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*Market Information Risk, Trading Activity and Organizational Characteristics: Combined influence on Price Discovery for Stocks Listed at the Nairobi Securities Exchange*

Dr. Ronald Chogii

**Market Information Risk, Trading Activity and Organizational Characteristics: Combined influence on Price Discovery for Stocks Listed at the Nairobi Securities Exchange**

*By: Dr. Ronald Chogii (PhD)* [1]

*Abstract*

*This study sought to determine the combined influence of Market Information Risk, Trading Activity and Organizational Characteristics on Price discovery for stocks listed at the Nairobi Securities Exchange. Besides being one of the yardsticks for assessing the quality of financial decisions by management in the maximization of shareholders wealth, stock markets around the world provide unparalleled investment destinations for investors. Consequently, the structure and design of a financial market for stocks must continuously attempt to discover efficient market clearing prices. 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 formation, preservation and 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 a period of six months using 60-minute intraday data during the continuous trading period. The hypothesis that was tested stated that there is no significant joint effect relationship of market information risk, trading activity and organizational characteristics on price discovery using a stepwise regression analysis. In establishing joint effect Bid-ask spread, trading volume, number of transactions, stock return volatility and ownership concentration were investigated individually and jointly. The results showed significant independent effects of market information risk, trading activity, organizational characteristics on price discovery and further it was established that the joint effect had a higher significance as compared to individual effects thus supporting the hypothesis. 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, liquidity and improve the process of price formation.*

*Keywords:    Market Microstructure, Trading Activity, Market Information Risk, Price Discovery, Stocks Listed at NSE, Intraday Regularities.*

## 1. Introduction

Price discovery and asset pricing for financial instruments trading in an exchange still remains a widely debated topic in the discipline of finance because of its implications for risk management, regulation, portfolio construction, capital allocation, and promotion of societal welfare (Subrahmanyam and Titman, 2001; Chen et al., 2007). Stock markets all over the world provide unparalleled investment destination for investors besides being one of the yardsticks for assessing

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[1]*Lecturer, Department of Finance & Accounting, University of Nairobi, Kenya, Kenya. E-mail*: *rchogii@uonbi.ac.ke*

the quality of fiduciary decisions of management in their pursuit of maximization of shareholders wealth. This is true for capital markets in an emerging economy like that of Kenya and especially the stock market which at least must strive to have the capacity to continuously attempt to discover prices of securities which do not depart from their intrinsic values, at least in part, given microstructure frictions. Price discovery in stock markets begins when participants arrive in the market either physically or virtually to engage in the process and activity of trading. Placement of orders signal a trade, and this generates trading activity which in market microstructure research is captured by trading volume, number of transactions, and turnover according (Beaver, 1968; Jones et al., 1994; Chordia et al., (2007); Agarwal, 2009). Furthermore, by inference, trading in itself is a vital source of information (Karpoff, 1986). However, this trade generated information may not be reflected in prices at any given point in time thus presenting a potential implicit market information risk that participants face and consequently the risk will be reflected in quoted bid and ask prices with the orders presumed to be generated based on any set of information that participants possess and how they interpret it (Vo, 2007). This implies that listed stocks will likely have multiple prices and the equilibrium price at any interval of time will, in reality, be arrived at through the trading mechanisms offered by the exchange.

There are predominantly two theories that attempt to explain asset pricing for securities trading in an exchange, and they include the efficient market hypothesis and market microstructure theory. This study was grounded on information-based models of market microstructure theory which prescribe how potential traders, whether in an auction or dealer market formulate trading strategies based on information set that they possess. It also explains behavioral tendencies of traders in a setting with information asymmetry which is the genesis of adverse selection, trading risk and intensity of trading activity that is usually deduced from the placed orders and prices quoted (Hasbrouck ,2013; O'Hara ,2015). In the heart of market microstructure analysis is the recognition that every market does not have homogeneously informed traders, and this implies that placement of orders and trades convey information which affects prices of listed stocks (Hasbrouck, 1991). Market information risk partly arises from asymmetric information prevalent in the stock market and the resultant difference in liquidity over time and between stocks trading in an exchange. Easley et al. (2002) describes market information risk as the possibility that asymmetrically informed traders may encounter each other at the marketplace where buying and selling of stocks

occurs. The risk of trading with informed traders is of much consideration and importance to the investor as it is to intermediaries who place orders on behalf of investors. The adverse selection problem and degree of market information risk is partly determined by the nature of market design and trading protocols in place which may dictate whether a market is transparent or not. Furthermore, information risk is an important consideration when coming up with trading strategies and making decisions as to whether to trade or not and this is eventually reflected in a firm's equity betas or intra-day bid-ask spreads. Ultimately, dynamic price movements in the short term, as characterized by microstructure effects, will be, in part, determined by the degree of information asymmetry.

The level of activity induced by informed investors has an impact on the degree of information asymmetry and this might have an impact on the level of market information risk and the nature of price discovery process (Karpoff, 1986; Vo, 2007). This study presents empirical evidence on the magnitude of impact of market information risk on price discovery when trading activity is introduced. It is evident that organizational characteristics might have an indirect effect on the price discovery in an exchange. Rhee and Wang (2009) in a study found out that ownership structure dominated by foreign investors contributes negatively to liquidity and market information risk mainly due to information asymmetry. Piotroski and Roulstone (2004) found that informed trading by investors and their consequent transfer of information following their valuations of managerial decisions influence the nature of trading activity and eventually price discovery especially for stocks with concentrated ownership. Stoll (2000) notes that foreign and block investors may induce real frictions effect by changing the level of trading activity through altering information environment in the market and this could indirectly cause potential market information risk as bid ask spreads might change to accommodate the potential fear. Cao et al., (2000) document that concentrated ownership dictates the degree of advantage in accessing firm specific information. The authors note that intraday data suggest that organizational information gets absorbed into stock prices faster depending on the level of investor concentration with the speed of information absorption being significant with participation of foreign investors. Attig et al. (2006) in a study of 1031 Canadian listed companies sought to establish the relationship among ownership concentration and liquidity. The authors find a positive significant relationship between highly concentrated firms and bid-ask spread whereas for widely held firms, findings revealed a

