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Domestic Retail Investors' Participation and Stock Price Efficiency in Nigeria

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Abstract

This study tests whether retail behaviour affects the stock price and pricing efficiency of stocks on the Nigerian Stock Exchange (NSE) using data on equity from retail investors' market transactions. The Delong, et al. (1990) model is used to measure retail mispricing and stock price efficiency, whereas the Least Squares (LS) and Generalised Least Square (GLS) techniques are used to estimate the static and probability distributed lag (PDL) models. The study finds that in the short run, temporary retail mispricing impacts stock prices and positively affects stock price efficiency. Hence, retail investors' pricing behaviour benefits the equity market in the short-run, but not in the long run. Thus, for sustaining the efficiency of prices in the NSE, retail investors should participate in the equity market and investor literacy programs to enhance their trading skills, which would reduce their losses and enhance their survival in the market over the long term.

Keywords: retail investors, equity price, price efficiency, stock market, Nigeria.

JEL Classification: D53, G12.

1. Introduction

Theoretical and empirical literature remains controversial over the existence and direction of the effect of retail investors' trades on equity price efficiency. The view that retail investors' trades affect equity prices, a phenomenon called retail price impact, was developed in noise trader models of capital asset pricing (Blume & Easely, 2006; DeLong, Shleifer, Summers & Waldmann, 1990; Kogan et al., 2006, 2017; Sadroni, 2000; Shiller, 1989). The common belief of these models is the view that irrational retail investors misprice stocks and therefore cause pricing errors (that is price inefficiency) in the equity stock market. The relevance of the view that a group of investors has price impacts in the stock market is hinged on its economic and theoretical implications. It negates key elements of market quality, that is, the informational and allocative efficiencies of the stock market. Theoretically, it contradicts the views of perfect markets and hence the absence of investor effect, which is held by neoclassical asset pricing models, based on rational expectations. This study quantifies retail pricing errors and tests for the impact on equity pricing errors to ascertain the effect of retail investor presence on the efficiency of equity market price in the NSE.

The major motivation for this study is that an outcome of regulatory programmes of market regulators, the NSE and Securities and Exchange Commission (SEC), which aim at stimulating retail investor participation is substantial retail participation in the Nigerian equity market. From June 2013 to May 2020, the period covered by this

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study, monthly retail investors' portfolio transactions in the Nigerian equity market as a percentage of total domestic transactions ranged between 12% and 77.36% and was between 36% and 46% as a percentage of total transactions (foreign and domestic). Such policy achievements in retail investors' participation may be important for the stock market's qualitative performance. In particular, market liquidity benefits may arise from high retail participation in the equity market (Kaniel, Saar and Titman, 2008). The theoretical proposition that retail investors' trades may have a price impact, and thus, affect the efficiency of stock prices limits the benefits of retailers' participation, as the stock market cannot play its role in the efficient allocation of real resources effectively. There is currently a large and growing literature examining retail price impact, evidencing that the phenomenon is of high concern. However, no study has been carried out on the Nigerian stock market.

The empirical literature on the retail mispricing and equity stock pricing errors relationship proposed by the noise trade models is vast. The expansion has been driven by studies using alternative empirical measures of the theoretical concepts of retail mispricing and different methodologies and environments to generate findings. The current study falls in the group of studies which employ market transaction data to measure retail mispricing. The findings of this group of studies are conflicting. Whereas the conclusion is that retailers misprice, the studies differ on whether the equity-price impact exists or not. Barber, Odean and Zhu (2008) and Kumar and Lee (2006) show that retail trade has a price impact, a finding that contradicts the view that retailers cannot affect prices over the long run either because they do not survive in the long run, as is asserted by the market selection hypothesis (Alchian, 1950; Friedman, 1953); or because retail trades are random and cancel one another (Blume and Easely, 2006: Sandroni, 2000). However, the persistence of retail price impacts has been attributed to a lack of insufficient trades by institutional traders to correct retail pricing errors in noise trader models (Kogan et al., 2006, 2017; Shiller, 1989). In other studies, Chang and Fang (2020), Lien, Hung & Lin (2020), Henker and Henker (2010), and Jackson (2003) find that retail trades have no price impacts.

This study aligns with the assumption that irrational retail investors misperceive the actual distribution of prices. The specific objective of this study, therefore, is to ascertain whether a long-run effect of retail mispricing exists per noise trader models, in the NSE. This study employs actual NSE market data on domestic retail trade in the equity market, the All-Share Index (NSE ASI), and stock dividends and use regression methods to estimate retail price impact. The main contribution to the existing literature is that the study formally estimates retail pricing errors and the price impact by applying NSE market data on monthly retail transactions to Delong et al.'s (1990) theoretical noise trader model. This method addresses the problem of using trade size and signed trades to identify retail trades, an approach deemed inadequate because institutional traders are known to try to hide their trades by making small multiple trades (Barber, Odean & Zhu, 2008; Cready, Kumas, & Subasi, 2014). The study uses the parametric regression technique to identify retail price impacts, and extends from non-parametric methods, the common approach used by market transaction data studies.

The study is organized into six sections. Sections 2 and 3 present the study environment and the review of literature, respectively. Sections 4 and 5 respectively, contain the theoretical framework and methodology, while section 6 is the conclusions and recommendations.

2. The Study Environment

This section presents both the trends in domestic retail investor transactions in NSE equities (DRT) and its co-movement with the stock price variable, the ASI. Domestic retail investor participation is measured using both domestic retail trade transactions, (DRT) as a percentage of total domestic trading transactions in NSE equities (DRTD) and as a percentage of total market transactions in equities in the NSE (DRTOT).

