MARKET INFORMATION RISK, TRADING ACTIVITY, ORGANIZATIONAL CHARACTERISTICS AND PRICE DISCOVERY FOR STOCKS LISTED AT THE NAIROBI SECURITIES EXCHANGE

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A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY IN BUSINESS ADMINISTRATION, FACULTY OF BUSINESS AND MANAGEMENT SCIENCES, UNIVERSITY OF NAIROBI

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DECLARATION

I hereby declare that, this PhD thesis is my own original work and has not been submitted in any institution of higher learning for examination or award of a degree.

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MAY THE ALMIGHTY GOD BLESS YOU ALL

DEDICATION

I dedicate this doctoral thesis to my nuclear as well as extended family for their moral and spiritual support and encouragement: A special mention to my dear wife and children. My parents, Jeniffer Terki Kibet and late Philip Chogii (Peace be upon his soul). You are sincerely a source of inspiration and encouragement.

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ABBREVIATIONS AND ACRONYMS

ADRs - American Depository Receipts

AMEX - American Stock Exchange

BAS - Bid Ask Spread

CMA - Capital Markets Authority

DSE - Dar es salaam Stock Exchange

ECNs - Electronic Communication Networks

EMH - Efficient Market Hypothesis

GARCH - Generalized Autoregressive Conditional Heteroskedasticity

GDRs - Global Depository Receipts

HFT - High Frequency Trading

HSE - Helsinki Stock Exchange

IPOs - Initial Public Offerings

IS - Information Share

IT - Information Technology

NASDAQ - National Association of Securities Dealers Automated Quotation System

NT - Number of Transactions

NSE - Nairobi Securities Exchange

NYSE - New York Stock Exchange

MIR - Market information risk

OC - Ownership Concentration

OCH - Organizational Characteristics

PD - Price Discovery

PIN - Probability of Informed Trading

SEC - Securities Exchange Commission

SRV - Stock Return Volatility

TA - Trading Activity

TV - Trading Volume

TSE - Toronto Stock Exchange

USA - United States of America

VAR - Vector Auto Regression

VIF - Variance Inflation Factor

VOL - Volatility

VECM - Vector Correction Model

WPC - Weighted Price Contribution

ABSTRACT

Besides being one of the yardsticks for assessing the quality of financial decisions by management in the maximisation of shareholders wealth, stock markets around the world provide unparalleled investment destination for investors. Consequently, the structure and design of a financial market for stocks must continuously attempt to discover efficient market clearing prices in order to attract investor who will then initiate and continuously participate in the activity of trading. Asset pricing for financial instruments trading in exchanges with unique trading mechanisms still remains a widely debated issue in the discipline of finance because of its implications for risk management, planning of consumption, portfolio decisions, and promotion of societal welfare given microstructure frictions. The general objective of this study was to determine the relationship among market information risk, trading activity, organisational characteristics and price discovery for stocks listed at the Nairobi Securities Exchange. The study was anchored on the information based market microstructure theory. This study followed the positivist paradigm and was guided by correlational descriptive research design. The population was all sixty six companies trading at the stock market for a period of six months using sixty minute intraday data. Using the quantitative data, hypotheses were tested using simple, stepwise and hierarchical regression analysis and sobel tests. The study found positive and a statistically significant relationship between market information risk and price discovery. The findings from Sobel tests found that the relationship between independent and dependent variable was affected by introduction of trading volume as a mediating variable. However, number of transactions did not mediate the relationship between market information risk and price discovery. Volume to transaction ratio, a composite variable, was found to influence the magnitude and direction of effect and as such, trading activity in general was found to be a mediator. Further, the coefficient of the interaction term for ownership concentration and stock return volatility was found to be significant thus confirming presence of moderation effect. The findings supported the hypothesis that ownership concentration and stock return volatility has a significant moderating influence. Based on the composite variable, ownership characteristics were found to moderate the relationship between market information risk and price discovery. The results also showed that when considered together, market information risk, trading activity and organizational characteristics independently showed significant variations in price discovery. Based on the results, the regulatory regime and other stakeholders should aim at developing appropriate policies in an attempt to design an efficient 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. It is important to introduce and adopt appropriate trading rules and mechanisms that improve the intensity of trading activity and process with which efficient short-term equilibrium prices are arrived at. The findings are expected to guide managerial practitioners and participants in terms of appreciating the integration of the various price discovery factors in the face of a challenging economic environment, and management of firm core processes in order to support entrepreneur spirit in the country. The government on the other hand has an obligation to provide stability of the economic environment which provides organizational characteristics through interventions that support eases market accessibility. It is recommended that other market microstructure studies should be undertaken using other measures of price discovery like information share and variance ratio. The study could also be replicated to cover cross listed stock and other securities not considered in this study.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Price discovery and asset pricing for financial instruments trading in an exchange still remains a widely debated issue in the discipline of finance because of its implications for risk management, regulation, portfolio construction, capital allocation, and promotion of societal welfare (Subrahmanyam & 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 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.

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. In traditional asset pricing models, information asymmetry plays no role as documented by Asmar and Ahmad (2011) who by introducing the concept of market microstructure, observe that microstructure models unlike classical models of finance acknowledge that , in reality, information about companies' true values may be analysed and interpreted differently by a seemingly rational market

participants. The discipline of economics which gave birth to financial economics and modern day finance posits that price is a point of intersection of supply and demand whereas neoclassical finance views price as being the intrinsic value of a security on which all market participants agree. Neither of these two propositions by neoclassical finance and economics is true to the real world because of information asymmetry and the nature of prevailing market structure which brings about divergent participant's future expectations about return distribution and therefore, prices keep on changing based on any information set arriving to the market besides other frictions. Consequently, it cannot explain how in the short term equilibrium prices arise paving way for market microstructure which best explains price discovery process as an economic function of an exchange (Barclay & Hendershott, 2008; Schwartz et al., 2010, Nevmyvaka et al,.(2005).

Hasbrouck (2007) presents three scenarios that constitute a market microstructure distinguishing it from traditional field of finance. First, in an environment with different market participants, and sets of either private or public information, market microstructure comes in handy to offer explanation as to sources of value and reasons for value. Secondly, it permits the existence of multiple prices and varying degree of trading activity at any given time period. Lastly, the structural, technological, trading mechanisms and regulatory regime in place cumulatively define the market structure and design and this undoubtedly is a continuously shifting target and a potential candidate for this kind of study. This study is therefore a product of this conjecture and is based on the market microstructure theory as opposed to the traditional theories of classical finance.

Organizational unique characteristics like nature of ownership structure and idiosyncratic volatility may dictate the amount of information available in the market place which impacts market players' level of participation and eventually price discovery through generated trading activity. As such, intraday research in stock markets is critical due to the existence of regularities that contest the efficient market hypothesis. Market microstructure make it impossible for market participants to have homogeneous expectations about the future distribution of stocks returns which imply that traders attach a different value to a stock and this is eventually reflected when orders are placed (Agarwal, 2009). The speed and efficiency of price discovery process is partly a function of the degree of stock market efficiency implying that the ability of a stock market to price securities appropriately is partly attributed to market design, trading mechanism and the process in place for matching and executing buy and sell orders generated by traders during the pre-open or continuous trading period. Besides design, intraday characteristics in respect of weighted price contribution, bid ask spread, trading activity and stock return volatility, arise from either operational or stock informational market inefficiency. This study therefore focused on the continuous trading period of the market design as opposed to pre-open period which is usually preceded by trading halt after the market closes. The theoretical and empirical literature reviewed in chapter two of this study show market design as having a significant effect on the behaviour of prices, spreads, trading volume, and volatility (Schwartz, 2010).

The role of market information risk, intensity of trading activity and organizational specific characteristics in asset pricing has become a topical issue with many of the microstructure studies concentrating on either sequential or parallel market price discovery process in more mature and sophisticated markets. Price discovery (PD)

generally refers to the speed at which information gets absorbed into prices and the subsequent emergence of short term equilibrium prices which do not largely depart away from their underlying intrinsic values. Market information risk (MIR) is deduced from the nature of information content of stocks and the inability of a market participant to trade at own prices given information they hold. The risk of meeting and trading with participants with superior information is real in the actual market place and this eventually has an impact on the order flow. The moderating variable in this study is organizational characteristics which simply refer to firm specific features that have the potential of varying the behavioural tendencies of traders in terms of beliefs which leads to disparity of expectations about intrinsic valuations and future short term distributions of return. However, there is little evidence on how ownership concentration and stock return volatility plays out in moderating the relationship between market information risk and price discovery in a thin emerging market which perhaps never had microstructure data in the recent decades, a situation that technology has changed through introduction of electronic trading. Empirical evidence on how market information risk, trading activity and organizational specific characteristics enhance or act as a constraint in the prices discovery process is essential in eventually shaping the market structure through actions of regulators and traders. Furthermore, this study has contributed to the empirical microstructure literature of Kenyan stock market and this firmly formed part of the motivation for study.

Price discovery in stock markets begin when participants arrive in the market either physically or virtually through electronic system in place 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.

In Kenya, the 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, trading activity and organizational characteristics drive the process of price evolution for stocks listed and trading at the NSE. The stock market as opposed to market for fixed income securities is characterized by extant movements which have a potential of either assuring or threatening the confidence of market participants.

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 behavioural 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).

1.1.1 Market Information Risk

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. A major determinant of stock price movements is private information and those in possession of this kind of information consistently attempt to take advantage of it when trading and this ultimately creates costs and risks in the trading process. Easley et al. (2002) describes market information risk (MIR) as the possibility that asymmetrically informed traders may encounter each other at the market place where buying and selling of stocks occurs. The risk of trading with informed trader is of much consideration and importance to the investor as it is to brokers who place orders on behalf of investors as well the market analysts. 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. Since a trader can infer and extract information from the order flow, the transparency of the market which allows the identity of the market participant placing the trade to be known will have implication for adverse selection process and intensity of trading. 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 firms equity betas or intra-day bid-ask spreads. Ultimately, dynamic price movements in the short–term, as characterised by microstructure effects, in part, will be determined by the degree of information asymmetry.

Easley and O'Hara (2003 & 2004) establish 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. At every point in time, market participants face a risk when they cannot trade at prices which reflect any set of information at a particular time and this has an impact on trading and hence trading activity. Consequently, bid-ask spreads arise and might vary to reduce the implicit market information risk which participants through their representatives face. Further, and at the level of participation of traders, Bhide (1993) noted that active participants who tend to reduce potential agency related costs by way of self-initiated internal monitoring helps to 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.

Glosten and Harris (1988) in a study noted that bid-ask spread captures information risk because it contains adverse selection problem. Furthermore, as pointed out by Madhavan et al. (1997), the absence of this risk means that price contains all relevant information and as such presence of risk is captured in the bid-ask spreads of stocks. Information asymmetry and hence MIR is not directly observable. However, the field of market microstructure has formulated ways or proxies of quantifying metrics it. These measures for estimating MIR include but not limited to Probability of Informed Trading, earnings forecast error, and bid ask spread as documented in Glosten and Harris (1988) and Madhavan et al. (1997). Stoll (1989) offers some insight on the components of bid-ask spread which include; order processing costs, inventory holding costs and adverse selection costs. This perspective by Stoll (1989) is true and limited to a dealer market unlike an agency market scenario like the NSE. In this thesis, the proxy for market information risk as guided by theory and empirical literature reviewed in chapter two is the inside quote of the bid ask spread.

1.1.2 Trading Activity

Trading activity (TA) sets the process of discovering an equilibrium price in motion through placement of orders as per the rule book of the exchange. Kandel and Pearson (1995) casts doubt on stocks having fundamental values by noting that market participants share more less the same fundamental information but may interpret it differently resulting in trading activity accompanied by multiple prices for a stock. Harris and Raviv (1993), provide a description of trading activity where trading occurs because of profit motives of privately informed market participants thus introducing private information as a driver of trading activity. Investors learn from the pattern of trading activity and apply it in the placement of quotes. This implies that trading in itself is a source of information that could initiate an activity.

Trading activity is an important characteristic of any stock market in any country and it has been described in various ways by different authors. Beaver (1968), notes that volume is a good measure for trading activity since it captures the magnitude of disagreement that exists with arrival of new information. However, Jones et al., (1994) states that number of transactions is an important variable whereas Chordia et al. (2007) notes that liquidity trading is based on stock visibility, difference in opinion and uncertainty about intrinsic values. Agarwal (2009) points out that turnover captures different aspects such as dispersion in beliefs induced by information difference among investors. Trading volume, an indicator of trading activity, plays a critical role in a stock market because it facilitates price discovery process by providing a platform where market participants, informed or uninformed, share risk .In this thesis, trading activity was quantified using trading volume and total number of transactions in each interval as the indicators.

In a market with specialists, the presence of highly informed traders may lead to presence of spreads even when the specialists are risk-neutral because the spread is a result of information advantage which leads to adverse selection costs and as such, trading activity has got to do with information disparities or surprises in the market. Furthermore, trading activity could also vary as investors continuously attempt to rebalance their portfolios and inventory throughout a trading day. 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.

1.1.3 Organizational Characteristics

Organizational characteristics are internal factors that are likely to play a significant role in influencing the behaviour of market participants with respect to placement of orders as pointed out by Duompos et al. (2012) and Charumati (2012). Organizations vary in terms of their unique features as enshrined in their policies and which could either attract foreign capital or domestic investors leading to varying ownership structures. The specific organizational features have a potential of influencing the return process through shaping behavioural tendencies of active stock market players or indeed any other indicator of performance in an organization.

Boeher and Kelly (2009) noted that investors with concentrated ownership can be classified as quasi-insiders and are usually more informed with firm specific information. This category of investors seems to significantly facilitate timing and process of price discovery besides being catalysts for such other factors as the density of trading activity. Bauwhede and Willekens (2008) identify size and leverage as common firm attributes, Jensen and Meckling (1976) identify ownership structure as a key internal feature. Furthermore, Eng and Mak (2003) identified such characteristics as industry type, growth opportunities, and analysts following an organization, stock price performance, profitability, ownership concentration, stock volatility, audit fee, and leverage. These organizational specific features may have an impact on level of trade participation and therefore influencing the dynamic price negotiation process simply because, the level of investor participation might influence the intensity of trading activity in a given interval during the continuous trading period.

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 interplay between ownership concentration and liquidity. The authors find a positive significant relationship between highly concentrated firms and bid-ask spread whereas for sparsely held firms, findings revealed a positive influence of market on liquidity. In another study of the Australian stock market, Camerton-Forde and Rydge (2006) investigated the relationship between ownership concentration and illiquidity. The authors used different proxies for ownership concentration; top twenty shareholders, large shareholders measured by HHI index, retail shareholdings, number of shareholdings and insider ownership. 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 OC 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 in this may dampen the relationship between market information risk and price discovery.

Falkenstein (1996) and O'Hara (2003) observed that mutual funds with low volatility are highly preferred by investors. Such funds are highly visible, have lower information and trading costs, and large market capitalization. This study therefore affirms that volatility is a key internal feature in an organization. Organization specific risk as quantified by stock return volatility has implications for investor degree of participation in the stock market and this eventually determines the intensity of how bid and ask prices will be formulated. This in the end may either enhance or dampen the speed of price discovery and how market information risk as measured by bid ask spread influences the weighted price contribution, a measure of price discovery.

1.1.4 Price Discovery

Prices in any exchange evolve and eventually equilibrate once trading occurs as captured by Barclay and Hendershott (2008) and Schwartz et al. (2010). 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. Furthermore, 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.

Cao et al. (2000) identifies continuous trading markets, call auction markets, price experimentation, and price signalling as some of the trading mechanisms in an exchange. NSE has got auction and continuous trading as market clearing mechanisms. Biais et al., (2005) documents that microstructure studies attempt to show how observed prices vary from long-term values in the short-term. The deviation arises because of frictions in the market reflecting costs of transaction, asymmetric information costs and the nature of the behaviour of participants. The price formation process in the market place is basically the question of how investors bid and ask quotes in placement of orders eventually translate to market equilibrium prices in auction or continuous markets.

As pointed out by Hasbrouck (2007), the eventual equilibrium price, just as it arises in a walrasian tatonement process, rarely manifests itself in a market microstructure setting. Different prices for the same stock such as bid and ask quotes cannot drift apart over time because of the underlying efficient price which is a stochastic factor. The efficient price differs from the observable prices because of transient microstructure friction and as such efficient price satisfies the martingale property since revision in expectations cannot be predicted. In this study, price discovery was measured using intra-day weighted price contrition (WPC) as opposed to information

share (IS) which is suitable for measuring price discovery for stocks listed in parallel markets or information flow on a sequential time periods. WPC measures the amount of information absorbed in prices by way of average proportion of the day's return for a given time frame which is a fixed period of time of one hour during the continuous trading day for a sample period of six months in this study.

1.1.5 The Nairobi Securities Exchange

The Nairobi Securities Exchange (NSE) is Kenya's only secondary market for stock, bonds and futures derivative instruments. This study focuses on the stock market where shares of listed companies are traded and prices determined throughout the trading period in a given day in the exchange process. NSE and Capital Markets Authority (CMA) records provide detailed history of the operations and evolution of the local capital market. The main aim of this study was to establish price discovery process at the NSE and the relationship among market information risk, trading activity, organizational characteristics and price discovery.

The market traces its existence to 1951 as a private stock broking firm owned by Francis Drummond then. There are sixty six listed companies in the NSE as at 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 stock brokers following collapse of some of them in the recent past and also capital requirement constraints for those who would wish to register and subsequently offer brokerage services.

The market architecture of NSE is defined and shaped by rules and regulations in place which govern the trading process from when a trade is initiated until when

settlement is done. The structure of a market ,in the short term, impact the process by which equilibrium prices are arrived at throughout the trading period by way of degree of information asymmetry and other induced frictions. The exchange is characterized by pre-open period (9.00a.m-9.30a.m), opening auction (9.30a.m), continuous trading (9.30a.m-3.00p.m), closing (3.00p.m), trade corrections (3.00p.m-3.15p.m) and trade halt period which is basically public holidays and overnight periods when trading does not take place.

1.2 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. As noted by Subrahmanyam and Titman (2001) and Chen et al. (2007), asset pricing process still remains widely debated issue in the discipline of finance largely because of its implication for wealth creation and societal welfare. 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. The speed with which short term equilibrium prices are arrived at during the continuous trading period or indeed any other period of trading at the stock market is partly a function of the trading mechanism in place and informational content of stocks. Price evolution process has implications as to the degree of absorption of information into prices and the level of disparity between the observable short term market clearing prices and the underlying fundamental values of stock trading at the exchange. 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 such variables as market information risk, trading activity and organizational characteristics 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, market information risk, and trading activity. Furthermore, Stock markets vary from one country to another as well as from time to time in terms of design, structure and shape which translates to unique microstructure characteristics. This uniqueness in itself justifies empirical studies in every stock market. It is 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, has distinct features as to structure and hence market microstructure as shown by 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. Bakeart 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. The capital markets regulator introduced new trading rules in the year 2013 which potentially changed the shape and structure of the exchange. In the same year, ownership structure of NSE changed from being owned by brokers to a public entity and this undoubtedly changed shape of the market. The change in market structure has an impact on the flow of information and hence trading activity. This study has helped shed more light by contributing to emerging market microstructure literature by not

only investigating the nature of price evolution but also the role of MIR, TA and organizational characteristics in the process for stocks listed and trading at NSE.

Brunnermeir 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.