positive impact on market liquidity. In another study of the Australian stock market, Camerton-Forde and Rydge (2006) investigated the relationship between ownership concentration and illiquidity. The study findings revealed that there was a positive relationship between ownership concentration and information risk as measured by bid-ask spread. However, they reported a negative relationship between ownership concentration and trading activity as measured by turnover ratio. The findings in the two studies somehow offer an explanation to the effect that ownership concentration, an indicator of organizational characteristics may dampen the relationship between market information risk and price discovery. The NSE market traces its existence to1951 as a private stock broking firm owned by Francis Drummond then. There are sixty-six listed companies in the NSE as of January 2019 categorized in sectors based on their nature of operations and they operate within the framework of CMA and NSE regulations. Market participants place their buy and sell orders through brokers although Kenyan stock market is characterized by a small number of stockbrokers following collapse of some of them in the recent past and capital requirement constraints for those who would wish to register and subsequently offer brokerage services. The research Question is; when considered jointly, how does market information, trading activity, and organizational characteristic impact price discovery for stocks listed at the Nairobi Securities Exchange?

## *Literature Review*

In this section, the author presents a discussion and synthesis of theories, empirical literature, summary of empirical literature review, identified knowledge gaps and a presentation of conceptual framework showing the relationship between the variables of the study.

## *Theoretical Review*

There are two paradigms in the theoretical framework of market microstructure. These are inventory and information-based models, which constitute the components of microstructure theory.

The Glosten and Milgrom model (1985) lends itself to the analysis of risk neutral, informed and uninformed traders and how prices emerge given the trading process in a multi-period setting by expanding Copeland and Galai (1983) into a sequential framework. This model involves a

sequential trade in which traders are assumed to trade an asset with competitive risk neutral market representatives (brokers) who quote bid and ask prices and adjust quotes across time based on the trades that occur, instructions from investors (traders) and this is rooted in the assumption that there exists heterogeneous groups of traders classified as either or uninformed. The spread arises as result of informed revisions in the assets' value conditioned by observed trades which are presumed to be carriers of information. This confirms the notion that a trade communicates some information and spreads implicitly represents market information risk or liquidity. This model largely incorporates adverse selection costs in making predictions, especially where dealers are uninformed and make inference of stock values based on trade history. Glosten and Milgrom model (1985) make some predictions of the evolution of prices and market information risk except that it doesn't attempt to address the issue of the speed at which prices tend to move and converge in an environment with information efficiency.

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 signal that is public can be observed majorly by participants on the market in totality whereas the information known to traders perceived informed is private. Because the traders that are informed gives higher profits, then when there is increase in those traders that are informed, then reduction in returns as well as spreads becomes inevitable. While updating their beliefs about future asset values and in quoting prices, traders' factors in private information and insider's trading strategy. Kyle, in the 1985 model makes the prediction that, in a situation where uninformed trading is largely inelastic, trading volume increases and market information risk becomes pervasive. The models theorizes that market makers and uninformed investors experience adverse selection problems 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 in poor trade decision when placing quotes

*Empirical Review*

Madura et al., (2006) undertook a study on trading halts and price discovery by empirically examining its effect on the evolution of stock prices based on NASDAQ listed firms which experienced trading halts in 1998 using daily and intra-day data for a total of 656 trading halts. They examined the price contribution of the pre-halt, during halt and post-halt period to price discovery based on the nature of news that occasioned the halt to separate firm specific characteristics. On analyzing the data, they find significant abnormal returns in the halt period (80 %) for the full sample. In the pre-halt period, they found some abnormal (15 %) returns while post-halt period showed no significant abnormal returns. In assessing price discovery, the researchers used the WPC measure where they find that price discovery is concentrated in the halt period for all types of new events while for the pre and post halt periods they find significant but low-price contribution and minimal price contribute on respectively. Their findings are consistent with that of Barclay and Hendershott (2003) but contrast with Howe and Schlarbaum (1986) findings where price discovery was found to occur in the post-halt period, which is the period beyond suspension by the regulator or the exchange. The study did not investigate whether trading halts in one way or another impede the speed at which new equilibrium prices are arrived at and probable determinants of price discovery.

Barclay and Hendershott (2008) undertook a comparative study by testing two hypotheses about trading in the pre-open and non-trading mechanisms for price discovery of 250 highest volume NASDAQ stocks between 1993 and 1999. The researchers used data for all after-hours trades from January to June 1999 and for trades executed during trading day (9.30 a.m- 4.00 p.m). They analyzed the data using the unbiasedness regression and WPC measure and they find that pre-open trading improved in the 1990's accompanied with decline in the degree of noisiness of the pre-opening price. Overall, they conclude that price discovery during opening period was reduced to 1.8 % and this huge reduction is attributed to the immense contribution of the pre-opening to price discovery which led to the improvement of efficient price discovery during the trading period. This is consistent with the findings of Cao et al., (2000) and Ellul, Shin and Tonks (2005) who also study price discovery in the trading day by measuring the percentage contribution attributable to the pre-opening period. In both studies the stock markets had varying length of pre-opening time, but all employed WPC measures adopted by Barclay and Hendershott (2008).

