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DOES MARKET INFORMATION RISK INFLUENCE PRICE DISCOVERY FOR STOCKS LISTED AT THE NAIROBI SECURITIES EXCHANGE?

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Abstract

This study sought to determine the influence of market information risk on price discovery for stocks listed at the Nairobi Securities Exchange. Price discovery for financial instruments trading in an exchange remains a widely debated issue in the discipline of finance because of its implications for risk management, portfolio construction, capital allocation, and promotion of societal welfare. This study was guided by market microstructure theory and specifically information based models and descriptive research design. The study population was based on all sixty companies whose stocks trade at the Nairobi Securities Exchange for the period of six months using 60minute intraday data during the continuous trading period. In answering the research question, the hypothesis was tested using regression and correlation analysis. Analysis revealed that the mean value of price discovery (WPC) indicator for the firms listed at the NSE was higher at interval one but had a decreasing trend between interval one and interval three in general implying that there is greater price discovery immediately after the market opened just before the continuous trading period. Furthermore, trend analysis indicate that bid ask spread tend to be higher immediately following the opening of the market and at the near close of the continuous trading period before post-closing auction takes place. The study found a strong relationship between market information risk and price discovery therefore supporting the hypothesis that market information risk significantly influence price discovery of stocks listed at NSE. Based on the results of this study, the government through Capital Markets Authority and other stakeholders should develop appropriate policies in an attempt to design the securities market to enable market participants ease of access to information, enhance information content of stock and improve the process of price evolution during trading.

Key words: Market Microstructure, Market Information Risk, Price Discovery, Stocks Listed at NSE

Background

The view of traditional Finance theory, beginning with the works of Fama (1970), is that prices of securities rapidly and instantaneously reflect new and relevant information about the security. However, on the operationalization aspect, it fails to explain how in the short term information gets impounded in securities prices in the actual market place with trading rules, clearing mechanisms and inherent information asymmetry. Hasbrouck (1995) defines price discovery as the process by which information gets absorbed in prices and finding the equilibrium value of a stock which is a point of consensus or convergence of market participants' beliefs. When there is efficient price discovery then it is expected that securities prices reflect the intrinsic value of a stock and as such the concepts of price discovery and market efficiency are very much tied with the latter describing the arrival speed of equilibrium price. Lehmann (2002) extends the description by Hasbrouck to include efficient and timely incorporation of either implicit or explicit information in securities prices. Madhavan (2000) asserts that price discovery is an economic concept which attempts to explain how in the short-term equilibrium prices are arrived at during the exchange process in the market given the trading mechanisms in place and degree of market information risk and it is better understood when the focus shifts to the rule book as opposed to the simplest economic concepts of demand and supply schedule determining the market clearing price. Easley and O'Hara (2003 & 2004) in a study find that uninformed traders encounter

market information risk because of varying information content of stock especially in a partially-revealing rational expectations model where implicit information risk can affect required return through liquidity and price discovery mechanisms. Every minute, market participants face a risk when they cannot trade at prices which reflect any set of information in their possession at a particular time and this has an impact on trading. Consequently, bid-ask spreads arise and might vary to reduce the implicit market information risk which participants through their representatives face. Further, and on the level of participation of traders, Bhidé (1993) noted that active participants who tend to reduce potential agency related costs by way of self-initiated internal monitoring do also help minimize extant market liquidity through the creation of adverse selection dilemma and market information risk in securities markets. The degree of active participation was partly deduced by the intensity of registered transactions at any given one hour time interval in this study.

Prices in any exchange evolve and eventually equilibrate once trading occurs as captured by Barclay and Hendershott (2008) and Schwartz et al. (2010). In Kenya just like in any other economy, capital markets play a critical role in mobilising funds for implementation of fixed capital projects by either private sector or government, and this will in long term have an impact on the economy. The Nairobi securities exchange (NSE) is Kenya's secondary market where financial securities previously issued in the primary market are reintroduced for trading. These instruments are largely stock and bonds. Derivative instruments which include

futures, swaps, options and forwards are yet to be fully introduced in the Kenyan financial markets. The stock market is particularly critical segment of NSE and therefore it must attempt to either discover or price stocks efficiently in order to attract both local and foreign investors. This study is limited to investigating the nature of the price discovery and how market information risk arising from differential information content of stocks drive the process of price evolution.

Research Problem

Price discovery as an important function of any exchange is undoubtedly one of the understudied and less understood in most emerging stock markets both in terms of its nature and underlying mechanisms that drive the process. Empirical evidence of this dynamic is critical for participants and health of any economy which is partly explained by nature and efficiency of ever evolving stock markets. This study seeks to contribute to knowledge through empirical evidence by undertaking to establish the nature of the price evolution process in Kenya and how market information risk affect the process. As pointed out by Bauwens and Gilt (2000), microstructure issues include the structure and the design of the market, the formation and discovery of prices as well as the costs of timing, disclosure of information and the behaviour of brokers and investors. These items which constitute market microstructure have enormous implication for price discovery and degree of market information risk. It is therefore justifiable to establish how the microstructure model manifests itself in an

emerging market such as NSE. This study is therefore based on the Kenyan stock market which compared to other markets, not only has different attributes but also distinct features as to structure and hence market microstructure as shown in Fidrmuc et al. (2006).