Figure 1 presents graphs of DRT and DRTOT, DRTDT. Examination of the plot of DRT in Figure 1 shows that each period of occurrence of very high DRT is followed by a large decrease in its amounts in several subsequent months. For example, the half-year high of ₦79,05b in July 2014 is followed by very low values amounting to ₦N16.13b, ₦9.92b, ₦17.46b, and ₦36.08b in August 2014 through December 2014 before DRT recovered to ₦60.08b in January 2015. This pattern suggests support for the view that retailers lose wealth, that is the value of their trades reduces due to wrong beliefs and thus does not survive (Alchian, 1950; Blume & Easley, 2006, 2000; Friedman 1953; Kogan et al., 2006).

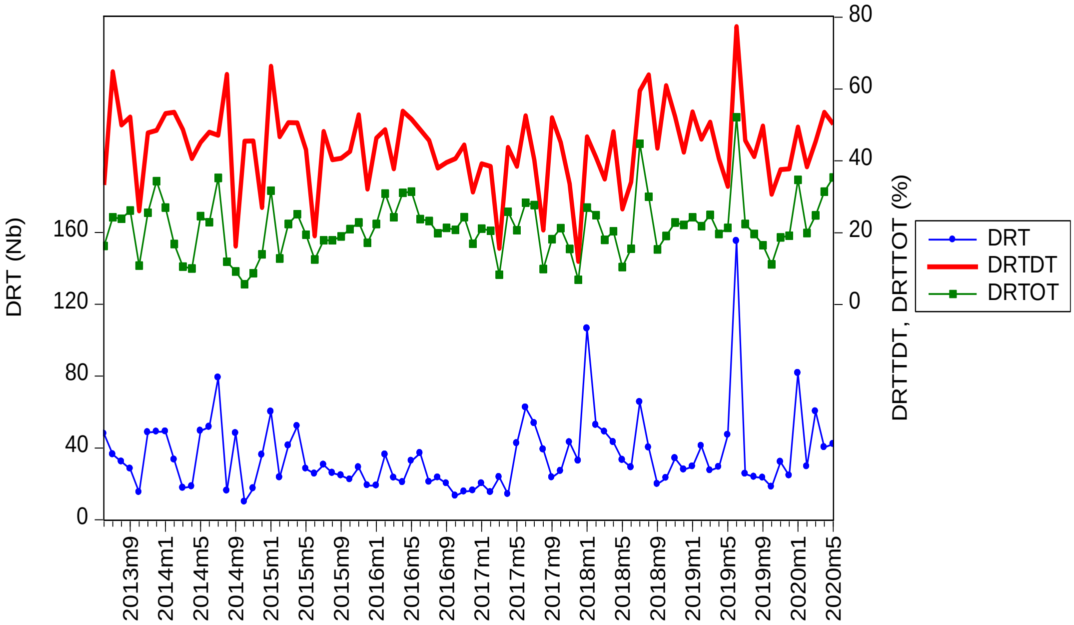

Figure 1: Domestic Retail Trade Transactions in NSE 2013-2020

Source: Author

Furthermore, the graph DRT as a percentage of domestic trading transactions (DRTDT) in the equities market of the NSE, shows very large values but it exhibits high variability. In particular, it attained an all-time high of 77.36% in June 2019, while the lowest value is 12% in December 2017. Such a high proportion of retail trade transactions in the stock market may imply that domestic institutional traders are unwilling to match the trade transactions of retailers. The price impact of retail trade is assumed to be consequent on the unwillingness of institutional traders to take arbitrage trades against retail trades. In contrast, the plot of DRTOT (based on total domestic trades, which includes both domestic institutional investors' transactions as well as foreign investors' transactions), shows the value of the proportion of retail trade transactions was persistently below 40% for the entire period, except in July 2018 and June 2019, when it was 44.78% and 52.19% respectively.

Figure 2 presents graphs of DRT and the NSE All-Share Stock Price Index (ASI).