Schwartz et al. (2010), in a study focusing on investor divergent adaptive valuations and its role in a dynamic price discovery process observes that market prices evolve by absorbing new information in a manner that is not monotonic and they attribute this volatility dynamic process of price discovery which they describe as being protracted and path-dependent. The authors acknowledge in all respects the role information asymmetry plays in intra-day price movements although it did not investigate its impact in terms of the direction of relationship. This study went beyond this by finding out the microstructure effects and their role in price discovery and most importantly how other factors impact price discovery focusing on intra-day events as opposed to opening and closing day prices which are undoubtedly a product of underlying noise brought about by information risk.

Agatha (2013) studied the impact of microstructure changes on market efficiency at the NSE. The results of the study indicated that mean market returns in the post-market automation period were higher and more volatile than those in the pre-market automation period thus the higher market returns were attributed to improved price matching process, while the higher volatility was due to changes in trading system, a characteristic of market microstructure. This study, however, did not attempt to find out the contribution of the change in the price discovery process but recommended the combination of the automated and open outcry trading system without empirical evidence as to its value in the provision of liquidity and enhancing efficient price formation process. Ngugi (2002) in a study, sought to establish the relationship between institute changes at NSE on trading activity and Liquidity, relying on microstructure theory. A total of thirty-nine firms were studied between the period 1990 and 2002. In this study, it was established that the quality of information determines market efficiency, resilience and depth. Furthermore, the study also found that trading activity is largely influenced by market returns and as such this study aims at investigating how this link impacts asset pricing at the NSE but focusing on organizational characteristics. Evidence from this study will form the basis of recommendations that call for strategic actions and institutional frameworks that would in the long term lower negative shocks and reduce information asymmetry.

Rizkianto and Surya (2014) while studying the efficient market hypothesis on weak and semi strong form in the Indonesian Stock Market using eight stocks as per the market capitalization in different eight sectors found that investing in stocks is higher for investors in concentrated ownership as they are privy to market information risk and also their organizational characteristics enables them to trade in volumes and invest even in markets with higher risks as compared to individual investors which the study found to have significant influence on price discovery.

Prokopiv (2019) in a paper testing informational inefficiency of stock price formation of Ukrainian companies-comparison between Ukrainian and Warsaw stock exchanges claimed that informational efficiency is impossible to achieve. This is due to the non-zero cost of information acquisition, and all existing information cannot be reflected in the prices. Furthermore, in the real world assumptions about investors being rational cannot always hold. Not every trader is trading in information; some investors are uninformed and trade just due to liquidity or personal reasons. The study argues that to reach the competitive equilibrium of security prices, it is enough that the information is inexpensive. On the one hand, the incentive of acquiring information comes into conflict with the efficiency of information spread by markets, leading to reduced trading activity behaviour. On the other hand, as markets evolve, price inefficiencies motivate more arbitrageurs to trade the wrongly priced assets depending on the characteristics of the individuals or organizations resulting to inefficiency in price discovery.

Anghel (2017) studying intraday market efficiency for a typical Central and Eastern European Stock Market in the case of Romania argued that investors are generally unable to use the dependencies embedded in the price movements to gain economic profits when using trading strategies derived from three popular technical analysis indicators. The use of information extracted from the adventure of technical analysis cast doubt on the idea of the market being efficient at least based on efficient market hypothesis in Fama (1970). This implies that, because of the existing market frictions in terms of market information risk and organizational characteristics, trading on high volumes and transactions is not feasible in the stock market of Romania, at least when using popular technical analysis indicators.

Pereira (2019) looking at the implications of Non-Tangible Assets (NTA) and Macroeconomic Parameters on Long-term Stock Performance of the United States on the stock price found that stock price reflects all relevant information on the market and any deviation of the information due to trading risks could result to low volume and transactions traded and a shift in ownership concentration and stock return volatility fluctuations. The findings significantly showed how prices of stocks on 45 corporations have significant association as opposed to 11 corporations.

## *Conceptual Framework*

This study contributes to the debate by providing empirical evidence of variables of study interact as shown in the diagram that follows.
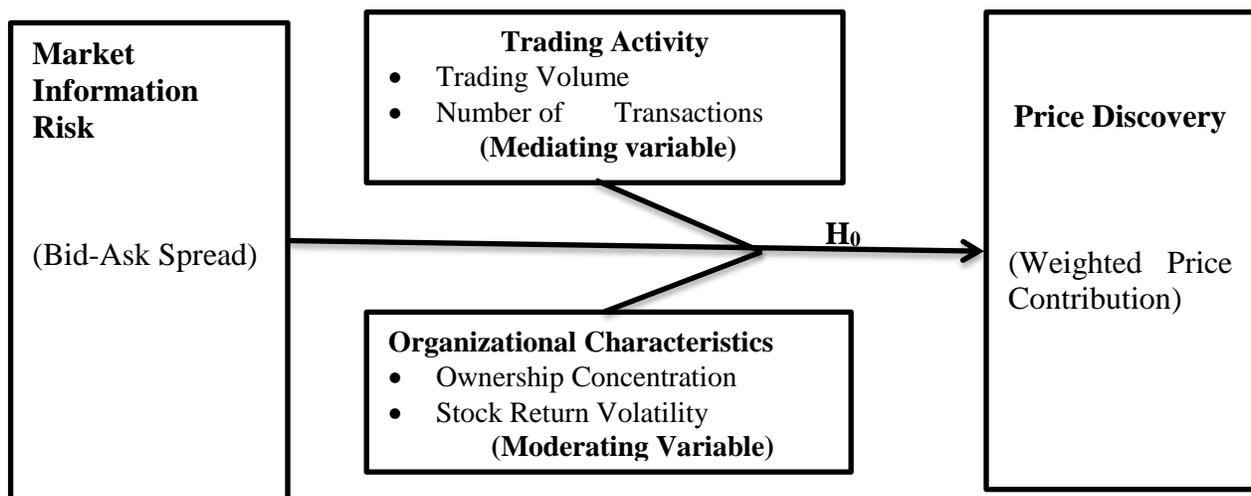


$H_0$: There is no significant joint effect of market information risk, trading activity and organizational characteristics on price discovery

## Research Methodology

This section presents research philosophy, research design, target population, data collection methods, diagnostic tests, operational definition and measurement of variables, and data analysis techniques and procedures.