A number of researchers have also studied market transparency, a cornerstone of MIR where the identity of the agent or trader placing an order is revealed and therefore making it impossible for holders of private information to exploit the market. At the NSE, the identity of the agent placing orders on behalf of traders is usually not revealed as per the existing laws. However, other studies have yielded contradicting findings. They include studies by Barclay et al. (2003), Theissen (2007), Lok and Kalev (2006), Foucault et al. (2007), Eun and Sabherwal (2003) Solnik et al. (1996), Comerton Forde et al. (2006), Bacidore and Sofianos (2002), Frijns et al. (2010), and Kadapakam et al. (2003). The reviewed empirical studies on intraday price discovery process has been on varying stock markets in developed economies although none offered an explanation for the likely source of contradiction. These studies can be replicated locally in order to offer some evidence and contribute to the either side of the contradiction in pursuit for a conclusive point of reference. The studies reviewed have concentrated on the nature of price discovery process in various stock markets. It is however established by both theory and empirical literature that information

content of a stock could dictate the level of participation by traders and this eventually would vary the degree of trading risk and level of trading activity. Besides establishing the nature of price discovery at the NSE, this investigated how MIR, trading activity and organizational characteristics interact in impacting price evolution. Furthermore, the debate on price discovery and choice of a mechanism that can deliver the most efficient short term prices is inconclusive and still remains a work in progress in the discipline of finance. This study therefore aimed at documenting evidence based results that fall on either side of the debate besides forming part of empirical literature for emerging market in terms of manifestation of market microstructure regularities.

Ngugi (2002) did a study on institutional changes at NSE and its impact on trading activity and liquidity whereas Agatha (2013) focused on effect microstructure changes on market efficiency at the NSE. Conceptually, none of the reviewed local studies have used MIR, TA, OCH and PD as study variables. This study extends the study by Ngugi (2002) and Agatha (2013) by the inclusion of additional variables which allowed for testing of direct, mediation and moderation, and joint effect. Other empirical studies undertaken in emerging stock markets in the region include Lukamia (2014) and Kadapakkam et al., (2003) which utilized end of the day index and end of day stock prices respectively. However, studies on price discovery are in a standard way undertaken using high frequency data. This study aims to fill this methodological gap by using intraday data for stocks listed at the NSE as opposed to end of stock prices or exchange indices.

Despite many studies done on price discovery, researchers have not been able to explain what contributes to efficiency in price discovery process. This could be due to

the fact that many studies have focused on few variables that influence price discovery. Empirical studies have attempted to explain the relationship, but the debate is inconclusive due to the divergent views of the scholars. For example, there is no consensus on how ownership concentration an indicator of organizational characteristics impact market information risk as documented in Stoll (2000) and Brockman et al. (2009).

Contextually previous studies have been done outside Kenya and even those done in Kenya did not use only stocks traded at NSE and price discovery as the dependent variables as opposed to performance as the common measure from previous studies. Furthermore, the uniqueness of the market structure of NSE which is largely based on the processes and rules for facilitating trades which in the short run influence direction of trade, determination price discovery and degree of market information risk is one of the motivations for undertaking this study. As noted by Kalay et al. (2002), Camilleri & Green (2009), Mosoud (2013) and Yilmaz et al. (2015), the intensity of trading activity may be dictated by stock market structure that is in place. Needless to say that, microstructure study of NSE has provided an opportunity to focus on intraday features such as bid price, ask price, transaction price, trading volume, stock return volatility and market information risk. Conceptually none of the studies reviewed have used market information risk, trading activity, organizational characteristics and price discovery as study variables. Methodologically, the studies identified have tested direct relationship but did not test moderation, mediating and joint effect at the same time. This study thus incorporated organizational characteristics and trading activity as a mediating and moderating variable respectively to establish the relationship between market information risk and price discovery of stocks listed at the NSE. In undertaking this study, the author holds the

view that there is lack empirical evidence on the interaction among MIR, TA, OC and PD for stock listed at the NSE. The study therefore sought to fill this gap using microstructure data and finding answers by way of empirical evidence to the following specific research questions.

1.3 Research Questions

(i) Does market information risk influence price discovery for stocks listed at the Nairobi Securities Exchange?

(ii) How does trading activity influence the magnitude and direction of effect between market information risk and price discovery for stocks listed at the Nairobi Securities Exchange?

(iii) Does organizational characteristic moderate the relationship between market information risk and price discovery for stocks listed at the Nairobi Securities Exchange?

(iv) When considered jointly, how does market information, trading activity, and organizational characteristic impact price discovery for stocks listed at the Nairobi Securities Exchange?

1.4 Objectives of the Study

The general objective was to determine the relationship among market information risk, trading activity, organisational characteristics and price discovery of stocks listed at the Nairobi Securities Exchange. The specific objectives are;

(i) To establish the effect of market information risk on price discovery for stocks listed at the Nairobi Securities Exchange

(ii) To determine the mediating effect of trading activity on the relationship between market information risk and price discovery for stocks listed at the Nairobi Securities Exchange

(iii) To determine the moderating effect of organizational characteristics on the relationship between market information risk and price discovery for stocks listed at the Nairobi Securities Exchange

(iv) To establish the joint effect of market information risk, trading activity and organisational characteristics on price discovery for stocks listed at the Nairobi Securities Exchange

1.5 Value of the Study

The findings of this study are important for practitioners, formulation of policy, theory and empirical literature for emerging stock markets. This study contributes to knowledge and empirical literature having documented the intra-day relationship among the variables of study during the one-hour frequency continuous trading period from January to June 2019.

First and foremost, market microstructure is a sub discipline of finance that has experienced enormous growth over the last two decades. This study contributes to the field of finance through documentation of empirical evidence of the microstructure of NSE using one hour frequency data and also pointing out the likely direction in terms of areas for future research. This study was based on the market microstructure theory and specifically Kyle (1985) and Glosten and Milgrom (1985) models. Market microstructure theory has not received thorough interview in finance literature especially on market information risk and price discovery of listed stocks.

Furthermore, findings of this study contributed to the existing body of knowledge and practices in the field of finance by providing a reflection of the effect of market information risk, trading activity and organizational characteristics on price discovery.

Empirical evidence on the impact of market information risk, trading activity and organizational characteristics on the price formation process is of great importance to investors because fair and efficient pricing of stocks enhances confidence and attracts more participants in the market since there will be minimal instances of adverse selection occasioned by information asymmetry or an element of unfair collusion by brokers who by description are the agents of investors and other market participants. Given that the market architecture dictates prices discovery process, market information risk, and trading activity, findings of this study are beneficial to investors in the formulation of an arbitrage strategies when instructing their brokers on matters of placement of either buy or sell order. Besides the investors, findings of this study are useful to managers of firms who rely on the financial markets for raising external capital. Price discovery which falls under Market microstructure is valuable to regulators in addressing such issues as market design, regulation and trading protocols.

The efficient price formation process is function of the market design, trading algorithms, investor behaviour, trading mechanisms and regulations governing trading. This in summary can be said to be the market rule book that defines the nature of market structure and this has tremendous effect on the quality and efficiency of price discovery. Empirical evidence documented in this study shows that high speed of price discovery and heightened trading activities occurred during the first two hours of opening and last one hour of closing. This information is useful to NSE

and CMA as the bodies in charge of formulating trading protocols in their pursuit of designing an efficient market clearing mechanism.

Academicians and researchers in universities and other research based institutions would find the study findings and conclusions valuable since it enhances their understanding of the role that trading activity, information asymmetry and trading process play in the exchange process and in the accomplishment of trades. This in turn would bring forth the inadequacy of the current theories and models paving way for a critique and perhaps development of alternative and more robust asset pricing models.

1.6 Organization of the Thesis

This thesis report is organised into six chapters. Chapter one provides an overview, background and justification for the study. It highlights the objectives of the study, expected contributions, motivation and the theories in which the study is anchored on. It is also in this chapter where the study variables namely, market information risk, trading activity and organizational characteristics and price discovery were briefly discussed. The chapter also discussed the context of the study which is the stocks listed at NSE in Kenya. The chapter concludes by providing information on how the findings of the study would be valuable by making contributions to knowledge, policy and practice.

Chapter two presents literature review on the relationship among market information risk, trading activity, organizational characteristics and price discovery. The empirical review is further presented as a summary clearly showing the knowledge gaps that this study endeavoured to fill. The last part of the chapter contains the conceptual framework that illustrates by way of a diagram the expected relationship

among the variables of the study and the formulated hypotheses which were tested in chapter five of the study.

Chapter three provides details of the methodological approach and framework that guided the study. The chapter begins by presenting the research philosophy that underpins the study. The chapter also contains details of research design, population, data collection process and diagnostic tests which were aimed at establishing presence or absence of econometric issues. In addition, it presents the analytical procedures adopted to meet the objectives and test the formulated hypotheses. Furthermore, under the rubric of analytical procedures is information on definition and operationalization of market information risk, trading activity, organizational characteristics and price discovery.

Chapter four documents study results in terms of data analysis and findings. The results were presented in three sections. Section one provided the initial analysis of the study. Section two offered the descriptive statistics of the data in question. The third section showed the results of correlation analysis. The chapter therefore details the descriptive statistics of the variables in the study. The chapter also contains results of trend analysis showing how the variables manifest during the five intervals during the sample period. It also presents the results of the diagnostics tests undertaken which showed no econometric issues that would have warranted formulation of mechanisms of dealing with them. Lastly, the chapter concludes by a presentation of the results of correlation analysis.

Chapter five of the study discusses the empirical findings of the regression analysis undertaken and results of the hypothesis testing. The chapter begins with the testing of the four hypotheses and then moves on to discuss the empirical findings obtained through regression analysis and in light of the objectives documented in chapter one of the study.

Chapter six of the study is divided into five sections. The chapter begins by a presentation of the summary of empirical findings of the study arising from the analysis undertaken in chapter four and five and as guided by the research objectives and tested hypotheses. The chapter also contains conclusion, contributions of the study, limitations and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

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

2.2 Theoretical Review

There are two paradigms in the theoretical framework of market microstructure. These are inventory and information based models and which constitute the components of microstructure theory. These microstructure models depict a situation in which informed and noise traders place orders during the pre-open and continuous trading period. The models predict that the action of informed participants depends on the realization of a noisy private signal of the unknown asset value which ultimately leads to asymmetric information. It then follows that price discovery and other intraday regularities largely depend on information asymmetry and its attendant effects. The other theory is the efficient market hypothesis of Fama (1970) which simply evaluates a market in terms of its capacity to incorporate information in prices of stock and not how the relevant information gets impounded in prices. However, as pointed by Hasbrouck (2013) and O'Hara (2015), complexities of trades and information in the high frequency trading may require formulation of new models for empirical analysis and investigation. The field of market microstructure which is concerned with price discovery is still evolving.

Researchers are continuously improving the existing models in order to come up with a solid unifying theory that will eventually explain price formation in secondary financial markets and this is undoubtedly one such avenue . As such, one model is an improvement of another and therefore must be presented together to achieve coherent flow. The choice of a theory in which this study was anchored on was largely based on empirical literature and postulation of the theory. The theory has to make attempts of modelling market participants and how equilibrium is arrived at given "n" number of traders, unique preference and utility functions. Secondly, the theory should focus on market mechanism on the lowest level of individual transactions as opposed to end of the day prices and at least offer explanation in regard to behavioural tendencies of traders in a setting with information asymmetry. The study is anchored on information based models of market microstructure theory as opposed to the other two theories because it attempts to explain how market participants through their brokers use information in formulation trading strategies.

2.2.1 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.

Garman (1976) is a one period model which focuses on the evolution of securities prices given a particular stochastic nature of market-order flow of buy and sell and the market clearing protocol based on the works of Smidt (1971) who argued that market

makers are not simply inactive providers of liquidity as suggested by Demsetz (1968), but actively adjust the bid-ask spread to take into consideration fluctuations in the levels of inventory. The model captures the process of how a risk-neutral dealer sets buy and sell prices only at the beginning of time, receives all orders and clears trades in order to maximize expected profits per unit of time while balancing inventory and avoiding bankruptcy. The spread in this market is positive and it is attributed to information cost, and the inventory and order processing cost. A striking phenomenon of this model is that inventory which takes the form of cash or stock is not explicitly incorporated into the market- makers' optimization decision simply because of the underlying assumption that the dealer sets prices at the onset of the trading. This is a major shortcoming and a liability of the model which by implication means that it cannot be applied in a setting where prices keep changing and updating based either on new information or change in valuation and beliefs of heterogeneous market participants.

Stoll (1978) model was formulated based on analysis of dealer's decision problem in terms of provision of intermediary services and the appropriate compensation where the market makers are risk averse. The dealer faces holding, order-processing, and information asymmetry costs in the provision of liquidity and immediacy. The dealer therefore sets ask and bid prices, hence the spread, for one transaction at a given time, taking into consideration the cost of proving immediacy. One shortcoming of the model is that it doesn't consider the inter-temporal dimension of the dealer's problem and the fact that order flow could be random raising serious concerns about its generalization to the operations of the modern day agency or non-agency exchanges.

Ho and Stoll (1981, 1983) extended the work of Stoll (1978) to a multi-period framework by which variables of analysis are random and largely stochastic and the monopolistic market maker is presumed to maximize the expected utility of wealth. The variables here include order flow and stock portfolio returns. The model assumes a finite horizon and the dealer's optimal pricing strategy as a function that specifies bid and asks prices, given the level of state variables of cash, inventory and base wealth position of the dealer. This model therefore predicts that the relative positions among dealers helps determine intensity of interdealer trading and level of inventory has a potential of influencing level of quotes but doesn't have the latitude to dictate the size of bid ask spread at any given time.

Amihud and Mendelson (1980) expanded Garman (1976) by taking into consideration how the market maker's prices change given change in inventory levels over time. The bid and ask prices and hence positive spread fall monotonically and they depend on inventory size and as such, change from time to time, depending on inventory position of the market maker eliminating probability of failure. The dealer's optimal pricing strategy takes into account the inventory balancing dilemma and the aim of covering order-processing and inventory based costs. This model focuses on the inventory position as opposed to the order arrival rates that may communicate possible variability in asset values by other factors other than dealer's problem. Furthermore, this model seemingly has same predictions as efficient market hypothesis theorem in that transaction prices realized in the course of activity of trading are serially correlated and this is based on the analogy that, for the market maker, there exists an optimal inventory position and when at variance with position, then they are left with no other option other than to quote prices that will ultimately get them to the optimal position.

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, adverse selection and trading activity. The models fail to provide a road map and succinct prediction of how the activities traders with different strategies and information play out and its implications for market information risk, trading activity and price formation.

The models discussed under inventory explain price formation in a dealer market where market makers trade on their own accounts. NSE is both auction and continuous market where individual and block investors trade through their agents as provided by the regulatory framework in place. The agents cannot trade on their own account. The models therefore do not aid in explaining the role of market information risk on price discovery process for stocks trading at the NSE. However, it is worth presenting them because it might be applicable in future if ever there will be a change in the market architecture. Stock markets are obviously not immune to evolution courtesy of technological advances or institution of new regulations.

2.2.2 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 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 theories views the stochastic process of evolution of prices as a function of the

trading process and the learning curve of the market participants where trading is seen as a game between a market maker and traders who choose to place orders at a random sequence. The underlying push for trading is either for purposes of liquidity or profit maximization by those endowed with private information and as such, in the short run, uninformed investors are exposed to adverse selection and this gives rise to aspect of market information risk. 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.

Copeland and Galai (1983) model formalized the concept of information asymmetry by developing a static one-period framework depicting pricing problem of the market marker. The risk-neutral dealer will always set a positive spread to take care of losses that might arise as result of trading with informed trader since he or she might not make a clear distinction between informed and uninformed market participants. The model addresses the aspects of probability of informed and uninformed trading and postulates that the size of BAS, an indicator of market information risk, is a function of market makers maximization problem. The theoretical prediction of this model is that, market participants tend to widen the bid-ask spread when faced with a scenario where they foresee a high degree information asymmetry. This approach to market microstructure provides an important characteristic of market information risk that is only limited to one single period and as such cannot be applied to a multi-period

setting like NSE. The model also fails to acknowledge that trading in itself is a source of information for traders which could potentially alter participant's behaviour, market information risk, trading activity, price discovery process and eventually prices.

The Glosten and Milgrom model (1985) lends itself to the analysis of risk neutral, informed and uninformed traders and how price emerge given the trading process in a multi-period setting by extending 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 informed or uninformed. The genesis of the observed spread can be attributed to the continuous nature of revisions in assets values by observed trades which are presumed to be carriers of information. This confirms the notion that a trade in itself 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.

Consequently, the determination of intensity of trading activity and market information risk can be demonstrated using the prediction that a stock has a potential of assuming multiple prices at a given period of trading and that transaction prices are not serially correlated unlike in the case of Amihud and Mendelson (1980) inventory based model. Market information risks as quantified by the size of bid ask spread is a

function of the potential value of a stock and actions of a population of informed traders. 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.

Easley and O'Hara (1987) expanded the Glosten and Milgrom (1985) model by incorporating potential variation in trade sizes and strategic behaviour of the market maker and the fact that investors through their brokers or agents can choose to either trade in large or small volume of a given stock. The model attempts to explain the scenarios where differential in trade quantities results in different prices with adverse selection problem as the only constant. However, unlike Glosten and Milgrom (1985), this model permits execution of any trade size and this implies that volume will be dependent on the beliefs of participants regarding importance of information and this allows uncertainty in the information arrival process of the informed traders through their brokers. Investors will prefer to trade in large volumes in a competitive market populated by informed participants in order to maximize profits. Bid ask spreads emerge as an indicator of market information risk and this is attributed to behaviour of informed investors. However, even with the options of small or large volumes, rational and informed traders may devise a strategy where they deliberately mix orders with those of investors with less information and still end up with large orders as they attempt to exploit superior information in their possession before it is revealed and reflected in prices through trading activity process. This strategy results in two sets of equilibrium. In the first place is when traders that are informed are able to be identified through their ability to trade volumes with others like informed trading in small quantities and in the second place where traders that are informed giving small

as well as large orders for the prices to be enhanced even in large volume trades. Thus this creates the correlation that is positive as far as the size of trading and spread size is concerned. This thesis presents empirical evidence on price discovery and how such intraday outcomes as trading volume, bid ask spread, number of transactions, stock return volatility and ownership concentration impact it. The aim of the study was never about classification and investigation of trade size during the sample period.

Easley, Kiefer and O'Hara (1996, 1997) formulated a measure of market information risk known as Probability of Informed trading Model (PIN) based on the Glosten and Milgrom Model where market participants are classified as informed traders, uninformed liquidity providers and risk neutral market representatives. Recent empirical researches and findings on the use of PIN model have called for improvements and extension to the measure to allow for maximum likelihood estimation procedure. Hasbrouck (2007) points out that one of the shortcomings of the model is that the input dataset only includes the number of buy and sell traders in a given day in total disregard of events that may occur once as opposed to several times occurrences in a day. Easley, Engle, O'Hara and Wu (2008) propose and provide an extension to the model to allow for time-varying PIN measure incorporating the GARCH family of volatility specifications.

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 of the fact that 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 factor in private information and insider's trading strategy. On placement, prices are expected to respond to density of trading activity implying that market prices reflect available information inherent in the informative nature of the order flow. 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 two information based models which this study was anchored on are that of Kyle (1985) and Glosten and Milgrom (1985). 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.

2.2.3 Market Efficiency Theory

Fama (1970) formulated the efficient capital markets theory and noted that markets are populated by homogeneous agents that act in a rational expectations environment where prices reflect all information and any change in any information set should be reflected immediately into the price dynamics. The theory posits that prices follow a random walk process and therefore any information available for predicting the stock prices is already incorporated in the prices and error term being only source of

uncertainty. However, Grossman and Stiglits (1980) discuss the problem of possible information heterogeneity in agents' price expectations and therefore trading activity in any market could be seen as largely heterogeneous. Gouree and Hommes (2000) while investigating bounded rationality listed three factors that cast doubt on the efficient capital market theory. Heterogeneity of participants, and secondly is the fact that participants may not follow rational expectations and as such may derive their expectations based on their beliefs. Lastly, other participants could follow price movements in the market.

