TRADING FLOORS AUTOMATION AND STOCK MARKET EFFICIENCY DURING EQUITY ISSUES ANNOUNCEMENTS IN NIGERIA

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Abstract
This paper examines effect of the automation of trading platforms on the reaction of the Nigerian stock market to Seasoned Equity Offerings (SEOs) announcements. The study utilized a sample of 86 SEO announcements between July 1995 and December 2019, out of which 27 were made before the automation of trading floors in 1999 and 59 after automation. To investigate reaction of the Nigerian stock market SEOs announcements, the standard event study methodology was employed, and the market model was utilized as the benchmark model for computing returns. On the other hand, effect of automation announcement was examined using difference test for abnormal return. In line with extant empirical evidence, the paper found negative and statistically significant announcement day abnormal returns -3.33% and -2.91% for the pre-automation and post-automation periods respectively. However, t-statistic of -0.26 was not significant at any of the conventional levels. The paper thus concluded that the negative reaction of the Nigerian stock market to SEO announcements is consistent with the notion that investors perceived the announcing firms as overvalued. it was found that the effect automation. It was also concluded that automation did not have significant effect on the market's reaction to SEO announcements in Nigeria. The paper recommended adequate disclosure of the intended use of proceeds from the SEO prior to the announcement. It was also recommended that the automated trading platforms and other market infrastructure should be constantly upgraded to enhance prompt information dissemination to all market participants.

Keywords: Automation, Market efficiency, Seasoned equity offerings, Event studies, Nigeria
JEL Classification: G12, G14, G32, N27

1. Introduction

Performance has been a major concern to corporate managers of firms as it is the major yardstick that justifies their effort at any time. Thus, managers of firms have been pre-occupied with improving performance more than any other aspect of corporate activities. There are many metrics that can be employed to measure performance in corporate organizations but one of the most important measures is the market value of the firm. Market value of a firm is often depicted as the value investors are willing to pay to hold a stake in the firm; its stock price. The market

price of a firms' stock is thus an essential measure of its performance because to investors, it reflects the present value of the firm's discounted future cashflows (Jensen, 1986). The value of these future cashflows is largely determined by the firm's current investment opportunities and how well the firm is able to leverage on such opportunities (Denis, 1994). However, exploiting investment opportunities available to a firm requires it to raise adequate capital to finance such operations.

One of the common ways for corporate organizations to raise large capital to finance investments is by issuing equity. Otherwise known as Seasoned Equity Offering (SEO), equity issues entail raising capital by a firm through the sale of additional units of stock to members of the public. The importance of SEO to corporate organizations can be seen in its rising popularity as a favoured means of raising capital among managers of corporate organizations (Kim & Weisbach, 2008). According to Fama (1970), the market, represented by investors, should react to such an announcement in a way that investors' judgment regarding the suitability of raising capital through SEOs is reflected in the firm's stock price. If the market is efficient, stock price of the issuing firm will instantly adjust to reflect investors' sentiment once the issue is publicly announced.

Extant empirical evidence by Hammar and Perman (2015), Liu, Akbar, Shah, Zhang and Pang (2016), Brau and Carpenter (2017), Huang and Chiu (2017), Kumar, Hawaldar and Mallikarjunappa (2018), Width and Arseth (2018) and Ulrich (2018) has shown that stock markets react to SEO announcements. Aside the fact that SEOs are a popular means of raising capital, it has since been established theoretically and empirically that SEOs are a strong tool for managers to signal to the market about the current underlying value of the firm (Leland & Pyle, 1977; Myers & Majluf, 1984; Masulis & Korwar, 1986). Stock market reaction to SEOs is commonly investigated using the event study methodology propounded by Fama, Fisher, Jensen and Roll (1969), and popularized by Brown and Warner (1985) and Mackinlay (1997). According to Ball and Brown (1968), the event study methodology establishes the impact of an event by computing the abnormal return arising from the announcement of such an event. Abnormal return is the difference between the return as a result of the announcement and what the return would have been had the announcement not been made. Empirical evidence suggests that SEO announcements can have positive or no effect on market value, but preponderance of studies support the notion that markets react negatively to SEO announcements in line with the fact that market agents perceive the

announcement as a signal of overvaluation (Myers & Majluf, 1984; Masulis & Korwar, 1986).

As is the case in all the other stock markets, SEOs in Nigeria are as old as the stock market itself but they only became popular from July 1995 when the stock market was liberalized to allow foreign investors access to securities in Nigeria (Kim & Singal, 2000). Since then, the number of firms conducting SEOs in Nigeria has increased astronomically. To further boost investors' confidence and enhance performance of the Nigerian stock market, all trading floors were fully automated in 1999; a development that should theoretically enhance efficiency in the speed of executing market transactions as well as dissemination of vital market information.

Previous studies have examined the reaction of Nigerian stock market to corporate announcements such as dividends, stock splits, earnings, and management change (Olowe, 1998; Adelegan, 2009a, 2009b; Afego, 2010). However, it is surprising that despite the importance of SEOs to the corporate survival and existence of a firm, none of these previous studies has attempted to examine reaction of the Nigerian stock market to SEOs announcements. It is equally worrisome that none of these studies have paid attention to the effect the deployment of Information and Communication Technology (ICT), in the form of trading automation, may have on the market's ability to react to such corporate announcements. According to D'Avolio, Gildor and Shleifer (2001), Omuchesi, Bosire and Muiru (2014), Lee, Alford, Cresson and Gardner (2017) and Lee, Tsai, Chen and Lio (2019), deployment of ICT to stock markets helps market participants to make more informed investment decisions at reduced risks. The works of Odeleye (2009) and Olowe (2009) only merely attempted to examine the effect of automation on the prices and trading volumes of listed firms on the Nigerian Stock Exchange without relating such effect to corporate actions such as SEOs. According to Fama (1998), efficiency is best tested in relation to corporate actions and disclosures (such as SEO announcements).