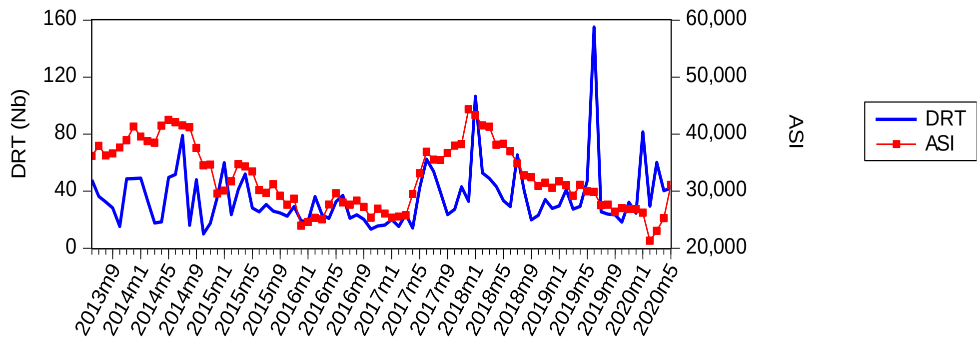

Figure 2: Domestic Retail Transactions and Stock Price in the NSE

Source: Author

Three observations arise from the graphs in Figure 2. One is that over the whole period, stock prices in the NSE display a high variability with persistent downward and upward trends as shown by the graph of ASI. In particular, the plot of ASI indicates that values of the ASI range from the highest value of 44, 344 in December 2017 to 21,300 in February 2020. The value also fell from 42, 483 in May 2014 to 23,916 in December 2015. Second, the NSE ASI tends to display bullish and bearish swings respectively that persist over several months. Specifically, the plot of ASI shows that an upward trend in price persisted from August 2013 to December 2013. Likewise, a downward trend emerged in September 2014 and remained till December 2014, whereas a subsequent price increase in February 2015 persisted till May of the same year. The observed pattern seems to align with the prediction of persistence in stock prices due to noise trader price effects (De long et al., 1990). The third key observation is that the graphs of ASI and DRT show substantial co-movement between DRT and ASI over the whole period. This observation appears to be buttressed by the correlations between monthly values of the NSE ASI and DRT (CORR) measured by the study.

Figure 3 presents bar charts of CORR and a plot of the corresponding values of average annual domestic retail transactions (ADRT). The charts show correlation coefficients that exceed 40% for five of the 8 years graphed in the Figure with values of 2.21% in 2013, 49.78% in 2015, 52.84% in 2017 and 68% in 2018.

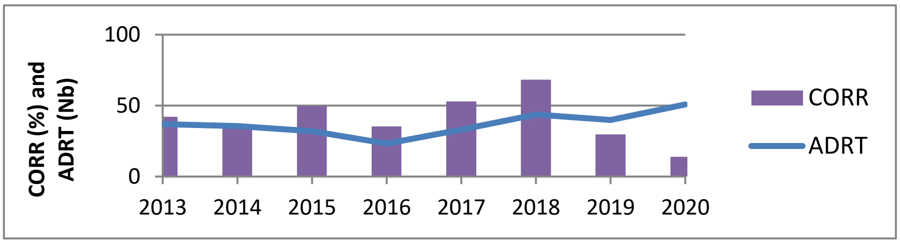

Figure 3: Price Effects on Domestic Retail Transactions in Equities in NSE
Source: Author

The pattern of the correlations appears to support that DRT and ASI are associated. The plots of CORR and ADRT indicate that changes in CORR tend to be in the same direction as changes in ADRT and lend further support to substantial co-movement between the two. Specifically, in 2014, ADRT fell to 35.6 from 36.8 in 2013; in association, CORR decreased to 35.24 from 42.21. The same pattern occurs in 2016 and 2018. The implication is that higher average levels of retail transactions occur in association with higher levels of correlations between retail transactions and the ASI.

3. Literature Review

Noise trader models of Blume and Easely, (2006), Delong et al. (1990), Kogan et al. (2017, 2006), and Shiller (1989) generally consider retailers (also variously referred to as the individual traders, uninformed, irrational or noise traders) as agents in the capital market with non-standard behaviour. These models assume that retailers misperceive the stock prices, and particularly, make trade decisions at prices that drive stocks away from their fundamental value. Three patterns of behaviour typify this set of agents. These are poor forecasting skills, meaning the inadequate capacity to acquire and process information; sentiment trading, referring to trades based on wrong beliefs rather than information-based (that is, noise trading); and herding, which describes correlated trading by retail investors. The noise trader models conclude that retail mispricing is reflected in the equilibrium prices determined in the stock market. The models, therefore, relate pricing efficiency, that is, the extent to which actual stock prices reflect fundamental value to stock mispricing by retailers in stock markets, a phenomenon known as retail price impact.

The empirical evidence on retail trader price impact is provided by investigations of retail traders' pricing behaviour as well as the price impacts of their trades. The studies of retail price impacts, which is the issue for this study, generally make conflicting findings in terms of the existence or not of retail trade price impacts. We examine both types of studies in more detail.

Among the price impact studies, Verma and Verma (2020) examine the response of the pricing errors of the S&P index to both retail and institutional sentiments. The results from the regression analysis show that institutional investors cause pricing errors, but retail investors do not. In addition, the effect of retail investors on pricing error is reported to be positive, whereas that of institutional investors is negative. The authors conclude, based on these findings, that retail investors' trades lack the force to move prices from their fundamental value and that institutional investors improve market efficiency.

Lien et al. (2020) and Verma and Verma (2020) sought to ascertain whose trades move stock prices using data on firms listed on the Taiwan Stock Exchange. The study assumed that trade orders impact stock prices and sought to determine the effect of order submission behaviour of investors; that is, order aggressiveness and trade size, on the price contribution of the trade orders. They also test whether order submission behaviour, as well as price contribution, predicts stock prices. The results of the study are that individual traders account for a large amount, exceeding 80% of price contributions of trades, but despite the large price contribution, their trading lots had no predictive power for future stock performance.

Using a different approach Henker and Henker (2010) examine the effect of retail trading on stock price anomalies in small-capitalization stocks. The authors assert that the price movements in the Australian stock market small-capitalization stocks were an environment likely to have high retail price impacts, based on Lee, Shleifer and Thaler's (1991) finding that small-capitalization stocks are dominated by retail holdings. The study finds from Granger causality analysis of different investor types trades and stock prices that retail investors do not have price effects. The authors provide important evidence against retail trader stock mispricing in settings where there is a high probability of price impacts of retail trades.