**Research Design**

As pointed out by Burns and Bush (2010), descriptive research design facilitates description of trends, attitude or opinions of large group in terms of asking questions of the topic and is guided by hypothesis testing and establishment of relationship between two or more variables. Besides description of the characteristics of the target population, the objective of the study was to establish relationships among the study variables. 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. This design therefore permits the researcher to offer description of variables of interest and discovery of associations among the variables in order to determine the strength or magnitude of the envisaged relationships. Kothari and Garg (2014) on research design documents that correlation analysis establishes the joint variation between or among variables of interest in a study.

*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 Secondary market. In this study, the focus was on stocks and not fixed income securities which include bonds and preference stock, and which are issued by listed firms. The unit of analysis therefore is stocks listed at the NSE and involved investigating all stocks listed and trading at the NSE. This was therefore a census study.

*Data Collection*

Burns and Grove (2010) pointed out that 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. The general objective of the study was to investigate the relationship between MIR, TA, organizational characteristics and price discovery of stocks listed at the NSE. This study used historical data that was obtained through observation and real time recording during the continuous trading session. This was instrumental in obtaining data from vendors, and online trading agents through live screens recordings. The intra-day data

used was both quote and transactional based. The period for this study was six months (January to June 2019) and secondary data of each stock was obtained for each interval. The study therefore provides the most recent investigation on price discovery, trading activity, market information risk and organizational characteristics. 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 sixty minutes translating to five intervals during each trading day.

## *Operationalization of study variables*

Saunders (2013) indicated that operationalization of study variables enables facts or constructs to be quantified so as to generate a metric for ease of understanding. 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. The weighting is designed to give lower weight to days with little relevant news

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

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…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 kth interval relative to the open-to close return $r_{it}$, od 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 Market Information Risk 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 Rusell (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.

$$\text{BAS} = \frac{\text{ASK}_{i,k} - \text{BID}_{i,k}}{\left( \frac{\text{ASK}_{i,k} + \text{BID}_{i,k}}{2} \right)}$$

Where,

BAS = Bid - Ask Spread

BID = Buying Price in the inside quoted

ASK = Selling price in the inside quote

i = Stock

k = Interval

*Trading activity*

Trading activity is an important characteristic of any stock market in any country and there are varied descriptions of it. Beaver (1968), notes that volume is a good measure for trading activity whereas Jones et al., (1994) states that number of transactions is a good measure. Agarwal (2009) in a study points out that turnover captures different aspects such as dispersion in beliefs that are induced by information difference among investors. The proxies for trading activity used in this study are trading volume and total number of transactions. These variables were standardized by taking their logarithm. Natural Log of total shilling value of stocks sold and bought and Natural Log of total number of both buy and sell initiated transactions.

*Organizational characteristics*

Based on empirical literature, two types of firm specific characteristics namely ownership concentration and stock return volatility were adopted in this study. Camerton-Forde and Rydge (2006) in a study of Australian listed firms used top twenty shareholders, large shareholders measured by Herfindahl - Hirschman Index (HHI), number of shareholders and insider ownership as proxies for ownership Concentration. Naes et al. (2011), Karuiths and Onyuma (2011) used HHI as a proxy for ownership concentration. Among the listed proxies, HHI establishes how concentrated a firm's shareholding is, as noted by Chin (2010). Furthermore, this index measures ownership concentration as the sum of the squared ownership state for each of the shareholders in the company thus offering a means of including all shareholders in a single concentration measure. HHI index was used in this study as proxy for the ownership concentration. The index was estimated as follows.

*HHI= $S_1^2 + S_2^2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + S_n^2$*

*Where;*

*Sn= the market share percentage of firm expressed as whole number*

*N= number of firms*

As noted by Reilly and Brown (2003), either variance or standard deviation of stock returns is often utilized as a measure of volatility. Stock return volatility was quantified using Standard

deviation of closing quote mid-points. The use of mid-quote had the benefit of solving the potential problem of spurious volatility as documented by Rusell (2006) and Lunde (2006).

$$R_{i,t} = \log_e = \frac{M_{i,k,t}}{M_{i,k,t-1}}$$

Where,

$$R_{i,t} = \text{Mid - Quote Return}$$

$$M = \frac{\text{Bid} + \text{Ask}}{2}$$

## *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. This study is based on correlation and multiple regression analysis which helped establish the relationship among variables as per the research question, research objective, and hypothesis. The research hypothesis of this study entailed testing the significant effect, if any, of market information risk, trading activity, and organizational characteristics on price discovery. In order to achieve this, a stepwise multiple regression analysis was used. The stepwise methodology was useful in establishing the effect of each of the indicators of the predictive variables. This process was also critical in establishing whether indicators are suppressors or confounding variables as per Mackinnon et al. (2000). The hypothesis was tested based using coefficient of determination, predictive power of the overall model and significance of the regression coefficients. The following model was used to establish the effect of each variable through stepwise regression analysis.

$$PD = \beta_0 + \beta_1 BAS + \beta_2 TV + \beta_3 NT + \beta_4 OC + \beta_5 VOL + \varepsilon$$