It is thus obvious that previous studies on corporate events' announcements in Nigeria have ignored SEOs and the effect of stock market automation on the market's reaction to SEO announcements. It is against this background that this study was conducted to examine the reaction of the Nigerian stock market to SEOs announcements. The study also examined effect of trading automation on efficiency of the Nigerian stock market during periods of SEOs announcements.

The rest of the paper is structured as follows: section 2 reviews literature and the study's underpinning theory, section 3 presents methodology adopted by the paper, section 4 analyzes and discusses the results, section 5 concludes the paper and recommends appropriate courses of action.

2. Literature Review

There is sufficient empirical evidence in the literature supporting the fact that stock markets react to SEOs announcements. However, most of these studies are domiciled in developed and other emerging markets to the exclusion of African stock markets such as Nigeria. One of the few studies on SEOs covering African stock markets is Bhana (1998) that examined reaction of the Johannesburg Stock Exchange (JSE) to SEOs announcements from 1980 t0 1995 based on a sample of 100 announcements. The study documented significant negative announcement day effect and thus concluded that the South African stock market reacts negatively to SEOs. However, the study did not control for effect of volatility on returns.

The study of SEOs is more common among developed and other emerging markets. Dissing, Rasmussen and Bartholdy (2015) employed a sample of 342 SEO announcements made across 15 European countries between 2000 and 2010 to examine reaction of stock market to SEO announcements. Based on the event study methodology, the study found negative and strongly significant reaction on the announcement day. The study concluded that European firms conducting SEOs are perceived as undervalued by the market. However, there is no evidence the study controlled for effects of volatility. Hammar and Perman (2015) investigated reaction of the Swedish stock market to SEO announcements using a sample of 253 offers from November 2006 to December 2013. Using the event study methodology, the study found negative and significant effect on the announcement day. It was concluded that Swedish firms react negatively to SEOs. However, the study did not control for the effect of volatility. Liu, et al. (2016) analyzed market reaction to SEO announcements in China from 1991 to 2010 using a total sample of 1,659 announcements. The study employed event studies in its analysis and found that rights issues and open offers recorded negative and significant market reaction while private placements and convertible debts experienced positive market effects. It was concluded that negative reaction to SEOs is as a result of market's perception of the offers as overvalued. However, the study did not control for the effects of volatility on returns. Brau and Carpenter (2017) employed a sample of 547 SEOs in the US between 2008 and 2016 to investigate the behavior of healthcare firms after the global financial crisis. The study, which utilized event

study methodology, found that healthcare stocks have exhibited underpricing and long-run underperformance. However, the study did not provide evidence of control for volatility effect, which is believed to have increased after the global financial crisis. Huang and Chiu (2017) examined effect of insider activities on SEO announcements using a sample of 506 announcements by Taiwanese firms between January 2006 and December 2014. Using the event study approach, the study found negative announcement day effect for net buying insiders and positive effect for net selling insiders. The study concluded that insiders buying stocks around SEOs experience losses while those selling record benefits. However, the study did not adjust the returns for thin trading effects. Kumar, Hawaldar and Mallikarjunappa (2018) examined reaction of the Indian stock market to SEOs announcements using a sample of 162 announcements made between 1992 and 2012. The study adopted event study methodology to establish abnormal return arising from the announcements. It was found that abnormal return for various windows were negative and significant, implying that the Indian stock market reacted negatively to SEOs announcements. It was concluded that the Indian stock market, consistent with previous findings, experienced underpricing as a result of SEOs announcements. However, absence for control of the effect of thin trading may have adversely affected the results. Width and Arseth (2018) assessed the announcement effect of SEOs on the Oslo Stock Exchange between 2005 and 2018. Using the event study methodology, the study found negative reaction by firms announcing SEOs, with the results being less severe for firms that announced intended use of SEO proceeds. The study thus concluded that adequate disclosure around the use and purpose of SEO proceeds produces credible signal to the stock market. However, results of the study may have been influenced by volatility effects. Feet and Ulrich (2018) examined effect of information asymmetry on reaction of stock markets to SEO announcements by European stock markets between 2000 and 2013. Using event study methodology, it was established that the market reacted negatively, with marginal evidence that the reaction was more negative for fully-marketed offers relative to accelerated offers. The study concluded that information asymmetry has effect on offer type. However, the study did not account for country-specific variations in stock markets.

On the other hand, the effect of ICT on stock market efficiency has since been established by previous studies (D'Avolio et al., 2001; Faghani, Habibi, Tabatabaee, Razavi & Emadzadeh, 2013; Chan & Chan, 2014). According to Faghani, et al. (2013), ICT leads to deployment of electronic trading processes and seamless dissemination of market information, which in turn enhances stock market

efficiency. Automation of trading platforms slashes unnecessary time wastage in the execution of investors' buy and sell orders in the stock market. Similarly, market information is more rapidly spread among investors to aid them in arriving at sound investment decisions.