Among the studies of retail trading behavioural patterns, Carpentier and Suret (2020) investigated the relative rationality of retail and institutional investors using meta-analysis techniques to ascertain retail trader irrational behaviour proposed by noise trader models to be the basis of retail mispricing. The approach of this study is that the degree of rationality is identified from the responses of investors to the occurrences of two categories of events, each of which has short-lived market reactions, with one category of the event having large negative market reactions and the second does not. The study found larger reactions from stocks with large institutional ownership to the first group of events than to the second set. The authors conclude that the observed behaviour aligns with the convention that the likelihood of investor irrationality is investor skill-based.

Barber et al. (2008) provide evidence on both behaviour of retail traders and the price impacts, using small-sized trades as a proxy for retailers' trading behaviour. Specifically, they analyse the patterns of retail trade order imbalances and movements in returns, in both small-capitalization stocks dominated by retail investors and large-capitalization stocks. The study yields two key findings of retail behavioural patterns and price impacts based on the patterns of retail trade order imbalances. One is that retailers herd and the second is that retail trade order balances predict future returns. Furthermore, the authors find support for poor retail forecasting skills for investments over the yearly period but not over weekly periods. The authors conclude that noise traders can move equity markets. This study raises the existence of variation in retailers' rationality: Retailers may not act in a rationally systematic way over the long run period but they do so over the short run.

Hvidkjaer's (2008) study also finds that stocks sold heavily by retailers earned higher returns than stocks heavily bought by retailers, which is similar to Barber et al. (2008) finding of poor retail forecasting skills. Moreover, for small-capitalization stocks, dominated by retail trades, the difference in stock returns persists for longer periods, which supports poor retail forecasting skills, sentiment trading, and price impacts.

Kaniel, Saar and Titman (2008) investigated the relationship between aggregate net retail trading and stock returns for firms in the NYSE, focusing on short periods. They identify a pattern in retail trading and subsequent returns depicting that retailers make excess returns on the investments over monthly periods. They conclude that individuals are liquidity providers and that retail trade activity was beneficial for market efficiency. In addition, the authors analyse the effect of individual investor sentiment on short-run horizon return reversals and conclude that their results indicate that retail sentiment predicts future returns.

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Jackson (2003), in a study of Australian individual investor trades, finds evidence in support of correlated trading behaviour. Moreover, the study estimated a Vector Autoregressive (VAR) specified for stock returns and stock trade flows from retail brokers as well as mixed brokers and full-service brokers and found that the net trades of retail investors fail to predict future returns. The paper concludes that though small investors are sentiment traders, they are not, particularly over the short-run period, irrational.

The review of the literature indicates that extant studies make findings on retail price impacts using majorly non-parametric techniques. A variation among the studies is also in terms of the use of alternative variables to identify retail mispricing, including sentiments, order submission behaviour of investors and retail transaction volume. This study contributes to the gap in the literature by using a model based on a measure of retail mispricing from the theoretical model of retail price impact, to establish a causal relationship using parametric techniques.

4. Theoretical Framework and Methodology

4.1 Theoretical Framework

The study employed DeLong et al. (1990) optimizing model of noise trader behaviour as a theoretical framework. This model develops the effect of retail investors' participation on stock prices, assuming two types of investors, the noise or retail traders who have a wrong perception of the price distribution of the stocks, and the rational or institutional traders who form accurate forecasts of prices but also takes account of noise traders mispricing. It also assumes that noise traders make up a fraction of the market given by θ , but limited arbitrage due to rational traders' short investment horizons, ensures that rational traders do not trade enough to correct the mispricing of noise traders. The model, therefore, develops theoretical magnitudes of noise traders' mispricing, and the pricing effect as the deviation of observed market equilibrium price from its fundamental value. Based on DeLong, (2005), the model is given as,

$$P_t = FV + \frac{\theta\rho_m}{r} + \frac{\theta(\rho_t - \rho_m)}{1+r} + \frac{2\sigma\,\theta^2\delta^2}{r(1+r)^2} \qquad (1)$$

Where FV is a fundamental value, that is the intrinsic value of the equity stock, $\frac{\theta\rho_m}{r}$ is the discounted value of noise trader misperceptions of long-run prices (that is, equity prices over a long-run period), and yields a price pressure effect because retailers misperceive long-run prices to be bullish. $\frac{\theta(\rho_t-\rho_m)}{1+r}$ is the present value of changes in retail mispricing in the short term in response to news and causes variations in price each period. Also, $\frac{2\sigma\,\theta^2\delta^2\rho_{t+1}}{r(1+r)^2}$ is the present value of the magnitude of the risk of NT mispricing. It causes a permanent deviation of P_t from FV. These three terms together describe retail price misperceptions. Thus, (1) gives the market-clearing equilibrium price P_t, in the presence of retail trader mispricing as a deviation from the fundamental value, (FV) in other words, pricing error caused by retail price misperception.

4.2 Empirical Models

The study's empirical analysis addresses the contending views on whether retail mispricing impacts pricing efficiency. One side of this argument held by noise trader models is that retail misperception of prices results in deviation of the equilibrium market price from the fundamental stock value. The opposing view is that retail traders do not survive so their mispricing cannot determine prices. However, retailer price impacts may be persistent because institutional traders do not make enough trades to correct retail pricing errors (Blume & Easely, 2006;

Kogan et al., 2006, 2017; Shiller, 1989), The empirical analysis starts by specifying pricing errors as a function of all components of retail mispricing (Model 1). Moreover, the study specifies a second model (Model 2) to explain deviations of prices from the fundamental value as a persistent effect of retail short-run price misperceptions. This specification is used to account for the observation that retailers do not appear to survive in the NSE equity market, based on the pattern of retail trade data, in Section 2.

