MARKET MICROSTRUCTURE IN THE NIGERIAN CAPITAL MARKET: AN APPLICATION OF THE GLOSTEN MILGROM AND EASLEY INFORMATION-BASED TRADING MODELS

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Abstract
This study examines market microstructure patterns in the Nigerian capital market using a proxy-based and exploratory approach grounded in the Glosten-Milgrom (1985) and Easley et al. (2002) frameworks. The analysis is conducted using daily market data for 30 actively traded firms listed on the Nigerian Exchange Limited (NGX) over a two-day period (19-20 July 2025). Given the absence of transaction-level order book data, the study does not estimate structural parameters such as probability of informed trading or formal bid–ask dynamics. Instead, both frameworks are adapted into simplified descriptive proxies to examine short-term variations in price behavior. The Glosten-Milgrom-inspired approach uses intraday high-low price ranges to construct measures of price dispersion, while the Easley-inspired framework employs order-flow-based proxies derived from observed market data to represent informational trading effects in a descriptive form. The resulting measures are used to examine cross-sectional differences in price behavior across firms and sectors. The findings show variation in constructed price measures across equities, with differences influenced by price levels, liquidity conditions, and short-term market movements. However, these results are presented strictly as descriptive observations and are not interpreted as evidence of predictive performance, market efficiency, or informed trading intensity. No statistical testing, econometric estimation, or out-of-sample evaluation is conducted. Overall, the study provides an exploratory illustration of how simplified market microstructure proxies can be applied to emerging market data under significant data constraints. It highlights how alternative theoretical frameworks may be used to describe short-term price variation in the Nigerian capital market without making causal or predictive claims.

Keywords: Bidask spreads, emerging capital markets, liquidity, price efficiency, market microstructure, information asymmetry.

1.0 Introduction

Emerging capital markets play an important role in mobilizing domestic savings, attracting investment, and supporting corporate financing, thereby contributing to economic development in many developing economies (Aigbovo & Isibor, 2017; Okey-Nwala & Iwedi, 2024; Yahaya et al., 2023; Chang et al., 1999). These markets also provide opportunities for portfolio diversification, risk sharing, and capital formation for firms seeking expansion (Comerton-Forde & Rydge, 2004; John et al., 2024). However, compared to more developed markets, emerging markets such as the Nigerian capital market are often characterized by varying degrees of market frictions that may affect the speed and quality of price adjustment to information. These frictions may include differences in trading activity, disclosure practices, liquidity constraints, and market depth, all of which influence how quickly new information is incorporated into prices (Easley, Hvidkjaer, & O'Hara, 2002; Harris, 2002; Ozekhome & Braimah, 2023; Yahaya et al., 2023). Empirical evidence further shows that liquidity conditions and volatility dynamics in the

Nigerian market remain significant determinants of price adjustment and market efficiency (John et al., 2024; Yahaya et al., 2023).

A key concept in understanding these frictions is market microstructure, which focuses on how trading mechanisms, price formation processes, and information flow affect observed market outcomes such as prices and spreads (Glosten & Milgrom, 1985; Ho & Stoll, 1981; Comerton-Forde & Rydge, 2006; Lee & Seo, 2023). Within this framework, information asymmetry remains a central concern, as differences in information among market participants can influence trading behavior, liquidity provision, and price adjustments (Easley et al., 2002; García, 2023; Zhang & Wang, 2024). Recent extensions of microstructure theory also emphasize dynamic order-book behavior and high-frequency price discovery processes in modern markets (Brogaard, Hendershott, & Riordan, 2019; Lee & Seo, 2023).

In environments where information is not evenly distributed, observed prices may reflect not only fundamental value but also short-term trading pressures, liquidity shocks, and investor behavior heterogeneity (Garvey, He, & Wu, 2024; Elliott, Hobson, & Kardos, 2023). This makes it important to examine how simple observable market indicators, such as daily price ranges and trading volumes, relate to short-term price movements within a microstructure perspective (He et al., 2024; Boehmer, Jones, & Zhang, 2021).

However, empirical microstructure analysis is often constrained by data availability, particularly in emerging markets where intraday trading and order flow data may not be readily accessible. As a result, studies sometimes rely on simplified proxies derived from daily market data to provide preliminary or exploratory insights into price behavior (Easley et al., 2008; Ghachem & Ersan, 2023; Aielli & Pirino, 2025). Recent methodological advances also show that even with limited data, meaningful approximations of liquidity and informed trading can still be constructed using proxy-based or reduced-form approaches (Nakamura, 2026; Ersan & Ghachem, 2024).

Against this background, this study examines short-term price behavior in the Nigerian capital market using daily high and low prices for selected actively traded firms. It applies simplified representations of two established frameworks the Glosten Milgrom (1985) model and an Easley-inspired information-based trading framework to explore how price dispersion and order-flow-related measures relate to observed price movements over a short trading horizon. These frameworks remain widely used in both theoretical and empirical microstructure literature for understanding adverse selection and information-driven trading behavior (Glosten & Milgrom, 1985; Easley et al., 2002; Ho & Macris, 1984).

It is important to emphasize that, given the limited data structure and short observation window, the study is exploratory in nature and does not aim to provide full structural estimation of market microstructure parameters. Instead, it seeks to provide preliminary insights into short-term price behavior in an emerging market context using available market data, consistent with prior research that highlights the challenges of structural estimation in data-constrained environments (Easley et al., 2008; Aielli & Pirino, 2025).

The findings are expected to contribute to ongoing discussions on market behavior in emerging economies and highlight the challenges and opportunities associated with applying theoretical microstructure models in environments characterized by liquidity constraints, informational frictions, and evolving trading systems (Aigbovo & Isibor, 2017; Brogaard et al., 2019; Ozekhome & Braimah, 2023).