Information asymmetry and its role in explaining price formation process constitute current issues in microstructure research and an important consideration in the design of stock markets. Bekaert and Harvey (2003) noted that there are limited empirical studies on large-section of emerging markets, including Kenya, which could largely be attributed to lack of intraday data which is the standard form of data in the analysis of price discovery process. This methodical aspect and dilemma has now been resolved with the adoption electronic trading for placing and submitting orders at the NSE. Brunnermeier and Pedersen (2005) pointed out that informed investors may have incentives to manipulate stock prices which induce market information risk and this could affect price formation. However, the researchers did not investigate how private information held by a particular group of participants could either impede or enhance price discovery process. Furthermore, information asymmetry which is responsible for adverse selection and moral hazard in a decision process could possibly vary from one market setting to another and this justifies determination of degree of MIR and how it impacts price discovery at the NSE. Needless to say that, microstructure study of NSE has provided an opportunity to focus on intraday features. The objective of the

study was to establish the effect of market information risk on price discovery for stocks listed at the Nairobi Securities Exchange

Theoretical Review of Literature

Inventory and information based models constitute the two paradigms in the theoretical framework of market microstructure theory.

Inventory based models

Inventory models represent a strand of market microstructure theory that investigate the uncertainty in the flow of orders placed by market participants and inventory risk as well as the problem of optimization by suppliers of liquidity and immediacy in the market. There are three perspectives under the inventory paradigm arising from research and literature of three groups of authors; Garman (1976) model, Stoll (1978) model, Ho and Stoll (1981) model and Cohen et al., (1981) model. The critique of inventory based models posits that it has undergone lopsided development due to the dominance of information based approaches to the study of intraday price discovery and adverse selection. The models fail to provide a road map and succinct prediction of how the activities of traders with different strategies and information play out and its implications for market information risk, and price formation.

Information asymmetry based models

Information based theories has its origins in a paper published by Bagehot (1971) where the market makers are faced with liquidity-motivated transactions especially transactions based on inside information and

as such trading entails the cost of information asymmetry. The information based models attempt to explain the behaviour of market participants based on asymmetric information and largely are classified as sequential, strategic and synthetic trade models. A critical consideration in empirical market microstructure literature is an in-depth synthesis of information content of trades. The information based models include Copeland and Galai (1983), Glosten and Milgrom model (1985), Easley and O'Hara (1987), Easley, Kiefer and O'Hara (1996, 1997) and Kyle (1985). It is important to note from the outset that, competitive micro structure models are extension of the Glosten and Milgrom (1985) sequential trading model. The information based trading models and specifically Glosten and Milgrom (1985) and Kyle (1985) form the theoretical anchorage of this study largely because of the limitations of inventory based models and other information based models as presented in the synthesis that follows.

This study was anchored on of Kyle (1985) and Glosten and Milgrom (1985) models. The models theorizes that market makers and uninformed investors experience adverse selection problem when trading with informed participants and this is the genesis of the market information risk and traders are limited in terms of the size of the trade that can be executed at any given trading day. The implication for this is that, informed traders consistently try to take advantage of the information they possess when formulating and eventual execution of buy or sale strategy. The model enables investors to understand how information

mismatch and microstructure frictions can result to poor trade decision when placing quotes

Review of Empirical Literature

Barclay and Hendershott (2003) in a study on price discovery process and trading after hours of selected stocks at NASDAQ investigated how investor decisions to trade after hours or during trading day affect the process through which information gets impounded in security prices. It is estimated that about 4 % of trading volume in this market occurs in the after-hours trading. The NASDAQ market structure is unique compared to the NSE where trading is done through a broker (the ECNs act both as a quasi-stock exchange and broker) and therefore trading is not confined to the exchange hours. The time and stocks used ranged from the trades categorized after hours with March to December together with hours that are normal that is 9.30 am and 4.00 pm the time of east Africa where it was shown that during the pre-open, there is a large amount of private information revealed through trades and price discovery is attributable to this even in the trading day. Information asymmetry generally declines over the day but the authors did not investigate how it impacts price discovery.

Lukanima (2014) undertook a study to establish efficiency of price discovery of an infant security markets with main focus being Tanzania. The researcher used end day all-Share Index which is composed of seventeen companies from the years 2006 to 2011. The author employed Autoregressive Conditional Heteroskedasticity model, Vector Error Correction Model and found

that price discovery mechanism at DSE is inefficient largely because it exhibited long memory effects. The index showed structural shifts which the researcher attributed to stock listings. However, the findings in the words of the author may not be 'sufficient to make a conclusion that DSE is inefficient.' This study was part of the foundation for this study largely because of two reasons. Firstly, using tick by tick data as opposed to end of day index in order to better understand the micro nature of price discovery in emerging stock markets, contextual setting being NSE. Secondly, it will add to the empirical literature by investigating the determinants of price discovery which could be exogenous as well as endogenous using tick based data as opposed to end of day index.