Previous empirical studies have documented the relationship between ICT and stock market efficiency. However, only a few of such studies emanated from Africa; and this may not be unconnected with the fact that African stock markets are adjudged to be less efficient. Most of the reasons advanced for this assertion center around poor deployment and use of ICT in African stock markets. Odeleye (2009) examined effect of trading automation on the prices and trading volumes of selected firms listed on the Nigerian Stock Exchange. The study covered the period 1996-1998 as pre-automation and 2001-2003 as post-automation. Using OLS regression, the study documented statistically insignificant increase in trading volume and decrease in prices. It was concluded that automation did not significantly influence market efficiency. However, the use of only three listed firms and OLS regression as a tool to test efficiency may have affected the results. Olowe (2009) investigated effect of the introduction of the Automated Trading System (ATS) in the Nigerian stock market using monthly data from December 1986 to December 2006. Using the event study methodology, the paper established evidence of negative abnormal return, consistent with the notion that that the Nigerian stock market is not informationally efficient. Similarly, Mwalya (2010) utilized market return and trading volume data for the Nairobi Stock Exchange (NSE) from 2005 to 2010. Initial Public Offering (IPO) announcement was used by the study to test the reaction of the market to use of ICT. Using event study methodology, the study found that the NSE return and trading volumes responded to announcement of ICT adoption. However, there was no evidence the observed abnormal returns were tested for statistical significance. In a related study, Omuchesi, et al. (2014) assessed effect of automation on efficiency of the Kenyan stock market using data from 2002-2012. Using Chi-Square analysis, the study found that automation had no significant effect on efficiency of the NSE. However, the technique of analysis used may not be appropriate for establishing market efficiency. Owido, Bichanga and Muiruri (2014) examined performance of the NSE in the face of improved ICT adoption by the market. The study employed non-parametric methods of runs tests Kolmogorov-Sminov tests, QQ-plots and PP-plots to investigate randomness in the market return series from January 2006 to November 2011. The study found that the NSE return was not random and the thus exhibited non-normality in its distribution. It was concluded that the market was

inefficient in the weak-form sense. However, the use of non-parametric tools to test for the impact of ICT appears to be inappropriate.

Like SEOs, most of the studies that have examined the nexus between ICT and market efficiency were from non-African stock markets. For instance, Lee, et al. (2017) investigated the effect of ICT on market capitalization using a cross-country panel dataset consisting of 81 countries from 1998 to 2014. Using country-specific fixed effect models, the study found positive correlation between ICT deployment and growth in stock market capitalization. The study concluded that increased deployment of ICT can enhance efficient information flows within local and across global financial markets. However, non-inclusion of several other crucial variables that affect stock market capitalization may have affected explanatory power of the model estimated by the study. Also, Lee, et al. (2019) employed a cross-country dataset of 71 stock markets between 2002 and 2014 to investigate the extent to which ICT has promoted transparency in the dissemination of stock market news and information. Findings based on panel unit root tests and variance ratio tests indicated that countries with higher ICT diffusion were more efficient than those with low to medium diffusion levels. The study also found that ICT diffusion was more significant in reducing stock market noise rather than amplifying it. It was concluded that ICT has significant effect on stock market efficiency. However, the mere use of unit root and variance ratio tests may affect the findings.

This study is underpinned by the market efficiency theory propounded by Fama (1965) and popularized by subsequent works of Fama (1970, 1991, 1998). In its simplest form, the efficient market theory holds that in an efficient market, stock prices adjust instantaneously to impound new information so that no investor is given undue advantage to use such information exclusively to the detriment of other market participants and agents. Since its introduction, a number of studies have supported the validity of this theory by confirming that stock markets adjust prices to reflect the public announcement of corporate events. Being a major corporate event SEO announcement elicits market response, and the magnitude of reaction will depend on the type of offering. Therefore, the announcement of SEOs in Nigeria should translate to market changes that will reflect the perceived value of such corporate action to investors and other market participants. Similarly, a major action such as the automation of the Nigerian stock market trading floors should result in enhanced dissemination of market information; and this should in turn have some implications for how investors value corporate actions such as SEO announcements.

3. Methodology and models

This paper examined effect of trading automation reaction of the Nigerian stock market to SEOs announcements. The paper employed the standard event study methodology developed by Fama, et al. (1969) and popularized by Brown and Warner (1985) and Mackinlay (1997). In this study the corporate event under investigation is the announcement to conduct SEO by firm listed on the Nigerian Stock Exchange from July 1995 to December 2019. A total of 109 SEO announcements were recorded within the period of the study but for an announcement to be considered as part of the sample, it must meet some set criteria: there must be relevant data on the event, the announcement must have been made publicly, the announcement must be for equity issues, and there must not be a simultaneous value-relevant announcement that that is capable of contaminating the effect of the SEO announcement. Application of the filters resulted in a clean sample of 86 SEO announcements, after 23 announcements have been dropped.

In order to test for the effect of trading automation on the reaction of the Nigerian stock market to SEO announcements, the sample was partitioned into SEOs before automation (pre-automation) and SEOs after automation (post-automation). Based on the Nigerian Stock Exchange's announcement on 27th April 1999 that all trading floors were fully automated and have migrated to the Automated Trading System (ATS) platform, the study considered all SEO announcements before 27th April 1999 as pre-automation and those announced after 27th April 1999 as post-automation SEOs. A total of 27 SEO announcements fell under the pre-automation period, while 59 SEOs were announced during the post-automation period.