Where;
PD     = Price Discovery
BAS   = Bid – Ask Spread
TV     = Trading Volume
NT     = Number of Transactions
OC     = Ownership Concentration
VOL = Stock Return Volatility
$\varepsilon$       = Error Term or Residual of the Equation
$\beta_0$     = Intercept of the Equation
$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5,$ = Regression Coefficients

### *Data Analysis, Results and Discussion*

The objective was to assess the combined influence of market information risk, trading activity and organization characteristics on price discovery. A multiple regression analysis was used to assess the joint effect of market information risk, trading activity and organizational characteristics. The proxy for market information risk was bid ask spread. The indicators for trading activity were trading volume and number of transactions and that for organizational characteristics were concentrated ownership and stock return volatility. The outcome variable is price discovery measured by weighted price contribution. To establish joint effect, a stepwise regression analysis was done to determine how jointly the individual measures of key variables (Bid-Ask Spread, Trading Volume, Number of Transactions, Ownership Concentration and Stock return Volatility) influence price discovery. The results are presented in Table 1, 2 and 3.

The results as shown in Table 1, 2 and 3 reveal that the joint effect of Market Information Risk (bid-ask Spread), Trading Activity (trading volume and number of transactions) and Organizational Characteristics (ownership concentration and stock return volatility) on price discovery was statistically significant as shown by Sig. F Change of .165. In model 1, Market Information Risk is regressed against price discovery. The results show that 29.5 % variation in price discovery (PD) is independently accounted for by bid-ask spread ($R^2 = .295$). In model 2, volume is added. The results reveal that bid ask spread and trading volume explain 33.5% variation in price discovery ($R^2 = .335$). In model 3, bid ask spread, trading volume and number of transactions are regressed against WPC. The results show that the three variables included in the model explain 34.8 ($R^2 = .348$) variation in price discovery. In model 4, ownership concentration is added. The regression results indicate that the coefficient of determination becomes .360 added to price discovery, meaning that the four variables account for 36.0% variation in WPC. In model 5, all the individual predictor variables are included and regressed against the outcome variable. The joint effect was 36.3% ($R^2 = .363$) thus higher and significant compared to the individual effect of individual variables therefore concluding that if all the sub variables are jointly considered in a model, price discovery effects would be higher than individual effects of each of them. The results presented therefore reveal that the combined effect of market information risk, trading activity and organizational characteristics on price discovery was statistically significant.

**Table 1:** *Model goodness of fit on the joint effect of market information risk, trading activity and organizational characteristics on Price Discovery*

**Model Summary[f]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | | Durbin-Watson |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change | |
| 1 | .543[a] | .295 | .293 | 1.55695 | .295 | 164.142 | 1 | 393 | .000 | |
| 2 | .579[b] | .335 | .332 | 1.51322 | .041 | 24.043 | 1 | 392 | .000 | |
| 3 | .590[c] | .348 | .343 | 1.50056 | .013 | 7.643 | 1 | 391 | .006 | |
| 4 | .600[d] | .360 | .354 | 1.48837 | .012 | 7.433 | 1 | 390 | .007 | |
| 5 | .603[e] | .363 | .355 | 1.48658 | .003 | 1.935 | 1 | 389 | .165 | 1.144 |

a. Predictors: (Constant), Bid-Ask Spread
b. Predictors: (Constant), Bid-Ask Spread, Trading volume
c. Predictors: (Constant), Bid-Ask Spread, Trading volume, Number of transactions
d. Predictors: (Constant), Bid-Ask Spread, Trading volume, Number of transactions, Ownership concentration
e. Predictors: (Constant), Bid-Ask Spread, Trading volume, Number of transactions, Ownership concentration, Stock return volatility
f. Dependent Variable: Price discovery

Table 1 presents the coefficient of determination for each model. In model 1, 29.5 % of the total variation in price is explained by market information risk based on R Squared value of .293. In model 3, 34.8% of the total variation in price discovery is explained by the regression and specifically market information risk and trading activity. In model 5, organizational characteristics are included in the regression which produces a $R^2$ value of .363. This implies that if considered jointly, the predictor variables explain 36.3 % variation in the dependent variable.

**Table 2:** *Model overall significance on the joint effect of market information risk, trading activity and organizational characteristics on Price Discovery*

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 397.896 | 1 | 397.896 | 164.142 | .000[b] |
| | Residual | 952.672 | 393 | 2.424 | | |
| | Total | 1350.568 | 394 | | | |
| 2 | Regression | 452.951 | 2 | 226.475 | 98.905 | .000[c] |
| | Residual | 897.617 | 392 | 2.290 | | |
| | Total | 1350.568 | 394 | | | |
| 3 | Regression | 470.160 | 3 | 156.720 | 69.601 | .000[d] |
| | Residual | 880.408 | 391 | 2.252 | | |
| | Total | 1350.568 | 394 | | | |
| 4 | Regression | 486.627 | 4 | 121.657 | 54.918 | .000[e] |
| | Residual | 863.941 | 390 | 2.215 | | |
| | Total | 1350.568 | 394 | | | |
| 5 | Regression | 490.904 | 5 | 98.181 | 44.427 | .000[f] |
| | Residual | 859.664 | 389 | 2.210 | | |
| | Total | 1350.568 | 394 | | | |

a. Dependent Variable: Price discovery

Table 2 presents the analysis of variance of the regression for model 1-5. The ANOVA was used to basically test the statistical significance of $R^2$ values in model summary in table 1 and to confirm that at least one of the regression coefficients is not equal to zero. The results reveal statistical significance of each model and therefore the null hypothesis that $R^2=0$ ($H_0:=0$) is rejected in each case. The F-statistics in model is 164.142 with a p-value of 0.00. The ANOVA results for model 1,2,3,4 and 5 which reveal statistical significance are respectively presented; [$F_{(1,393)} =164.142$, $p < 0.05$], [$F_{(2,392)} =98.905$, $p < 0.05$],[$F_{(3,391)} =69.601$, $p < 0.05$],[$F_{(4,390)} =54.918$, $p < 0.05$], [$F_{(5,389)} =44.427$, $p < 0.05$],