Denoting the stock price efficiency variable $P_t - FV_t$ as P_{Et}, long-run retail price misperception, $\frac{\theta \rho_m}{r}$ as M_{Lt}; the short-run misperception, $\frac{\theta(\rho_t - \rho_m)}{1+r}$ as M_{Lt}, and retail mispricing risk, $\frac{2\sigma\,\theta^2\delta^2}{r(1+r)^2}$ as B_{Mt}, (1) is then expressed as,

$$P_{Et} = F(M_{Lt}, M_{St}, B_{Mt}) \quad (2),$$

Where,

P_{Et} = Pricing errors
M_{Lt} = Price pressure effect of retail behaviour
M_{St} = Temporary retail mispricing effect
M_{Bt} = Retail Risk

(2) is the empirical expression of stock pricing errors. Note that P_{Et}, is specified as a difference variable, that is, the difference between the change in stock prices and the change in fundamental value each period. This specification measures both abnormal bullish and bearish changes in the stock market price above bullish and bearish changes, respectively, in fundamentals.

Model 1*: *Retail Price Impact Model Equity Stock Pricing Errors

Model 1 specifies the deviation of stock prices from the Fv, (P_{Et}) as a linear function of long-run retail mispricing, M_{Lt}, the retail short-run mispricing, M_{St} and retail risk, M_{Bt} . That is,

$$P_{Et} = C_1 + C_2 M_{Lt} + C_3 M_{St} - C_4 M_{Bt} \quad (3)$$

The specification in (3) tests the study's proposition that deviation of equilibrium stock price from the correct value is the effect of retail mispricing. To derive the functional form in (3), the study considers that given the description of price efficiency, stock pricing errors (P_{Et}) may depend negatively or positively on retail long-run mispricing (M_{Lt}), depending on whether retailers are on the average bearish or bullish, respectively (Delong et al., 2005). Thus, the direction of effect is to be empirically determined. M_{St} captures the effect of retail behaviour on equilibrium price and hence in errors in stock price due to temporary retail mispricing. The amount of the variation in equilibrium price explained by M_{St} depends on the variability in short-run price changes and the number of retail investors in the market. In particular, the larger the abnormal short-run bullishness or bearishness of retail investors, the higher the variability of pricing errors. P_{Et} will be a positive or negative function of M_{St}, according to whether retailers are on average abnormally bullish or bearish over the short run. Note that a negative (positive) effect of M_{Lt} (M_{St}) implies that retail long-run mispricing (temporary mispricing) helps improve (reduce) price efficiency (Verma & Verma, 2020). Furthermore, B_{Mt} is expected to affect negatively P_{Et}, given the definition of the latter as a markup on the fundamental value. In particular, since B_{Mt} measures the risk arising from retail behaviour in the market, investors demand higher returns to bear the risk, leading to lower prices, therefore, retail risk causes a decrease in the equilibrium market price and reduces the equilibrium price to its FV.

Apriori Expectation: C_2, $C_3 \lesseqgtr 0$; $C_4 < 0$.

Model 2

Model 2 specifies an effect of retail traders on price efficiency as an alternative view to the market selection hypothesis view (Alchian, 1950; Friedman, 1953) that retailers cannot affect prices because they do not survive. It is used to obtain a measure of the persistent effects of M_{St} on P_{Et}. Specifically, the model specifies P_{Et} as a function of current and lagged values of M_{St}. That is,

$$P_{Et} = C_0 + \sum_{k=0}^{K} C_i L^K M_{St} \quad (4)$$

Where L^k is the lagged operator.

The specification takes the form of a Polynomial distributed lag (PDL), essentially for the numerical purpose to address the collinearity of current and lagged values of M_{St} (Wooldridge, 2002). Equation 4 is thus, expressed in the form of a ρ^{th} order Polynomial distributed lag (PDL) which allows modelling the k lags using a reduced number (ρ) of parameters,

$$P_{Et} = C_0 + C_1 Z_t + C_2 Z_{t-1} + C_3 Z_{t-2} + \ldots + C_{\rho+1} Z_{\rho+1} \quad (5)$$

Where,

$Z_t = M_{St} + M_{St-1} + \ldots + Mt\text{-}k$

$Z_{t-1} = -cM_{St} + (1-c)M_{St-1} + \ldots + (k-c)M_{St-k}$

…

$Z_{\rho+1} = -c^{\rho}M_{St} + (1-c)^{\rho}M_{St-1} + \ldots + (k-c)^{\rho}M_{St-k}$

The constant *c* is added to reduce the number of parameters to be estimated and is derived based on the number of lags k. The coefficients on the k lags of M_{St} in (4), which show immediate and k-lagged effects of short-run mispricing on pricing efficiency are recovered from (5) using the associated almon lag (Wooldridge, 2002). In addition, the measure of the long-run effect of M_{St} on P_{Et} called the long-run multiplier (LRM) is obtained as the sum of the coefficients on the lags.

4.3 Variables for Studying the Effect of Retail Mispricing on Pricing Efficiency

The variables P_{Et}, M_{Lt}, M_{St}, and B_{Mt} are not observable and are generated by the study (Table 1). The variables, P_t, and FV_t in the equation for P_{Et} are respectively observable and not observable, and obtained using the following methods: P_t is correctly proxied by NSE ASI. FV_t is constructed as the sum of $\frac{d}{r}$, the present value of a perpetual dividend (d), and $\frac{2\sigma\delta_\epsilon^2}{r}$, the risk premium of institutional investors in the stock market.