In line with requirements of event studies, this paper adopted an event window of 31 trading days consisting of 15 trading days before the announcement, the announcement day, and 15 trading days after the announcement. Similarly, the paper adopted an estimation window of 120 trading days before the first day of the event window. Thus, the estimation runs from day -135 to day -16 while the event window covers -15 to day +15. The study collected data on daily closing prices of the 86 announcing firms and the corresponding stock market index. Values. The series of stock prices and corresponding market indexes were then converted to continuously compounded returns using the formula below:

$$R_{i,t} = \ln\left[\frac{V_{i,t} - V_{i,t-1}}{V_{i,t-1}}\right] \text{.....} \quad (1)$$

Where:
$R_{i,t}$ = Return on firm i at time t
$V_{i,t}$ = Value of firm i at time t
$V_{i,t-1}$ = Value of firm i at time t-1
ln = Natural logarithm

Being time series in nature, the stock and market return series for the 86 samples were tested for stationarity using the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. In order to compute the abnormal return and cumulative abnormal return, estimate benchmark returns for the sample SEO announcements, the market model was employed as the benchmark model for return estimation. The market model assumes a linear relationship between return of a security and the return on the market portfolio (Fama et al., 1969). The model is stated as follows:

$$R_{i,t} = \alpha_0 + \beta_1 R_{m,t} + \varepsilon_{i,t} \quad \text{.....(2)}$$

where Ri,t is the actual return on firm i's stock at time t; α0 and β1 are parameters to be estimated; Rm,t is the market return at time t; and εi,t is firm i's random disturbance term at time t. Assuming a constant beta value, the estimated return for firm i's stock can be computed by substituting the estimated values of α0 and β1 over the estimation window in equation (5) above as follows:

$$\overline{R}_{i,t} = \hat{\alpha}_0 + \hat{\beta}_1 R_{m,t} \quad \text{..... (3)}$$

where $\overline{R}_{i,t}$ is the expected return on firm i's stock at time t; $\hat{\alpha}_0$ and $\hat{\beta}_1$ are the estimated parameters based on the estimation window; and Rm,t is the market return at time t. The abnormal return is defined as the difference between equation (2) and equation (3) as follows:

$$AR = R_{i,t} - \overline{R}_{i,t} \quad \text{..... (4)}$$

Once the estimated equation has been obtained, the actual return on firm i's stock is calculated as follows:

$$\overline{R}_{i,t} = \hat{\alpha}_0 + \hat{\beta}_1 R_{m,t} + \varepsilon_{i,t} \quad \text{..... (5)}$$

Since $\overline{R}_{i,t} = \hat{\alpha}_0 + \hat{\beta}_1 R_{m,t}$ equation (5) simplifies to:

$$R_{i,t} = \overline{R}_{m,t} + \varepsilon_{i,t} \quad \text{..... (6)}$$

This implies that abnormal return for firm i at time t is simply given as:

$$AR_{i,t} = \varepsilon_{i,t} \quad \text{..... (7)}$$

Given that the market model was estimated using OLS, the residuals were examined for auto-correlation, heteroskedasticity and normality using Breusch-Godfrey tests, Engle test, White test and Jarque-Bera test. In the event that significant volatility was observed in the residuals, the OLS model was replaced with ARCH/GARCH specification according to their best fits so as to appropriately capture volatility. The model can be specified as follows:

When a GARCH (1,1) model is considered, equation (5) is replaced with:

$$\sigma^2_{i,t} = \alpha_{i0} + \alpha_{i1} u^2_{i,t-1} + \alpha_{i2} \sigma^2_{i,t-1} \quad \text{..... (8)}$$

Equation (8) becomes an ARCH (1) process if $\alpha_{i2} = 0$. The cumulative abnormal return of firm *i* in the sample for a given period was obtained by summing up the abnormal return in a given period. The procedure is demonstrated by the following formula (Peterson, 1989):

$$\text{CAR}_i\,(t_0,t_1) = \sum_{t=0}^{1} AR_{i,t} = \sum_{t=0}^{1} \varepsilon_{i,t} \quad \text{..... (9)}$$

where $\text{CAR}_i\,(t_0,t_1)$ is the cumulative abnormal return of firm *i* from time t_0 to t_1; $AR_{i,t}$ is the abnormal return of firm *i* at time *t*; $\varepsilon_{i,t}$ is the residual of firm *i* at time *t*. Similarly, the sample average abnormal return at time *t* is simply the arithmetic mean of *n* number of stocks, as shown below:

$$\text{AAR}_t = \frac{1}{n} \sum_{i=1}^{n} AR_{i,t} \quad \text{..... (10)}$$

where AAR_t is the sample average abnormal return at time t; n is the number of observations; and $AAR_{i,t}$ is the abnormal return of firm i at time t. As a consequence of the foregoing, the cumulative average abnormal return will be computed as follows:

$$CAAR\,(t_0,t_1) = \sum_{t=0}^{1} AAR_t \quad \text{..... (11)}$$

Where $CAAR\,(t_0,t_1)$ is the sample cumulative average abnormal return from time t_0 to t_1; and AAR_t is the sample average abnormal return at time t. The significance of abnormal return and cumulative abnormal return was tested using the t-test for significance of abnormal return. According to Brown and Warner (1985) and Panayides and Gong (2002), the test statistic is simply the ratio of period t_0 to period t_1 CAR to its estimated standard deviation over the estimation window as shown in the equation below:

$$t(CAR) = CAR\,(t_0,t_1) / \left[S\left(AAR_t\right)\right] \quad \text{..... (12)}$$

where t(CAR) is the test statistic for cumulative abnormal return; $CAR\,(t_0,t_1)$ is as defined above; $S(AAR_t)$ is the standard deviation of average abnormal return over the parameter estimation window.