**Table 3:** *Regression* **coefficients on the joint effect of market information risk, trading activity and organizational characteristics on Price Discovery**

<div align="center">Coefficients<sup>a</sup></div>

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| 1 | (Constant) | 2.652 | .153 | | 17.385 | .000 | | |
| | Bid-Ask Spread | .513 | .040 | .543 | 12.812 | .000 | 1.000 | 1.000 |
| 2 | (Constant) | 2.163 | .179 | | 12.102 | .000 | | |
| | Bid-Ask Spread, Trading volume | .484 | .039 | .512 | 12.305 | .000 | .978 | 1.023 |
| 3 | (Constant) | 2.252 | .180 | | 12.502 | .000 | | |
| | Bid-Ask Spread, Trading volume, Number of transactions | .505 | .040 | .534 | 12.708 | .000 | .943 | 1.061 |
| 4 | (Constant) | -2.306 | 1.681 | | -1.372 | .171 | | |
| | Bid-Ask Spread, Trading volume, Number of transactions, Ownership concentration | .498 | .039 | .527 | 12.610 | .000 | .939 | 1.065 |
| 5 | (Constant) | -2.139 | 1.684 | | -1.270 | .205 | | |
| | Bid-Ask Spread, Trading volume , Number of transactions, Ownership concentration, Stock return volatility | .495 | .039 | .524 | 12.521 | .000 | .935 | 1.069 |
| a. Dependent Variable: Price discovery | | | | | | | | |

Table 3 presents result of coefficients of the independent variables used in each hierarchical model which are utilized in assessing the degree of relationship with the outcome variable. The results indicate that the constant for each model is 2.652, 2.163, 2.252,-2.306 and -2.139. Based on the coefficients, t-tests and p-values, market information risk, trading activity and organizational characteristics are useful determinants and predictors of price discovery. Market information risk as measured by bid ask spread has a coefficient of 0.513 (t-value = 12.812, $p < 0.05$). The beta coefficient for trading volume and number of transactions indicate positive statistical significance with coefficients of .484 (t-value = 12.305, $P < 0.05$) and .505 (t=12.708, $p < 0.05$). The regression further provide a positive significant coefficient of .498 (t = 12.610, $p < 0.05$) for ownership concentration. Stock return volatility positively and significantly influences price discovery based on the Unstandardized Coefficient of .495 (t= 12.521, $p < 0.05$).

These findings support the alternative hypothesis that is taken together, Market information risk (bid-ask spread), trading activity (trading volume and number of transactions) and organizational characteristics (ownership concentration and stock return volatility) have a significant joint effect on price discover (weighted price contribution). This results and findings further reveal that none of the predictor variables considered in this study is a suppressor or a confounder.

Based on the results, the regression model is substituted as follows:

$$PD = .495 + .513BAS + .484TV + .505NT + .498OC + .495SRV$$

where;

$PD$ = Price Discovery

$BAS$ = Bid - Ask Spread

$TV$ = Trading Volume

$NT$ = Number of Transactions

$OC$ = Ownership Concentration

$SRV$ = Stock Return Volatitlity ($J$ = Joint influence)

The model above implies that independently, a unit change in bid-ask spread, trading volume, number of transactions and ownership Concentration leads to .513, .484, .505 and .498 change in price discovery and jointly leads to .495 changes in price discovery which are all significant at 0.05 statistical levels and therefore supporting hypothesis four. Rizkianto and Surya (2014) argued that investing in stocks is higher for investors in concentrated ownership as they are privy to private information besides the advantage of being able to trade in volumes and invest even in markets with higher risks as compared to thinly spread investors.

### *Findings*

The objective of the study was to determine combined influence of market information risk, trading activity and organizational characteristics on price discovery. The hypothesis that was tested stated that there is no significant joint effect relationship between market information risk, trading activity and organizational characteristics on price discovery. In establishing joint effect Bid-ask spread, trading volume, number of transactions, stock return volatility and ownership concentration were investigated individually and jointly The results showed significant independent effects of market information risk, trading activity, organizational characteristics on price discovery and further it was established that the joint effect had a higher significance as compared to individual effects thus supporting the hypothesis. The findings support Madura et al., (2006) in an argument that in the pre-halt period, they find some abnormal (15 %) returns while

post-halt period showed no significant abnormal returns. In assessing price discovery, the researchers used the WPC measure where they find that price discovery is concentrated in the halt period for all types of new events while for the pre and post halt periods they find significant but low-price contribution and minimal price contribute on respectively. Their findings are consistent with that of Barclay and Hendershott (2003) but contrast with Howe and Schlarbaum (1986) findings where price discovery was found to occur in the post-halt period, which is the period beyond suspension by the regulator or the exchange. The study did not investigate whether trading halts in one way or another impede the speed at which new equilibrium prices are discovered and probable determinants of price discovery. This is further consistent with the findings of Cao et al., (2000) and Ellul, Shin and Tonks (2005) who also study price discovery in the trading day by measuring the percentage contribution attributable to the pre-opening period. In both studies the stock markets had varying length of pre-opening time, but all employed WPC measures adopted by Barclay and Hendershott (2008).