There is a known behaviours that are irrational especially where investment decisions is key and thus the prices of stocks gives an indication that many traders often gets carried on by either bubbles of the assets or booms as well as economics behaviour (Fama, 1970). This includes the effects of herding which is further emphasized by Dreman, in a 1995 paper which explains how price earnings ratio that are low gives returns that are greater and also unavoidable under performance. The theory is important but was not applicable in the current study largely because it is limited in its explanation of how information gets incorporated into prices. Furthermore, it does not appreciate the reality of stock markets where trading protocols in place and other frictions brought about by nature of market microstructure in place and which have been documented empirically as factors that drive trading activity, and price discovery process .

2.3 Empirical Literature Review

In this section, a critical synthesis of empirical studies is presented as per the study variables clearly showing the potential extension and knowledge gaps that would be classified as methodological, contextual or conceptual.

2.3.1 Market Information Risk and Price Discovery

Barclay and Hendershott (2003) in a study on price discovery process and trading after hours of selected stocks at NASDAQ investigated how investor choice to place orders after or during trading day affect the PD. 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 as from 9.30 am to 4.00 pm, East Africa time. The authors found that there is a large amount of private information revealed during the pre-open period. The revealed information was also found to enhance price discovery in the pre-open and continuous trading part of the 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.

Chung, Hrazdil and Suwanyangyuan (2016) investigated how information disclosure in terms quantity and quality affects the efficiency of prices of stocks when the reported on annual basis. The authors analysed electronically archived data in the years 2003 and 2013. In estimating information and the amount available in terms of public in the stock exchange of Toronto, showed that when reports are large or to more extent long, information is reduced with immediacy costs lowered as well as activities of trading being higher and discovery price being more efficient. The robustness of the results come when other determinants are associated including costs of trading, volatility, effects of information as well as characteristics that are specific to the firms.

Chung, Hrazdil and Trottier (2015) studied how the transfer of the industry intra information happen gives an indication that there is delayed transfers of information over time in terms of mispricing with an explanation that there was improved efficiency in terms of the pricing processes of formation especially in US markets. When information arrives late to some traders, they are likely to experience bigger loses and therefore inverse relationship is depicted. The activities of trade and also liquidity increment have resulted to efficiency in pricing which has been a norm in the recent years.

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 the 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, that is, manager prefer disclosure that is selective and investor prefers disclosure regime that is fair.

Chung, Hrazdil, Novak and Suwanyangyuan (2019) studying how information that is quantified in disclosures at corporate level plays a role on how investors efficiently use newly acquired information for prices of stocks in disclosures of 10-K, DQ and TQ where the results displayed significantly showed how DQ as well as TQ improving discovery of prices from information efficiency. The results also indicated how information creates efficiency in the minds of the managers and also investors to make great decisions concerning the level and quantity to trade on the market in a given trading activity.

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 into 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.

Dye and Hughes (2018) in studying disclosures in voluntary equilibrium pricing of assets and transfer of information through formula of pricing development where multiple securities are traded showed that uncertainties in the mind of the investors is perceived to create value and cash flow in future where interpretation and disclosure of assets by firms becomes key to generation of externalities of information to other firms in question.

2.3.2 Market Information Risk, Trading Activity and Price Discovery

Masulis and Shivakumar (2001) in a study of the speed with which market clearing prices emerge in markets with varying structures in the US found that indeed microstructure impacts the process by either retarding or accelerating it. The authors also find that proportion of foreign investors present is an important factor other than market reforms which drives liquidity and enhanced market efficiency. This study justifies why studies of microstructure nature can be undertaken in every stock market because of their uniqueness.

Kadapakkam et al. (2003) studied Indian cross-listed stocks in LSE and particularly the role of advanced foreign market and emerging domestic market in price discovery using 23 large Indian stocks with GDRs and trading in London for a period 1999 to

2002 using daily closing prices. The LSE opens one hour earlier than Mumbai Stock Exchange. They found ownership as far as foreign is concerned is key to price discovery especially on markets that are emerging. In as much as they linked foreign ownership to level of contribution, this study introduces MIR, trading activity and organizational characteristics variables to establish the combined effect of these factors on price discovery. Furthermore, the reviewed study focused on securities in parallel markets whereas this study was based stocks listed and trading at the NSE which utilises the WPC as opposed to IS as a measure of price discovery.

Lok and Kalev (2006) in an error correction model and how New Zealand as well as Australia behave in a cross listing found no contribution of each market in discovery of prices as far as home market is concerned. These findings are consistent with that of Bacidore and Sofianos (2002) and Solnik et al. (1996) who suggest that price discovery takes place the home market where substantial information originates. However, Lok and Kalev (2006) fail to show how each market contributes to price discovery process either explicitly or implicitly following the confirmation and conclusion that each market contributes to price discovery. Frijns et al. (2010) replicated the study by Lok and Kalev (2006) by studying cross listed stocks for Australia and New Zealand using Information Share (IS) methodology of Hasbrouck (1995). With regard to price formation, they found that home market was dominant compared to the foreign market. They also found that each specific and unique market structure contribute to price discovery. However, Eun and Sabherwal (2003) and Kadapakam et al. (2003) find the foreign market dominating in price discovery and they attribute it to higher percentage of ownership in the cross listed stocks. This is a clear testimony that the debate on where price discovery occurs for cross listed stocks is not yet conclusive.

Czerwonko, Khoury, Perrakis and Savor (2012) studied how tick size and microstructure noise together with informed trading and volatility inversion influence price discovery. The findings followed that informed traders increases the efficiency of trading activities since they are able to detect information risk on the market which significantly influence price discovery process. The results further shows that tick size changes as a result of shared market information, reduced risks related to information and also concerns equities and exchange funds traded.

Harris (2013) studied how information Share in Options Markets influences announcements of earnings with volume and volatility playing moderating roles. Using panel data in a sample of 500 stocks it was established that the volume of trading significantly increases when announcement of earnings happen since the risks of market information reduces as perceived by market participants. The results further shows that information sharing relating to market has no difference significantly as far as the option market is concerned relating to either put or call with the argument that when the volume of stock trading is higher, the information concerning market is efficient, exhibiting low market risks. The results further show that volatility in prices is positively and significantly related to sharing of information in a higher level which in turn improves price discovery process.

Kryzanowski and Lazrak (2011) examining how informed trading plays a role in price discovery among stocks listed at Toronto Stock Exchange in Canada with the findings that when either public or private information is available, the volume of trading increases significantly due to reduced bid ask spreads and increased liquidity. During periods of enhanced announcements or communication of relevant news, bid ask spreads shrink and this enhances price discovery significantly due to investors ability

to monitor market risks during announcements periods and the fact that adverse selection problem is drastically minimized.

Riordan, Storkenmaier, Wagener and Zhang (2013) studied how information on newswire and trading activity influences intraday price discovery through immediacy management among electronic order market with the findings revealing that information arrival is critical in determining levels of trading activity. The implication was that, adverse selection costs and intensity of trading is increased with the availability of information and where investors are believed to possess different information market reaction is induced leading to significant drop in trading intensity and volume.

Hu (2019) studying the delays that are intentional and the quality of the market and how discovery of prices is influenced in regression analysis shows that when trading costs decline, trading activities increases due to reduced information risks which in turn influences significantly the process of price discovery. The results also shows that price discovery increases significantly with stocks with historical trading activity since they possess low market information risks that is these changes may be related to a reduction in "sweep risk" after IEX becomes an exchange.

Brolley and Cimon (2018) studying liquidity, nature of order flow, segmentation, and price discovery taking into account the role of latency delays in the review of literature found that when trading is well informed, investors will take advantage of the information available to trade largely since there would be decreased risks associated to the market. This will thus enhance the discovery of prices and liquidity will be improved on stocks and the trend may reverse significantly when information

is insufficient to make trading decision as this will create many risks on the market thus making investors to engage in low trading activities.

2.3.3 Market Information Risk, Organizational Characteristics and Price Discovery

Amihud, Mendelson and Murgia (1990), documented how stock return volatility and price discovery at the Milan Stock Exchange is influenced by market microstructure in place. Call auction and continuous are the two dominant clearing mechanisms in the investigated market. The researchers report varying degrees of volatility with the opening consummated trade in the continuous market registering highest volatility and efficient price discovery compared to starting off the exchange with a call auction based transactions. The trading and matching mechanism in an exchange whether call auction or continuous uninterrupted trading is critical in the evolution of trading activity, volatility, bid ask spreads and indeed price discovery.

Eun and Sabherwal (2003) sought to establish the contribution of international cross-listings to price discovery for stocks. Specifically, the extent of price contribution by U.S stocks exchange on non-US securities listed on the exchange. They used a sample of 62 TSE listed securities of which 38 are cross-listed at NYSE, 3 in AMEX and 21 on NASDAQ over a period of six months, from February to July, 1998. The data utilized in the study was regularly spaced mid-point bid and ask quotes over a ten minute interval and analysed using the error correction model. They found that prices on TSE and US exchanges are non-stationary with a unit root meaning that they are cointegrated price adjustments due to cross-market information flows that take place in both exchanges but the US exchange adjusts more. In conclusion, the researchers observed that high magnitude of medium-sized trades in US relative to TSE served as a catalyst in speeding the process of price discovery.

Murinde (2006) investigated microstructure characteristics of selected African capital markets and their impact of institutional changes or reforms on market efficiency, liquidity and volatility. The studied exchanges were Nigerian Stock Exchange, NSE and Johannesburg Stock Exchange. The study found that with institutional changes, market efficiency and liquidity improved while volatility reduced in the three exchanges. The researcher proposes a model for investigating institutional changes and microstructure characteristics pre and post reforms and how it impacts stock efficiency, liquidity and volatility. This was an event study which focused on temporal aspect of introduction of reforms at a given point in time with little attention on potential frictions that the institutional changes may have brought and which could have had an impact on price market information risk, price discovery and level of participation by investors.

Kasmiati and Santosa (2019) in an empirical evidence on Indonesia stock exchange studying the effect of trading earning information, financing decision on risk and stock return using the data panel regression showed that trading earning information, financing decision on risk positively affect stock returns and that jointly influences how price discovery process behaves. Further, stock returns volatility show a negative effect on price discovery process especially when adverse selection problem is minimal. The implication is that information content of stocks and financing decision on risk may create stock return volatility and this ultimately has impact on price evolution process and overall stock value.

Skrinjaric (2019) studying index composition of stock market changes and effect on returns of stock taking the context of Zagreb Stock Exchange between 2015 and 2018 found that short run mechanism impacts on changes of stock exchange returns

confirming that when stock is excluded from the index of the market, return volatility is reduced and that the effects of asymmetric information gives deviation on values of the assists and the information risks related to markets and composition as far as returns on stocks in concerned.

Nguyen and Darne (2018) studying forecasting and risk management in the Vietnam Stock Exchange applied the family of GARCH-type models in the investigation. The study aimed at recording short and long memory effects based on filtered and raw collected data. The data sample covered indices of the Vietnam Stock Exchange between 2007 and 2015. Empirical evidence revealed that the multivariate fractionally integrated asymmetric power Arch (FIAPARCH) model is the most suitable model for the indices utilized in the study and that ownership concentration acts as a control variable where market information risk creates major deviations in price discovery.

Ali (2018) while focusing on firm listed at the NSE investigated how quality of financial reporting drives observed Prices of securities trading at the exchange using descriptive research design. The unit of analysis was firms listed at the exchange between year 2011 and 2017. Based on empirical findings, the author observed that there was an explicit mismatch between the inherent values of shares and the book values and this was attributed to poor quality of financial reporting. Furthermore, the mismatch also contributed to extant market information inefficiencies which were then found to influence stock returns implying that relevance and timeliness of market information leads to an increase in stock prices which was also found to be a function of stock return volatility.

Siikanen (2018) studying investors knowledge on market information risk in case of how information arrives, and liquidity from stock volatility in an empirical Evidence

from financial markets provide evidence that the potentially biased information of stock released affects the behaviours of different investors in the stock market differently depending on the ownership structure exhibited. The results show that traders observe relatively tight spreads when there is existence of asymmetric market information and traders with more information observe more improvements in spread.

Mutemeri (2019) on determining how prices perform on offers at public initials in a study which is comparatively at the stock exchange in Nigeria on performance of price initial offer and the indicators at macroeconomic levels among South Africa in a least square technique found market structure together with risks of information and the structure of ownership are related to price discovery. Further it was established that on initial trading in Nigeria showed higher prices as compared to South African economy. Further the model showed significant effect of market information risk and price discovery for both the countries and economies as the rate of inflation as well as interest correlates positively to changes in prices when information risk is less and ownership is concentrated for both economies and stocks.

Rupande et al., (2019) studied investor sentiment and the direction of effect on SRV by drawing evidence from Johannesburg Stock Exchange between 2002 and 2018. The research results and findings showed a significant link between investor sentiment and stock return volatility. By inference, this implicitly points at investor sentimental set of beliefs which are eventually embedded in the quoted and this eventually shapes the degree of market information risk. The level and interplay of varying set of organizational characteristics can significantly explain the pattern of stock returns and eventually prices of the stocks at the Johannesburg Stock Exchange.

2.3.4 Market Information Risk, Trading Activity, Organizational Characteristics and Price Discovery

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 in order to separate firm specific characteristics. On analysing the data, they find significant abnormal returns in the halt period (80 %) for the full sample. 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 found that concentration of price discovery was in the halt period for all types of new events while for the pre and post halt periods they found significant but low price contribution and minimal price contribute on respectively. Their findings are consistent with that of Barclay and Hendershott (2003) 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 between 9.30 a.m. and 4.00 p.m. They analysed the data using the

unbiasedness regression and WPC measure and they found 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 reduced to 1.8 % and this huge reduction is attributed to the immense contribution of the pre-opening to price discovery which lead to the improvement of efficient price discovery. 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 measure 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 changes in market design on market efficiency at the NSE. The results indicated higher market returns and increased volatility on the introduction and automation of processes at the exchange compared to pre-market automation period. The author attributed the higher market returns 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 instituted 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. Based on the results, 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 weak and semi strong form EMH 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) undertook a study by comparing companies at the Ukrainian and Warsaw stock exchanges sought to present a comparative nature of informational inefficiency of stock price formation. The author found that informational efficiency was impossible to achieve 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 actually trading on 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 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) studied central and Eastern European Stock Market, the case of Romania. The study sought to offer empirical explanation in regard to intraday market efficiency in the identified context. The findings showed that, in general, investors cannot use historical and market based price information to formulate superior trading strategies that would guarantee short term arbitrage profits. The use of information extracted from the adventure of technical analysis casts doubt on the idea of the market being efficient at least based on efficient market hypothesis attributed to Fama (1970). This implies that, market frictions in terms of market information risk, trading volumes and transactions is not feasible in the stock market of Romania, at least when using popular technical analysis indicators.

2.4 Summary of Empirical Review and Knowledge Gaps

It is evident from the empirical reviews undertaken that although there are quite a large empirical literature and the fact that microstructure research is still evolving, there are knowledge gaps identified that are contextual, conceptual and methodological in nature.

The structural, technological, trading mechanisms and regulatory regime in place constitute market structure and design of an exchange. The market design is always a shifting target depending on changes instituted in the black box and other trading protocols. Stock markets vary from one country to another and from time to time in terms of design, structure and shape which translate to unique microstructure characteristics. Empirical studies on price discovery reviewed in this chapter have documented how information is priced in various markets whether developed or emerging and these markets have unique structures and microstructure orientation from NSE and this in itself justified this empirical study.

Most of the studies reviewed have also investigated price discovery process in various stock markets. However, drivers of the process and how they accelerate or impede the process is an area that has not received much attention. It is evident from both empirical literature and theoretical review that information content of stocks could dictate the level of participation by traders and this in turn determines the magnitude of trading risk and intensity of trading activity. This study introduced such concepts as market information risk, trading activity and organizational characteristics and further investigated how they individually and jointly impact the price discovery. This study investigated price discovery process during the continuous trading period.

The evidence from empirical literature reviewed on various aspects of price discovery, trading activity and market information risk has yielded contradicting results. For example, there seems to be no consensus on how ownership concentration impacts MIR. The question of where does price discovery occurs is as well not fully settled given results and findings undertaken in various exchange. It follows therefore that research and evidence based debate on the area of market microstructure, price discovery and how BAs, TV, and ownership concentration and SRV affect price evolution is not conclusive.

Microstructure structure studies in any securities market aim at establishing intraday dynamics and more so how in the short term new equilibriums are arrived at. However, these equilibriums are not realized until when participants troop to the market virtually through their agents and engage in the activity of trading. The behaviour of traders at any given time is by inference learned through observation of intraday variables such as bid ask spreads, intensity of trading activity and speed at which new equilibriums are arrived at. It then follows that, the standard form of data is secondary data that is obtained from data vendors, data streams or observation and recording from live trading screens and systems should be intraday either during trading halts, pre-open, post-closing or continuous trading periods. The empirical studies reviewed on the market microstructure of emerging markets have either used end of day stock prices and exchange indices which might not reveal intraday regularities. This study employed intraday of a frequency of sixty minutes during the continuous trading period at the NSE.

In the section that follows, titled Table 2.1, summary of empirical findings and how the identified knowledge gaps were addressed in this study is presented.