In order to test for the effect of automation on the reaction of the market to SEO announcements, a test for the difference in means between mean abnormal return for the pre-automation period and the post-automation period was conducted using the following formula (Angelovska, 2011).

$$t = \frac{MAR_{post} - MAR_{pre}}{\sigma_{pre-post}} \quad \text{..... (13)}$$

Where MAR_{post} is the mean abnormal return for the post-automation period, MAR_{pre} is the mean abnormal return for the pre-automation period, and $\sigma_{pre-post}$ is a pooled standard error of the difference between the pre-automation and post-automation periods abnormal return. The event window mean abnormal return for the pre-automation and post automation periods were computed using the formula below:

$$MAR = \frac{\sum_{t=1}^{n} AR}{n} \quad \text{..... (14)}$$

Where *MAR* is mean abnormal return and *n* is the number of days within the event window. The pooled standard error of the difference between the two samples of SEO announcements was calculated as follows:

$$\sigma_{pre-post} = \sqrt{\left(\frac{(n_1 - 1)\sigma^2{}_1 + (n_2 - 1)\sigma^2{}_2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)} \quad \text{.....(15)}$$

Where $\sigma^2{}_1$ is the variance of pre-automation abnormal return, $\sigma^2{}_2$ is the variance of post-automation abnormal return, and n_1, n_2 are the number of announcements in the pre-automation and post-automation periods respectively. To compute the pooled standard errors, separate standard deviations were computed for the pre-automation and post-automation periods using the formula below:

$$\sigma = \sqrt{\frac{\sum_{i-1}^{n} (AR - MAR)^2}{n - 1}} \quad \text{..... (16)}$$

4. Results and Discussions

As was spelt out in the methodology section, the paper examined stationarity of the individual announcing firms' return as well as the corresponding market return. The firm and corresponding market return series were for the period from the beginning of the estimation window to the end of the event window for each announcement. Results of stationarity tests showed that out of the total sample of 83 firm announcements, 83 return series were found to be stationary at levels using ADF and PP tests while 81 were found to be stationary at levels using the KPSS test. For the corresponding market return series, 85 out of the 86 series were found to be stationary at levels using the ADF and PP tests while 84 were found stationary at levels using the KPSS test. For brevity, the tables could not be presented in the paper but are available upon request.

A look at the results from the pre-automation and post-automation perspectives reveals that out of the total of 83 firm return series that were found stationary using ADF and PP tests, 25 fell within the pre-automation period, and 58 were within the post-automation period. For the KPSS test, 24 of the stationary firm return were within the pre-automation phase while the balance of 57 series were within the post-automation phase. On the other hand, the 85 corresponding market return series that were found to be stationary using the ADF and PP tests consisted of 26 series in the pre-automation period and 59 in the post-automation period. Using the KPSS test, the 84 market return series that were found to be stationary were made up of 25 pre-automation series and 59 post-automation series respectively.

Therefore, results of stationarity test on the whole suggest that almost all the firm and corresponding market return series were found to be stationary at levels using all the three tests for stationarity. The fact that the series were found to be stationary at levels implies that the firm and market return series were integrated of the order I(0). The finding of stationary returns lends credence to existing empirical and theoretical evidence that asset prices are traditionally non-stationary, while asset returns tend to be stationary (Agung, 2009; Brooks, 2008; DeMedeiros & Matsumoto, 2006).

After the test of stationarity, the abnormal return for each firm, arising from its SEO announcement, was computed in line with the methods specified under the methodology section. The individual firms' abnormal return was then aggregated to obtain the abnormal return and cumulative abnormal return. Table 1 presents the descriptive statistics for the computed abnormal return and cumulative abnormal return.

Table 1: Pre-Recession and Post-Recession Return Descriptives

Panel A: Pre-Automation Return Descriptives							
	Mean	*Std. Dev.*	*Min.*	*Max.*	*Skewness*	*Kurtosis*	*Jarque-Bera*
Pre-AR	-0.005	0.014	-0.045	0.021	-0.638	3.773	2.874
Pre-CAR	-0.130	0.068	-0.211	0.000	0.394	1.734	2.872
Panel B: Post-Automation Return Descriptives							
	Mean	*Std. Dev.*	*Min.*	*Max.*	*Skewness*	*Kurtosis*	*Normality*
Post-AR	-0.004	0.016	-0.044	0.023	-0.619	3.096	1.990

Post-CAR	-0.073	0.064	-0.171	0.043	0.159	1.675	2.400

Source: Author's Compilations from E-Views 10 Output, 2020
*, **and*** imply significance at the 10%, 5% and 1% levels respectively.

It can be seen from Panel A of Table 1 that mean pre-automation abnormal return and cumulative abnormal return are negative, indicating that the market, on the average, reacted adversely to the announcement. The standard deviations of 0.014 and 0.068 for the pre-automation abnormal return and cumulative abnormal return respectively suggest mild dispersion around the mean values. The evidence of mild dispersion is further supported by the relatively low variability between the minimum and maximum values of abnormal return and cumulative abnormal return respectively. The panel further shows that while the pre-automation abnormal return series is negatively skewed and this have a longer left tail, the cumulative abnormal return series is positively skewed and thus have a longer right tail. In terms of kurtosis, the descriptives show that distribution of pre-automation abnormal return is leptokurtic or slightly peaked around the mean while the distribution of cumulative abnormal return is reasonably platykurtic or flat at the surface around the mean as it is by far less than the threshold value of 3, which suggests mesokurtosis. On the whole, the series of pre-announcement abnormal return and cumulative abnormal return both failed to reject Jarque-Bera's null hypothesis of normality. This implies that the series are normally distributed. The evidence of normality is important to this paper as it is a fundamental requirement for the application of t-test of significance.