Two groups of variables are used in this study, (Table 1), the price efficiency variables including market price, P_t, the fundamental value, FV_t and pricing errors, P_{Et}, and the retail behaviour variables M_{Lt}, M_{St}, B_{Mt}.

Table 1: Measurement of Variables of the Study

Category	Variable	Description of Variable	Measurement
Price Efficiency	P_t	The equilibrium price in the stock market	NSE All-Share Index
	FV_t	The fundamental value of stock	The sum of the present values of perpetual dividends and institutional investors' risk premium. $\left(\frac{d}{r} + \frac{2\sigma\delta_\epsilon^2}{r}\right)$
	P_{et}	Stock price efficiency	The difference between P_t and FV_t. $(P_t - FV_t)$
Retail Behaviour	M_{Lt}	Price pressure effect on retail behaviour	$\frac{\theta\rho_m}{r}$
	M_{St}	Temporary retail price misperception effect	$\frac{\theta(\rho_t - \rho_m)}{1+r}$
	B_{Mt}	Retail investors risk	$\frac{2\sigma\,\theta^2\delta^2}{r(1+r)^2}$
	Θ	Retail presence in the stock market	(Domestic retail trade transactions divided by total domestic trade transactions) * 100
	ρ_t	The retail pricing error per period	$(P_t = P_{t-1} + e_t) - \theta(\bar{P}_t - P_t)$
	ρ_m		
	Δ		
	Σ	The coefficient of absolute risk aversion	The ratio of excess return on the market to the variance of the market return.
	R	The real risk-free rate	Nigerian 3-month treasury bill rate (TBR) corrected for inflation

Source: Author.

Table 1 shows retail mispricing variables derived based on the definitions in Delong et al. (1990) of the variables θ (retail presence in the stock market) ρ_t and ρ_m (retail long-run mispricing and its long-run average), σ (the coefficient of absolute risk aversion), and δ^2 (the variance of retail misperceptions). θ is measured as a fraction of retail trading transactions in total market transactions, DRTOT. The derivation of ρ_t following Kirman (1991) is given as $[(P_t = P_{t-1} + e_t) - \theta(\bar{P}_t - P_t)]$, where the first term is the retailer's naive price forecasts and the second is optimal forecasts. Furthermore, the derivation of σ, as the ratio of excess risky asset return to the product of the variance of market return and the demand for the risky asset follows Paun, Brasoveanu, and Musettescu (2007). In line with the convention in capital asset pricing literature, r is proxied by the real 3-month treasury bill rate (TBR).

4.4 Data Sources and Econometric Method

Data on domestic retail trade transactions in equity was obtained at a monthly frequency from the NSE over the period June 2013 to May 2020. The NSE ASI and 3-month treasury bill rate (TBR), as well as the Inflation rate, were each obtained at a monthly frequency over the same period from the Central Bank of Nigeria (CBN) Statistical Bulletin. Data on corporate dividends at monthly frequency was also obtained from the Securities and Exchange commission statistical (SEC) bulletin. The econometric analysis uses the two techniques of Least Square (LS) with robust errors and the Generalised Least squares (GLS). The GLS method corrects for the departures of the variables of the study from the Classical Least Square assumptions of zero means and normal distributions (Table 2).

5. Results and Discussion of the Results

The use of time series in econometric study necessitates that a description of the statistical distribution of each variable used in the econometric analysis is conducted, to motivate the econometric model adopted. In addition, the variables were subjected to unit root tests to ascertain the stationarity characteristic of each of the variables, based on the Augmented Dickey-Fuller (ADF) test for Unit roots.

5.1 Summary Statistics and Correlations Among the Variables of the Study

The summary statistics of the variables of the study (Table 2) show that all the variables have non-zero means; and except M_{St}, they all have negative means.

Table 2: Descriptive Statistics of the Variables of the Study

	P_{Et}	M_{Lt}	M_{St}	B_{Mt}
Mean	-83.24999	345530.2	-818935.4	-1.20E+22
Maximum	6101.635	4271502.	8258540.	1.12E+22
Minimum	-5088.334	-659542.9	-14939417	-7.74E+22
Std. Dev.	2072.626	812654.0	3424611.	1.87E+22
Jarque-Bera	4.384490	300.3045	98.54484	49.37278
Probability	0.111666	0.000000	0.000000	0.000000
Observations	82	82	82	82

The maximum and minimum values for each of the variables indicate that all the variables have high dispersion, as also shown by the standard deviations. The variable with the highest standard deviation (1.87E+22) is the Basic mispricing variable, $B_{mt.}$ Based on the associated probability values, the Jarque-Bera tests for normality show that the variables, except for P_{Et}, have non-normal distributions.

Table 3. Estimated Correlations Among the Variables of the Study

	P_{Et}	M_{Lt}	M_{St}	B_{Mt}
P_{Et}	1.000000			
M_{Lt}	-0.070570	1.000000		
	(-0.632776)	-----		
M_{St}	-0.301038	0.053200	1.000000	
	(-2.823547)	(0.476512_	-----	
B_{Mt}	-0.056189	-0.802029	0.252460	1.000000
	(-0.503368)	(-12.01029)	(2.333660)	-----

Note: t-values of estimated coefficients are in parenthesis.