Wei (2017) in studying the investors' diversity especially on their beliefs and how informativeness of the stock prices and found that information regarded private as well as trading precision determines informativeness. It is thus explained that beliefs that are private are either diverse or concentrated and if diverse then accuracy results in the prices of the stock and thus becomes more accurate. However the investors at individual level will tend to rely less to the information regarded private as more information in the prices becomes available.

Gong (2019) in analysing how disclosure at selective basis as well as persuasion disclosure that is fair pricewise to which misinformation and misalignment exist between investors and managers found that managers get flexibility from disclosure that

is selective by choosing among investors who can receive information whereas disclosure which is fair enable managers to be regulated in a manner that he can reveal or allow information to circulate to investors with interest. The conclusion follows that both investors as well as managers prefer sufficient information which gives fair ground to make decisions pertaining investment and trading. Further investors and managers differ where asymmetric information prevails where manager prefer disclosure that is selective and investor prefers disclosure regime that is fair.

Boujelbene and Besbes (2012) in a study that creates asymmetry in information and the determinants based on investors and managers with the use of panel data between 1999 to 2008 and also taking in to consideration SBF 250 firms listed found various factors as determinants in asymmetric information and also showed in random effects that majority of the variables were not significant and that volumes under trade influences in a positive way information asymmetry which is further influenced by stock returns volatility.

Data and Research Methodology

Research Design

In this study, correlational descriptive research design was adopted and the choice was guided by research objectives, nature of data, study variables, and method of data analysis. Kothari and Garg (2014) on research design documents that correlation analysis establishes the joint variation between or among variables of interest in a study. Creswell and Creswell (2017) suggested that many studies in the field of

finance utilize correlational descriptive design. It is also not costly and allows the collection of data from different organizations and facilitates the relationship determination among the key variables.

Population

The study targeted the NSE listed companies from all sectors of the economy in Kenya which were sixty six. These companies source new long term capital from the capital markets by issuing equity or fixed income securities. These instruments subsequently trade at the exchange.

The focus was on stocks and not fixed income securities which include bonds and preference stock and which are issued by listed firms. The price evolution process in the short term for stocks is more complex and highly influenced by information asymmetry, idiosyncratic volatility among other factors as opposed to fixed income securities whose intrinsic values do not largely depart from the posted prices. The unit of analysis therefore was stocks listed at the NSE and involved investigating all stocks listed and trading at the NSE during the continuous trading period.

Data and Data Collection

As pointed out by Burns and Grove (2010), data collection is a systematic gathering of information that is useful in answering research questions and meeting the research objectives. According to the authors, data can be obtained through interviews, questionnaires, focused group discussions, participant observation and secondary sources. This study used historical data that was obtained through observation and real

time recording during the continuous trading session using Microsoft excel sheet as the data collection form. This was instrumental in obtaining data from vendors, and online trading agents through live screens recordings. Empirical investigations of price discovery largely focus on short –term periods, as evidenced in the empirical review of literature. Madhavan (2000) asserts that price discovery is an economic concept which attempts to explain how in the short-term equilibrium prices are arrived at during the exchange process in the market given the trading mechanisms in place and degree of market information risk. The process in essence therefore can be estimated for short term period of a quarter or semi-annual frequency. The intra-day data used was both quote and transactional based. This kind of data was critical in revealing some intra-day regularities at NSE such indicators as; Bid-ask spread (BAS) and weighted price contribution (WPC). The period for this study was six months (January to June 2019) and secondary data of each stock was obtained for each interval. The focus was the continuous trading period at the NSE as from 9.30 a.m to 2.30 p.m. The intraday interval was of sixty minutes translating to five intervals during each trading day which is aptly appropriate for a thinly trading exchange that does not experience high frequency trading that warrant one-minute interval study.

Diagnostic Tests

Diagnostic tests were undertaken in order to establish how well the model fits the sample data. Furthermore, the tests were carried out

to ensure that the study models are statistically robust and all classical assumptions of ordinary least squares are not violated. Specifically, multicollinearity, normality and Stationarity tests were undertaken by way of variance inflation factors, Durbin Watson test and Jarque - Bera tests.

Operationalization of study variables

In microstructure research, most of the concepts are not observable and as such constructs are measured through operationalization of variables of the study. Operationalization generally defines variables into measurable facts. As noted by Bryman (2012), a meaningful way to understand a construct is to consider how other researchers operationalized them in their work as presented in the sections that follow.

Price Discovery

In empirical market microstructure research, there are three popular measures of price discovery. They include WPC, IS, and Variance Ratio (VR). In this study, intraday WPC was utilized as proxy for price discovery over the sixty minute interval in the spirit of Barclay and Warner (1993), Cao et al. (2000), Barclay and Hendershott (2003, 2008), Huang (2002) and Ellul et al (2005) .Unlike IS and VR, WPC methodology provides estimates of price discovery for different intraday intervals. WPC captures the contribution of different periods within a day to the price discovery.

$$WPC_{i,k} = \sum_{t=1}^T \frac{|r_{i,t}|}{\sum_{t=1}^T |r_{i,t}|} * \frac{r_{i,t,k}}{r_{i,t}}$$

Where,

$r_{i,t}$ = Return on stock i on day t . This was computed using the open - to - close weighted average volume price

$r_{i,t,k}$ = Return on stock i in interval k on day t (for $k = 1,2,3,4$ & 5) and ($t = 1 \dots T$).