## *Conclusions*

The objective of the study was to assess the joint effect of market information risk, trading activity and organization characteristics on price discovery. In the regression model, price discovery was the dependent variable, while market information risk, trading activity and organizational characteristics were predictor variables. The results revealed that the joint effect market information risk, trading activity and organizational characteristics on price discovery was statistically significant. The results show that all the variables; market information risk, trading activity and organizational characteristics independently showed significant variations in price discovery. The joint effect was higher and significant as compared to the individual effect of individual variables therefore supporting the hypothesis.

## *Contributions to the Study Findings*

The study has helped in reducing the controversy on the relationship between market information risk and price discovery by showing that the positive relationship that is direct and significant is between bid price and ask price which the proxies of bid-ask are spread and price discovery. This can explain why many researchers who have tested the relationship between market information risks as a composite variable not split into various sub variables or elements and price discovery

have found contradictory results with some concluding that the relationship between the variables is positive, negative or not significant at all. This study has showed that the effect of market information risk on price discovery can best be understood by considering how trading activities in form of trading volume and number of transactions as well as organizational characteristics influences relationship between elements of market information risk measured by bid-ask spread and price discovery measured by weighted price contribution for stocks listed at the Nairobi Securities Exchange. The findings contribute to new knowledge by establishing the magnitude of the effect and how variables (market information risk, trading activities and organizational characteristics can be ranked in a decision-making process to come up with new ways of carrying out unique processes in the listed firms.

## *References*

Abhyankar.A, D.Ghosh, E. Levin 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.

Agarwal, S.; Liu, C. & Rhee, S. G. (2007). Where does price discovery occur for stocks traded in multiple markets? Evidence from Hong Kong and London. *Journal of International Money and Finance, 26, 46-63.*

Aggarwal, R., & Conroy, P., (2000): Price discovery in initial public offerings and the role of lead underwriter. *The Journal of Finance*, 55(6), 2903-2922

Aktasa N, Bodta E de, Declerckc F., & Oppensa H van. (2007): The PIN Anomaly around M&A Announcements. *Journal of Financial Markets*, 10(2):169–191.

Amihud, Y., & Mendelson, H. (1980). Dealership market: Market-making with inventory. *Journal of Financial Economics*, 8(1), 31-53.

Amihud, Y., Mendelson, H., & Murgia, M. (1990). Stock market microstructure and return volatility: Evidence from Italy. *Journal of Banking & Finance*, 14(2-3), 423-440.

Asmar, M., & Ahmad, Z. (2011). Market microstructure: the components of black box. *International Journal of Economics and Finance*, 3(1), 152.

Bae, K. H., Chan, K., & Ng, A., (2004). Investibility and return volatility. *Journal of Financial Economics,* 71, 239-263

Bacidore, J. & Sofianos, G. (2002). Liquidity provision and specialist trading in NYSE-listed non-U.S. stocks. *Journal of Financial Economics, 63, 133-158.*

Bagehot, W. (1971). The only game in town. *Financial Analysts Journal*, 22, 12-14

Barclay, M. J. & Warner, J.B. (1993). Stealth trading and volatility: Which trades move prices? *Journal of Financial Economics 34, 281 – 305.*

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.*

Bekaert, G. & Harvey, C. R. (2003). Emerging market finance. *Journal of Empirical Finance 10, 3-55.*

Biais, B., Foucault, T., & Salanie, F., (1998). Floors, dealer markets and limit order markets. *Journal of Financial Markets 1, 253-284.*

Biais, B.; Glosten, L., & Spatt, C. (2005). Market microstructure: A survey of micro foundations, empirical results, and policy implications. *Journal of Financial Markets 8 (2), 217-264*

Bowe, M., Hyde, S., & Johnson, I. (2011). Price Discovery in the Absence of Trading: Insights from the Malta Stock Exchange Pre-opening Period. Eastern Finance Association annual conference, Savannah, Georgia, USA. (April, 2011) Emerging Markets Finance conference, Cass Business School, UK (May 2011). Financial Management Association annual conference, Denver, USA. (October 2011).

Chordia, T., Avanidhar, S., & Ravi, A. (2001). Trading Activity and Expected Stock Returns. *Journal of Financial Economics*, 59, 3-32

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.

Cai,J.,Ho,R, Korajczyk, R.A.,& Zhang, Z.(2013). Price Discovery, Foreign ownership, and Rule of Law. Foreign ownership, and Rule of Law. (August 15, 2013)

Cao, C., Ghysels, E., & Hatheway, F. (2000). Price discovery without trading: Evidence from the Nasdaq pre-opening. *Journal of Finance 55, 1339 – 1365.*

Comerton-Forde, C. & Rydge, J. (2006). The current state of Asia-Pacific stock exchanges: A critical review of market design. *Pacific-Basin Finance Journal 14 (1), 1-32.*

Demsetz, H. (1968). The cost of transacting. *Quarterly Journal of Economics 82(l), 33-53.*

Demsetz, H. (1997). Limit orders and the alleged Nasdaq collusion. *Journal of Financial Economics 45(l), 91-95.*

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, 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., (1992). Time and the process of security price adjustment. *Journal of Finance* 47, 577-606.

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.

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

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.*

Eun, C., & Sabherwal, S., (2003). Cross-border listings and price discovery: Evidence from U.S.-listed Canadian stocks. *The Journal of Finance,* 53(2), 549-574.