Table 2.1: Summary of Empirical Literature Review and Knowledge Gaps Identified

Author (S)	Focus of Study	Findings	Knowledge Gaps	Addressing knowledge gaps in the current study
Amihud, Mendelson and Murgia (1990)	How return volatility and nature of price discovery is driven by stock market microstructure at the Milan Stock Exchange	Authors reported high stock return volatility and efficient price discovery during opening transaction of continuous market.	Milan is a developed and a foreign market. Study is relatively old justifying replication. Milan and NSE has varying market shapes and structures. The study did not investigate the possible drivers of price discovery	The focus of this study was NSE, a thin emerging market in Kenya. Price discovery at interval of one hour during the continuous trading period, for six months was investigated. Stock Return volatility, a firm specific phenomenon was considered as one of the indicators of the organizational characteristics in the study. The focus was then to establish if return volatility is a moderator.
Aggarwal and Conroy (2000)	Investigated where learning and price change occur given the process from offer price, first trade price and finally the quoting behaviour of lead underwriter during the pre-opening period for IPOs.	The five minute window saw massive learning and enhance price discovery.	Study done on NASDAQ stock market, a developed market. The study can be done in Kenya to establish nature of price discovery post IPO when shares now trade in the secondary market but with focus on NSE listed stocks.	This study focused on stocks that are already listed and currently trading at NSE. The study documented the intraday dynamics observed during the sample period of the study. In particular, price discovery and some of its determinants during the continuous period and not pre-open or call auction period was investigated.
Masulis and Shivakumar	Focus was US and specifically markets with	They found that market microstructure is relevant in	Market structures vary from time to time and from one	This study focused on the continuous trading period as

Author (S)	Focus of Study	Findings	Knowledge Gaps	Addressing knowledge gaps in the current study
(2001)	distinct structure and market microstructure affect.	dictating the speed at which information I s absorbed and emergence of equilibrium prices.	country to another. There is a need to investigate the nature of PD at the NSE and extending the nature by establishing how information asymmetry accelerates or retards the process.	the mechanism for matching and clearing trades. The study sought to establish where information gets incorporate into prices faster during the five intervals of sixty minutes each. Furthermore, the study investigated how bid ask spreads, volatility, volume manifest itself and their impact on weighted price contribution.
Booth, G, G., Lin, J., Teppo, M., & Tse, Y., (2002):	Studied trading activities and pricing mechanisms of upstairs and downstairs at the Helsinki Stock Exchange	They found preference for the upper market by uninformed traders as opposed to the informed trader's cohort whose chose both markets randomly when trading. They also find that PD occurs largely in the downstairs market which reflects the permanent effect in the upstairs market	This study can only be replicated in exchanges that have both types of markets. This is absent in Kenyan stock market	The context of this study is NSE and the unit of analysis was stock listed and trading in the market.
Kadapakkam, P, R., Misra, L., & Tse, Y., (2003).	The role of advanced foreign market and emerging domestic market in price discovery using 23 large Indian stocks with GDRs and trading in London for a period 1999 to 2002 using	Found that the foreign market contributes considerably to PD for emerging market stocks largely because of the degree of foreign ownership in a firm as well the size of GDRs issued. They also find that London GDR price and the	LSE and Mumbai Stock Exchange have different trading and opening hours. They used daily closing prices. Using high frequency data could	First and foremost, this study employed intraday data whose frequency was sixty minutes during the continuous trading period. Secondly, the study employed ownership concentration as a proxy for organizational characteristics

Author (S)	Focus of Study	Findings	Knowledge Gaps	Addressing knowledge gaps in the current study
	daily closing prices using IS of Hasbrouck and the Gonzalo and Granger	Mumbai stock price are cointergrated with one common factor and therefore each market contributes almost equally to price discovery	different results	by investigating its impact in regard to the magnitude and direction of relationship between MIR and PD when introduced.
Barclay and Hendershott (2003)	Study investigated price discovery process past trading hours for selected stocks at NASDAQ. Also, the impact of decision by an investor to trade after hours or during trading day on asset pricing	Pre-open period constituted a period that recorded a higher ratio of informed trading. In the post-close period, there is less informed trading, price discovery compared to the pre-open period. Finally, there is large amount of insider and private information during pre-open and this is revealed through trades and price discovery	The NASDAQ market structure is unique compared to NSE where trading is done through a broker and therefore trading is not confined to the exchange hours as is the case at the NSE.	This study focused on market information risk and its role in price discovery process at NSE during the continuous trading mechanism.
Eun and Sabherwal (2003)	sought to establish the extent of price contribution by U.S stocks exchange on non-US securities listed on NYSE, AMEX and NASDAQ using error correction model	Authors report that the exchanges are non-stationary with a unit root. The US exchange contribution to PD increases as the proportion of medium-sized trades in US relative to TSE increase.	Researcher not aware if such study has ever been done to investigate price discovery for Kenyan Stocks cross listed. Empirical evidence on NSE is critical even before undertaking a parallel market study of Kenyan stock cross listed in East African Exchanges to assess which market dominates in price	This study focused on sequential PD at the NSE and how TA, OC and MIR affect the process.

Author (S)	Focus of Study	Findings	Knowledge Gaps	Addressing knowledge gaps in the current study
			contribution.	
Hansen and Lunde (2006)	How volatility, and bias correction of the realized variance is explained by the properties of market microstructure noise.	The authors found that there is a correlation between Microstructure noise which is largely time-dependent and increments in component of efficient prices.	Study can be replicated using tick by tick data available at the NSE after automation in 2006.	This study used 60-minute based data to establish the size and direction of interactions among the variables of study which included; price discovery, market information risk, trading activity, and organizational characteristics.
Madura, J., Richie, N., Tucker, A., (2006):	Studied 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. They examined the price contribution of the pre-halt, during halt and post-halt period to price discovery using WPC measure	They found significant abnormal returns in the halt period (80 %), (15 %) abnormal returns in the pre-halt period, while post-halt period showed no significant abnormal returns. In assessing price discovery, they find that PD 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.	Mixed findings in this study The study did not investigate whether trading halts give room for all participants to get the information. The study did not also investigate whether trading halts in one way or another impede the speed at which new equilibrium prices are discovered	Though the study did not focus on weekends and public holidays where there is no trading, it acknowledges the possibility of accumulation of information during the trading halt periods. Market participants would then take advantage of that kind of information. This study investigated information flow after halts and during week trading days as well.
Lok and Kalev (2006)	Contribution to price discovery of New Zealand and Australian cross listings using the error-correction model	Each independent market contributes to PD. However, prices in the foreign market are mostly more efficient.	Mixed findings which could be attributed to varying ownership and structure. The same study can be carried out locally.	The focus of this study was price discovery at NSE on sequential time basis. Also, the effect of organizational characteristics on price discovery.

Author (S)	Focus of Study	Findings	Knowledge Gaps	Addressing knowledge gaps in the current study
Barclay and Hendershott (2008)	It was a comparative study testing two hypotheses about trading in the pre-open and non-trading mechanisms for price discovery of NASDAQ stocks using the unbiasedness regression and WPC measure	The pre-open trading improved in the 1990's accompanied with decline in the degree of nosiness of the pre-opening price. PD shifted from the opening trade of the day to pre-open and for most stocks, the amount of information with or without trading was reflected in the opening price.	Study done in a more developed exchange with unique market structure. Study used only WPC measure. The same study can be done using other measure of price discovery like IS, Coefficient ration in order to compare results.	This study utilised the WPC measure and the interval time period is restricted to the continuous time period excluding clearing mechanism during pre-open and post-closing period which is largely auction.
Chung, Hrazdil, Novak and Suwanyangyuan (2019)	Investigated the degree with which participants update their beliefs based on the quantity of information in corporate disclosures.	DQ and TQ are highly correlated leading to attainment of overall improvement of absorption of information in prices.	The study was carried out in foreign market with varying market shapes and structures as compared to NSE. The study did not investigate the possible drivers of price discovery	This study's focus was NSE, a thin emerging market in Kenya. Price discovery at interval of one hour during the continuous trading period, for six months was investigated. Stock Return volatility, a firm specific phenomenon was considered as one of the indicators of the moderating variable. The focus was then to establish if return volatility is a moderator.
Chung, Hrazdil and Suwanyangyuan (2016)	Sought to establish how efficiency in pricing of stock is related to disclosure of information.	They found inverse relationship between disclosure quantity and information asymmetry and cost of immediacy. However there was some association	Study done on Toronto stock market, a developed market. The study can be done in Kenya to establish nature of efficiency on price	This study focused on stocks that are already listed and currently trading at NSE. The study documented the intraday seasonality observed during the sample period of the sty.

Author (S)	Focus of Study	Findings	Knowledge Gaps	Addressing knowledge gaps in the current study
		with trading activity, and price discovery	discovery with focus on NSE listed companies.	In particular price discovery and some of its determinants during the continuous period.
Wei (2017)	The extent to which informativenes of stock prices is driven by diversity of investors' beliefs.	Information content of stocks is influenced both by rational valuations of investors and the set of private information in their possession.	Market structures vary from time to time and from one country to another. There is a need to investigate PD at the NSE and extending the nature by establishing how information asymmetry accelerates or retards the process.	The information content of stocks and hence MIR, and it its effect on price discovery was restricted to the aspect of timing measured by how moving returns depart from zero. This study will focused on how information gets into prices over a sequence of five intervals.
Czerwonko, Khoury, Perrakis and Savor (2012)	How tick size and microstructure noise together with informed trading and volatility inversion influence price discovery	Informed traders increase the efficiency of trading activities since they are able to detect information risk on the market which significantly influences price discovery process.	This study can only be replicated in exchanges that have efficient source of knowledge on the markets. This is absent in Kenyan stock market	Market information risk was the independent variable in this study as measured by intraday bid ask spreads which were derived from inside quotes.
Harris (2013)	Information Share in Options Markets influences announcements of earnings with volume and volatility playing moderating roles	The volume of trading significantly increases when announcement of earnings happen since the risks of market information reduces	Announcements of earnings may not necessarily relate to market information risk. Using market information risk could give different results	The role of trading activity in the relationship between market information risk and price discovery is given upper hand. The study did adopt WPC as a measure of price discovery as opposed to IS for reasons already documented in chapter one of the study

Author (S)	Focus of Study	Findings	Knowledge Gaps	Addressing knowledge gaps in the current study
Kryzanowski and Lazrak (2011)	Informed trading plays a role in price discovery	When information is available, the volume of trading increases significantly due to reduced market information risks	Toronto Stock Exchange in Canada market structure is unique compared to NSE where trading is done through a broker and therefore trading is not confined to the exchange hours as is the case at the NSE resulting to information asymmetry.	This study focuses market information risk and its role in price discovery process at NSE during the continuous trading mechanism.
Riordan, Storkenmaier, Wagener and Zhang (2013)	How information on newswire and trading activity influences intraday price discovery through liquidity management among electronic order market	Information arrival is influence highly by adverse selection costs and that intensity of trading is increased with the availability of information and where investors are believed to possess different information market reaction is induced leading to significant drop in trading intensity and volume.	Researcher not aware if such study has ever been done to investigate price discovery for Kenyan Stocks cross listed. Empirical evidence on NSE is critical even before undertaking a parallel market study of Kenyan stock cross listed in East African exchanges to assess which market dominates in price contribution.	This study focuses on sequential price discovery at the NSE and also some of the factors that contribute to its speed or lack of it.
Kasmiati and Santosa (2019)	Investigated the effect of trading earning information, financing decision on risk and stock return	Trading earning information, financing decision on risk positively affect stock returns and that jointly influences how price discovery process behave	Study can be replicated using tick by tick data that may be gotten through observation or from data vendors.	In the current study, MIR experienced by market participants was quantified using the size of BAS and as such is the key consideration in the current study

Author (S)	Focus of Study	Findings	Knowledge Gaps	Addressing knowledge gaps in the current study
Skrinjaric (2019)	The context of the study was Zagreb Stock Exchange. For this market , the study sought to find out how composition of the index in terms of firms that constitute it influence stock returns	There exist asymmetric effects of market information risk index composition on stock returns which results to deviation and significant fluctuation in market discovery	Mixed findings which could be attributed to varying ownership and structure. The same study can be carried out locally.	The focus of this study is price discovery at NSE on sequential time basis. Also, the effect of organizational characteristics on price discovery.
Rizkianto and Surya (2014)	Investigated how weak and semi strong form EMH manifest itself at Indonesian Stock Market.	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	Study done in a more developed exchange with unique market structure. Study used only 8 stocks of diverse market capitalization measure. The same study can be done using other measure of market information risk in order to compare results.	This study utilised the bid-ask spread measure and price discovery where the interval time period is restricted to the continuous time period excluding clearing mechanism during pre-open and post-closing period.
Bowe, M., Hyde, S., Johnson, I. (2011)	Price discovery process during the 8.30 a.m. to 10.00 a.m. pre-opening period at the Malta stock Exchange using both the WPC and the IS measure	The two methods yield similar conclusions that the pre-opening period contribute significantly to the daily price discovery process for the stocks in the study over the full sample.	The authors did not test for the critical assumptions in the data for the WPC measure to be appropriate. The study used only six companies (three most active and three less active stock)	This study takes in to consideration how ownership concentration and volatility as organization characteristics play the role in the process of price formation.

Author (S)	Focus of Study	Findings	Knowledge Gaps	Addressing knowledge gaps in the current study
Wang, J. & Yang, M. (2014)	Price discovery contribution of Taiwanese ADRs listed in NYSE and NASDAQ together with their underlying stocks	The findings are that; 1. ADRs provide price information during the trading periods 2. Closing prices serve as a guide in hypothesizing the direction of movement in opening prices	The study recorded mixed findings as compared with other studies reviewed and which focused on the question of; Where does price discovery occur between local and foreign market for cross listed stocks. The study can be replicated focusing on Nairobi listed companies	The NSE stocks are key consideration in this study with price discovery process given upper hand. Focus was also on continuous trading period which constitutes more that 80% of the time available for placing and revising orders.

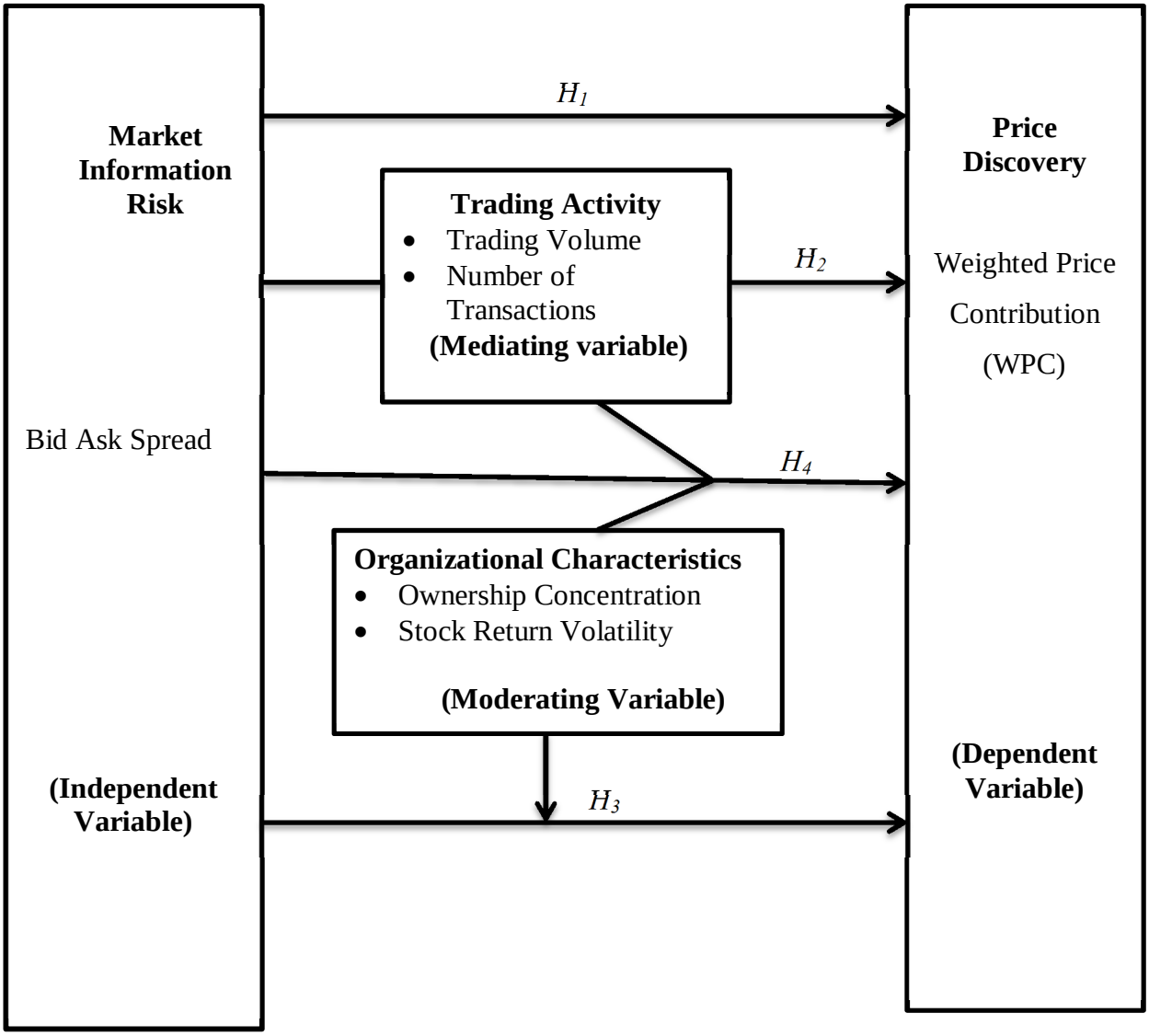
2.5 Conceptual Framework

This study sought to establish price discovery for stocks listed at the NSE and how it is influenced by market information risk, trading activity and organizational characteristics. Empirical evidence from reviewed literature suggests that private information is a key driver of price discovery process in stock markets. Furthermore, the degree of market information risk that is largely brought about by information asymmetry dictates the frequency with which both liquidity and arbitrage traders place their quotes hence level of trading activity.

The magnitude of Market information risk is the independent variable measured by bid-ask spread whereas trading activity which is a mediating variable was measured by trading volume and number of transactions. The study also considered organizational characteristics as the moderating variable and it was measured by ownership concentration and stock return volatility. In this study, price discovery was the dependent variable and was measured using weighted price contribution.

The schematic presentation in Figure 2.1 shows the relationship among study variables was conceptualized based on microstructure theory and empirical literature review. However, to the best of the knowledge of the researcher, and given the evolution nature of exchanges in emerging stock markets, debate on how microstructure frictions play a role in price discovery remains active, fertile and inconclusive. This study contributed to the debate by providing an empirical evidence of how variables of study interact as shown in the diagram that follows. Figure 2.1 presents the relationship and the hypothesis formulated.

Figure 2.1: Conceptual Model



2.6 Research Hypotheses

The research null hypotheses arising from the study objectives which were tested are as presented below

H_{01}: There is no significant effect of market information risk on price discovery;

H_{02}: There is no significant mediating effect of trading activity on the relationship between market information risk and price discovery;

H_{03}: There is no significant moderating effect of organizational Characteristics on the relationship between market information risk and price discovery;

H_{04}: There is no significant joint effect of market information risk, trading activity and organisational characteristics on price discovery.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, the research methodology adopted in answering the research questions is presented. Specifically, the chapter discusses the research philosophy, research design, target population, data collection methods, diagnostic tests, operational definition and measurement of variables, and data analysis techniques and procedures.

3.2 Research Philosophy

A research philosophy is the belief that underpins the choices that need to be made to be able to take a research position. Two of the main research paradigms are positivism and phenomenology and it is the latter view that guided this study. The phenomenological paradigm is concerned with understanding human behaviour from the researchers own frame of reference as outlined by Miller and Salkind (2002) and Collins and Hussey (2003)

According to Sanders et al. (2007), positivism is an objective and a scientific approach whereby conceptual and theoretical structures are developed then tested through empirical investigation. The approach to a large extent emphasises quantification of constructs. In this study, the concepts are market information risk, trading activity, organizational characteristics and price discovery which are anchored mainly on the information based theory of Kyle (1985) and Glosten and Milgrom (1985). Hypotheses developed on the nature of expected relationship were tested empirically and as such, this study was based on existing theory and by which hypotheses are formulated and tested.

Therefore, this study followed the positivist paradigm where a number of quantitative hypotheses were formulated and tested as presented in chapter five.

3.3 Research Design

The aim of this study was to establish how market information risk as mediated by trading activity and moderated by organizational characteristics drive price discovery and the research design to be adopted was one that provides a road map for data collection on characteristics of population, and testing of hypotheses in order to answer research questions. In social science research, research designs can be categorized as exploratory, causal and descriptive. As noted by Cooper and Schindler (2003), the objective of descriptive research design is mainly description of characteristics associated with a population, and discovery of association among variables. 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.

As pointed out by Burns and Bush (2010), descriptive research design facilitates description of trends, attitude or opinions of groups 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 was to establish relationships among the variables of this study. 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 documented 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.

3.4 Population

The study targeted the NSE listed companies from all sectors of the economy in Kenya which were sixty six (appendix I). 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. 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 were stocks listed at the NSE and involved investigating all stocks listed and trading at the NSE. This was therefore a census study.

3.5 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 was to investigate the relationship among MIR, TA, organizational characteristics and price discovery of stocks listed at the NSE. This objective is premised on the positivist philosophical paradigm which dictates that procedures for collecting data are put in place. Empirical investigations of price discovery largely focus on short –term periods, as evidenced in the empirical review of literature.