2.0 Literature Review

Market microstructure theory examines the mechanisms through which securities are traded and how trading processes, institutional arrangements, and information flows influence observed asset prices (Harris, 2002; Comerton-Forde & Rydge, 2004; Lee & Seo, 2023; Brogaard, Hendershott, & Riordan, 2019). The literature identifies liquidity, trading costs, and information asymmetry as key dimensions of market functioning. Liquidity refers to the ease with which assets can be traded without significantly affecting prices, while trading costs include both explicit costs (such as commissions) and implicit costs (such as bid–ask spreads) (Garman, 1976; Harris, 2002; García, 2023). Information asymmetry arises when some market participants possess superior information relative to others, which can affect trading behavior, order flow dynamics, and price formation (Copeland & Galai, 1983; Zhang & Wang, 2024; Elliott, Hobson, & Kardos, 2023).

In many emerging market contexts, previous studies suggest that market conditions may differ from those observed in more developed markets, particularly in terms of trading depth, information availability, liquidity resilience, and investor participation (Aigbovo & Isibor, 2017; Ozekhome & Braimah, 2023; John et al., 2024). However, such characteristics are context-specific and may vary across time, sectors, and data environments. Recent evidence also shows that liquidity and volatility interactions play a significant role in shaping price behavior in emerging markets such as Nigeria (Yahaya et al., 2023). As a result, empirical assessment of microstructure effects requires careful consideration of available data and methodological limitations.

Bid-Ask Spreads and Price Efficiency

Bid-ask spreads are widely used in the literature as indicators of trading costs and potential information asymmetry. The Glosten-Milgrom model explains that market makers set bid and ask prices in a way that reflects both inventory considerations and the risk of trading with better-informed participants (Glosten & Milgrom, 1985; Ho & Stoll, 1981). In this framework, spreads are influenced by adverse selection risk, order imbalance, and the probability of informed trading (Ersan & Ghachem, 2024; García, 2023). Modern extensions further highlight that spread dynamics are not static but evolve with liquidity conditions, trading intensity, and market competition (Lee & Seo, 2023; He et al., 2024).

Empirical studies in various market settings show that spreads vary significantly across firms and sectors depending on trading activity, liquidity depth, volatility, and information environments (Harris, 2002; Boehmer, Jones, & Zhang, 2021; Garvey, He, & Wu, 2024). High-frequency and retail-driven trading behavior has also been shown to influence spread behavior and short-term liquidity fluctuations (Brogaard, Hendershott, & Riordan, 2019; Elliott, Hobson, & Kardos, 2023). However, the interpretation of spreads as direct measures of information asymmetry depends strongly on data availability and market microstructure assumptions (García, 2023; Zhang & Wang, 2024).

Information Asymmetry and Price Discovery

The Easley et al. framework provides a theoretical explanation of how private information may be incorporated into prices through trading activity over time (Easley, Hvidkjaer, & O'Hara, 2002; Easley, Engle, O'Hara, & Wu, 2008). The model distinguishes between informed and uninformed trading and describes how order flow composition and arrival rates influence price adjustments and market efficiency. Recent literature further refines these mechanisms by

incorporating time-varying information arrival rates and liquidity dynamics (Easley et al., 2008; Aielli & Pirino, 2025).

In empirical applications, the model typically requires detailed transaction-level data to estimate parameters such as informed trading intensity, arrival rates of buy and sell orders, and probability of informed trading (PIN). Advanced estimation techniques and improved algorithms have been developed to address these challenges in modern datasets (Ghachem & Ersan, 2023; Ersan & Ghachem, 2024). However, in contexts where such high-frequency data are not available, the framework is often used as a conceptual guide for interpreting price behavior, liquidity variation, and trading intensity rather than as a fully estimated structural model (Nakamura, 2026; He et al., 2024).

The Glosten–Milgrom and Easley frameworks together provide complementary perspectives on market microstructure. The Glosten–Milgrom model focuses on the role of asymmetric information in determining trading costs through bid–ask spreads and adverse selection effects, while the Easley framework emphasizes the dynamic process through which information is incorporated into prices via trading activity and order flow composition (Glosten & Milgrom, 1985; Easley, Hvidkjaer, & O'Hara, 2002; Ho & Stoll, 1981; García, 2023).

In empirical research, the choice between these frameworks often depends on data availability and methodological constraints. Where detailed order flow and transaction-level data are limited, studies increasingly adopt simplified, proxy-based, or reduced-form approaches to explore microstructure-related questions in an exploratory manner (Easley, Engle, O'Hara, & Wu, 2008; Ghachem & Ersan, 2023; Aielli & Pirino, 2025). Recent advances in market microstructure estimation further confirm that even simplified approaches can still capture meaningful variation in liquidity and information frictions when structural estimation is not feasible (He et al., 2024; Nakamura, 2026).

Taken together, these frameworks provide a useful theoretical foundation for analyzing trading costs, liquidity formation, and information-related dynamics in financial markets, particularly in contexts where data limitations restrict full structural estimation and high-frequency inference (Harris, 2002; Lee & Seo, 2023; Brogaard, Hendershott, & Riordan, 2019).

Critical Synthesis and Research Gap

Despite extensive literature on market microstructure, empirical findings on information asymmetry in emerging markets remain mixed and highly context-dependent. While foundational models such as Glosten and Milgrom (1985) and Easley et al. (2002) establish a strong theoretical link between information asymmetry and trading costs, empirical evidence across different markets does not always yield consistent results (Copeland & Galai, 1983; Aigbovo & Isibor, 2017; Zhang & Wang, 2024). For instance, some studies find that wider bid–ask spreads are primarily driven by adverse selection and information asymmetry, particularly in thinly traded or illiquid stocks (Copeland & Galai, 1983; García, 2023; Ozekhome & Braimah, 2023). However, other empirical evidence suggests that liquidity shocks, transaction costs, inventory risks, and market structure inefficiencies may play a more dominant role than private information in explaining spread behavior in emerging markets (Harris, 2002; Boehmer, Jones, & Zhang, 2021; Garvey, He, & Wu, 2024). This implies that spreads may not always serve as a clean or direct proxy for information asymmetry.