The returns were computed using transaction (trading) prices in each interval

$\frac{r_{i,t,k}}{r_{i,t}}$ = Measures the contribution of the return in the k th interval relative to the

open - to - close return $r_{i,t}$, on day t

$\frac{|r_{i,t}|}{\sum_{t=1}^T |r_{i,t}|}$ = This term weights the relative importance of information, over the

T day sample period of the open - to - close return on each trading day t .

Market information risk

The field of market microstructure has formulated probability of informed trading, earnings forecast error, and bid ask spread as proxy measure for estimating MIR as documented in Glosten and Harris (1988) and Madhavan et al. (1997). Market information risk was measured at each

interval using bid – ask spread by obtaining the best inside quote as per Abhyankar et al., (1977, 2001) and Llorente et al. (2002). As documented by Russell (2006) and Lunde (2006), bid-ask quotes is a best measure as opposed to transaction prices which suffer from residual noise and bid-ask bounce effects.

$$BAS = \frac{ASK_{i,k} - BID_{i,k}}{\left(\frac{ASK_{i,k} + BID_{i,k}}{2} \right)}$$

Where,

BAS = Bid - Ask Spread

BID = Buying Price in the inside quoted

ASK = Selling price in the inside quote

i = Stock

k = Interval

Data Analysis and Analytical Models

As suggested by Sekaran (2006) and Zikmund et al. (2013), data analysis entails the application of various procedures with the aim of determining consistent patterns and summarizing the relevant outcomes. A simple linear regression analysis was used to determine the relationship between market information risk and price discovery for stocks listed at the Nairobi Securities Exchange. The relationship was determined based on the predictive ability of the model using “F” statistic, coefficient of determination, and the significance of regression coefficient using “t” statistic and p-values at 95% level of confidence.

Data Analysis, Results and Discussion

The results of trend and regression analysis based on the formulated objective and hypothesis are presented in this section.

Diagnostic Tests

Normality Test

In this study the Jarque - Bera method was applied to test for normality of the study variables. For normal distribution the JB statistic is expected to be statistically indifferent from zero.

$$H_0: JB = 0 \text{ (normally distributed)}$$

$$H_1: JB \neq 0 \text{ (not normally distributed)}$$

Rejection of the null for any of the variables would imply that the variables are not normally distributed and a logarithmic transformation is necessary. The results are the presented in the table below.

Table 1: Jarque - Bera Normality Test Results

	BP	AP	BAS	WPC
Jarque-Bera	20.2675	1846.378	567.895	20.96803
Probability	0.00004	0.00000	0.00000	0.000028
Sum	191.6576	12.66647	70.341	7286.903
Sum Sq. Dev.	16.82449	9.687048	12.564	1492.477
Observations	396	396	396	396

Scale; BP=Bid Price, AP=Ask Price, BAS=Bid-Ask spread, WPC=Weighted Price Contribution

The residual values had $p < 0.05$ hence reject the null hypothesis and thus conclude that the residuals were normally distributed. This

therefore rules out the possibility of getting non-standard estimators.

Test of Multicollinearity

This study utilized the variance inflation factors (VIF) tests to assess Multicollinearity state and the outcome. The multicollinearity

assumption has a VIF threshold value of 10 maximum (Gatwirth et al., 2009).

Table 2: Test for Multicollinearity

Model	Collinearity Statistics		Comment
	Tolerance	VIF	
1 (Constant)			
Bid price	.111	9.023	No multicollinearity
Ask price	.113	8.846	No multicollinearity
Bid-Ask Spread	.613	1.631	No multicollinearity

As shown in Table the results revealed no problem of multicollinearity. The variables of the study indicated VIF values of between 1.631 and 9.023 which are less than 10; the figure recommended by the rule of thumb. This indicated that the data set displayed no multicollinearity.

Stationarity Test

This test was necessary since the study employed presumably a continuous time series data recorded over discrete time intervals. This was thus key in establishing stationary point in the variables as a key consideration in regression analysis and or any other statistics at inferential level. Augmented Dickey-Fuller (ADF) test was used in establishing this test of stationarity. The results appended in Table 3

Table 3: Stationarity Tests

	t-statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.367641	
PD 5% level	-4.156910	0.0078
Augmented Dickey-Fuller test statistic	-4.768504	
BAS 5% level	-4.131890	0.0032

Stationary was achieved as shown within the results thus rejecting hypothesis of the unit root at null level thus unit root existence

where Test of critical values are much higher or greater than the Augmented

Dickey-Fuller test statistic) as shown in Table 3.

