} \right]$

$MCAP_t$  = Nigerian Stock Exchange market capitalization at time  $t$ ,

$ASI_t$  All share index at NSE, at current period,

$ASI_{t-1}$  All share index at NSE, at previous period.

## 4. RESULTS AND DISCUSSIONS

### 4.1. Descriptive Statistics

In the descriptive statistics in Table 1, coronavirus new positive cases (otherwise called confirmed cases) (CNNP) has an average number of 358 where its minimum and maximum indices stand at 0 and 1174 respectively. Given its standard deviation not exceeding the mean number, the series is considered not widely dispersed. CNNP of roughly 0 and 3 in skewness and kurtosis coefficients, suggest the normality of the variable. This is formally confirmed by its Jarque-Bera (J-B)'s p-value, which is very high ( $p > 10\%$ ). Hence, the non-rejection of hypothesis of normality in the variable.

Furthermore, stock market returns (SMR) ranges between a minimum of -0.1449 and a maximum of 0.0694 in the study period. There is an average stock returns of 0.0027. SMR is negatively skewed and its kurtosis exceeds 3, thus suggesting non-normality of the series. Formally J-B statistics with p-value less than 1%, means that the hypothesis of normality of the variable, is rejected at 1% level of significance.

The stock market size (SMS) has an average value of 2.5500 and the associated minimum and maximum value of 2.3973 and 2.7067 respectively. Just like stock market returns, SMS is also negatively skewed but its kurtosis stays around 3. The kurtosis and J-B statistics ( $p > 10\%$ ), jointly confirm the normality of stock market size as a variable.

**Table 1: Descriptive Statistics**

	<i>Mean</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Std. Den.</i>	<i>Skewness</i>	<i>Kurtosis</i>	<i>Jarque-Bera</i>
<b>SMR</b>	0.0027	-0.1449	0.0694	0.0348	-2.0061	11.2928	116.6959*
<b>SMS</b>	2.5500	2.3973	2.7067	0.0721	-0.1378	3.0544	0.1085
<b>CNNP</b>	357.7273	0.0000	1174.000	306.6746	0.8983	3.2266	4.5089

*Source:* Authors' computation

*Note:* \* significant at 1%.

#### 4.2. Unit Root Tests

The unit root tests of the kinds Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) tests were applied to determine the unit root properties of the variables. The ADF and PP tests reject the hypothesis of presence of unit root in both variables after first difference (SMS and LOGCNNP). The tests however, reject the hypothesis of unit root in respect of stock market returns (SMR) in its level form. The results of the unit root tests indicate that SMR is stationary at level while SMS and CNNP attains stationarity only after difference. Hence, the variables of study are I(0) and I(1) series.

**Table 2: Unit Root Tests**

	<i>ADF</i>		<i>PP</i>	
Variables	Adj. t-Stat	I(d)	Adj. t-Stat	I(d)
SMR	-3.3498**	I(0)	-4.7822*	I(0)
SMS	-3.1798**	I(1)	-7.4815*	I(1)
LOGCNNP	-6.2386*	I(1)	-6.1957*	I(1)

*Source:* Authors' computation

*Note:* \*significant at 1% ( $p < 1\%$ ); \*\* significant at 5% ( $p < 5\%$ ).

#### 4.3. Cointegration Test

Since the variables are I(0) and I(1) series, this study applies the F-Bounds test of cointegration. The result of the test (shown in Table 3) indicates that the three variables are cointegrated. In other words, there is an existence of long run relationship between stock market returns, coronavirus and stock market size in Nigeria. This implies that the

relationship among the three variables has long term policy implications. It is also safe to estimate both long run and short run models.

**Table 3: F-Bounds Cointegration Tests**

<i>Test Statistic</i>	<i>Value</i>	<i>Signif.</i>	<i>I(0)</i>	<i>I(1)</i>
F-statistic	62974.37*	10%	2.63	3.35
K	2	5%	3.1	3.87
		1%	4.13	5.00

*Source:* Author's computation

\* Rejection of hypothesis of no level relationships since the F-statistic exceeds all the three critical values

#### 4.4. Models Estimation

The ARDL model is estimated based on lag length one formation as prescribed by the Akaike information criterion (AIC). The result of the ARDL long run and, short run and error correction models are presented in Table 4. The long run estimates show stock market size (SMS) to be positively signed (1.0012) with stock market returns in the short run. This positive effect is also significant at 1%. In the long run, the result is mixed. While the level form (current value) of stock market size (1.0012) has positive effect on stock market returns, the 1-week lag of stock market size (SMS(-1) exerts negative effect on stock market returns in Nigeria. Both current and lagged values of stock market size are significant at 1% level. The net effect of stock market effect of both level and lagged values of stock market size, is negative, (by subtracting the coefficients, 1.0012-1.0031). In other words, given a net coefficient of -0.0019, stock market size still has negative effect on stock market returns in Nigeria in the long run.

With a coefficient of 6.20E-05 and p-value (0.5195), coronavirus new confirmed cases in Nigeria has a positive but non-significant effect on stock market returns in the long run. This suggests that coronavirus does not have a significant effect on stock market returns in Nigeria. In other words, coronavirus disease does not matter in the market size-returns relationship in the Nigerian capital market.

Given the negative error correction term (ECT) (-1.0001) which is statistically significant (at 1% level), the model adjusts itself dynamically to restore long run equilibrium position, in case of disturbance to the model. The ECT further buttresses the long run estimated also.