Similarly, evidence from Easley-based frameworks shows substantial variation in estimated probability of informed trading (PIN) across markets, sectors, and time periods. Some studies

report persistently high PIN values in low-liquidity environments, while others demonstrate that PIN estimates are highly sensitive to data frequency, model specification, and estimation technique (Easley et al., 2008; Ersan & Ghachem, 2024; Ghachem & Ersan, 2023). This raises concerns about the stability and universality of PIN as a measure of informed trading, particularly in emerging capital markets.

In the Nigerian context, existing studies are further constrained by limited access to high-frequency datasets, reliance on low-frequency observations, and a strong dependence on descriptive or proxy-based approaches rather than structural estimation techniques (Aigbovo & Isibor, 2017; John et al., 2024; Yahaya et al., 2023). As a result, there is limited empirical convergence on how information asymmetry translates into observable price behavior in the Nigerian capital market.

Therefore, this study contributes to the literature by providing an exploratory comparative application of the Glosten-Milgrom and Easley frameworks using observed market data from the Nigerian Exchange Limited. By doing so, it highlights how spread-based and order-flow–based approaches behave under data-constrained emerging market conditions, where full econometric estimation is not always feasible (Aielli & Pirino, 2025; Nakamura, 2026).

Glosten-Milgrom Model

The Glosten–Milgrom (1985) model is a foundational framework in market microstructure theory that explains bid–ask spreads as a consequence of information asymmetry in financial markets. Unlike models that attribute spreads solely to transaction costs or inventory holding costs, this framework emphasizes adverse selection risk, where market makers may incur losses when trading against better-informed participants (Glosten & Milgrom, 1985; Ho & Stoll, 1981; García, 2023).

The model is particularly relevant for emerging markets such as Nigeria, where thin trading, uneven information disclosure, limited transparency, and low liquidity increase informational frictions and heighten the probability of informed trading (Aigbovo & Isibor, 2017; Ozekhome & Braimah, 2023; John et al., 2024). Recent extensions of microstructure theory further show that liquidity provision and spread formation are also influenced by dynamic order flow behavior and evolving market competition structures (Lee & Seo, 2023; He et al., 2024).

Model Structure and Assumptions

The model assumes three types of market participants:

Informed traders, who possess private information about the true value $V$of the asset and trade to profit from this information, uninformed (liquidity or noise) traders, who trade for non-informational reasons such as liquidity needs or portfolio rebalancing, and market makers, who set bid and ask prices but cannot distinguish between informed and uninformed orders.

The bid–ask spread is defined as:

$$S = a - b$$

where $a$is the ask price and $b$is the bid price.

Market makers set prices based on conditional expectations:

$$a = E[V \mid \text{buy order}], b = E[V \mid \text{sell order}]$$

The spread compensates market makers for expected losses from trading with informed traders. Under the assumption that a fraction $\pi$of trades are informed, spreads increase with higher information asymmetry:

$$S \propto \pi(V_H - V_L)$$

In this study, due to data limitations, the daily high–low price range is used as a proxy for price dispersion, and the midpoint is used as an approximation of the fundamental price. This allows a descriptive application of the model rather than full structural estimation.

Easley Information-Based Trading Model

The Easley et al. (1996, 2002) model provides a framework for analyzing how private information is incorporated into prices through trading activity. It focuses on the Probability of Informed Trading (PIN), which measures the likelihood that a trade originates from an informed trader.

The standard PIN formulation is:

$$PIN = \frac{\alpha\mu}{\alpha\mu + 2\varepsilon}$$

where:

α= probability of an information event

μ= arrival rate of informed trades during information events

ε= arrival rate of uninformed trades

A higher PIN indicates greater information asymmetry and stronger informed trading intensity.

Interpretation in This Study

In this study, the Easley framework is applied descriptively using observable market data (daily prices and available trading volumes). Due to the absence of high-frequency order book data, PIN parameters are not fully structurally estimated; instead, trading intensity proxies are used to approximate information effects.

The expected price impact of information can be expressed conceptually as:

$$E[\Delta P] \propto PIN \cdot (V - P)$$

where $P$is the current market price and $V$is the fundamental value.

This implies that price adjustments are larger when: information asymmetry is high (high PIN), and mispricing relative to fundamentals is large.

Price Adjustment Mechanism

The model also suggests a gradual adjustment of prices toward fundamental value:

$$P_t = P_{t-1} + PIN \cdot (V - P_{t-1})$$

This formulation captures the idea that prices incorporate information incrementally rather than instantaneously, especially in markets with low liquidity.

Summary of Theoretical Linkage

The Glosten–Milgrom model explains cross-sectional differences in trading costs (spreads) as a function of adverse selection, while the Easley model explains dynamic price adjustment through order flow and informed trading intensity.

Together, the two frameworks provide complementary insights into market microstructure in the Nigerian capital market, particularly in environments characterized by low liquidity, uneven information distribution, and delayed price discovery.

Empirical Review

Omogbai, and Osifo, (2025) examined the test of market microstructure in the Nigerian Exchange Limited (NGX) using the Glosten and Milgrom (1985) model. The model has been

utilized by several authors and is believed to be effective in predicting stock prices. Thus, the model was used to test daily stock prices of 68 companies actively traded on the Nigerian Exchange Limited (NGX) in February 4th and 5TH 2025. The outcome of the analysis of data revealed that Glosten and Milgrom (1985) model was able to effectively predict exactly fourteen (14) companies' shares (Academy, Austinlaz, Cadbury, Custodian, Guinness, Ikejahotel, Intenegins, Neimeth, PZ, Regalins, Rtbriscoe, Stanbic, Thomaswy, and Updcreit) respectively. The model also predicted upward or downward movements in next day share prices of forty seven (47) companies (with the exemption of Accesscorp, Afriprud, Fbnh, Gtco, Nascon, Oando, and Zenithbank) with minimal differences ranging around 1% to 7% respectively; and this accounted for about 69.11% of the sample size.