Intraday Regularities

This section presents a documentation of regularities in the pattern of intraday weighted price contribution and bid ask spread in each of the time interval (k=1, 2, 3, 4 & 5). One of the key questions among many other questions in market microstructure research is; where does price discovery occur during the continuous trading period given trading mechanism in place? The pattern for Weighted Price Contribution (WPC) for the five 60-minute time intervals for the sample stocks listed at the NSE indicate that the mean value of price discovery (WPC) indicator for the firms listed at the NSE was higher in interval one but had a decreasing trend between interval one and three in general. There was further exponential increase between intervals three and four after which falls in subsequent interval five. This depicts that price discovery is high at the Market microstructure theory predicts that prices adjust to information – motivated order flow as proposed by Glosten and Milgrom (1985) and Kyle (1985). In essence, trading is necessary ingredient for mitigating the problem of mispricing in the market. The findings of this study where WPC generally is “U- Shaped” is supported by Chordia, Roll and Subrahmanyam (2005) who found that price adjustments to new information occur substantially within the first few hours of trading and this was attributed to strategic market participants who have the ability to move prices through their trading activity. In the case of Bid –

beginning of trading and towards the end. This is a very important phenomenon at the stock market. The mean WPC is higher in the first two intervals and the last intervals as shown in figure 1. This means that there is greater price discovery immediately after the market opens and followed by the continuous trading period. This finding is supported by Admati and Pfleiderer (1988) who document that when large numbers of informed traders participate, the process of price discovery is enhanced since uninformed players in the market are more willing to trade in an environment of excess liquidity.

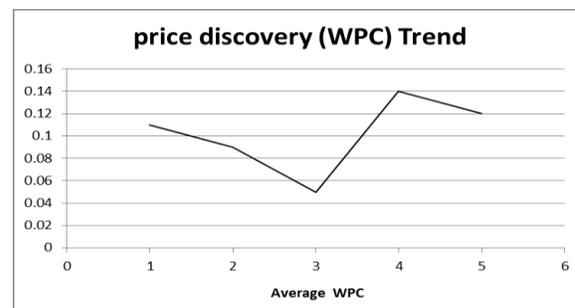


Figure 1

Ask Spread, analysis of pattern over the intervals revealed two significant spikes around the second and fourth intervals as depicted in the figure 2.



Figure 2

The widening of the bid-ask spread reflects the rational response of market information concerning trading risks. Interestingly the existence of two spikes may suggest stock traders are playing the market with misinformation. The subsequent narrowing and then re-widening of the bid-ask spread may suggest traders are reacting too early and profiting from subsequent corrections. From the pattern, it is apparently clear that bid ask spread tend to be higher immediately following the opening of the market and at the near close of the continuous trading period before post-closing auction takes place. This is supported by the findings of Brock and Kleidon (1992, Chan et al. (1993) and Hamao and Hasbrouck (1991) and Hamao and Hasbrouck (1993) is a study of stocks trading at the Tokyo Stock Exchange, found that mean bid ask spread, a measure of market information risk in this study tend to be higher at the beginning and close trading session and this finding was also confirmed by Chan et al. (1993) in a study of NASDAQ stocks. This trend is inconsistent with of Brock and Kleidon (1992) model which predicts that bid ask spreads are wider during opening and towards close.

Results of Regression Analysis and Hypothesis Testing

Simple regression analysis was utilized where market information risk was regressed against price discovery. This process was aimed at testing objective of the study which

was to determine the relationship between market information risk as the predictor variable and price discovery as the outcome variable for stocks listed at the NSE. The null hypothesis that was tested is;

H₁: There is no significant relationship between the market information risk and price discovery.

The proxy for market information risk was bid - ask spread based on inside quotes whereas that of price discovery was measured by weighted price contribution whose composite index was determined through averaging their respective data over the sample period using both intraday transaction prices and end of the day weighted volume average prices. However, before investigating the effect of market information risk on price discovery, the study first determined the effect of individual components of market information risks which were bid price and ask price on price discovery through formulation of the sub hypotheses. This step was critical in establishing the extent to which bid and ask quotes track the price evolution process. The sub-hypotheses are;

H_{1a}: There is a significant relationship between the bid price and price discovery

H_{1b}: There is a significant relationship between ask price and price discovery

Table 4 summarizes the results of the relationship between the bid price and price discovery

Table 4: Regression Results on the relationship between Bid Price and Price Discovery

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.354 ^a	.125	.123	1.73186	.125	56.299	1	394	.000
a. Predictors: (Constant), Bid price									
ANOVA									
Model		Sum of Squares	Df	Mean Square	F	Sig.			
1	Regression	168.858	1	168.858	56.299	.000 ^b			
	Residual	1181.738	394	2.999					
	Total	1350.596	395						
a. Dependent Variable: Price discovery									
b. Predictors: (Constant), Bid price									
Coefficients									
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.			
		B	Std. Error	Beta					
1	(Constant)	-6.292	1.418		-4.437	.000			
	Bid price	9.333	1.244	.354	7.503	.000			
a. Dependent Variable: Price discovery									

Based on results in Table 4, the study found a moderate relationship between bid price and price discovery ($R = .354$). Coefficient of determination ($R^2 = .125$) which indicates that bid price explain 12.5% of variation in price discovery. Further the overall model is significant; $F(394, 1) = 56.299, p < 0.05$. The significant relationship is further manifested by the t-value in the coefficient table ($\beta = 9.333, t = 7.503, p < 0.05$). This therefore depicts that bid price is key in determining price discovery for stocks listed at the