This study used historical data obtained through observation and real time recording during the continuous trading session using Microsoft excel sheet labelled data collection form in appendix II. This was instrumental in collecting data from NSE and other data vendors licensed by NSE. 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), weighted price contribution (WPC), volatility and trading volume. Data on ownership concentration was obtained from published books of accounts for companies whose stocks trade at the NSE. 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 of sixty minutes translating to five intervals during each trading day.

3.6 Diagnostic Tests

Diagnostic tests were undertaken in order to establish how well the model fits the sample data and to ensure that the study models were statistically robust and all classical assumptions of ordinary least squares were not violated. Specifically, multicollinearity, autocorrelation, normality and heteroscedascity tests were undertaken by way of variance inflation factors, Ljung-Box Q (or Durbin –Watson), Chi-square and white's tests respectively. Furthermore, the tests undertaken were critical in determining the appropriateness of the method of data analysis chosen before commencing analysis and hypothesis testing. In testing the hypotheses of the study, regression analysis was undertaken. Diagnostic tests are therefore essential in order that appropriate interpretation

of coefficients, confidence intervals and standard errors is correctly done. The diagnostics are also important in prescribing any treatment of the sample data just in case it doesn't meet classical assumptions of regression analysis.

3.6.1 Normality Test

The error of statistics manifests a lot in the literature of scientific undertakings. The procedures of analysis and associated techniques like correlation, t-tests, ANOVA as well as regression follow as assumption that distribution of data is normal. It is thus in assumption that population in which data is derived gives normal representation for accurate understanding of data. 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.

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

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

3.6.2 Test of Multicollinearity

Multicollinearity is where there is existence of high correlations among dependent or independent variables which occurs in the model of regressions especially multiple form thus resulting to estimates that are unreliable as far as coefficients are concerned. The results which are strange are now inevitable and therefore not realistic in making conclusions that such an individual independent variable influences significantly the dependent variable in the equation (Creswell, 2014). Multicollinearity tests were conducted using Variance Inflation Factor (VIF) to asses if or whether correlations in a certain relation are high or low.

3.6.3 Heteroscedasticity Test

Homoscedasticity is believed to be one of basic assumptions within regression model that is linear and classical stating that the distribution in probability in the term of disturbance remains same or rather constant for the observations. Heteroscedasticity is said to be present in a situation where the disturbance terms do not have the same variance (Bedru and Seid, 2005). Although existing literature as documented by Woolridge (2003) and Baltagi (2005) point out that panel data greatly helps in alleviating this problem, this kind of data may pose some problems. Presence of heteroscedasticity, may pose some challenges in making conclusions because of the resultant biased estimates of "F" and "t" statistic as pointed out by Gujarati (2003). Accordingly, , Breusch-Pagan test was utilized in this study detect the heteroscedasticity.

3.6.4 Autocorrelation Test

Autocorrelation is the issues in econometric which need to be further established before subjecting data to any other analysis. This is where covariance at zero of error terms are established meaning associated errors in a particular observation and another are uncorrelated. Durbin Watson test was used to detect serial correlation.

3.6.5 Stationarity Test

This test was necessary since the study employed presumably a continuous time series data recorded over discrete time intervals. The tests were necessary 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 useful in establishing this test of stationarity.

3.7 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. Descriptive statistics were utilized to describe the basic features of the data at the very onset. Using the quantitative data, the outlined hypotheses were tested. Ordinary Least squares analytics were ran for each interval and stock for the panel data over the sample period with clear specification of panel regression being simple linear, multiple and stepwise. Regression and correlation analysis was undertaken between the dependent and independent variables controlling for organizational characteristics and the mediating variable. This procedure was also done for the other variables of study.

Furthermore cross sectional stepwise regression in the spirit of Huang (2020) was ran to establish the joint effect of the MIR, trading activity and organizational characteristics on price discovery. The nature of the coefficients informed conclusions on the direction of impact for every objective and hypothesis. ANOVA analysis was then undertaken to establish if there was any variation in price discovery in each of the time interval (k=1, 2, 3, 4 & 5), specifically if it was equal across all stocks in the study sample.

In microstructure research, at is the cases in most of the social studies, 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 the variables in their work as presented in the sections that follow.

3.7.1 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 (2020) 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.

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

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 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.

3.7.2 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 in 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.

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

Where,

BAS = Bid - Ask Spread

BID = Buying Price in the inside quoted

ASK = Selling price in the inside quote

i = Stock

k = Interval

3.7.3 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.

3.7.4 Organizational Characteristics

Based on the empirical literature, two types of firm specific characteristics that would affect the magnitude of the relationship between MIR and PD used in the study are ownership concentration and stock return volatility.

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), Karuitha 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;

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

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,

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

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

3.8 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 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 objectives, and hypotheses.

3.8.1 Market Information Risk and Price Discovery

A simple linear regression analysis was used to determine the relationship between market information risk and price discovery for stocks listed at the NSE. Hypothesis one was that MIR has no significant effect on PD. The following linear regression model was used to test the first hypothesis of the study.

$PD = a + \beta MIR + \varepsilon$…….……..…… Equation 3.1

Where

PD = Price discovery

a = Constant in the equation

β = Regression coefficient

MIR = Market Information Risk

ε = Random Error term that accounts for unexplained variation

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.

3.8.2 Market Information Risk, Trading Activity and Price Discovery

The second objective was to establish the mediating effect of trading activity on the relationship between market information risk and price discovery. In this study, mediation was tested using the causal steps approach and sobel tests. The hypothesis tested was that TA does not significantly mediate the relationship between MIR and PD. To facilitate the causal process for testing mediation, the following four steps and models were developed based on Hayes (2013).

STEP ONE :

$$PD = a_1 + \beta_1 MIR + \varepsilon_1 \quad \text{Equation 3.2}$$

STEP TWO :

$$TA = a_2 + \beta_2 MIR + \varepsilon_2 \quad \text{Equation 3.3}$$

STEP THREE :

$$PD = a_3 + \beta_3 TA + \varepsilon_3 \quad \text{Equation 3.4}$$

STEP FOUR :

$$PD = a_4 + \beta_4 MIR + \beta_5 TA + \varepsilon_4 \quad \text{Equation 3.5}$$

Based on equations 3.2 - 3.5, the test for indirect effect ($\beta_{Indirect} = \beta_2 * \beta_3$) was then undertaken. Specifically, the following hypothesis was tested; $H0 : \beta_2 * \beta_3 \neq 0$.

where;

PD = Price Discovery

MIR = Market Information Risk

TA = Trading Activity

a_1, a_2, a_3 and a_4 = intercepts of the equation

$\varepsilon_1, \varepsilon_2, \varepsilon_3$ and ε_4 = corresponding residuals in each equation

$\beta_1, \beta_2, \beta_3, \beta_4$ and β_5 = Regression coeffcients

Equations 3.2, 3.3 and 3.4 were used to establish that zero-order relationship does exist among the variables. According to Hayes (2013), mediation is not possible if one or more of the first three steps is non-significant. The test for the indirect effect was done using the sobel z-test and non-parametric bootstrapping which is based on bias-corrected confidence interval as per Hayes (2013).

The sobel test for establishing mediation is based on the normal theory of standard errors as presented below.

$$\text{sobel} = S_{\beta 2\beta 3} = \sqrt{S_{\beta_2}{}^2 * \beta_3{}^2 + S_{\beta 3}{}^2 * \beta_2{}^2}$$

Where;

$S_{\beta_2}{}^2 = \text{Variance of Standard Error of } \beta_2 \text{coefficient}$

$S_{\beta_3}{}^2 = \text{Variance of Standard error } \beta_3 \text{coefficient}$

The test for presence of mediation effect was done using sobel z-test confidence intervals and the resultant *p-values* that were critical in testing for significance.

In this study, the mediating variable which is trading activity was represented by two indicators; trading volume and number of transactions. Besides testing the mediation effect of trading activity based on trading volume to transactions ratio, specific indirect effect of each indicator was also tested.

3.8.3 Market Information Risk, Organizational Characteristics and Price Discovery

Based on empirical and theoretical literature, this study sought to investigate whether organizational characteristics has a significant moderating effect on the relationship between market information risk and price discovery for stocks listed at the Nairobi Securities Exchange.

Hierarchical multiple regression analysis was used to test for change in the coefficient of determination and the significance of the coefficients β_1 and β_2 in equations 3.6 and 3.7 respectively.

The following models aided in the testing of the third hypothesis of the study.

$$PD = a_1 + \beta_1 MIR + \varepsilon_1 \quad \text{Equation 3.6}$$

$$PD = a_2 + \beta_2 MIR + \beta_3 OCH + \beta_4 MIR * OCH + \varepsilon_2 \quad \text{Equation 3.7}$$

Where;

PD = Price Discovery

MIR = Market Information Risk

OCH = Organizational characteristics

β_2 = coefficient relating MIR to PD when Orgc = 0

β_3 = coefficient relating orgc to PD when MIR = 0

β_4 = coefficient of the interaction term (MIR * OCH)

β_1 = Coeffcient of the predictor variable MIR on the outocme PD

a_1, a_2 = Equation intercepts

$\varepsilon_1, \varepsilon_2$ = Residual in the equations

A critical step in the establishment of the existence of a moderator was to come up with the interaction term which was obtained by multiplying indicator for MIR by that of organizational characteristics. The derivation of an interaction term was however preceded by the process of standardization of the indicators. This was done by centering the variables before computing the interaction term (MIR*OCH). This process was necessary in order to solve a potential problem of possible multicollinearity and for ease of interpretation of results. In this study, the indicators for organizational characteristics, which are the moderating variable, were ownership concentration and stock return volatility. Testing for statistical significance of the coefficient of interaction term was done in order to establish existence or absence of moderation. This was done for the individual indicators of the moderating variable after establishing overall moderation based on composite derived through averaging the two indicators.

3.8.4 Market Information Risk, Trading Activity, Organizational Characteristics and Price Discovery

The fourth hypothesis of this study entailed testing the significant effect 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 the establishment the effect of each of the indicators of the predictive variables. This process was also critical in establishing whether particular indicators are suppressors or confounding variables as per Mackinnon et al. (2000). The hypothesis was tested 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 multiple regression analysis

$$PD=a+\beta_1 MIR+\beta_2 TA+\beta_3 OCH+\varepsilon \quad \text{.....equation 3.8}$$

Where;

PD= Price Discovery

MIR= Market information risk

TA= Trading Activity

OCH= Organizational Characteristics

a = equation intercepts

β, β_1 &β_3 = Coefficients

ε_1 = Residual of the equation

Table 3.1: Summary of Data analysis, Hypothesis Testing and Interpretation of Results

Objective	Hypothesis	Analysis Techniques	Interpretation
Objective one: Determine the effect of market information risk on price discovery	**H_1**: There is no significant effect of market information risk on price discovery This hypothesis **(H_1)** is further translated into sub-hypotheses **H_{1a}** and **H_{1b}** as presented below **H_1**: There is no significant relationship between TA (bid ask spread) and price discovery	Simple linear Regression Analysis was undertaken $PD=a+\beta MIR+ \varepsilon$ Where; PD= Price discovery MIR=Market information risk a=Intercept of the equation; β=Regression Coefficient ε=Residual in each equation The specific equation is as follows: $PD=a+\beta BAS+ \varepsilon$ Where; PD= Price discovery BAS=Bid ask spread a=Intercept of the equation; β=Coefficient ε=Residual in each equation	Based on the Model summary value of R^2 and the F-statistic, relationship is either significant or insignificant. Relationship exists as R^2 approaches ±1 and also significance of beta (β) coefficient was tested using *p-value* at 95 % level of confidence.
	H_{1a}: *There is no significant effect of bid price on price discovery*	Simple linear Regression Analysis $PD=a+\beta BP+ \varepsilon$ Where; PD= Price discovery BP=Bid price a=Intercept of the equation; β=Coefficient ε=Residual in each equation	Based on the Model summary value of R^2 relationship will either be significant or insignificant. Relationship exists as R^2 approaches ±1 and also testing for significance of β using the t-statistic.
	H_{1b}: *There is no significant effect of ask price on price discovery*	Simple linear Regression Analysis $PD=a+\beta AP+ \varepsilon$ Where; PD= Price discovery AP=Ask price a=Intercept of the equation; β=Coefficient ε=Residual in each equation	Interpretation of results was based on the model summary value of R^2 which was used to establish whether relationship is either significant or insignificant. Relationship exists as R^2 approaches

Objective	Hypothesis	Analysis Techniques	Interpretation
			±1 and also testing for significance of β.
Objective Two: Establish the effect of trading activity on the relationship between market information risk and price discovery	**H_2:** There is no significant mediating effect of trading activity on the relationship between market information risk and price discovery The hypothesis **(H_2)** is further translated into sub-hypotheses **H_{2a}** and **H_{2b}** as explained below.	Stepwise Regression Analysis $PD = a_1 + \beta MIR + \varepsilon_1 \ldots\ldots\ldots\ldots (1)$ *Then,* $TA = a_2 + \beta_2 MIR + \varepsilon_2 \ldots\ldots\ldots\ldots (2)$ $PD = a_3 + \beta_3 TA + \varepsilon_3 \ldots\ldots\ldots\ldots (3)$ $PD = a_4 + \beta_4 MIR + \beta_4 TA + \varepsilon_4 \ldots (3)$ Where; PD= Price discovery MIR=Market information risk TA=trading Activity a_1, a_2, a_3 and a_4 are intercepts of each equation ε_1, ε_2, a_3 and ε_4 are corresponding residuals in each equation β=Coefficient Testing of indirect effect was done as per works of Sobel (1982) and Hayes, A (2013)	Relationship exists as R^2 approaches ±1 and also testing for β if significant in each equation and existence of zero order relationship. Then, a test for indirect effect to establish mediation using sobel z tests and bootstrapping methods for comparison of results. $\beta_{indirect} = \beta_{2*}\beta_{3;}$ $\beta_{indirect} = \beta_2 - \beta_2$ (using unstandardized values) **(**from equations 1,2 &3) Specifically, H0: $\beta_{2*}\ \beta_{3=}\ 0$ If indirect effect coefficient is significant then trading activity is a mediator.
	H_{2a}: *There is no significant mediating effect of trading Volume on the relationship between market information risk and price discovery*	Stepwise Regression Analysis $PD = a_1 + \beta MIR + \varepsilon_1 \ldots\ldots\ldots\ldots (1)$ *Then,* $TV = a_2 + \beta_1 MIR + \varepsilon_2 \ldots\ldots\ldots\ldots (2)$ $PD = a_3 + +\beta_3 TV + \varepsilon_3 \ldots\ldots\ldots\ldots (3)$ $PD = a_4 + \beta_4 MIR + \beta_4 TV + \varepsilon_4 \ldots (4)$ Where; PD= Price discovery MIR=Market information risk TV=trading Volume	Relationship exists as R^2 approaches ±1 and also testing for β if significant in each equation and existence of zero order relationship. Then, test for indirect effect to establish

Objective	Hypothesis	Analysis Techniques	Interpretation
		a_1, a_2, and a_3 are intercepts of each equation ε_1, ε_2, and ε_3 are corresponding residuals in each equation β=Coefficient Testing of indirect effect was be done as per works of Sobel (1982) and Hayes,A (2013)	mediation using sobel z tests and bootstrapping methods for comparison of results. $\beta_{indirect} = \beta_{2*}\beta_{3;}$ $\beta_{indirect} = \beta_2-\beta_2$ (using unstandardized values) **(**from equations 1,2 &3) Specifically, H0: $\beta_{2*}\ \beta_{3=}\ 0$ If indirect effect coefficient is significant then trading activity is a mediator.
	$H_{2b:}$ *There is no significant mediating effect of Number of transactions on the relationship between market information risk and price discovery*	Stepwise Regression Analysis $PD= a_1+\beta MIR+ \varepsilon_1$*…….....(1)* *Then,* $NT=a_2+ \beta_1 MIR+ \varepsilon_2$*…….…(2)* $PD=a_3+ \beta_3 NT+\varepsilon_3$ *…….…..(3)* $PD= a_4+\beta_4 MIR+\beta_4 NT+\varepsilon_4$*.(4)* Where; PD= Price discovery MIR=Market information risk NT=Number of transactions a_1, a_2, and a_3 are intercepts of each equation ε_1, ε_2, ε_3 and ε_4 are corresponding residuals in each equation β=Coefficient Testing of indirect effect was done as per works of Sobel (1982) and Hayes,A (2013)	Relationship exists as R^2 approaches ±1 and also testing for β if significant in each equation and existence of zero order relationship. Then, test for indirect effect to establish mediation using sobel z tests and bootstrapping methods for comparison of results. $\beta_{indirect} = \beta_{2*}\beta_{3;}$ $\beta_{indirect} = \beta_2-\beta_2$ (using unstandardized values) **(**from equations 1,2 &3) Specifically, H0: $\beta_{2*}\ \beta_{3=}\ 0$ If indirect effect

Objective	Hypothesis	Analysis Techniques	Interpretation
			coefficient is significant then trading activity is a mediator.
Objective Three: To find out the effect of organizational characteristics on the relationship between market information risk and intraday price discovery	**H_3:** There is no significant moderating effect of organizational Characteristics on the relationship between market information risk and price discovery The hypothesis **(H_3)** is further translated into sub-hypotheses **H_{3a},** and **H_{3b}.**	Hierarchical Multiple Regression Analysis $PD=a_1+\beta MIR+\varepsilon_1$ …….....*(1)* $PD=a_2+\beta_1 MIR+\beta_2 OC+\varepsilon_2$ *(2)* $PD=a_2+\beta_1 MIR+\beta_2 OCH+MIR*OCH+\varepsilon_2$ ……..…….*(3)* Where; PD= Price discovery MIR=Market information risk OCH=Organizational characteristics a_1 & a_2 are equation intercepts β, β_1 &β_3 =Coefficients ε_1 & $\varepsilon_{2=}$ equation residuals	Test for change in R^2 and significance of coefficients β and $\beta 1$ in equation (1) and (2) respectively. Then, test the statistical significance of β_3, which is the coefficient of interaction term. If β_3 is statistically different from zero, then, organizational characteristic is a moderator. Specifically, the following sub-hypothesis was tested. H_0: $\beta_3=0$
	H_{3a}:*There is no significant moderating effect of Ownership concentration on the relationship between market information risk and price discovery*	Hierarchical Multiple Regression Analysis $PD=a_1+\beta MIR+\varepsilon_1$ ……...*(1)* $PD=a_2+\beta_1 MIR+\beta_2 OC+\varepsilon_2$ *(2)* $PD=a_2+\beta_1 MIR+\beta_2 OC+\beta_3 MIR*OC+\varepsilon_2$ ……..…….*(3)* Where; PD= Price discovery MIR=Market information risk OC=Ownership concentration a_1 & a_2 are equation intercepts β, β_1 &β_3 =Coefficients ε_1 & $\varepsilon_{2=}$ equation residuals	Test for change in R^2 and significance of coefficients β and $\beta 1$ in equation (1) and (2) respectively. Then, test the statistical significance of β_3, which is the coefficient of interaction term. If β_3 is statistically different from zero, then, organizational characteristic is a moderator.