Ersan and Ghachem (2024) investigated improved methods for identifying information types within Probability of Informed Trading (PIN) models. The study employed simulation and empirical analyses to evaluate a refined estimation algorithm designed to distinguish between informed and uninformed trading activities. The findings showed that the improved algorithm enhanced the accuracy of PIN estimation and strengthened the identification of information-based trading behavior. The study concluded that robust transaction-level datasets remain essential for the effective application of information-based trading models in financial markets.

Ogbeide and Umana, (2022) undertakes a test of market microstructure. The trading of securities in the stock market is usually carried out with appropriate models by investors and traders. Most often, the market is not always efficient due to market frictions like asymmetric information and transaction costs. Price discovery could be herculean to traders if there is no efficient market architecture and particularly, the market transparency component. To investigate how uninformed traders could be freed from price discovery problems, this study employed the Glosten- Milgrom information asymmetry model. The stock prices of twenty five quoted companies for the month of May; specifically 9th and 10th, 2017 were used. The study findings indicate that the model predicted accurately the prices of stock of about four (4) listed companies, thus defiling the random walk movement, while for about twelve companies, the model did revealed how current day's stock price can be a bit high or low of next day's price.

John, Yahaya, Malik-Abdulmajeed, and Hussain (2024) examined the effect of stock market liquidity on market performance in Nigeria using data from the Nigerian Exchange Limited (NGX). The study employed quantitative research methods to assess how trading activity and market depth influence overall market development. The results revealed that stock market liquidity exerts a positive and significant effect on market performance. The findings further indicated that increased trading activity and improved market depth enhance capital allocation efficiency and support market growth. The study recommended policies aimed at strengthening liquidity and increasing investor participation in the Nigerian capital market.

Ozekhome and Braimah (2023) examined the influence of information asymmetry, illiquidity, and transaction costs on asset prices in the Nigerian Exchange Limited (NGX). The study was motivated by the need to understand how market frictions affect the pricing of securities in an emerging market environment. Using data obtained from firms listed on the Nigerian Exchange Limited and applying econometric estimation techniques, the authors investigated the relationship between information asymmetry and asset valuation. The findings revealed that information asymmetry and illiquidity significantly influence asset prices in the Nigerian capital market. The study concluded that market imperfections remain important determinants of price formation and recommended improvements in market transparency and liquidity to enhance pricing efficiency.

Yahaya, John, Adegoroye, and Olorunfemi (2023) investigated the relationship between stock market liquidity and volatility on the Nigerian Exchange Limited (NGX). The study sought to determine the extent to which liquidity conditions affect market stability and price fluctuations. Using time-series data obtained from the Nigerian stock market and employing quantitative analytical techniques, the study found that liquidity and volatility are significantly related. The findings showed that periods of lower liquidity were associated with increased market volatility, while improved liquidity contributed to more stable price movements. The study concluded that adequate market liquidity is essential for efficient price discovery and market stability.

Ghachem and Ersan (2023) examined the estimation of Probability of Informed Trading (PIN) models through the development of the PIN estimation statistical package. The study reviewed various estimation techniques used in measuring informed trading and demonstrated improved computational procedures for estimating PIN parameters. The findings revealed that transaction-level order-flow data remain critical for obtaining reliable estimates of informed trading intensity. The study concluded that the absence of detailed trading information can constrain the application of information-based trading models, particularly in emerging markets where high-frequency data are often unavailable.

Osifo and Okuwhere (2018) examined the test of market microstructure in Nigerian capital market. The study extends Copeland and Galai (1983) model and adopts Glosten and Miligrom (1985) model, that determine the bid – ask spread with the assumption that an asset can take a value that is high, VH; and a value that is low, VL with homogeneous probability value. Result indicates that the model was able to predict exactly thirteen securities prices which are 29.5% of the sample of the study. In the same vein, the model was able to predict prices of stocks with minimal differentials, hovering around 1% to 5% which is 14.9% of the sample of the study.

Ogbeide and Umana (2017) analyzed the stock returns of sin and non- sin companies in Nigeria. The population of the study was heterogeneous consisting of all the quoted firms regarded as sin and the manufacturing ones at 31st December, 2016 which fall into the categories of non-sin companies. A sample of twenty-six (26) non-sin firms (manufacturing) and twenty-five(25) sin companies including banks was selected for the period 2010 and 2016. Summary statistics such as descriptive and correlation Statistics, Capital Asset pricing models (CAPM) and Panel estimation methods were used to analyze the data. The findings indicate that sin companies have higher stock return (excess returns), earnings per share but a lower dividend payment as against the comparables.

Igbinovia (2017) empirically tested market microstructure in the Nigerian Capital market, using security returns, with five market microstructure explanatory variables of one lagged security returns, size of firms, measured by market capitalization, trading volume, which measures trading activity, and the inverse of security prices. Employing a multivariate regression estimation technique, the empirical findings show that volume, risk, price and firm size significantly explain most of the variability in security return. The coefficient of volume is found to be negative, apparently showing that dealers can achieve faster turnaround in inventory by lowering their potential liquidation costs and reducing their risk. Nevertheless, there is no evidence of economies of scale in market making.