Nairobi Securities Exchange and thus reject the null hypothesis that there is no significant influence of bid price on price. However the constant value is negative implying that there are uncertainties in price discovery process which is a clear indication of the stochastic nature of the process by which prices evolve. The study also determined the influence of ask price on price discovery through a sub hypothesis

H_{1b}: There is a significant relationship between ask price and price discovery. Table

5 summarizes the results of the relationship between ask price and price discovery

Table 5: Regression Results on the relationship between Ask Price and Price Discovery

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.152 ^a	.023	.021	1.82981	.023	9.379	1	394	.002
a. Predictors: (Constant), Ask price									
ANOVA									
Model		Sum of Squares	Df	Mean Square	F	Sig.			
1	Regression	31.403	1	31.403	9.379	.002 ^b			
	Residual	1319.193	394	3.348					
	Total	1350.596	395						
a. Dependent Variable: Price discovery									
b. Predictors: (Constant), Ask price									
Coefficients									
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.			
		B	Std. Error	Beta					
1	(Constant)	-.292	1.512		-.193	.847			
	Ask price	4.107	1.341	.152	3.063	.002			
a. Dependent Variable: Price discovery									

The results in Table 5 found a weak relationship between ask price and price discovery (R= .152). Coefficient of determination ($R^2 = .023$) indicates that ask price explain 2.3% variation in price discovery. However the overall model is significant, $F(354, 1) = 9.379, p < 0.05$. The significant relationship is further manifested by the t-value in the coefficient table ($\beta = 4.107, t = 3.063, p < 0.05$). This therefore

depicts that ask price is key in determining price discovery for stocks listed at the Nairobi Securities Exchange and thus the hypothesis that there is significant influence of ask on price discovery is confirmed though weak.

The study also investigated the overall relationship between market information risk as measured by bid-ask spread and price discovery. The bid – ask spread is the average of the inside quote of the ask price and bid price for each interval during the

sample period. The hypothesis formulated was that;

H₁: There is a significant relationship between the market information risk and price discovery.

Table 6: Regression Results on the relationship between Market information risk and Price Discovery

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.542 ^a	.294	.292	1.55588	.294	163.923	1	394	.000
a. Predictors: (Constant), Market information risk									
ANOVA									
Model		Sum of Squares	Df	Mean Square	F	Sig.			
1	Regression	396.817	1	396.817	163.923	.000 ^b			
	Residual	953.779	394	2.421					
	Total	1350.596	395						
a. Dependent Variable: Price discovery									
b. Predictors: (Constant), Market information risk									
Coefficients									
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.			
		B	Std. Error	Beta					
1	(Constant)	2.653	.152		17.407	.000			
	Market information risk	.511	.040	.542	12.803	.000			

a. Dependent Variable: Price discovery

The results of the regression analysis in Table 6, show a strong relationship between market information risk and price discovery (R= .542). Coefficient of determination (R² =.294) indicates that market information risk explain 29.4 % of the variation in price discovery. Further the overall model is significant (F=163.923, p<0.05) implying that there exists a statistically significant relationship between the predictor and the outcome variable which cannot be attributed to a random process of chance. The significant relationship is further manifested

by the t-value in the coefficient table $\beta = t = (12.803) = .511, p < 0.05$. There is positive significant relationship between MIR and PD and this would imply that price discovery accelerates based on the degree of information disparities communicated through arrival of placed order for each stock. This therefore depicts that market information risk as measured by bid ask spread, is key in determining price discovery for stocks listed at the Nairobi Securities Exchange and as such, the hypothesis that there is significant influence of market

information risk on price discovery is confirmed.

Conclusions

The objective of the study was to determine the relationship between market information risk and price discovery for stocks listed at NSE. Market information risk was measured by bid-ask spread (BAS) derived from inside quote for each stock in the sample. Price discovery was measured using WPC computed by dividing return on stock i on day t computed using the open-to-close weighted average volume price and return on stock i in interval k on day t computed using transaction (trading) prices in each interval. Using a simple linear regression analysis model, the study established a positive statistically significant relationship between market information risk and price discovery.

The study supports information based models. For instance Kyle (1985) presents a model where a single informed investor trades a single asset together with certain number of uninformed noise traders with the source of information being both public and private. The public signal is observed by all market participants, whereas the private information is known only to informed traders. Since profits are generated by using superior information, which is available only to informed traders, an increase in the number of informed traders is expected to result in reduced spreads and returns. While updating their beliefs about future asset values and in quoting prices, traders factor in private information and insider's trading strategy. The findings contradicts with Lukanima (2014) who does not support

significance influence of market information risk by arguing that Information asymmetry generally declines over the day. The findings further support studies of Barclay and Hendershott (2003) whose findings was based on market information risks manifest on the stock market with the argument that there exist greater information asymmetry and a higher ratio of informed trading in the pre-open than any other time of the day and that in post-close period, there is less informed trading, price discovery than the pre-open and majority of the trades are with market makers with large amount of private information through trades and price discovery. The results reveal that for stocks listed at the Nairobi Securities Exchange, price discovery are highly dependent on information content of stocks as exemplified by market information risk.