The regression results generally reveal that the positive significant effect of stock market size on stock market returns is limited to the short run. In the long run, however, the effect is reversed to significant negative. This finding partly agrees in fact with the

findings of Abdullahi *et al.* (2011) when they assert that firm or sectoral size has no significant influence on sectoral risk and return, and that investment in big sector or firm does not necessarily often guarantee safety and high returns from stock investment.

Furthermore, the coefficient of coronavirus (6.20E-05), though positive but is not statistically significant. This suggests that coronavirus does not matter greatly in determining changes in stock market returns in Nigeria in the period of investigation. This finding is in consonance with Ikwuagwu *et al.* (2020) but contrary to the negative nexus between coronavirus and stock returns asserted by Al-Awadhi *et al.* (2020) and Liu *et al.* (2020).

**Table 4: ARDL Long Run and Short Run and Error Correction Estimates**

<i>Long Run Estimates</i>		<i>Short Run and Error Correction Estimates</i>	
<i>Variable</i>	<i>Coefficient</i>	<i>Variable</i>	<i>Coefficient</i>
SMR(-1)	-0.0001	D(SMS)	1.0012*
SMS	1.0012*	ECT	-1.0001*
SMS(-1)	-1.0031*		
LOGCNP	6.20E-05		
R-squared (R <sup>2</sup> )	0.9997	R <sup>2</sup>	0.9999
Adj. R <sup>2</sup>	0.9997	Adj. R <sup>2</sup>	0.9999
F-statistic	27942.28*	Durbin-Watson	2.3497
Durbin-Watson	2.3497		
Breusch-Godfrey Serial Correlation LM		[0.3278]	
Jacque-Berra Normality		[0.0000] *	
ARCH Heteroskedasticity		[0.8767]	
Ramsey RESET Linearity		[0.8399]	

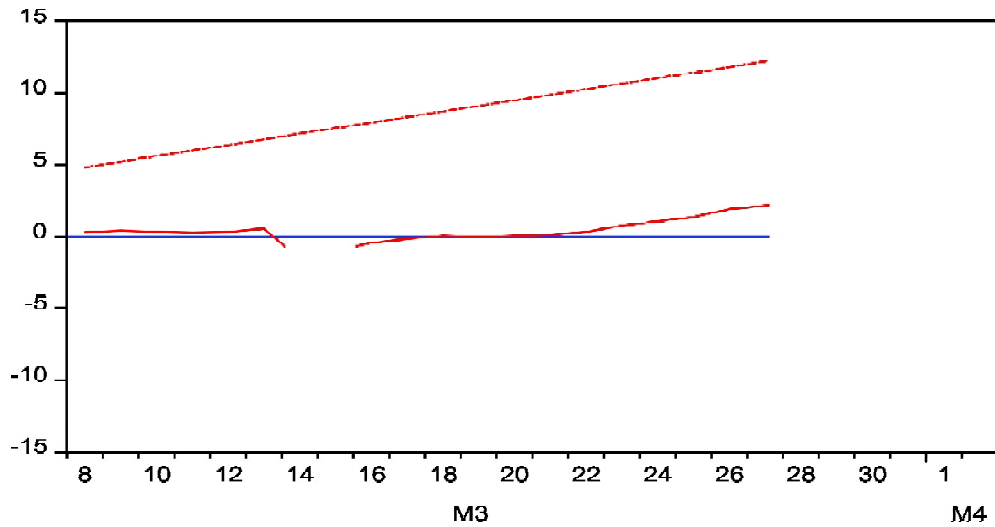
*Source:* Author's computation

*Note:* \* significant at 1% (because p-value<0.01); [] p-values

Furthermore, the statistical properties of the models (reported in Table 4) show generally very high coefficients of determination (R-squared). This implies that a very high proportion of the changes in stock market returns (dependent variable) is explained by the joint and several influence of the independent variables (stock market size, coronavirus). The diagnostic tests of the models suggest that the estimated models are free from heteroscedasticity, has no misspecification error, and its residuals are serially independent. Though, its normality is questionable, the parameters of the model are considered stable over time. This is because, the plot of the CUSUM test of stability in Figure 1, shows that the line does not gyrate beyond both upper and lower boundaries of then test graph.



Figure 1: CUSUM Stability Graph



Source: Author's computation

## 5. CONCLUSION AND RECOMMENDATIONS

Using autoregressive distributed lag (ARDL), this study examined the dynamics of stock market size, stock market returns, and coronavirus disease in Nigeria. Empirically, the study established that the positive significant effect of stock market size on stock market returns is limited to the short run. In the long run, however, the effect is reversed to negative but statistically significant. However, coronavirus does not have statistically significant effect on stock market returns in Nigeria. It can therefore be concluded that stock market size has negative significant effect on stock market returns in Nigeria but stock market size positively and significantly impacts stock returns in Nigeria in the short run. Coronavirus, however, does not constitute a significant determinant of stock market returns in Nigeria and therefore does not distort the negative association between stock market size and stock returns in Nigeria.

The study therefore recommends that investors should not rely on market size analysis only in their investment risk mitigation strategy as the 'bigger the better' view may not yield expected output in capital market investment in Nigeria. Policies that ensure positivity of market size-returns nexus in the short-run should be elongated to the long-run to reverse the negative long-run implications of stock market size on stock returns in Nigeria. It is also suggested that the impact of other market fundamentals (liquidity, risk, concentration/diversification) in conjunction with coronavirus, should be explored by

future studies. Moreover, capital markets in other countries be examined singularly and in panel using the current variables adopted by this study.

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