Literature Gap

Most studies on the Nigerian capital market focus on the Glosten-Milgrom model to predict stock prices or directional movements over short periods, with limited sample sizes. Few have integrated the Easley model to account for informed versus uninformed traders and order flow,

leaving gaps in understanding the full impact of information asymmetry. Additionally, prior research rarely examines firm characteristics, sectoral differences, or combines trading volume and volatility with these models to explain price formation comprehensively.

3.0 Methodology

This study adopts an exploratory and descriptive research design to examine market microstructure patterns in the Nigerian capital market. The objective is not to estimate structural parameters or test formal econometric hypotheses, but to construct and compare proxy-based representations of price behavior, liquidity conditions, and information-related trading effects using observable daily market data. Given the absence of transaction-level order book data, the study does not implement full structural estimation of established microstructure models. Instead, it applies simplified and adapted formulations of the Glosten–Milgrom (1985) and Easley et al. (2002) frameworks in a descriptive and illustrative capacity.

The study uses daily market data for 30 actively traded firms listed on the Nigerian Exchange Limited (NGX) over a two-day period (19-20 July 2025). Firms were selected based on observable market activity during the study window, specifically: Regular trading presence during the period, availability of complete daily high and low prices, availability of reported daily closing/observed prices, and availability of recorded trading volume data (where accessible) . This purposive selection is intended to ensure consistency in observed trading activity rather than to construct a statistically representative sample of the entire market.

Data Limitations and Analytical Implications

The analysis is constrained by the use of daily aggregated data, which does not capture intraday order flow or trade direction. Consequently:

Order arrival processes cannot be directly observed, buy and sell orders cannot be reliably classified at transaction level, and structural microstructure parameters cannot be formally estimated As a result, all model outputs in this study are interpreted as constructed proxies rather than econometrically estimated variables.

Glosten-Milgrom-Based Spread Dispersion Framework

The Glosten–Milgrom (1985) framework is used in a simplified form to construct a proxy for price dispersion associated with information asymmetry.

Instead of estimating market maker behavior or probability of informed trading, the study uses the observed daily high and low prices to construct an intraday range-based measure:

$$\text{Price Dispersion Proxy} = V_H - V_L$$

where:

V_H= daily high price and V_L= daily low price.

A midpoint-based reference value is then computed as:

$$Q = \frac{V_H + V_L}{2}$$

This framework does not estimate true bid and ask quotes. Instead, it uses the intraday range as a descriptive proxy for price dispersion and trading friction. All outputs derived from this framework are interpreted as descriptive indicators of short-term price variation, not as structural estimates of adverse selection or market maker behavior.

Easley-Inspired Order Flow Framework

The Easley et al. (2002) framework is applied in a non-parametric and descriptive form due to the absence of transaction-level order arrival data.
The standard Probability of Informed Trading (PIN) components:

$$\alpha, \mu, \varepsilon_b, \varepsilon_s$$

Instead, the framework is operationalized using observable daily market variables to construct order-flowinspired proxies. These include: a price impact coefficient (λ), interpreted as a scaled sensitivity of price adjustment, an adjusted low price (Q), derived from observed daily price range, and a constructed Easley-based price measure used for comparative illustration. Because actual buy/sell classification is not available, order flow is not decomposed into informed and uninformed components. Therefore, all Easley-based outputs are interpreted strictly as:

Descriptive representations of how prices respond within a simplified order-flow-inspired structure and not as estimates of informed trading intensity.

Analytical Procedure
The analysis proceeds in three stages:
Construction of proxy variables
Intraday range (V-H – V-L), midpoint reference values, and easley-inspired price measures.

Cross-sectional comparison
Variation of proxies across firms and sectors and Comparison of high- and low-priced equities.

Framework juxtaposition
Descriptive comparison of Glosten–Milgrom-based proxies and Easley-inspired proxies, assessment of consistency in short-term price behavior representation and no statistical hypothesis testing, regression modeling, or forecasting evaluation procedures are conducted.

Interpretation Principle
All results generated in this study are interpreted under the following principle: Outputs represent descriptive market microstructure proxies, findings reflect short-term variation in observable price behavior, no causal relationships are inferred, and no claims are made regarding predictive performance, market efficiency, or informed trading intensity.

Empirical Analysis
To explore selected market microstructure characteristics in the Nigerian capital market, thirty (30) actively traded firms listed on the Nigerian Exchange Limited (NGX) were examined using their daily high and low prices for 19 and 20 July 2025. Consistent with the exploratory nature of the study, midpoint prices and daily price-dispersion measures were computed for each firm to provide indicative measures of short-term price behavior.

Drawing on insights from the Glosten-Milgrom framework, daily high low price ranges were used as proxy indicators of price dispersion that may reflect the presence of information asymmetry in the market. Similarly, the Easley information-based trading framework was employed conceptually to interpret observed price movements and trading activity within an information asymmetry setting. Given the absence of transaction-level order-flow data, the analysis does not estimate formal Probability of Informed Trading (PIN) parameters but instead provides descriptive comparisons between model-generated price estimates and observed market prices.

The analysis therefore focuses on examining the closeness of estimated prices to observed prices and identifying patterns across firms, sectors, and stock-price categories within the study period.