The findings of this study are useful to various stakeholders including investors, NSE corporate managers, regulators and the government. The effects of market information risk on price discovery as documented in the study help investors and NSE corporate managers when determining factors that contributes mainly to price discovery in an optimal combination. The findings of the study in terms of timing of price discovery revealed an inverted J-Shape (U-Shape) phenomena which means that high speed price discovery was witnessed immediately the market opened and towards the closing time. This finding is critical for regulators and other market participants especially in formulation of trading strategies and in the design of stock markets.

References

- Abhyankar, A. D., Ghosh, E., Levin, E. and R.J.Limmack. (1997). Bid Ask Spreads, Trading Volume and Volatility: Intra-Day Evidence from the London Stock Exchange. *Journal of Business, Finance and Accounting*, 24 (3) & (4), 343-362.
- Barclay, M. & Hendershott, T. (2003). Price discovery and trading after hours. *The Review of Financial Studies* 16, 1041 – 1073.
- Barclay, M. & Hendershott, T. (2008). A comparison of trading and non-trading mechanisms for price discovery. *Journal of Empirical Finance* 15, 839 – 849.
- Barclay, M. J. & Warner, J.B. (1993). Stealth trading and volatility: Which trades move prices? *Journal of Financial Economics* 34, 281 – 305.
- Barclay, M. J., & Hendershott, T. (2003). Price discovery and trading after hours. *The Review of Financial Studies*, 16(4), 1041-1073.
- Bauwhede, H., & Willekens, M. (2008). Disclosure on corporate governance in the European Union. *Corporate Governance: An International Review*, 16(2), 101-115.
- Bekaert, G. & Harvey, C. R. (2003). Emerging market finance. *Journal of Empirical Finance* 10, 3-55.
- Bekaert, G., & Harvey, C. R. (2003). Emerging markets finance. *Journal of empirical finance*, 10(1-2), 3-55.
- Bhide, A. (1993). The hidden costs of stock market liquidity. *Journal of financial economics*, 34(1), 31-51.
- Boujelbene, Y., & Besbes, L. (2012). The determinants of information asymmetry between managers and investors: a study on panel data. *IBIMA Business Review*, 2012, 1.
- Brockman, J. E. (2009). What have you changed your mind about?: Today's leading minds rethink everything. HarperPerennial.
- Brunnermeier, M. K., & Pedersen, L. H. (2005). Predatory trading. *The Journal of Finance*, 60(4), 1825-1863.
- Burns, A. C., & Bush, R. F. (2010). *Market research*, 6th edn.
- Cao, C., Ghysels, E., & Hatheway, F. (2000). Price discovery without trading: Evidence from the Nasdaq pre-opening. *Journal of Finance* 55, 1339 – 1365.
- Cao, Z., Leng, F., Feroz, E. H., & Davalos, S. V. (2000). Corporate governance and default risk of firms cited in the SEC's Accounting and Auditing Enforcement Releases. *Review of Quantitative Finance and Accounting*, 44(1), 113-138.
- Charumati, B. (2012). On the determinants of profitability of Indian life insurers: An empirical study. u: *Proceedings of the World Congress on Engineering*. London UK, 1.
- Chordia, T., Avanidhar, S., & Ravi, A. (2001). Trading Activity and Expected Stock Returns. *Journal of Financial Economics*, 59, 3-32
- Chordia, T., Huh, S. W., & Subrahmanyam, A. (2007). The cross-section of expected trading activity. *The Review of Financial Studies*, 20(3), 709-740.
- Cohen, K., S. Maier, R., S., & Whitcomb, D. (1981). Transaction Costs, Order Placement Strategy, and Existence of the Bid-Ask Spread. *Journal of Political Economy*, 89.
- Copeland, T., & Galai, D., (1983). Information effects on the bid-ask spread. *Journal of Finance* 38, 1457-1469.
- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Easley D, O'Hara M, Engle R, & Wu L (2008): Time Varying Arrival Rates of Informed and Uninformed Traders. *Journal of Financial Econometrics*, 6:171–207.