Eun, C., S., & Sabherwal, S., (2003): cross-border listings and price discovery. Evidence from U.S-Listed Canadian stocks. *The journal of finance,* 53(2), 549-575

Falkenstein E., (1996), 'Preferences for stock characteristics as revealed by mutual fund portfolio holdings". *Journal of Finance* 51, 111-135

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

Frijns, B.; Grilbert, A. & Tourani-Rad, A. (2010). The dynamics of price discovery for cross-listed shares: evidence from Australia and New Zealand. *Journal of Banking and Finance 34, 498-508.*

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(l), 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(l), 71 -100.*

Glosten, L. (1994). Is the electronic open limit order book inevitable? *Journal of Finance 49(4), 1127- 1161.*

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.*

Harris, L. (2002). Trading and Exchanges: Market Microstructure for Practitioners. Oxford University Press.

Harris, F.; McInish, T. H. & Wood, R. A. (2002). Security price adjustment across exchanges: An investigation of common factor components for Dow stocks. *Journal of Financial Markets, 5, 277 – 308.*

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.

Hasbrouck, J. (2013). High frequency quoting: Short-term volatility in bids and offers. Working paper available at: http://ssrn.com/abstract=2237499.

Hasbrouck, J. and Saar, G. (2009). Technology and liquidity provision: The blurring of traditional definitions. *Journal of Financial Markets, 12, 143-172*

Hasbrouck, J., & Saar, G. (2013). Low-latency trading. *Journal of Financial Markets*, 16(4), 646-679.

Hayes, A.F(2013). Introduction to mediation, moderation, and conditional process Analysis: A regression – based approach. Guilford press

Ho, T., & Stoll, H. R. (1981). Optimal dealer pricing under transactions and return uncertainty. *Journal of Financial economics*, *9*(1), 47-73.

Ho, T. S., & Stoll, H. R. (1983). The dynamics of dealer markets under competition. *The Journal of Finance*, *38*(4), 1053-1074.

Kadapakkam, P, R., Misra, L., & Tse, Y., (2003). International price discovery for emerging market stocks: evidence from Indian global Depository Receipts. *Review of Quantitative finance and Accounting*, 21,179-199

Kang, J. K., and Stulz, R., (1997), 'Why is there a home bias?' An analysis of foreign portfolio equity ownership in Japan. *Journal of Financial Economics*, 46, 3-28

Klemperer, P., & Meyer, M., (1989). Supply function equilibria in oligopoly under uncertainty. *Econometrica*, 57, 1243-1277

Kyle, A., (1985). Continuous auctions and insider trading. *Econometrica*, 53, 1315-1335

Lanterbach, B. (2001). A note on trading mechanisms and securities, the analysis of rejects from continuous trade. *Journal of Banking and Finance* 6, 419-430

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.

Lehmann, B. N. (2002). Some desiderata for the measurement of price discovery across markets. *Journal of Financial Markets*, *5*(3), 259-276.

Lintner, J., (1969). The aggregation of investor's diverse judgements and preferences in purely competitive securities market. *Journal of Financial and Quantitative Analysis,* 4, 437-500

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.

Madura, J., Richie, N., & Tucker, A., (2006): *Journal of financial services research,* 3, 311-328

Masulis, R., & Shivakumar, L., (2001) Price Reaction Speed to Stock Offering Announcements: A NYSE/AMEX and NASDAQ Comparison. Working Paper Vanderbilt University Nashville.

Madhavan, A. (2000). Market microstructure: A survey. *Journal of Financial Markets 3 (3), 205-258.*

Majnoni, G., & Massa, M. (2001). Stock exchange reforms and market efficiency: the Italian experience. *European Financial Management*, 7(1), 93-116.

Milgrom, P., & Stokey, N. (1982). Information, trade and common knowledge. *Journal of Economic Theory*, 26(1), 17-27.

Mugenda, O. M. and Mugenda (2003). Research Methods: Quantitative and Qualitative approaches. Nairobi, Acts press.

Ngugi, R. W.; Murinde, V. & Green, C. J. (2002). Does the revitalization process really enhance stock market microstructure? Evidence from the Nairobi stock exchange. *The African Finance Journal 4(l), 32-63.*

O'Hara, M. (1995). Market Microstructure Theory: Blackwell Publishers, USA.

O'Hara, M. (2001). *Overview: market structure issues in market liquidity*. Paper presented at the BIS workshop.

O'Hara M. (2003). Presidential address: liquidity and price discovery. *Journal of Finance 58(4), 1335–1354.*

O'Hara, M. (2015). High frequency market microstructure. *Journal of Financial Economics*, 116(2), 257-270.

Onnela, J. P.; Tyli, J. & Kaski, K. (2009). Tick size and stock returns. *Physica A: Statistical Mechanics and its Applications 388 (4), 441-454*

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

Saunders, M., Lewis, P. & Thornbill, A. (2007), Research Methods for Business, 4th Edition. Prentice hall financial times, Harlow.

Smidt, S., (1971). Which road to an efficient stock market: free competition or regulated monopoly? *Financial Analysts Journal,* 27 (18}20), 64-69

Solnik, B., Boucrelle, C., & Le Fur, Y., (1996). International market correlation and volatility. *Financial Analysts Journal*, 52, 17-34.

Stoll, H., (1978). The supply of dealer services in securities markets. *Journal of Finance,* 33, 1133-1151

Su, Q., & Chong, T. (2007). Determining the contributions to price discovery for Chinese cross listed stocks. *Pacific-Basin Finance Journal, 15, 140-153.*

Wong, W. K.; Liu, B. & Zeng, Y. (2009). Can price limits help when the price is falling? Evidence from transactions data on the Shanghai stock exchange. *China Economic Review, 20 (1), 91-102*

Yan, B. & Zivot, E. (2010). A structural analysis of price discovery measures. *Journal of Financial Markets 13, 1 – 19.*

Zikmund G. w. (2009). Business Research Methods, 7th Edition. New Dheli, Cengage Learning

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