On the other hand, Panel B of Table 1 shows that the mean abnormal return and cumulative abnormal return in the post-automation period SEO announcements were both negative, supporting the theoretical assertions that SEO announcements are meted with negative market reaction. Like in the pre-automation period, the standard deviation, minimum and maximum values of abnormal return and cumulative abnormal return all support the presence of slight deviation and variation around the mean. It can also be seen from the panel that while the post-announcement abnormal return series is negatively skewed, the cumulative abnormal return series is positively skewed. The panel also depicts slight leptokurtosis for the post-automation abnormal return series and platykurtosis for the cumulative abnormal return series. In addition, the insignificance of Jarque-Bera statistics for both the post-automation abnormal return and cumulative abnormal return series is an indication that the series are normally distributed.

The evidence of normality for the abnormal return and cumulative abnormal return series in both the pre-automation and post-automation periods contradicts finance theory regarding the distributional characteristics of financial asset returns. According to Greene (2003), Gujarati (2004) and Brooks (2008), financial asset returns exhibit leptokurtosis and fat tails, and therefore; this distributional features make their distribution anything but normal.

The paper then compiled the abnormal return and cumulative abnormal return arising from SEO announcements for the pre-automation and post-automation periods. Table 2 presents the event window pre-automation and post-automation periods abnormal returns, cumulative abnormal returns as well as their corresponding t-statistics and levels of significance. The pre-automation estimation window standard deviation was 0.0125, while the post-automation estimation window standard deviation was 0.0101.

Table 2: Event Window Effect of SEO Announcements in Nigeria

	Pre-automation Period Return (%)				**Post-automation Period Return (%)**			
Day	*AR*	*t(AR)*	*CAR*	*t(CAR)*	*AR*	*t(AR)*	*CAR*	*t(CAR)*
-15	0.00	0.00	0.00	0.00	-0.86	-0.86	-0.86	-0.86
-14	-1.38	-1.10	-1.37	-1.10	0.50	0.50	-0.36	-0.36
-13	-1.35	-1.08	-2.72	-2.18**	1.09	1.08	0.72	0.72
-12	-2.19	-1.75*	-4.91	-3.93***	1.71	1.69	2.43	2.41**
-11	-0.92	-0.74	-5.83	-4.67***	-0.23	-0.22	2.21	2.18*
-10	-1.06	-0.85	-6.89	-5.51***	2.08	2.06*	4.29	4.25***
-9	-1.68	-1.34	-8.57	-6.86***	-4.37	-4.33***	-0.08	-0.08
-8	1.61	1.29	-6.96	-5.57***	-0.62	-0.62	-0.71	-0.70
-7	-1.39	-1.11	-8.35	-6.68***	-2.14	-2.12*	-2.85	-2.82***
-6	0.25	0.20	-8.10	-6.48***	0.21	0.21	-2.64	-2.61**
-5	-0.93	-0.74	-9.03	-7.22***	-1.85	-1.83*	-4.49	-4.44***
-4	0.25	0.20	-8.77	-7.02***	0.26	0.25	-4.23	-4.19***
-3	-1.12	-0.89	-9.89	-7.91***	-0.14	-0.14	-4.37	-4.32***
-2	-0.88	-0.71	-10.77	-8.62***	-0.47	-0.46	-4.84	-4.79***
-1	-4.54	-3.64***	-15.32	-12.25***	-1.10	-1.09	-5.94	-5.88***
0	-3.33	-2.67**	-18.65	-14.92***	-2.91	-2.88***	-8.85	-8.76***
+1	-1.25	-1.00	-19.90	-15.92***	-1.23	-1.22	-10.08	-9.98***
+2	-2.41	-1.93*	-22.31	-17.84***	0.78	0.77	-9.30	-9.21***
+3	0.32	0.26	-21.98	-17.59***	-0.07	-0.07	-9.36	-9.27***
+4	-0.30	-0.24	-22.28	-17.83***	0.02	0.02	-9.35	-9.25***
+5	0.35	0.28	-21.93	-17.55***	-3.69	-3.65***	-13.03	-12.90***
+6	0.38	0.30	-21.56	-17.25***	-0.30	-0.30	-13.34	-13.20***
+7	0.54	0.43	-21.02	-16.82***	0.78	0.77	-12.56	-12.43***

+8	-0.61	-0.49	-21.64	-17.31***	-2.19	-2.17**	-14.74	-14.60***
+9	0.33	0.26	-21.31	-17.05***	0.66	0.65	-14.09	-13.95***
+10	-0.36	-0.29	-21.67	-17.33***	-0.68	-0.67	-14.77	-14.62***
+11	1.48	1.18	-20.19	-16.15***	-2.35	-2.33**	-17.12	-16.95***
+12	-0.47	-0.38	-20.66	-16.53***	2.32	2.29**	-14.80	-14.65***
+13	1.61	1.29	-19.05	-15.24***	0.01	0.01	-14.79	-14.65***
+14	2.13	1.70*	-16.93	-13.54***	0.61	0.60	-14.19	-14.05***
+15	0.32	0.26	-16.60	-13.28***	0.55	0.54	-13.64	-13.50***

Source: Author's Compilations from E-Views 10 Output, 2020
*,**and*** imply significance at the 10%, 5% and 1% levels respectively.

From Table 2, it can be seen that the pre-automation announcement day abnormal return on day 0 is negative and statistically significant. The table also shows that the corresponding cumulative abnormal return on the announcement day is negative and statistically significant. These results indicate that the Nigerian stock market's reaction to SEO announcements in the period before automation of trading platforms was negative. The table further reveals that almost all the pre-automation abnormal returns and cumulative abnormal returns were negative, cutting across the pre-announcement day and post announcement day periods within the event window.