Objective	Hypothesis	Analysis Techniques	Interpretation
			Specifically, the following sub-hypothesis was tested. H_0: $\beta_3=0$
	H_{3b}: *There is no significant moderating effect of Stock return volatility on the relationship between market information risk and price discovery*	Hierarchical Multiple Regression Analysis $PD=a_1+\beta MIR+ \varepsilon_1$ ……..…..*(1)* $PD=a_2+\beta_1 MIR+\beta_2 SRV+\varepsilon_2$.*(2)* $PD=a_3+\beta_3 MIR+\beta_3 SRV+\beta_3 MIR*SRV+\varepsilon_3$ ……..……..…*(3)* Where; PD= Price discovery MIR=Market information risk SRV=Stock return volatility a_1 & a_2 are equation intercepts β, β_1 &β_3 =Coefficients ε_1 & ε_2= equation residuals	Test for change in R^2 and significance of coefficients β and $\beta 1$ in equation (1) and (2) respectively. Then, test the statistical significance of β_3, which is the coefficient of interaction term. If β_3 is statistically different from zero, then, organizational characteristic is a moderator. Specifically, the following sub-hypothesis was tested. H_0: $\beta_3=0$
Objective Four: Determine Effect of market information risk, trading activity and organisation characteristics on price discovery	**H_4:** There is no significant joint effect of market information risk, trading activity and organisational characteristics on price discovery **Specifically;** There is no significant joint effect relationship of Bid-Ask Spread, Trading Volume, Number of Transactions, Ownership	Multiple Regression Analysis on the following model will be done $PD=a+\beta_1 MIR+\beta_2 TA+\beta_3 OCH+\varepsilon$ Where; PD= Price discovery MIR=Market information risk TA=trading Activity OCH=Organizational characteristics a = equation intercepts β, β_1 &β_3 =Coefficients ε_1 = Residual of the equation $PD=a+\beta_1 BAS+\beta_2 TV+\beta_3 NT+\beta_4 OC+\beta_5 SRV+\varepsilon$ Where;	Based on the Model summary value of R^2 relationship was either significant or insignificant. Relationship exists as R^2 approaches ±1 The following hypothesis will be tested based on the overall F-statistic and *P-value* of the model summary The hypothesis is H_1: $\beta_j \neq 0$ for j=1,2 and 3

Objective	Hypothesis	Analysis Techniques	Interpretation
	Concentration and Stock Return Volatility on price discovery	PD= Price discovery BAS=Bid-ask Spread TV=Trading Volume NT=Number of Transactions OC=Ownership Concentration SRV=Stock Return Volatility $a_{=}$ equation intercepts β, β_1 &β_3 =Coefficients ε_1 = Residual of the equation	The following hypothesis was tested based on the overall F-statistic and *P-value* of the model summary The hypothesis is H_1: $\beta_j \neq 0$ for j=1,2,3,4 and 5

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the findings of the data analysis and discussions of the findings as per the main study objective which was to determine the relationship among market information risk, trading activity, organizational characteristics and price discovery for stocks listed at the Nairobi Securities Exchange. The general objective was broken down into four objectives as per the research questions and each had a corresponding hypothesis.

The chapter commences with presentation of descriptive statistics as well as diagnostic tests to establish how well the model fits the sample data and to ensure that the study models are statistically robust, significant and all classical assumptions of ordinary least squares are not violated. Specifically, multicollinearity, autocorrelation, normality, heteroskedascity and stationarity tests were undertaken by way of Jarque - Bera method, VIF, Breusch-Pagan test and Durbin Watson test respectively.

4.2 Descriptive Statistics

Descriptive statistics presents the distribution of the variables considered in the study in terms of how they manifest in terms of minimum, maximum, mean, standard deviation, skewness and kurtosis. The independent variable is market information risk measured by bid ask spread based on inside quotes. Price discovery which is the dependent variable was quantified through computation of weighted price contribution. The mediating variable is trading activity which had two indicators; trading volume measured by shilling

amount of buy and sells transactions and total number of transactions which was based on the total number of placed buy and sell orders. The other variable is organizational characteristics, a moderating variable in the study and whose indicators were ownership concentration and stock return volatility. Ownership concentration was computed using HHI index whereas standard deviation was estimated to represent stock return volatility. The descriptive statistics presented in Table 4.1 were useful in the establishment of the nature of dataset and how the data is distributed before embarking on the regression analysis and testing of hypothesises. The descriptive statistics results in respect of the variables of the study are presented in Table 4.1.

Table 4.1: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic
Bid price	396	1.000	1.273	1.13795	.070059	-.124	-.882
Ask price	396	1.000	1.273	1.12517	.068660	-.169	-.915
Bid-Ask Spread	396	.94	1.03	1.0196	.02094	-2.075	3.480
Trading volume	396	1.000	9.000	3.07843	1.993564	.941	-.040
Number of transactions	396	1.000	71.600	11.78758	14.038742	1.866	3.441
Ownership concentration	396	.010	.720	.23203	.189829	.443	-1.100
Stock return volatility	395	1.00	5.00	2.5848	1.04458	.237	-.501
Weighted price contribution	396	.000	.430	.09459	.096822	1.273	.996
Valid N (listwise)	395						

Source: Author, 2020

From the Findings in Table 4.1, the mean of weighted price contribution (WPC) which is a measure of price discovery was 0.0946 with a standard deviation of 0.0968 and minimum and maximum values of 0.000 and 0.430 respectively taking into account each stock and the respective time interval. WPC metric of price discovery varies from one stock to another depending on the information content of that particular security. The low registered standard deviation implied that price discovery did not exhibit high levels of jumps during the sample period in this study and specifically during the continuous trading period. The data also presents positive skewness at 1.273 and a level of peakedness at .996 which means that there are more values of WPC below the observed mean. The high positive skewness depicts the manner in which evolution of prices changes rapidly in a shortest time possible.

Descriptive statistics on market information risk as measured by bid ask spread component is as follows. The minimum and maximum value recorded from data was .94 and 1.03 respectively. During the sample period, BAS recorded a low standard deviation of .02094, negative high skewness of -.2.0075 and a level of peakedness of 3.480 as shown in the results and by the value of kurtosis. The establishment of mean and standard deviation statistic for bid ask spread and indeed other variables was to establish whether they conform to the idea that thinly traded stocks which are predominantly observed in emerging stock markets exhibit relatively high spreads and hence heightened MIR as documented in Easley et al., (1996) and Calamia (1999).

In reference to inside bid price quote, the mean value of was 1.1379 with a standard deviation of 0.070059. The minimum and maximum values for the bid price were 1.00 and 1.273 respectively. This mean score shows that bid price is at the lowest

manifestation. The low standard deviation shows that the bid price did not exhibit high levels of variability. Data on bid price has a negative skewness of -.124 and a kurtosis level of -.882. The study also shows that, the mean of the ask price variable was 1.1251 with a standard deviation of 0.0687 with minimum and maximum values of 1.00 and 1.273 respectively. The levels of means and standard deviation show that bid price and ask price exhibited some levels of variability though very minimal. Data on ask price has a negative skewness of -.124 and a low level of peakedness with the kurtosis value of -.915.

The results further indicate that, the mean for trading volume was 3.0787 and a standard deviation of 1.9935. The minimum and maximum values for trading volume were 1.00 and 9.00. The positive minimum and maximum value observed indicates that all listed companies are trading on stocks although not on the same scale. The low standard deviation shows that the levels of trading volume amongst firms whose stocks trade at the NSE did not exhibit high levels of variabilit**y**. Data on trading volume has a positive skewness of .941 and a low level of peakedness with the kurtosis level at -.040.

Furthermore, results also indicate that the mean value for number of transactions was at 11.787 with a standard deviation of 14.0387. The results indicate that the number of transactions were the most varying variable evidenced by minimum and maximum values of 1.00 and 71.600 respectively. It is noted that many companies during this period experienced high submitted buy and sell orders. This therefore is an indication of relative variability and intensity of trading activity for stocks listed at the NSE.

Finally ownership concentration which is a measure of organizational characteristics had an average mean score of .23203 and standard deviation of .1898 with a positively skewed data at skewness of .443 and a kurtosis level at -1.100. This implies that on average during the period covered by the study, the ownership concentration of various companies was 23.203% on average. The minimum and maximum values were 0.010 and .720 respectively indication that certain companies had ownership concentration of as high as 72.0 % while others experienced a concentration of as low as 1.0%.

4.3 Trend Analysis

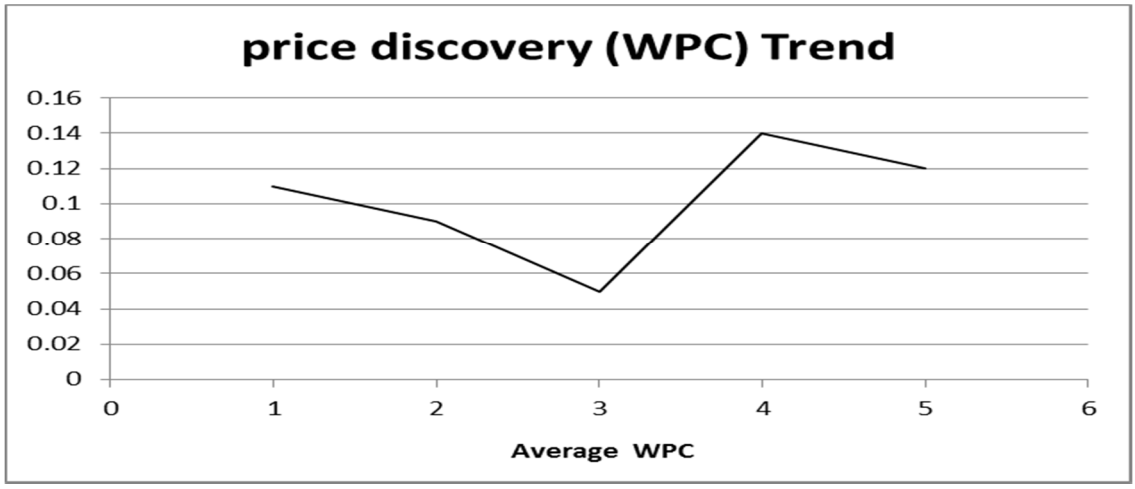
This section presents a documentation of regularities in the pattern of intraday weighted price contribution; bid ask spread, stock return volatility and trading volume using a 60 minute aggregate data. Furthermore, the section shows and presents the trend analysis of mean value of study variables over the five intra-day intervals; price discovery measured by weighted price contribution, market information risk quantified by BAs, TV, NT, and SRV.

Prior to diagnostic test, trend analysis was undertaken first as a way of explicit exposition of intraday regularities at the NSE. Trend analysis revealed the variations of the study variables as part of the process and question of establishing price discovery process for stocks listed at the NSE in each of the time interval (k=1, 2, 3, 4 & 5) across all stocks in the study sample. The outcome of analysis of the time series changes of the variables is presented using graphical models. Trend analysis for price discovery (WPC) was carried out to determine the general changes.

4.3.1 Weighted Price Contribution

Figure 4.1 below shows the price discovery (WPC) trend for the five 60 minute time intervals for the sample stocks listed at the NSE. 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?

Figure 4.1: Trend of Weighted Price Contribution



Source: Author, 2020

Figure 4.1 above indicate 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. There was further exponential increase between intervals three and four after which falls in subsequent intervals. This depicts that price discovery is high at the 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. This means that there is greater price discovery immediately after the market opens and followed by the

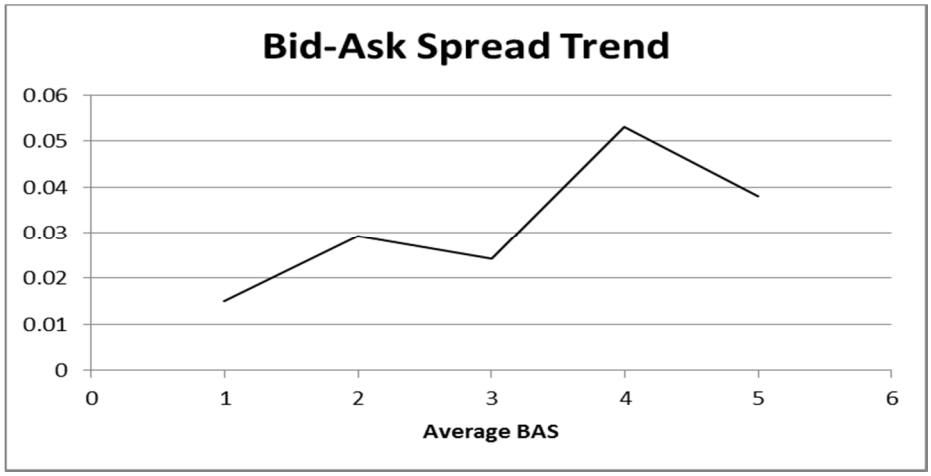
continuous trading period. This finding is supported by Admati and Pfleiderer (1988) who document that when large numbers of informed traders participate, the process of price discovery is enhanced since uninformed players in the market are more willing to trade in an environment of excess liquidity. In essence, trading is necessary ingredient for mitigating the problem of mispricing in the market. The findings where WPC generally is "V- Shaped" is supported by Chordia, Roll and Subrahmanyam (2005) who found that faster price movements 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.

As evidenced in Figure 4.4 in subsequent trend analysis, the early part of the trading session attracts huge number of submitted orders as captured by the number of transactions and this also helps speed the process of price discovery. The speed is partly engineered in the early session by uninformed traders who congregate and are ready to provide immediacy. This supports the information based models of market microstructure.

4.3.2 Bid Ask Spread

Figure 4.2 below shows the Bid Ask spread trend for the five 60 minute time intervals for the sample stocks listed at the NSE.

Figure 4.2: Trend of Bid-Ask Spread



Source: Author, 2020

Figure 4.2 shows two significant spikes in the average bid-ask spread around the second and fourth intervals. The widening of the BAS 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 BAS may suggest traders are reacting too early and profiting from subsequent corrections. From the trend, it is apparently clear that bid ask spread tend to rise immediately following the opening of the market and at the near close of the continuous trading period before post-closing auction takes place.

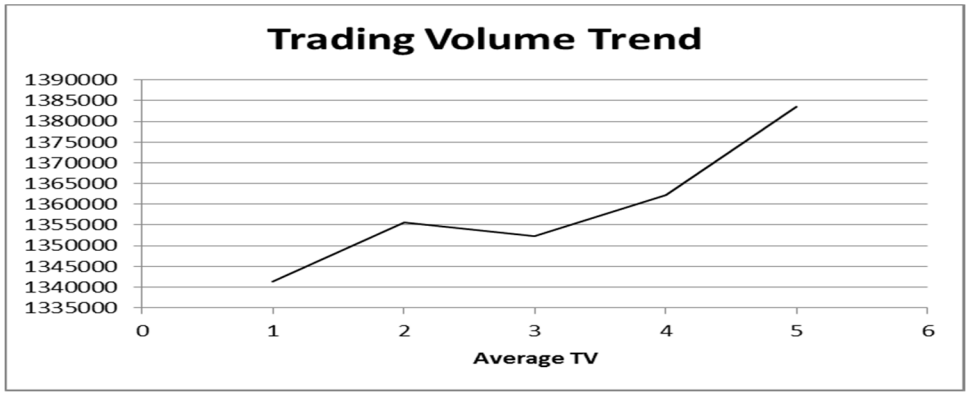
This is supported by the findings of Brock and Kleidon (1992, Chan et al. (1993) and Hamao and Hasbrouck (1993) and Hamao and Hasbrouck (1993) in a study of stocks trading at the Tokyo Stock Exchange, found that mean bid ask spread, a measure of market information risk tend to be higher at the beginning 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. Market information risk as measured by bid Ask spread seems to widen at the opening and closing implying revelation of any new information or it could be based on the intensity of submitted quotes.

4.3.3 Trading Volume

Figure 4.3 below shows the Trading Volume trend for the five 60 minute time intervals for the sample stocks listed at the NSE.

Figure 4.3: Trend of Trading Volume



Source: Author, 2020

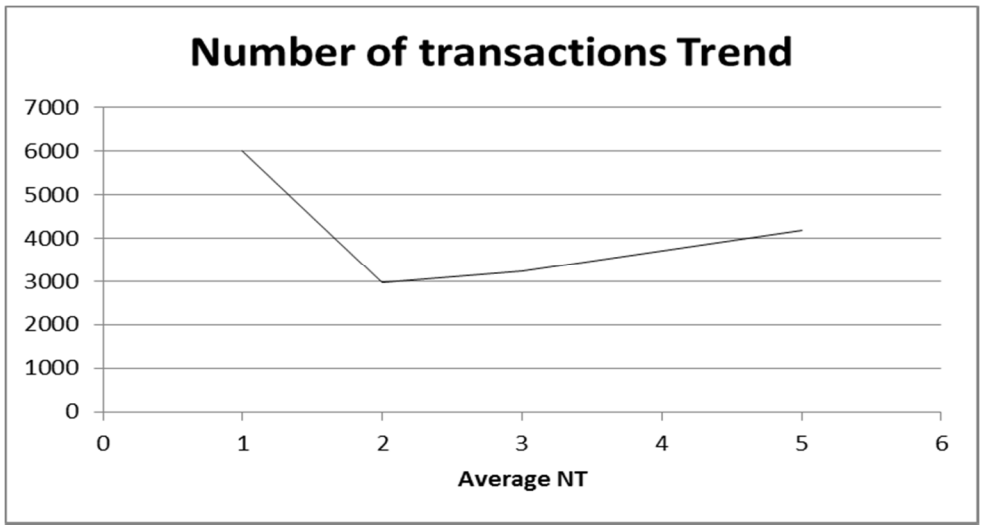
This figure depicts the volume traded for the stocks for five time intervals with volume figures showing increased measures in the first two intervals after which it drops in the third interval and increases exponentially for the subsequent intervals four and five depicting many traders joining as intervals increases. From the trend analysis, it is evident that there is enhanced liquidity immediately the market opens implying that providers of immediacy troop the market after the end of pre-opening auction. However,

the mean values for each interval does not conform to U-shaped curve as evidenced by Jain and Joh (1988), Foster and Viswanathan (1990) and Gerety and Mulherin (1992).

4.3.4 Number of Transactions

Figure 4.4 below shows the trend on number of transactions for the five 60 minute time intervals for the sample stocks listed at the NSE.

Figure 4.4: Trend of Number of Transaction



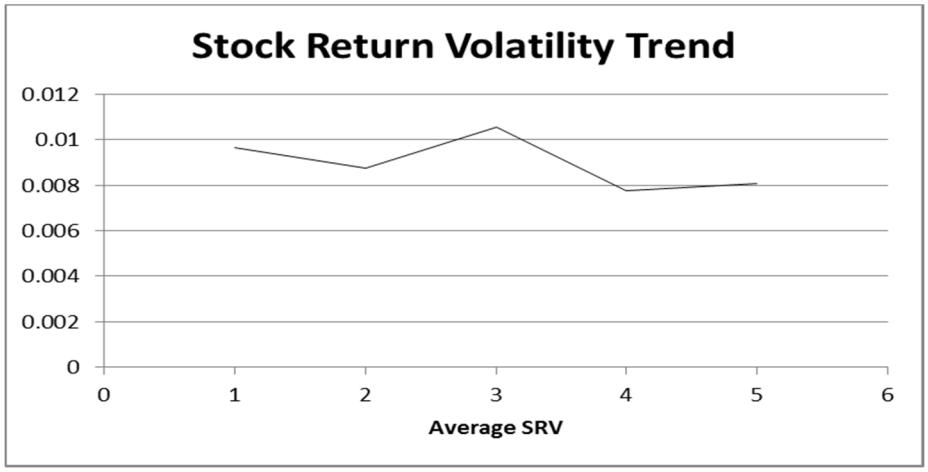
Source: Author, 2020

The total number of transactions in a given interval represents cumulative amount buy and sell orders submitted by market participants. The number of transactions of stocks shows highest for interval one then decreases exponentially in interval time two then slowly increases in subsequent time intervals. This depicts trade engagement as more stock information is available to traders. In the second time interval stock transaction reduces as understanding of information is at high level before they start fully engaging in stocks.

4.3.5 Stock Return Volatility

Figure 4.5 below illustrates the Stock Return Volatility trend for the five 60 minute time intervals for the sample stocks listed at the NSE.