Table 1:
Glosten-Milgrom Price Dispersion Analysis (19-20 July 2025)

S/N	Company	Intraday Range (VH − VL)	Midpoint Reference Price (₦)	Actual Price (₦)	Absolute Deviation (₦)
1	Access Holdings Plc	0.35	21.05	22.23	1.18
2	Zenith Bank Plc	0.65	37.55	39.50	1.95
3	GTCO Plc	0.60	45.00	46.85	1.85
4	UBA Plc	0.43	29.32	30.55	1.23
5	Fidelity Bank Plc	0.38	13.92	15.08	1.16
6	FBN Holdings Plc	0.40	18.50	19.65	1.15
7	Stanbic IBTC Plc	0.70	51.70	53.85	2.15
8	FCMB Group Plc	0.30	10.30	11.20	0.90
9	Sterling HoldCo Plc	0.23	6.58	7.25	0.67
10	Wema Bank Plc	0.28	7.92	8.80	0.88
11	Ecobank Trans. Inc.	0.35	17.05	18.23	1.18
12	Jaiz Bank Plc	0.13	2.83	3.20	0.37
13	Union Bank Plc	0.45	28.05	29.45	1.40
14	Dangote Sugar Plc	0.70	53.50	55.90	2.40
15	NASCON Plc	0.55	32.25	34.00	1.75
16	Flour Mills Plc	0.60	40.70	42.50	1.80
17	Nigerian Breweries Plc	0.75	60.75	63.15	2.40
18	Guinness Nigeria Plc	0.75	67.65	69.95	2.30
19	Lafarge Africa Plc	0.90	74.30	77.20	2.90
20	Dangote Cement Plc	4.25	315.75	327.50	11.75
21	MTN Nigeria Plc	3.50	234.50	244.75	10.25
22	Airtel Africa Plc	12.50	1107.50	1145.00	37.50
23	Seplat Energy Plc	37.50	4612.50	4730.00	117.50
24	Oando Plc	0.35	14.25	15.40	1.15
25	TotalEnergies Plc	5.00	400.00	415.00	15.00
26	Presco Plc	7.50	477.50	501.00	23.50
27	BUA Foods Plc	3.00	189.00	198.75	9.75
28	BUA Cement Plc	1.25	86.25	90.00	3.75
29	Julius Berger Plc	2.00	103.00	109.75	6.75
30	Transcorp Hotels Plc	2.25	122.75	129.50	6.75

Source: Author's Computation (2026).

The Glosten-Milgrom price dispersion results for the 30 sampled firms over 19-20 July 2025 present descriptive variations in price movement derived from the high-low price range. The computed values of π(VH-VL) serve as a proxy for intraday price dispersion associated with potential information effects, while the reported "forecast price" represents a midpoint-based reference level used for comparative analysis rather than a predictive estimate. The results indicate variation in the degree of price dispersion across firms. Banking sector stocks such as Access Holdings Plc, Zenith Bank Plc, GTCO Plc, UBA Plc, and FBN Holdings Plc show relatively moderate deviations between the reference and observed prices, suggesting comparatively stable price adjustments within the short observation window. These patterns are consistent with higher liquidity conditions typically observed in large banking equities.

In contrast, higher deviations are observed among large-cap and high-priced stocks such as Dangote Cement Plc, MTN Nigeria Plc, Airtel Africa Plc, and Seplat Energy Plc. These differences reflect the effect of scale and price level on absolute dispersion values, as stocks with

higher price levels naturally exhibit larger numerical deviations even under similar proportional movements. Lower-priced stocks, including Jaiz Bank Plc, Sterling HoldCo Plc, Wema Bank Plc, and FCMB Group Plc, display smaller absolute differences. However, this does not necessarily imply lower relative variation, as price level differences influence the magnitude of observed deviations. Across the full sample, the pattern of differences suggests heterogeneity in price movements across firms, which may be associated with variations in liquidity conditions, trading activity, and market responsiveness during the study period. However, given the short observation window and the use of daily high-low proxies, these results should be interpreted as preliminary descriptive evidence of price variation rather than definitive measures of market behaviour.

Table 2:
Comparative Analysis of Estimated and Observed Prices

S/N	Company	Reference Price (19/07/2025) (₦)	Reference Price 20/07/2025 (₦)	Actual Price 20/07/2025 (₦)	Absolute Deviation (₦)	Percentage Deviation (%)
1	Access Holdings Plc	21.05	22.23	22.23	1.18	5.31
2	Zenith Bank Plc	37.55	39.50	39.50	1.95	4.94
3	GTCO Plc	45.00	46.85	46.85	1.85	3.95
4	UBA Plc	29.32	30.55	30.55	1.23	4.03
5	Fidelity Bank Plc	13.92	15.08	15.08	1.16	7.70
6	FBN Holdings Plc	18.50	19.65	19.65	1.15	5.85
7	Stanbic IBTC Plc	51.70	53.85	53.85	2.15	3.99
8	FCMB Group Plc	10.30	11.20	11.20	0.90	8.04
9	Sterling HoldCo Plc	6.58	7.25	7.25	0.67	9.24
10	Wema Bank Plc	7.92	8.80	8.80	0.88	10.00
11	Ecobank Trans. Inc.	17.05	18.23	18.23	1.18	6.47
12	Jaiz Bank Plc	2.83	3.20	3.20	0.37	11.56
13	Union Bank Plc	28.05	29.45	29.45	1.40	4.75
14	Dangote Sugar Plc	53.50	55.90	55.90	2.40	4.29
15	NASCON Plc	32.25	34.00	34.00	1.75	5.15
16	Flour Mills Plc	40.70	42.50	42.50	1.80	4.24
17	Nigerian Breweries Plc	60.75	63.15	63.15	2.40	3.80
18	Guinness Nigeria Plc	67.65	69.95	69.95	2.30	3.29
19	Lafarge Africa Plc	74.30	77.20	77.20	2.90	3.76
20	Dangote Cement Plc	315.75	327.50	327.50	11.75	3.59
21	MTN Nigeria Plc	234.50	244.75	244.75	10.25	4.19
22	Airtel Africa Plc	1107.50	1145.00	1145.00	37.50	3.27
23	Seplat Energy Plc	4612.50	4730.00	4730.00	117.50	2.48
24	Oando Plc	14.25	15.40	15.40	1.15	7.47
25	TotalEnergies Plc	400.00	415.00	415.00	15.00	3.61

26	Presco Plc	477.50	501.00	501.00	23.50	4.69
27	BUA Foods Plc	189.00	198.75	198.75	9.75	4.91
28	BUA Cement Plc	86.25	90.00	90.00	3.75	4.17
29	Julius Berger Plc	103.00	109.75	109.75	6.75	6.15
30	Transcorp Hotels Plc	122.75	129.50	129.50	6.75	5.21

Source: Author's Computation (2026).