5.2 ADF Tests for Unit Roots Results

The result of the Augmented Dickey-Fuller (ADF) unit roots test in Table 4 shows that all the variables are stationary, and the computed ADF test statistic for each variable rejects the null that the variable is a unit root at the 1% level of statistical significance.

Table 4: Augmented Dickey-Fuller (ADF) Unit Root Test Results
(*Lag Length: Automatic Based on SIC, maxlag =11)*

Variables	Exogenous	Lags	ADF t-Statistic	Prob.[(a)]	Remarks
PE_t	Constant	0	-7.481497*	0.0000	Stationary
M_{Lt}	Constant	0	-4.721119*	0.0002	Stationary
M_{ST}	Constant	1	-2.586760*	0.0999	Stationary
B_{Mt}	Constant	0	-4.848789*	0.0001	Stationary

Notes: ([a]) Probs are MacKinnon one-sided p-values.; (*) = Statistical Significance at the 1% level.

6. Estimated Results and Discussion

6.1 Presentation of Results

This section presents the estimation results and the discussion. Model 1 presents the GLS result, which showed an improvement in the precision of the estimators. The results for Model 2 are from Least Squares (LS) with a robust standard error technique. The PDL form of Model 2 set out in Equation 5 is estimated as a 4-lag, polynomial distributed lag (PDL) of order one. The lag order of 4 rather than higher lags was determined based on the Wald Coefficient restriction and other model parameters and a first-order autoregressive of the dependent variable, $P_{Et}(-1)$, is included in Model 2 to deal with serial correlation. The results for Model 1 are presented in column (1) and the GLS results for Model 2 are presented in column (2) in Table 5.

Table 5: Results from Estimation of Models 1 and 2

The dependent Variable is P_{Et}

Variables	Model 1: GLS Estimates	Model 2: Robust Standard Errors LS Estimates
Z_t		-1.76E-06*** (-2.34)
Z_{t-1}		1.36E-06 (1.49)
M_{Lt}	-0.0004 (-0.85)	
M_{St}	-0.0002*** (-3.29)	-4.5E-06*** (-2.39)
$M_{St}(-1)$		-3.1E-06*** (-2.84)
$M_{St}(-2)$		-1.8E-06*** (-2.34)
$M_{St}(-3)$		-4.0E-07 (-0.32)
$M_{St}(-4)$		9.6E-07 (0.46)

B_{Mt}	-1.21E-20	
	(-0.53)	
$P_{Et}(-1)$		0.57***
		(3.66)
Intercept	-261.26	-40.68**
	(-0.95)	(-1.73)
LRM		-8.8E-06***
		(-2.34)
R^2	0.12	0.35
R^{-2}	0.09	0.32
F-statistic	3.46	13.26
Prob(F-statistic)	(0.02)	(0.00)
Durbin-Watson stat	1.62	1.91

Source*:* Author. Figures in parenthesis () are t-values. (***); (**) denotes statistical significance at the 1% and the 5% level respectively.

Model 1

Column (1) Table 5 presents the results for Model 1 with P_{Et} explained by M_{Lt}, M_{St}, B_{mt} as well as an intercept term. All the estimated coefficients are negatively signed, and rather small, except for the intercept term. The estimated signs do not contradict the study's theoretical expectations that B_{Mt} has a negative effect and that the effects of both M_{Lt} and M_{St} could be of either sign. The negative direction of effect estimated for M_{Lt} contradicts the price pressure effect, which suggests that retail investors are on average bullish over the long run (Delong, 2005; Delong et, 1990). Moreover, based on the t-values, all the variables are statistically insignificant except $M_{St.}$ Specifically, the estimated coefficient on M_{St} amounts to -0.0002 and it is statistically significant. The summary statistics suggest that the model does not perform very well in explaining the monthly variations in stock pricing errors. The adjusted R-Squared statistic is 0.09. The variables are, however, jointly significant in explaining Pricing errors, based on the F-Statistic value of 3.46 and associated probability value of 0.02. The Durbin-Watson Statistic of 1.62 does not support the absence of autocorrelation.

Model 2

The results for Model 2 in Column (2) of Table 5 are the estimated coefficient and t-values for the retail mispricing variables M_{St}, its 4-lags and the associated Long run multiplier (LRM). They also include results for the PDL equation variables, Z_t and Z_{t-1}, the intercept, as well as the autoregressive term, $P_{Et}(-1)$. Z_t is negative, small-sized and significant. But Z_{t-1} is positive and statistically insignificant. The size of the intercept and the autoregressive term, $P_{Et}(-1)$ amounts to 40.68 and 0.57 respectively. Both variables are statistically significant at the 5% and 1% levels, respectively.

The estimated coefficients for current and lagged values of M_{St} are all negative, except for the fourth lagged, and are all very small in magnitudes. Specifically, the immediate effect of a unit change in M_{St} on P_{Et} in the month it occurs is -4.5E-06, and the effect amounts to -3.1E-06 in the first month following, and -1.8E-06 in the second month. Based on the estimated t-values of -2.35, -2.84, and -2.34 respectively, current M_{St} and the first and second lags are statistically significant at the 1% level of significance. The results imply that the change in retail temporary mispricing in one particular month has an immediate impact on pricing errors and the effects persist for two months after the month of change. LRM also has a very small-sized coefficient with a value of -8.8E-06 and is statistically significant based on its t-value of -2.33. This result, in turn, is evidence that retail temporary mispricing has a persistent effect on pricing errors.