Figure 4.5: Trend of Stock Return Volatility



Source: Author, 2020

The graphical representation in form of trend show the stock return volatility of each interval with zigzag trend where there is a decrease in the first interval, an increase in interval two to three and sharply decease at internal three and four and eventually levels in interval four to five. Thus, the volatility of every stock return could be equated with any other stock market along with amount and quantum of an equity market affected by such factors as information content of stocks or the randomness by which information is revealed through act of trading.

4.4 Diagnostic Tests

This section presents diagnostic tests conducted to ensure model assumptions as highlighted in chapter three are not violated in order to come up with a suitable model. The results of the following diagnostic tests are presented in the table below test for

multi- collinearity, autocorrelation, heteroscedasticity, panel unit root test and Hausman specification tests.

4.4.1 Normality Test

The error of statistics manifests a lot in the literature of scientific undertakings. The procedures of analysis and associated techniques like correlation, t-tests, ANOVA as well as regression follow as assumption that distribution of data is normal. It is thus in assumption that population in which data is derived gives normal representation for accurate understanding of data. 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.

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

$\boldsymbol{H_1}$: JB ≠ 0 (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 Table 4.2 below.

Table 4.2: Jarque - Bera Normality Test Results

	BP	AP	BAS	TV	NT	OC	SRV	WPC
Jarque-Bera	20.2675	1846.378	567.895	6386.116	123.8761	2881.628	2694.893	20.96803
Probability	0.00004	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	0.000028
Sum	191.6576	12.66647	70.341	32.99276	64.16302	784.7957	41.0451	7286.903
Sum Sq. Dev.	16.82449	9.687048	12.564	7.647097	10.96235	2437.564	9.5621	1492.477
Observations	396	396	396	396	396	396	396	396

Scale; BP=Bid Price, AP=Ask Price, BAS=Bid-Ask spread, TV=Trading volume, NT=Number of transactions, OC=Ownership Concentration, SRV=Stock Return Volatility, WPC=Weighted Price Contribution

Source: Author, 2020

The null hypothesis under this test was that disturbance values are not normally distributed. If the p- value is less than 0.05, the null of normality at the 5% level was to be rejected. The residual values had $p<0.05$ hence reject the null hypothesis and thus conclude that the residuals were normally distributed.

4.4.2 Test of Multicollinearity

Williams, et al. (2013) explains that the presence of high interrelationship of predictor variables translates to multicollinearity problem. In a study scenario where multicollinearity prevails, the condition inflates the error term and the confidence intervals. Belsley, et al. (1980) presents that from this kind of influence, individual predictor coefficients become unstable. This study thus 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 4.3: 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
	Number of transaction	.711	1.406	No multicollinearity
	Trading volume	.944	1.060	No multicollinearity
	Ownership concentration	.974	1.027	No multicollinearity
	Stock return volatility	.856	1.168	No multicollinearity

Source: Author, 2020

A VIF value of 10 or higher points to presence of severe multi-collinearity (Newbert, 2008). A tolerance threshold value of below 0.1 indicates that collinearity is present (Menard, 2000). As shown in Table 4.3 the results revealed no problem of multicollinearity. The variables of the study indicated VIF values of between 1.027 and 9.023 which are less than 10.

4.4.3 Heteroscedasticity Test

Homoscedasticity is believed to be one of basic assumptions within regression model that is linear and classical stating that the distribution in probability in the term of disturbance remains same or rather constant for the observations. Although existing literature as documented by Woolridge (2003) and Baltagi (2005) point out that panel data greatly helps in alleviating this problem, this kind of data may pose some problems. Presence of heteroscedasticity, may pose some challenges in making conclusions because of the resultant biased estimates of “F” and “t” statistic as pointed out by Gujarati (2003).

The results are as presented in table 4.4.

Table 4.4: Heteroscedasticity Test

Heteroscedasticity Test: Breusch-Pagan-Godfrey				
F-statistic	0.493179	Prb F(3,10)		0.6856
Obs*R-squared	1.802199	Prb Chi Square(3)		0.6247
Scaled explained SS	1.736267	Prb ChiSquare(3)		0.6211
Test Equation:				
Dependent Variable PD^2				
Method. Least Squares.				
Date: 01/06/2020 Time: 17:17				
Sample. Jan June				
Included observations. 396				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.121825	1.215546	1.767651	0.1160
D(MIR)	0.133612	0.531557	0.245775	0.8133
D(TA)	0.135124	0.240595	0.569177	0.5653
D(OC)	0.548373	0.535541	1.002423	0.3393
R-squared	0.127557	Mean dependent var		2.283013
Adjusted R-squared	-0.122546	S.D. dependent var		4.184591
S.E. of regression	4.433156	Akaike info criterion		6.056569
Sum squared resid	187.4144	Schwarz criterion		6.247146
Log likelihood	-38.28791	Hannan-Quinn criter.		6.037667
F-statistic	0.482169	Durbin-Watson stat		1.262489
Prob(F-statistic)	0.685584			

Source: Author, 2020

This test states that if the p-value is significant at 95% confidence interval, the data has heteroscedasticity problem. As shown in Table 4.5, there is no heteroscedasticity problem for this study since the p-value (0.6856) is greater than significance value of 0.05.

4.4.4 Autocorrelation Test

Autocorrelation is the issues in econometric which need to be further established before subjecting data to any other analysis. This is where covariance at zero of error terms are established meaning if associated errors in a particular observation and another are uncorrelated. Durbin Watson test was used to detect serial correlation. The results are as indicated in Table 4.5.

Table 4.5: Autocorrelation Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	3.326662	Prb F(2,9)	0.0733
Obs*R-squared	5.886769	Prb Chi-Square(2)	0.0424
Test, Equation			
Dependent Variable: PD,			
Method: Least, Squares			
Date: 01/06/2020 Time: 17:15			
Sample. Jan June.			
Included observations: 396			
Resample lagged residuals set to zero			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MIR)	0.052359	0.182985	0.330789	0.7311
D(TA)	-0.015745	0.073501	-0.058621	0.9457
D(OC)	-0.058421	0.185451	-0.350481	0.7440
RESID(-1)	-0.832108	0.326239	-2.566606	0.0302
RESID(-2)	-0.469221	0.361192	-1.241464	0.2548
R-squared	0.411291	Mean dependent var		-0.120632
Adjusted R-squared	0.164932	S.D. dependent var		1.564765
S.E. of regression	1.438856	Akaike info criterion		3.835482
Sum squared resid	18.41055	Schwarz criterion		4.043736
Log likelihood	-22.76844	Hannan-Quinn criter.		3.705364
Durbin-Watson stat	2.138366			

Source: Author, 2020

The coefficients from the results are significant at statistical level with tight fit. The hypothesis thus is not rejected that there is no serial correlation with LM indicating the test of 0.0524>0.05) which depicts serial uncorrelated. Accordingly, the computed "d" in this study was 2.138366 near to 2 implying absence of autocorrelation problem.

4.4.5 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 4.6.

Table 4.6: Stationarity Tests

		t-statistic	**Prob.***
Augmented Dickey.Fuller test statistic		-4.367641	
Y	5% level	-4.156910	0.0078
Augmented Dickey.Fuller test statistic		-4.768504	
$\mathbf{X_1}$	5% level	-4.131890	0.0032
Augmented Dickey.Fuller test statistic		-5.497891	
$\mathbf{X_2}$	5% level	-4.210256	0.0012
Augmented Dickey.Fuller test statistic		-4.109464	
$\mathbf{X_3}$	5% level	-4.047810	0.0067

Source: Author, 2020

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 4.6.

4.5 Correlation Analysis

Pearson correlation was used to assess the degree of association between variables i.e. predictor variables (Market information risk, trading activity and organizational characteristics) and the dependent variable (price discovery).

Correlation analysis was critical in establishing the nature of association among the study variables. Furthermore, the results of correlation analysis are essential before one sets out to undertake regression analysis and hypothesis testing. The correlation coefficient measures the strength of linear relationship between two variables of interest and it is denoted by r. Cooper and Schindler (2003) indicates that when r approaches +1 or -1, then the strength of association between the two variables under consideration is strong. The results presented in Table 4.7 show individual indicators and how they relate to each other.

Table 4.7: Correlation Analysis Results

		Bid price	Ask price	Bid-Ask Spread	Trading volume	Number of transactions	Ownership concentration	Stock return volatility	Weighted price contribution
Bid price	Pearson Correlation	1							
	Sig. (2-tailed)								
	N	396							
Ask price	Pearson Correlation	.941**	1						
	Sig. (2-tailed)	.000							
	N	396	396						
Bid-Ask Spread	Pearson Correlation	-.195**	.148**	1					
	Sig. (2-tailed)	.000	.003						
	N	396	396	396					
Trading volume	Pearson Correlation	.216**	.181**	-.108*	1				
	Sig. (2-tailed)	.000	.000	.031					
	N	396	396	396	396				
Number of transactions	Pearson Correlation	.489**	.459**	-.090	.093	1			
	Sig. (2-tailed)	.000	.000	.073	.063				
	N	396	396	396	396	396			
Ownership concentration	Pearson Correlation	-.135**	-.108*	.080	-.100*	-.119*	1		
	Sig. (2-tailed)	.007	.032	.113	.047	.018			
	N	396	396	396	396	396	396		
Stock return volatility	Pearson Correlation	.048	.061	.041	-.001	.043	.038	1	
	Sig. (2-tailed)	.343	.223	.417	.986	.390	.453		
	N	395	395	395	395	395	395	395	
Weighted price contribution	Pearson Correlation	.223**	.189**	-.088	.025	.297**	.022	.118*	1
	Sig. (2-tailed)	.000	.000	.080	.627	.000	.660	.019	
	N	396	396	396	396	396	396	395	396

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Author, 2020

4.5.1 Market Information Risk and Price Discovery

Market information risk and price discovery are independent and dependent variables of the study respectively. The indicator for Market information risk was bid ask spread and that for price discovery was weighted price contribution. The results of correlation analysis shown in Table 4.7 indicate that there is a weak negative (r = -.088) and insignificant (p-value>0.05) association between WPC and BAS.

4.5.2 Market Information Risk and Trading Activity

In this study, trading activity was represented by two indicators; trading volume and total number of transactions. From the results of correlation analysis presented in Table 4.7, bid ask spread is negatively (r = -.18) and significantly (p-value <0.05) related to trading volume. The negative correlation between the two variables is however weak. On the other hand, the correlation between total number of transactions and bid ask spread is weak, negative (r = -.09) and insignificant (P-value >0.05)

4.5.3 Market Information Risk and Organizational Characteristics

Organizational characteristics were conceptualized as a moderating variable and it had two indicators; stock return volatility and ownership concentration. Based on the results of correlation analysis reported in Table 4.7, bid ask spread is positively (r = .041) and insignificantly (p-value > 0.05) related with stock return volatility. The positive association is weak and is similar to findings of Calamia (1999) that found a positive correlation between stock return volatility and bid ask spread. This positive relationship between bid ask spread and stock return volatility is consistent with the findings of Wang and Yau (2000) who found a positive relationship between the two

variables. The relationship between ownership concentration and bid ask spread was positive (r = .08) and insignificant (P-value > 0.05).

4.5.4 Trading Activity and Price Discovery

Based on results in Table 4.7, the relationship between trading volume and weighted price contribution is positive but weak (r= .025) and it is insignificant. Total number of transactions which is the second indicator of trading activity was found to have a weak positive (r = .297) association with weighted price contribution and the relationship was insignificant (p-value > 0.05)

4.5.5 Organizational Characteristics and Price Discovery

As shown in Table 4.7, stock return volatility and weighted price contribution were positively (r = .118) and insignificantly (p-value > 0.05). The results of correlation analysis also revealed that ownership concentration was positively and insignificantly associated with weighted price contribution (r = .022, P-value > 0.05).

4.5.6 Trading Activity and Organizational Characteristics

The study also sought to establish the correlation between indicators of trading activity and those of organizational characteristics (ownership concentration and stock return volatility). The results presented in Table 4.7 indicate that trading volume is negatively (r = -.001) and insignificantly related to stock return volatility (P-value > 0.05) unlike in Darrat et al., (2003) where the authors found a positive correlation between trading volume and stock return volatility. The association is so weak that the correlation coefficient is close to zero a near indication of no correlation. Trading volume is as well negatively(r = -.10) and insignificantly (P-value > 0.05) associated with ownership concentration. Total number of transactions was found to have a weak negative (r= -.119) and a significant (P-value <0.05) (relationship with ownership

concentration. However, total number of transactions was positively (r = .043) and insignificantly (P-value > 0.05) related

4.5.7 Trading Volume and Number of Transactions

This section presents the nature of relationship between the two indicators of trading activity which are trading volume and number of transaction. Results presented in table 4.7 show that the two variables have a weak positive (r = .093) and insignificant (P-value > 0.05) relationship.

4.5.8 Ownership Concentration and Stock Return Volatility

As already discussed and indicated, organizational characteristics were operationalized with two indicators; Ownership concentration and stock return volatility. The results of correlation analysis show that ownership concentration and stock return volatility are positive (r =0.028) and insignificant (P-value > 0.05).

4.6 Chapter Summary

The chapter presented initial preliminary findings on descriptive statistics on key study variables; market information risk measured by inside quote bid ask spread; trading activity measured by trading volume and number of transactions; organizational characteristics measured by ownership concentration and stock return volatility, and price discovery measured by weighted price contribution. The descriptive statistics involved; mean standard deviation, maximum, minimum, skewness and kurtosis which were computed for all the variables of the study. Diagnostic tests for multicollinearity were conducted using variance inflation factor and established that all the variables had VIF values of less than 10 leading to the conclusion that there was absence of Multicollinearity.

Jaque – Berra tests for normality confirmed that the residual values had $p<0.05$ and thus residuals were normally distributed. Breusch-Pagan test was used to detect the problem of heteroscedasticity. From the tests results, it was concluded that there is no heteroscedasticity since the p-value is greater than significance value of 0.05. The LM test was further tested and result indicated that the residuals are not serially correlated is $0.0524>0.05$). All the variables were differenced to arrive at a stationary level where test critical values are greater than the Augmented Dickey-Fuller test statistic as shown by the results.

The results of correlation confirmed positive relationship among the variables; market information risk as measured by bid-ask spread had negative and insignificant influence on price discovery. Furthermore, trading volume and ownership concentration had positive insignificant relationship with price discovery. However, total number of transactions and stock return volatility were positively and statistically significantly related to weighted price contribution, an indicator of price discovery. The results of the descriptive analysis and diagnostics tests informed the basis of hypothesis testing since the initial pretesting confirms suitability of data for further statistical tests. The descriptive analysis, observed trends, diagnostic tests, and results of correlation analysis undertaken laid a foundation and basis upon which further analysis was carried out in chapter five especially regression analysis and testing of formulated hypotheses.

CHAPTER FIVE

HYPOTHESES TESTING AND DISCUSSION OF FINDINGS

5.1 Introduction

In this section, results and findings of the regression analysis are documented and presented. Hypotheses were formed on the basis of theoretical review, empirical

literature review as well as research objectives; they were tested using simple regression for direct relationship in hypotheses one, stepwise regression analysis for testing of mediating effect was done as per works of Sobel (1982) and Hayes (2013), Hierarchical multiple regression analysis for testing moderation and stepwise regression analysis for testing joint effect.

Coefficient of determination (R^2) was used in this study as a tool capable of giving the variation in the outcome variable explained by the predictor variable (s). This measure was therefore useful in showing how each variable provided useful information in reference to the dependent variable. However, in testing joint effect, adjusted R^2 was utilized. As noted by Anderson& Darling (1954), the adjusted R^2 measure is useful where predictor variables are many and this is based on the fact that degrees of freedom tend to be lost as more variables are added. The F-test was used as a test of significance for the overall regression whereas t-tests were utilized to establish independent contribution of each variable in the prediction of the outcome variable. Significance judgment was based on p-values. Rumsey (2011) documents the range of p-values as being between 0 and 1 where p-value ≤ 0.05 indicated strong evidence against the null hypothesis paving way for the rejection of the null hypothesis. However, a p-value > 0.05 indicated weak evidence against the null hypothesis and as such fail to reject the null hypothesis.

In testing for mediation, Baron and Kenny path analysis as well as sobel tests were applied. The fundamental issue in establishing mediation was whether trading activity depends on market information risk and therefore a mediator and as such, the mediation process involved tracing the route of the path analysis. Bootstrapping was used in order to estimate how much the mediation effect varied over repeated

samples. In establishing indirect effect of trading activity as a mediator, standard errors were used which presumes that the multiple of path coefficients of path 2 (Step 2) and path 3 (step 3) were normally distributed. As a remedy in the unlikely scenario, Bootstrapping was adopted where confidence were computed using coefficients and standard errors derived by way of simulated distribution.

In the following sections of the chapter, findings of the analysis are presented along with the study objectives and corresponding hypotheses.

5.2 Relationship between Market Information Risk and Price Discovery

The objective was to determine the effect of market information risk on price discovery. A simple regression analysis was utilized where market information risk was regressed against price discovery. This process aimed at testing the first 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 study therefore investigated the overall relationship between market information risks as measured by bid-ask spread (BAS) and price discovery as quantified using WPC. The BAS was computed as the spread divided by the average of the two price quotes for each interval during the sample period. The hypothesis formulated was that*;*

H_{01}: There is no significant effect of market information risk on price discovery

This was tested through the simple linear regression analysis which was in the form;

$$PD = a + \beta MIR + \varepsilon$$

where;

PD = Price Discovery

MIR = Market Informatio n Risk

a = constant in the equation

β = Regression coeffcient

ε = Error term or residual of the equation

The results of the regression model are presented in Tables 5.1 (a), 5.1 (b) and 5.1 (c).

Table 5.1 (a): Model Goodness of Fit 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

Source: Author, 2020

Linear regression analysis results as shown in model summary in Table 5.1 (a) provided a R^2 value of .294 and Std. Error of the Estimate of 1.55588. The significance of the overall model summary is presented in Table 5.1 (b).

Table 5.1 (b): Model Overall Significance on the Relationship between Market Information Risk and Price Discovery

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

Source: Author, 2020

Table 5.1 (b) presents the regression results of the analysis of variance which were useful in testing the overall statistical significance of the R^2 value in the model summary. The ANOVA results indicate significance F=163.923, P < 0.05] which suggests that the population R^2 is significantly greater than zero. If the predictor variables in the regression were more than one, statistical significance would then mean that at least of the regression coefficients is not equal to zero. Thus the model was significant.

Table 5.1 (c): Regression Coefficients on Relationship between Market information Risk and Price Discovery

Coefficients						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	T	Sig.
1	(Constant)	2.653	.152		17.407	.000
	Market information risk	.511	.040	.542	12.803	.000

a. Dependent Variable: Price discovery

Source: Author, 2020

Table 5.1 (c) documents the results of coefficients of the independent variable used in the model and which was used to assess the degree of relationship with the dependent variable. The results indicate that the model constant was 2.653 with a t-value of

17.407 and p-value of .000. The constant value of 2.653 represents the value of price discovery when the independent variable is zero. Market information risk has a positive significant influence on price discovery with a beta coefficient of .511, t-value of 12.803 and p-value < 0.05.

The results of the regression analysis in Table 5.1 (a), 5.1 (b) and 5.1 (c), show a strong relationship between market information risk and price discovery (R= .542). Coefficient of determination (R^2 =.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 β= 0.511, t= 12.803, 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 no significant influence of market information risk on price discovery is rejected. Based on the outcomes of the results as presented in Table 5.1 (c), the model is expressed as follows:

$$PD = 2.653 + .511MIR$$

Where;

PD is price discovery

MIR is market information risk

This implies that a unit change in market information risk results in .511 changes in price discovery. However when market information risk is rated zero, price discovery is 2.653. This shows that in absence of market information risk, the price discovery for stocks listed at the Nairobi Securities Exchange is far above the break-even point depicting the importance of monitoring the process of price discovery for the stocks. Chung, Hrazdil and Suwanyangyuan (2016) argue reduced information asymmetry, enhanced trading activity, and improvement in price discovery is associated with quantity and quality of annual reports.