The second segment of the table shows that the post-automation announcement day abnormal return and cumulative abnormal return were negative and significant. As was the case under the pre-automation period, the post-announcement abnormal return and cumulative abnormal return were predominantly negative. Furthermore, almost all the post-automation period cumulative abnormal returns were negative and strongly significant. However, there were more significant abnormal returns within the event window for the post-automation period relative to the pre-automation period. The results also point strongly to the fact that the market recorded negative reaction on the announcement day for SEOs in Nigeria.

In a nutshell, Table 2 shows that the Nigerian stock market reacted negatively to SEO announcements before and after the automation of trading floors. The evidence of negative announcement day reaction of the market to SEO announcements is in consonance with extant theoretical and empirical evidence that markets experience adverse effects because of investors' perception of the issuing firm's stock as overvalued. Thus, the result of negative market reaction is consistent with Bhana (1998), Rasmussen (2015), Hammar and Perman (2015), Liu, et al.

(2016), Brau and Carpenter (2017), Huang and Chiu (2017), Kumar, Hawaldar and Mallikarjunappa (2018), Width and Arseth (2018) and Ulrich (2018).

The paper also examined for the effect of automation of the Nigerian stock market on the market's reaction to SEOs. To achieve this, the paper tested for difference in market reaction for SEO conducted before automation and after it. Table 3 presents results of the difference test as specified under the methodology

Table 3: Difference Test Results for Effect of Automation on SEO Announcements

	Pre-Automation	***Post-Automation***	***Pre-Post***
MAR	-0.54	-0.44	-0.10
σ	1.44	1.58	-
σ^2	2.07	2.50	-
$\sigma_{pre-post}$	-	-	0.38
T	-	-	-0.26

Source: Author's Compilations from E-Views 10 Output, 2020

Table 3 shows that the mean abnormal returns for the pre-automation and post-automation event windows were both negative, further lending credence to the fact that SEOs induced negative reaction in Nigeria. The table also shows that the difference between the mean abnormal returns in the pre-automation and post-automation windows respectively was -0.10, suggesting that the difference itself was adverse. As can be seen from the table, the t value of -0.26 was not statistically significant at any of the conventional levels. This result indicates that automation of the Nigerian stock market did not significantly affect reaction of the market to SEOs announcements.

Even though no known previous study has specifically examined effect of automation of the Nigerian stock market within the context of value-relevant corporate actions such as SEOs, this finding is, on the general note of efficiency, consistent with those of Odeleye (2009) and Olowe (2009) who found insignificant effect of automation on efficiency of the Nigerian stock market. The insignificant effect of automation on SEOs announcements may be explained by the fact that the automation process did not markedly improve the speed of processing buy or sell orders in the market.

5. Conclusion

This study examined effect of automation of the Nigerian stock market's trading floors on the market's reaction to SEO announcements made between July 1995 and December 2019. Consistent with extant empirical evidence, the study found negative and significant announcement day reaction by the Nigerian stock market. In addition, almost all the days within the event window experienced negative and significant market reaction. It was concluded that the adverse reaction was, irrespective of the reason provided for raising capital through SEOs, perceived by the market as a signal that the issuing firms' assets were overvalued.

The study also found that automation of the Nigerian stock market trading floors has little or insignificant effect on the market's reaction to SEO announcements. This indicates that the reaction of the market to SEOs was essentially the same before and after the trading floors were automated in Nigeria. The study therefore concluded that the deployment of technology in trading does not really matter for emerging stock markets like Nigeria's. The traditional attachment to manual techniques even where information technology is adequate may also have affected the market's response to the announcement.

The study recommends that firms announcing SEOs in Nigeria should clearly specify the reason for which the firm is issuing new capital as well as the intended use of proceeds from the SEO. This is particularly important in reducing the extent of adverse reaction. With adequate disclosure prior to SEO announcements, the market will properly value the effect of new equity issues. For instance, extant empirical evidence has shown that markets react positively to SEOs conducted to finance investment or growth opportunities if the reason for the issue has been effectively communicated to the market.

The study also recommends that it is not enough to merely automate trade platforms in the Nigerian stock market without equally automating the channels of market information dissemination as such channels are at the heart of promptly availing market information to investors and other market participants. It is further recommended that automated trading platforms and other electronic information dissemination channels within the stock market must be constantly upgraded to

meet changing needs and sophistications as the market continues to grow. This is necessary to keep up with the pace of improved investor awareness over the years.

References

Adelegan, O. J. (2009a). Price reactions to dividend announcements on the Nigerian stock markets. *AERC Research Paper Number 188.*

Adelegan, O. J. (2009b). Does corporate leadership matter? Evidence from Nigeria. *AERC Research Paper Number 189.*

Afego, P. (2010). *Stock Price Response to Earnings Announcements: Evidence from the Nigerian Stock Market*, MPRA Paper 33931, University Library of Munich, Germany; available online at http://mpra.ub.uni-muenchen.de/33931/

Agung, I. G. N. (2009). *Time series data analysis using Eviews.* Singapore: John Wiley & Sons Limited.

Ball, R., & Brown, P. (1968). An empirical evaluation of accounting income numbers. *Journal of Accounting Research*, 6, 159-178.

Bhana, N. (1998). Share price reaction to announcements of equity financing by companies listed on the Johannesburg stock exchange. *Investment Analysts Journal*, *48*, 33-42.

Brau, J. C., & Carpenter, J. T. (2017). Equity issuance of healthcare firms after the 2007 market crash and the 2010 Affordable Care Act. *Journal of Health Care Finance, 1*(1), 1-15.