- Easley, D., & O'Hara, M., (1987). Price, trade size, and information in securities markets. *Journal of Financial Economics* 19, 69-90.
- Easley, D., & O'Hara, M., (1991). Order form and information in securities markets. *Journal of Finance*, 46, 905-928.
- Easley, D., & O'Hara, M., (1992). Time and the process of security price adjustment. *Journal of Finance* 47, 577-606.
- Easley, D., Engle, R., F., O'Hara, M., & Wu, L., (2008). Time-Varying arrival rates of informed and uninformed trades. *Journal Financial Economics*, 6(2), 171-207
- Easley, D., Hvidkjaer, S., & O'hara, M. (2002). Is information risk a determinant of asset returns?. *The journal of finance*, 57(5), 2185-2221.
- Easley, D., Kiefer, N., & O'Hara, M., (1996). Cream-skimming or prot-sharing? The curious role of purchased order ow. *Journal of Finance* 51, 811-833.
- Easley, D., Kiefer, N., & O'Hara, M., (1997). One day in the life of a very common stock. *Review of Financial Studies* 10, 805-836.
- Ellul, A.; Shin, H. & Tonks, I. (2005). Opening and closing the market: Evidence from the London stock exchange. *Journal of Financial Quantitative Analysis*, 40, 779 – 801.
- Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *Journal of Finance* 25, 383-417.
- Fidrmuc, J. P., Goergen, M., & Renneboog, L. (2006). Insider trading, news releases, and ownership concentration. *The Journal of Finance*, 61(6), 2931-2973.
- Garman, M.B. (1976). Market Microstructure. *Journal of Financial Economics* 3(3), 257-275
- Glosten, L. & Harris, L. (1988). Estimating the components of the bid/ask spread. *Journal of Financial Economics* 21(1), 123-142.
- Glosten, L. & Milgrom, P. (1985). Bid, ask, and transaction prices in a specialist market with heterogeneously informed traders. *Journal of Financial Economics* 14(1), 71 -100.
- Glosten, L. (1994). Is the electronic open limit order book inevitable? *Journal of Finance* 49(4), 1127- 1161.
- Glosten, L. R., & Milgrom, P. R. (1985). Bid, ask and transaction prices in a specialist market with heterogeneously informed traders. *Journal of financial economics*, 14(1), 71-100.
- Glosten, L.; Jagannathan, R. & Runkle, D. (1993). On the relation between the expected value and the volatility of the nominal excess return on stocks. *The Journal of Finance* 48, 1779-1801.
- Gong, Y. (2019). Which is better, selective disclosure or fair disclosure? The effects of information asymmetry and incentive misalignment. *Asia-Pacific Journal of Accounting & Economics*, 1-25.
- Hansen, P. R., & Lunde, A. (2006). Realized variance and market microstructure noise. *Journal of Business & Economic Statistics*, 24(2), 127-161.
- Hasbrouck, J. (1991). The summary informativeness of stock trades: An econometric analysis. *The Review of Financial Studies*, 4(3), 571-595.
- Hasbrouck, J. (1995). One security, many markets: Determining the contribution to price discovery. *Journal of Finance*, 50(4), 1175-1199
- Hasbrouck, J. (2007). *Empirical Market Microstructure: The Institutions, Economics, and Econometrics of Securities Trading*. New York: Oxford University Press.
- Ho, T. S., & Stoll, H. R. (1983). The dynamics of dealer markets under competition. *The Journal of finance*, 38(4), 1053-1074.
- Ho, T., & Stoll, H. R. (1981). Optimal dealer pricing under transactions and return uncertainty. *Journal of Financial economics*, 9(1), 47-73.

- Huang, P., & Lu, Y. (2020). Institutional blockholders and the variability of firm performance. *International Journal of Managerial Finance*.
- Kothari, C., & Garg, G. (2014). *Research Methodology: Methods and Strategy*. New age international.
- Kyle, A., (1985). Continuous auctions and insider trading. *Econometrica*, 53, 1315-1335
- Lehmann, B. N. (2002). Some desiderata for the measurement of price discovery across markets. *Journal of Financial Markets*, 5(3), 259-276.
- Lok, E., & Kalev, P. S. (2006). The intraday price behaviour of Australian and New Zealand cross-listed stocks. *International Review of Financial Analysis*, 15(4-5), 377-397.
- Lok, E., & Kalev, P. S. (2006). The intraday price behaviour of Australian and New Zealand cross-listed stocks. *International Review of Financial Analysis*, 15(4), 377-397.
- Lukanima, B. K. (2014). Price Discovery and Memory Effects in Infant African Stock Markets: Evidence from Tanzania. *International Journal of Economics and Finance*, 6(11), 36.
- Madhavan, A. (2000). Market microstructure: A survey. *Journal of Financial Markets* 3 (3), 205-258.
- Madhavan, A., Richardson, M., & Roomans, M. (1997). Why do security prices change? A transaction-level analysis of NYSE stocks. *The Review of Financial Studies*, 10(4), 1035-1064.
- Milgrom, P., & Stokey, N. (1982). Information, trade and common knowledge. *Journal of Economic Theory*, 26(1), 17-27.
- Rusell, J. L., Stouffer, R. J., & Dixon, K. W. (2006). Intercomparison of the Southern Ocean circulations in IPCC coupled model control simulations. *Journal of Climate*, 19(18), 4560-4575.
- Schwartz, R., Wolf, A. & Paroush, J. (2010), "Dynamic process of price discovery in an equity market", *Managerial Finance*, Vol. 36 Iss 7 pp. 554 – 565
- Sekaran, U. (2006). *Research methods for business: Business research methodology*. YM Kwan (Trans.). Jakarta, Indonesia: Salemba Empat.
- Stoll, H. R. (1989). Inferring the components of the bid-ask spread: Theory and empirical tests. *the Journal of Finance*, 44(1), 115-134.
- Stoll, H., (1978). The supply of dealer services in securities markets. *Journal of Finance*, 33, 1133-1151
- Wei, X. (2017). How does the diversity of investors' beliefs affect stock price informativeness?. *Applied Economics*, 49(6), 515-520.
- Zikmund G. w. (2009). *Business Research Methods*, 7th Edition. New Dheli, Cengage Learning India private limited.
- Zikmund, W. G., Carr, J. C., & Griffin, M. (2013). *Business Research Methods (Book Only)*. Cengage Learning.