The specified model explains 32% of the variation in pricing errors based on the adjusted R-square of 0.32. The F-value of 13.26 supports a rejection of the null hypothesis that the group of explanatory variables are jointly non-significant. The DW statistic of 1.81 shows the absence of serial autocorrelation.

6.2 Discussions of Results

Based on Model 1, the absence of effects of both the long-run mispricing and noise trader risk indicated by the non-significance of the estimated coefficients on M_{Lt} and B_{mt} indicates that the price pressure effect of long-run mispricing and the price deflation effect of noise trader risk cannot be confirmed by this study. The non-significance of these variables may arise from the high correlation between M_{Lt} and B_{Mt}. Given the low amount of variation in P_{Et} which is explained by the model, the grounds for pursuing a remedy to the potential effects of multicollinearity are not obvious. The results may be interpreted to mean that M_{Lt} and B_{Mt} do not affect monthly levels of pricing errors.

Several key findings follow from the estimated results of Model 2. First, is that retail temporary mispricing has a small but important negative immediate impact as well as negative effects over the short run on stock pricing error in the NSE equity market. To see this, note that M_{St} has standard deviation (SD) of 3424611. Therefore, given the definition of pricing errors as a markup over the fundamental value, the results imply that a change in the magnitude of retail investors' temporary mispricing by one SD leads to a reduction in the stock pricing errors by -15.41 units in the month of the change, -10.63 units and -6.2 units respectively, in the first and second months following the month of the change. The key implication of these findings is that retail short-run behaviour reduces stock pricing errors in the short run and is in accord with Verma and Verma (2020). The finding is also supported by the view that retailers tend to forecast market prices correctly in the short run (Barber et al., 2008; Jackson, 2003).

The second finding is that retail investors' mispricing in the short run tends to be dominantly bearish, a fact also supported by the negative mean of the statistical distribution of $M_{St.}$ The associated finding is that the bearish tendency of retail investors over the short run is an important determinant of the tendency for stock prices to be selling over the short run. To see this, note that the definition of pricing errors also gives rise to the implication that in response to a one SD change in retail mispricing in the short run, the equilibrium price reduces by -15.4 units, -10.63 and -6.2 in the month of change and the first and second months following respectively.

The third key finding follows from the implication that a one SD change in retail mispricing in a particular month will cause pricing errors to decrease by -30.14 units at the end of three months based on the -8,8E-06 coefficient on LRM. This is interpreted to mean that the retail temporary mispricing effect on stock prices lasts over the short-run period. The findings from this model thus support the view that retail investors' presence in the stock market may contribute to stock price efficiency in the short-run period. In addition, the non-significant effects of M_{St} after the third month suggest the absence of retail price effects over the long run period. The further implication may be that retail investors do not survive in the stock market over the long run.

The model diagnostics test results for Model1 and Model 2 in Table 6 support the reliability of the estimated models. The Chi-Sq value for a Wald coefficient restriction test shows acceptance of the null that the coefficients of M_{Lt} and B_{Mt} in Model 1 are jointly zero at the 1% level. Furthermore, for both models, the Breusch-Godfrey LM statistic shows the absence of serial autocorrelation at the 1% level. The Breusch-Pagan-Godfrey heteroskedasticity test supports homoskedasticity of the error variances for Model 1 but not Model 2. However, Model 2 was estimated using the White heteroskedastic consistent covariance matrix, which corrects for the misleading and incorrect standard errors problem of heteroskedasticity. In addition, Ramsey's reset test shows evidence of the stability of the two estimated models.

Table 6: Model Diagnostics Tests Results

	Model 2 GLS Estimates		**Model 1 LS Estimates**	
	χ^2 Statistic	***Prob.***	***χ^2 Statistic***	***Prob.***
Wald coefficient Restrictions:				
Null Hypothesis: $M_{Lt} = 0$, B_{Mt} $B_{Mt} = 0$	1.04	0.59		
Breusch-Godfrey Serial Correlation LM Test	10.31	0.24	5.25	0.73
Breusch-Pagan-Godfrey Heteroskedasticity Test	3.08	0.38	0.92	0.02
Ramsey's Reset Test Log likelihood Ratio	0.02	0.88	0.73	0.4031

7. Conclusions and Recommendations

This study considered that the efficiency of financial markets is the principal motivation behind the concern over the price impact of retail investors' trades in equity markets. Hence, it analysed the effect of retail investors' mispricing on pricing errors in the NSE equity market. The study defined pricing errors as a markup over the fundamental value of equity stock and sought to identify whether the variables that capture price impacts of retail mispricing explain pricing errors. The researcher adopted the Delong (1990) Noise trader model to generate both pricing errors, long-run mispricing, temporary mispricing and noise trader risk as to the channels of the effect of retail price misperception on stock prices. These measures of retail mispricing were used as explanatory variables in the static and PDL models of pricing errors. The study finds that temporary mispricing by retail investors had negative immediate and short-run effects on pricing errors but could not confirm the price pressure effect of long-run mispricing nor the price deflation effect of noise trader risk. In addition, the study finds that retail investors may not survive.

The conclusion from these findings is that retail investors' pricing behaviour has efficiency benefits for the stock market over the short-run period but a long-run effect does not exist. The study recommends that regulatory policy by market regulators, the NSE and SEC should encourage retail investors' participation in the equity market as a means of sustaining the efficiency of prices in the NSE. Second, it recommends investor literacy programs directed at enhancing retail investor trading skills, to reduce retailers' investment losses, and hence, their survival in the market over the long-run period.

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