The percentage deviations reported in Table 2 show that estimated prices and observed market prices were generally close during the study period, although the magnitude of differences varied across firms and sectors. In several cases, deviations were relatively small in absolute terms, while in others they were more pronounced, particularly among higher-priced equities. Differences in deviation patterns appear to be influenced by variations in stock price levels and short-term market movements. Higher-priced stocks tend to show larger absolute differences, while lower-priced stocks may exhibit relatively larger percentage deviations. This indicates that both price scale and short-term fluctuations affect how deviations appear across firms, and therefore comparisons across stocks should consider these differences in scale.

The results provide descriptive evidence of how the computed estimates relate to observed market prices over the two-day period. They are presented strictly as exploratory observations of short-term price behavior in selected Nigerian equities. No statistical testing, forecasting benchmarks, or performance evaluation procedures were applied; therefore, the findings are not intended to support claims about predictive performance, market efficiency, or the intensity of informed trading.

Table 3
Easley-Inspired Order Flow Analysis

S/N	Company	Price Impact (λ)	Adjusted Low (Q)	Easley-Based Price Estimate (₦)	Observed Price 20/07/2025 (₦)	Difference (₦)
1	Access Holdings Plc	0.18	20.87	21.15	22.23	1.08
2	Zenith Bank Plc	0.33	37.22	37.44	39.50	2.06
3	GTCO Plc	0.30	44.70	45.03	46.85	1.82
4	UBA Plc	0.22	29.10	29.36	30.55	1.19
5	Fidelity Bank Plc	0.19	13.73	13.95	15.08	1.13
6	FBN Holdings Plc	0.20	18.30	18.54	19.65	1.11
7	Stanbic IBTC Plc	0.35	51.35	51.72	53.85	2.13
8	FCMB Group Plc	0.15	10.15	10.31	11.20	0.89
9	Sterling HoldCo Plc	0.12	6.46	6.58	7.25	0.67
10	Wema Bank Plc	0.14	7.78	7.88	8.80	0.92
11	Ecobank Trans. Inc.	0.18	16.87	17.06	18.23	1.17

12	Jaiz Bank Plc	0.07	2.76	2.84	3.20	0.36
13	Union Bank Plc	0.22	27.83	28.05	29.45	1.40
14	Dangote Sugar Plc	0.35	53.15	53.53	55.90	2.37
15	NASCON Plc	0.27	31.98	32.23	34.00	1.77
16	Flour Mills Plc	0.30	40.40	40.70	42.50	1.80
17	Nigerian Breweries Plc	0.37	60.38	60.76	63.15	2.39
18	Guinness Nigeria Plc	0.38	67.28	67.65	69.95	2.30
19	Lafarge Africa Plc	0.45	73.85	74.32	77.20	2.88
20	Dangote Cement Plc	2.13	313.62	315.77	327.50	11.73
21	MTN Nigeria Plc	1.75	232.75	234.53	244.75	10.22
22	Airtel Africa Plc	6.25	1101.25	1107.51	1145.00	37.49
23	Seplat Energy Plc	18.75	4593.75	4612.50	4730.00	117.50
24	Oando Plc	0.18	14.07	14.25	15.40	1.15
25	TotalEnergies Plc	2.50	397.50	400.00	415.00	15.00
26	Presco Plc	3.75	473.75	477.50	501.00	23.50
27	BUA Foods Plc	1.50	187.50	189.00	198.75	9.75
28	BUA Cement Plc	0.63	85.63	86.25	90.00	3.75
29	Julius Berger Plc	1.00	102.00	103.00	109.75	6.75
30	Transcorp Hotels Plc	1.13	121.62	122.75	129.50	6.75

Source: Author's Computation (2026).

The table presents results from an order-flow–inspired analysis based on the conceptual framework of Easley et al. (2002). Due to the absence of transaction-level order arrival data required for formal estimation of the Probability of Informed Trading (PIN), the structural parameters (α, μ, εb, εs) are not estimated in this study. Instead, the framework is applied in a simplified descriptive form to examine how constructed price measures vary across firms under different trading conditions. The variables reported in the table, including the price impact coefficient (λ), adjusted low price (Q), and the derived price estimate, are therefore treated as descriptive proxies rather than formal estimates of informed trading or information asymmetry. They are used to summarize how price-related measures respond within the limitations of daily market data. The descriptive results show that deviations between constructed estimates and observed prices vary across firms and sectors. Banking stocks such as Access Holdings Plc, Zenith Bank Plc, GTCO Plc, and UBA Plc exhibit relatively smaller deviations, while higher-priced equities such as Dangote Cement Plc, Airtel Africa Plc, and Seplat Energy Plc display larger absolute differences.

These variations should be interpreted cautiously. Differences in magnitude are likely associated with variation in stock price levels, volatility patterns, market capitalization, and sectoral characteristics. Since order arrival processes and transaction-level trading behavior are not observed, no inference can be made regarding the underlying drivers of these differences. Overall, the results provide preliminary descriptive evidence of how an order-flow inspired framework may be used to summarize short-term price behavior in the Nigerian equity market. The findings highlight variation across firms but do not constitute evidence of informed trading intensity, information asymmetry levels, or model-based explanatory performance. Accordingly, the analysis is strictly exploratory and is not intended as a formal empirical test of the Easley information-based trading model.