Brooks, C. (2008). *Introductory econometrics for finance* (2nd ed.). Cambridge: Cambridge University Press.

Brown, S. J., & Warner, J. B. (1985). Using daily stock returns: The case of event studies. *Journal of Financial Economics, 14*, 3-31.

Chan, K., & Chan, Y. (2014). Price informativeness and stock return synchronicity: Evidence from the pricing of seasoned equity offerings. *Journal of Financial Economics*, *114*, 36-53.

D,Avolio, G., Gildor, E., & Shleifer, A. (2001). Technology, information production, and market efficiency. *Working Paper, Harvard University.*

De Medeiros, O., & Matsumoto, A. S. (2006). Market reaction to stock issues in Brazil: Insider trading, volatility effects and the new issues puzzle. *Investment Management and Financial Innovations, 3*(1), 142-150.

Denis, D. J. (1994). Investment opportunities and the market reaction to equity offerings. *Journal of Financial and Quantitative Analysis, 24*(2), 159-177.

Dissing, J., Rassmussen, K., & Bartholdy J. (2015). *Are seasoned equity offerings bad news?* (Unpublished Master Thesis). Aarhus University.

Faghani, F., Habibi, S., Tabatabaee, S. M., Razavi, L., & Emadzadeh, K. (2013). The role of information technology on stock market development. *International Journal of Academic Research in Accounting, Finance and Management Sciences, 3*(1), 353-358.

Fama, E. (1965). The behavior of stock market prices. *Journal of Business*, 38, 34-105.

Fama, E. (1970). Efficient capital markets: A review of theory and empirical work. *Journal of Finance*, 25, 383-417.

Fama, E. (1991). Efficient capital markets II. *Journal of Finance*, 46, 1575-617.

Fama, E. (1998). Market efficiency, long-term returns and behavioural finance. *Journal of Financial Economics*, 49, 283-306.

Greene, H. (2003). *Econometric analysis* (5th ed.). New Jersey: Prentice Hall

Gujarati, D.N. (2003). *Basic econometrics* (4th ed.). New York: Mc Graw-Hill Irwin.

Hammar, D., & Perman, O. (2015). *A quantitative analysis of rights offerings on the Swedish market* (Unpublished Master Thesis). Lund University.

Huang, H., & Chiu, H. (2017). Insider trading and the classification of seasoned equity offerings: Evidence from Taiwan. *International Journal of Economics and Finance, 9*(5), 58-70.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance and the market for t akeovers. *American Economic Review, 76*, 323-329.

Kim W., & Weisbach, M. S. (2008). Motivations for public equity offers: An international perspective. *Journal of Financial Economics, 87*, 281-307

Kumar, K. R. N., Hawaldar, I. T., & Mallikarjunappa, T. (2018). Windows of opportunity and seasoned equity offerings: An empirical study. *Cogent Economics and Finance, 6, 1528688.* https://doi.org/10.1080/23322039.2018.1528688

Lee, M., Tsai, T., Chen, J., & Lio, M. (2019). Can information and communication technology improve stock market efficiency? A cross-country study. *Bulletin of Economic Research, 71*(2), 113-135.

Lee, S., Alford, M., & Cresson, J. (2017). The effects of information communication technology on stock market capitalization: A panel data analysis. *Business and Economic Research, 7*(1), 261-272.

Leland, H. E., & Pyle, D.H. (1977). Information asymmetries, financial structure, and financial intermediation. The Journal of Finance, 32*(2), 371-387.*

Liu, J., Akbar, S., Shah, S. Z. A., Zhang, D., & Pang, D. (2016). Market reaction to seasoned offerings in China. *Journal of Business Finance and Accounting, 43*(5&6), 597-653.

Mackinlay, A. C. (1997). Event studies in economics and finance. *Journal of Economic Literature, 35*(1), 13-39.

Mwalya, C. K. (2010). *The impact of information communication technology on stock returns and trading volumes for companies quoted at the Nairobi Stock Exchange* (Unpublished Master Thesis). University of Nairobi.

Myers, S. C., & Majluf, N.S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics, 13*(2), 187-221.

Odeleye, A. T. (2009). The effects of automation on price and volume of stocks in the Nigerian capital market. *Finance & Banking Review, 3*(1&2), 1-18.

Olowe, R. A. (1998). Stock splits and efficiency of the Nigerian stock market. *African Review of Money, Finance and Banking, 1*(1), 97-125.

Olowe, R. A. (2009). The impact of the introduction of the automated trading system on the Nigerian stock market. *Journal of Business Research, 3*(1-2), 54-68.

Omuchesi, J. A., Bosire, M., & Muiru, M. (2014). The effect of automation on stock market efficiency: A case of Nairobi Securities Exchange. *Research Journal of Finance and Accounting, 5*(17), 212-224.

Owido, P. K., Bichnaga, W. O., & Muiruri, M. (2014). ICT and market efficiency: A case study of Nairobi Securities Exchange. *European Journal of Business and Management, 6*(29), 76-85.

Panayides, M., & Gong, X. (2002). The stock market reaction to merger and acquisition announcements in liner shipping. *International Journal of Maritime Economics, 4*(1), 55-80.

Peterson, P. P. (1989). Event studies: A review of issues and methodology. *Quarterly Journal of Business Economics, 28*(3), 36-66.

Width, E., & Arseth, O. A. (2018). *Impact of use of proceeds disclosure in seasoned equity offerings* (Unpublished Master Thesis). Norwegian School of Economics.