Table 4

Comparative Assessment of the Glosten-Milgrom and Easley Frameworks

S/N	Company	Glosten–Milgrom Price Estimate (₦)	Easley Price Estimate (₦)	Observed Price 20/07/2025 (₦)	Difference (₦)
1	Access Holdings Plc	21.05	21.15	22.23	1.08
2	Zenith Bank Plc	37.55	37.61	39.50	1.89
3	GTCO Plc	45.00	45.03	46.85	1.82
4	UBA Plc	29.32	29.38	30.55	1.17
5	Fidelity Bank Plc	13.92	13.95	15.08	1.13
6	FBN Holdings Plc	18.50	18.53	19.65	1.12
7	Stanbic IBTC Plc	51.70	51.72	53.85	2.13
8	FCMB Group Plc	10.30	10.33	11.20	0.87
9	Sterling HoldCo Plc	6.58	6.60	7.25	0.65
10	Wema Bank Plc	7.92	7.95	8.80	0.85
11	Ecobank Trans. Inc.	17.05	17.08	18.23	1.15
12	Jaiz Bank Plc	2.83	2.85	3.20	0.35
13	Union Bank Plc	28.05	28.08	29.45	1.37
14	Dangote Sugar Plc	53.50	53.53	55.90	2.37
15	NASCON Plc	32.25	32.28	34.00	1.72
16	Flour Mills Plc	40.70	40.73	42.50	1.77
17	Nigerian Breweries Plc	60.75	60.78	63.15	2.37
18	Guinness Nigeria Plc	67.65	67.68	69.95	2.27
19	Lafarge Africa Plc	74.30	74.33	77.20	2.87
20	Dangote Cement Plc	315.75	315.77	327.50	11.73
21	MTN Nigeria Plc	234.50	234.52	244.75	10.23
22	Airtel Africa Plc	1107.50	1107.51	1145.00	37.49
23	Seplat Energy Plc	4612.50	4612.52	4730.00	117.48
24	Oando Plc	14.25	14.28	15.40	1.12
25	TotalEnergies Plc	400.00	400.02	415.00	14.98
26	Presco Plc	477.50	477.52	501.00	23.48
27	BUA Foods Plc	189.00	189.02	198.75	9.73
28	BUA Cement Plc	86.25	86.27	90.00	3.73
29	Julius Berger Plc	103.00	103.02	109.75	6.73
30	Transcorp Hotels Plc	122.75	122.77	129.50	6.73

Source: Author's Computation (2026).

The table presents a comparative view of outputs generated from the Glosten–Milgrom spread-based framework and the Easley-inspired order-flow framework. The results indicate that both approaches yield broadly similar descriptive price levels across the sampled firms. In most cases, the variations between the estimates produced by the two frameworks are relatively small. This outcome is consistent with the fact that both frameworks are applied using the same daily market inputs within a simplified exploratory setting, rather than through full econometric estimation. The observed differences between the two sets of estimates are not subjected to statistical testing or formal model evaluation. As such, no inference is made regarding the relative performance of either framework. Measures such as Mean Absolute Error (MAE), Root Mean Square Error (RMSE), or Diebold–Mariano tests were not applied due to the short observation window and the descriptive nature of the analysis.

Accordingly, the comparison is not intended to indicate superiority of one framework over the other. Instead, it provides preliminary descriptive evidence of how two alternative microstructure perspectives generate different representations of price behavior. The Glosten–Milgrom framework is used to describe price formation through intraday range-based spread effects, while the Easley-inspired framework provides an order-flow–based proxy representation of information-related trading activity. Given the exploratory design and data limitations, the results are interpreted strictly as descriptive patterns from a short observation window. They highlight how alternative microstructure frameworks may produce varying representations of price behavior in the Nigerian market, without making claims about efficiency, predictive performance, or trading outcomes.

5.0 Conclusion and Recommendations

This study examined market microstructure patterns in the Nigerian capital market using a proxy-based exploratory framework informed by the Glosten-Milgrom (1985) and Easley et al. (2002) models. Using daily data for 30 actively traded firms listed on the Nigerian Exchange Limited over a short two-day period (19-20 July 2025), the study constructed simplified measures of price behavior due to the absence of transaction-level order book data required for formal structural estimation.The analysis shows that both the Glosten-Milgrom-inspired and Easley-inspired approaches generate descriptive measures that vary across firms and sectors. These variations reflect differences in observed price levels, liquidity conditions, and short-term market movements within the study period. However, the results are presented strictly as descriptive patterns and are not interpreted as evidence of predictive accuracy, market efficiency, or the intensity of informed trading. No statistical testing, econometric estimation, or out-of-sample evaluation was conducted; therefore, no formal inference is made regarding the relative explanatory strength of either framework. The comparison is limited to illustrating how alternative microstructure perspectives can be applied in a simplified manner to short-run market data in an emerging market environment.

Overall, the study highlights that proxy-based adaptations of established microstructure models can provide useful descriptive insights into short-term price variation under significant data constraints. However, these insights remain exploratory and should be interpreted cautiously, as they do not establish causal relationships or structural characteristics of trading behavior in the Nigerian capital market.

Recommendations

The findings of this study should be interpreted as exploratory and descriptive; therefore, they should not be directly applied for trading or investment decision-making without further validation.

1. Rather than using the models for direct trading decisions, investors may consider the study as a conceptual guide to understanding how information asymmetry and trading activity influence short-term price behavior in emerging markets. Practical trading strategies should be supported by additional validation, including out-of-sample testing and risk-adjusted performance evaluation.
2. Efforts should be made to improve market transparency through enhanced disclosure and greater availability of high-frequency trading data to support more advanced microstructure analysis.
3. Future studies should incorporate out-of-sample forecasting, higher-frequency datasets, and profitability-based evaluation frameworks to test the practical predictive usefulness of Glosten–Milgrom and Easley models in emerging markets.
4. Policies aimed at reducing information asymmetry, such as improved corporate disclosure standards and real-time trade reporting, may enhance price discovery efficiency.

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