As noted, the proxy for market information risk was bid - ask spread based on inside quotes whereas that of price discovery was measured by WPC 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, after investigating the effect of market information risk based on BAS on price discovery, the study further determined the extent to which components of bid-ask spread track price evolution process by way of establishing effect of bid price and ask price on price discovery through formulation of the sub hypotheses.

$H_{01a:}$ *There is no significant effect of bid price on price discovery*

$H_{01b:}$ *There is no significant effect of ask price on price discovery*

Table 5.1 (d), 5.1 (e) and 5.1 (f), summarizes the results on the effect of bid price on price on price discovery.

Table 5.1(d): Model Goodness of Fit on the Relationship between Bid Price and Price Discovery

Model Summary									
				Std. Error	Change Statistics				
Model	R	R Square	Adjusted R Square	of the Estimate	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

Source: Author, 2020

The model summary of the linear relationship between bid price and price discovery metric of weighted price contribution provided a R^2 of 0.125 implying that inclusion of other factors in the model would generally improve the predictive power of the model by explaining 87.5 % variation in PD not explained by bid price.

Table 5.1(e): Model Overall Significance on the Relationship between Bid Price and Price Discovery

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

Source: Author, 2020

The ANOVA of the regression model results in Table 5.1 (e) provided regression sum of squares of 168.858and model residual of 1,181.738 with a mean square of 2.999 for the residual. The ANOVA regression results produced an F-statistic of 56.299 with a p-value =.000. A p-value of < .005 signifies that the probability of the model giving false prediction is zero.

Table 5.1(f): Regression Coefficients on the Relationship between Bid Price and Price Discovery

Coefficients						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	-6.292	1.418		-4.437	.000
	Bid price	9.333	1.244	.354	7.503	.000
a. Dependent Variable: Price discovery						

Source: Author, 2020

In Table 5.1 (f), the results of coefficient of the independent variable used in the model in this section and which are used to assess the degree of the relationship with dependent variable. The model provided a constant value of -6.292 with a t-value of -4.437 and a p-value of .000 which is <.05. Bid price was found to have a significant positive coefficient of 9.333 with a t-value of 7.503 and a p-value <.005.

Based on results in Tables 5.1 (d), 5.1 (e) and 5.1 (f), 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 explains only 12.5% of variation in price discovery. Further the overall model was significant; F =56.299, $p<0.05$. The significant relationship also manifested in the t-value in the coefficient (β=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 the hypothesis that there is no significant influence of bid price on price discovery is rejected. 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})

H_{01b}: *There is no significant effect of ask price on price discovery*. Results are presented in Table 5.1 (g), 5.1 (h) and 5.1 (i)

Table 5.1 (g): Model Goodness of Fit on the Effect of Ask Price on Price Discovery

Model Summary									
				Std.	Change Statistics				
Model	R	R Square	Adjusted R Square	Error of the Estimate	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

Source: Author, 2020

The model summary in Table 5.1 (g), reports R Square value of .023, an indication that only 2.3% of the total variation in price discovery is explained by Ask Price. The standard error of estimate is 1.8298. The adjusted R^2 value is .021. However, because the predictor variable is only one, R^2 value was used to assess the level of explained variation. The value of 2.3% means that inclusion of other predictors in the regression equation would improve power of the model.

Table 5.1 (h): Model Overall Significance on the Effect of Ask Price on Price Discovery

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

Source: Author, 2020

Table 5.1 (h) presents the results of analysis of variance (ANOVA). The F-statistic shows that the overall regression model F=9.379, $p < 0.05$]. This significance result clearly indicates that there is a probability of 0.00% that the model would give a false prediction.

Table 5.1 (i): Regression Coefficients on the Effect of Ask Price on Price Discovery

Coefficients					
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		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						

Source: Author, 2020

Table 5.1 (i) documents the results of coefficients of the ask price which is the predictor variable used in the study. The model provided a constant value of -.292 with a t-value of -.193 and a p-value of .847. The regression model reported a significant positive coefficient with a t-value of 4.107 and p-value < 0.05.

The results in 5.1 (g), 5.1(h) and 5.1 (i), 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 was significant, F =9.379, $p<0.05$. The results of the coefficients indicate significance based on the t-value in the coefficient table (β=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 therefore the null hypothesis is rejected.

5.3 Relationship among Trading Activity, Market Information Risk and Price Discovery

The second objective was to examine whether trading activity mediates the relationship between market information risk and price discovery. Trading activity was measured by trading volume (TV) and total number of transactions (NT). Regression analysis was carried out to establish mediation. The analysis in this section sought to establish the magnitude of the impact of market information risk on price discovery when trading activity herein labelled as a mediating variable was introduced. This was done for composite variable and each of the indicators through documented steps and rightly so by checking whether the effect of market information risk on price discovery changes when trading activity was introduced.

5.3.1 Mediating Effect of Trading Activity on the Relationship between Market Information Risk and Price Discovery

The overall mediation effect of TV and NT on the relationship between MIR and PD was done and a composite variable, volume –transaction ratio was estimated. The computation of a composite variable was based on Ley (1972) who noted that composite is a variable of two or more measures that are related either statistically or conceptually and resultant variable ought to capture theoretical and logical meaning of the attribute. In this section, meaningful grouping method of creating a composite variable was utilized as opposed to averaging based on context, objective, and the field of market microstructure where the two indicators are drawn from.

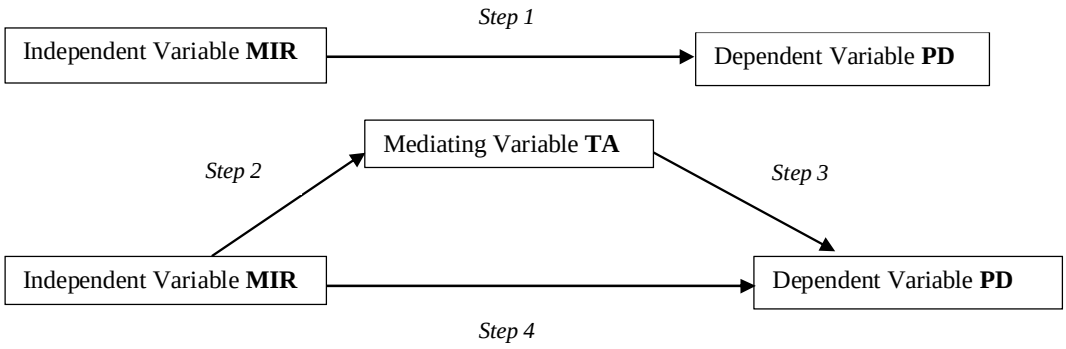
The estimated volume to transactions ratio composite variable deeply accounts for trends and regularities in a given trading time in an exchange (Guha and Mukherjee, 2008; Lo and Wang, 2000). The composite ratio measures the depth of the market and

it is useful in investigating whether trading activity conveys valuable information especially in provision of leads for the disagreement in expectations and beliefs by market participants which by inference could influence the size of spreads for a particular stock and hence the stochastic speed of price discovery. The corresponding hypothesis that was tested is;

H_{02}: There is no significant mediating effect of trading activity on the relationship between market information risk and price discovery

The structural model and process of mediation was evaluated using the path coefficients based on the paths depicted in the Figure 5.1 (a) below as per (MacKinoon, 2007; Sobel, 1990 and Schultheis, 2016)

Figure 5.1 (a): Mediation Process of Trading Activity on the Relationship between Market Information Risk and Price Discovery



In Step one, the significance and nature of the relationship between the dependent variable (Price Discovery) and independent variable (market information risk) was assessed. The results are presented in table 5.2 (a), 5.2 (b) and 5.2 (c).

Table 5.2 (a): Model Goodness of Fit on the Effect of Market Information Risk on 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

Source: Author, 2020

Linear regression analysis results as shown in model summary in table 5.4 (a) provided a R^2 value of .294 and Std. Error of the Estimate of 1.55588. The significance of the observed R^2 value in the model summary is presented in table 5.4 (b) through the analysis of variance.

Table 5.2 (b): Model Overall Significance on the Effect of Market Information Risk on Price Discovery

ANOVA[a]

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

Source: Author, 2020

Table 5.2 (b) presents the regression results of the analysis of variance which were useful in testing the statistical significance of the R^2 value in the model summary. The ANOVA results indicate significance [$F(1,394) = 163.923$, $P < 0.05$] which suggests that the population R^2 is significantly greater than zero. If the predictor variables in the regression were more than one, statistical significance would then mean that at least one of the coefficients does not have a value of zero.

Table 5.2 (c): Regression Coefficients on the Effect of Market Information Risk on Price Discovery

Coefficients[a]					
	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.
1 (Constant)	2.653	.152		17.407	.000
Market information risk	.511	.040	.542	12.803	.000
a. Dependent Variable: Price discovery					

Source: Author, 2020

Table 5.2 (c) documents the results of coefficients of the independent variable used in the model and which was used to assess the degree of relationship with the dependent variable. The results indicate that the model constant is 2.653 with a t-value of 17.407 and p-value of .000. The constant value of 2.653 represents the value of price discovery when the independent variable is zero. Market information risk has a positive significant influence on price discovery with based on a beta coefficient of .511, t-value of 12.803 and p-value < 0.05.

The results presented in tables 5.2 (a), 5.2 (b) and 5.2 (c) generally show that market information significantly influence price discovery with coefficient of determination R^2 of .294 and p-value<0.05). The overall model is also significant with F-value of 163.923 and p-value<0.05. The results showed that there is a significant positive (t-value = 17.407, beta value = 0.542) relationship, suggesting that MIR has an effect on PD.

In Step two, the relationship between market information risk (MIR) and a mediating variable, Trading Activity (TA) based on the volume to transactions ratio composite was tested. The results are presented in table 5.2 (d), 5.2 (e) and 5.2 (f).

Table 5.2 (d): Model Goodness of Fit on the Effect of Market Information Risk on Trading Activity

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate

1	.303[a]	.092	.090	1.52110

a. Predictors: (Constant), Market information risk

Source: Author, 2020

Table 5.2 (d) displays the model summary results of the regression analysis composite value of volume to transaction ratio against market information risk. The results reveal R^2 value of .092 which means 9.2 % of the total variation in the dependent variable is explained by the regression. 91.8% of the total variation is attributable to variables not considered in the model and whose inclusion would enhance the predictive power of the model.

Table 5.2 (e): Model Overall Significance on the Effect of Market Information Risk on Trading Activity

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	92.371	1	92.371	39.923	.000[b]
	Residual	911.614	394	2.314		
	Total	1003.986	395			

a. Dependent Variable: Trading activity

b. Predictors: (Constant), Market information risk

Source: Author, 2020

The model of overall significance in table 5.2 (e) results produced an F-significance value of 39.923 and a p-value of .000 which is less than .05 [$F(1,394) = 39.923$, $p < .05$]. This is an indication of the significance of the predictive power of the model.

Table 5.2 (f): Regression Coefficients on the Effect of Market Information Risk on Trading Activity

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.905	.149		19.494	.000
	Market information risk	.247	.039	.303	6.318	.000

a. Dependent Variable: Trading activity

Source: Author, 2020

Table 5.2 (f) shows results of coefficients of the volume to transactions composite variable used for establishing combined mediation. The model provided a constant of 2.905 with a t-value of 19.494 and a p-value of 0.000. The coefficient for the independent variable revealed a value of .247 with a t-value of 6.318 and a p-value of 0.00. Market information risk has a positive and a statistically significant effect on volume to transactions ratio being a composite variable for trading activity

The results documented in tables 5.2 (d), 5.2 (e), and 5.2 (f) show that market information risk significantly influence trading activity with coefficient of determination R^2 of .092 and p-value<0.05. The overall model is also significant with F-value (394, 1) =39.923 and a p-value<0.05. The finding further reveals that MIR has an impact on TA with the results showing that there is a significant (t-value = 6.318) and a positive (beta = 0.247) relationship between these two constructs. The significance of the results in step one and two permits the analysis of path results in step three.

Step three of the path analysis of coefficients tested the effect of the combined mediating variable (TA) on the dependent variable PD. The results are presented in tables 5.2 (g), 5.2 (h) and 5.2 (i)

Table 5.2 (g): Model Goodness of Fit on the Relationship between Trading Activity and Price Discovery

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.405[a]	.164	.162	1.69272

a. Predictors: (Constant), Trading activity

Source: Author, 2020

Table 5.2 (g) presents the model summary of the regression analysis. The regression produced R-Squared of 0.164 showing that 16.4 % of the total variation in price discovery is accounted for by the composite variable of volume to transactions ratio. The composite variable explains more variation in price discovery as compared to when consider trading volume and number of transactions are considered independently.

Table 5.2 (h): Model Overall Significance on the Relationship between Trading Activity and Price Discovery

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	221.670	1	221.670	77.364	.000[b]
	Residual	1128.926	394	2.865		
	Total	1350.596	395			

a. Dependent Variable: Price discovery
b. Predictors: (Constant), Trading activity

Source: Author, 2020

The ANOVA of regression results in table 5.2 (h) provided an F-significance value of 77.364 and a p-value of 0.000 which is less than the critical value 0.05 [F (1,394) = 77.364, P < 0.05]. The regression model is a good fit with zero probability of its predictive value being false.

Table 5.2 (i): Regression Coefficients on the Relationship between Trading Activity and Price Discovery

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.584	.216		11.971	.000
	Trading activity	.470	.053	.405	8.796	.000

a. Dependent Variable: Price discovery

Source: Author, 2020

The regression model also show results of coefficients of the independent variable applied in the regression analysis. The model yields a constant value of 2.584 with t-value of 11.971 and p-value of 0.000. As explained elsewhere, 11.971 represents the conditional mean of price discovery when volume transaction ratio composite variable is set to be zero. Furthermore, the composite variable for trading activity is determinant of price discovery because it has positively and statistically significant influence based on the Unstandardized Coefficient value 0.470. The t-test value is 8.796 and p-value of 0.000 which is less than 0.05.

The results presented in tables 5.2 (g), 5.2 (h) and 5.2 (i) show that trading activity based on the composite significantly influence price discovery with coefficient of determination R^2 of .164 and *p*-value<0.05). The overall model is also significant with F-value of 77.364 and p-value<0.05.

The findings showed that there is a significant (t-value = 8.796) and a positive (beta = 0.470) relationship between TA and PD. The final step (Step four) involved the evaluation of the influence of the mediating variable on the relationship between MIR and PD as per Sobel – Score tests as shown in table 5.2 (j)

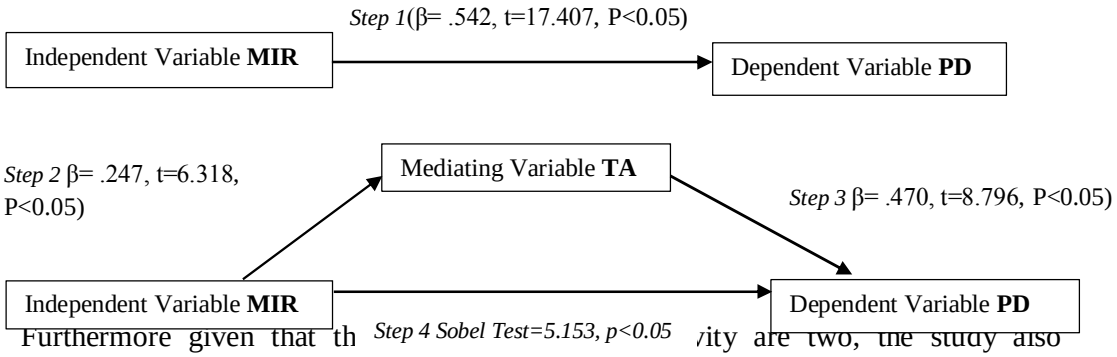
Table 5.2 (j): Calculation for the Sobel Test of Significance on the Mediation effect of Trading Activity

	Input:		**Test statistic:**	**Std. Error:**	***p*-value:**
a	.247	Sobel test:	5.153	0.022	0.000
b	.470	Aroian test:	5.132	0.022	.0002
s_a	.039	Goodman test:	5.175	0.022	.0002
s_b	.053				

Source: Author, 2020

Sobel test table showed that the relation between the independent variable, MIR and the dependent variable, PD, was affected by the introduction of the mediating variable, TA. The relationship between MIR and PD was mediated to the extent that the relationship p-value falls below the alpha value of 0.05 and therefore mediation effect is significant which confidence < 1.96 @ 95% confidence is). Trading activity as measured by the volume to transactions ratio composite variable was found to be mediator. The revised mediation effect model was as shown in Figure 5.1(b).

Figure 5.1 (b): Mediation Results of Trading Activity on the Relationship between Market Information Risk and Price Discovery



Furthermore given that th ...ity are two, the study also proceeded to determine the specific mediating influence of each of the indicators through the development of the following sub hypotheses.

H_{2a}: There is no significant mediating effect of trading volume on the relationship between market information risk and price discovery

H_{2b}: There is no significant mediating effect of Total number of transactions on the relationship between market information risk and price discovery

Regression analysis was carried out to establish whether trading activity mediates the relationship between market information risk and price discovery. In testing the formulated hypothesis, the model of Baron and Kenny (1986) and sobel z-test were

used to test the sub-hypotheses. The sub hypotheses developed and tested are presented below.

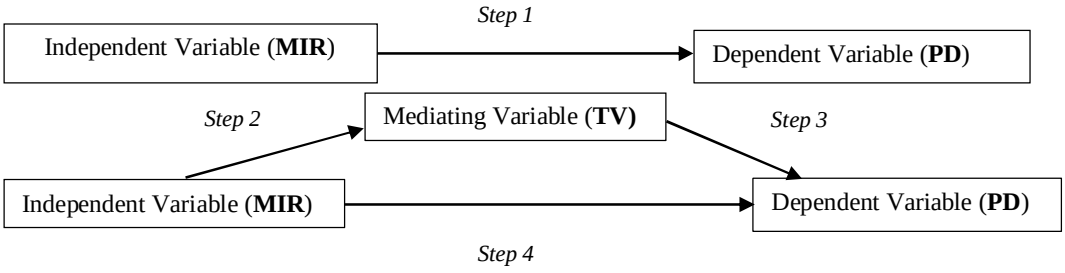
5.3.2 Trading Volume, Market Information Risk and Price Discovery

The study further determined further whether Trading Volume (TV) significantly mediates the relationship between market information risk and price discovery. The sub-hypothesis tested was;

H_{02a}: *There is no significant mediating effect of trading volume on the relationship between market information risk and price discovery*

The study therefore determined whether trading volume significantly mediates the relationship between market information risk and price discovery through path analysis using bootstrapping with 500 resamples as per (Chin, 1998). The mediation Process was assessed following a four-step procedure (Schultheis, 2016; MacKinoon, 2007; Sobel, 1990), as shown in Figure 5.2 (a).

Figure 5.2 (a): Mediation Process of Trading Volume on the Relationship between Market Information Risk and Price Discovery



In this thesis, the mediating variable is trading activity which is represented by two indicators namely, trading volume and the total number of transactions. The total number of transactions will be the sum total of buy and sell order respectively.

Step one assessed the significance and nature of the relationship between Market information risk (MIR) as the predictor variable and Price Discovery (PD) as the outcome variable as represented in the equation below.

$PD = a + \beta MIR + \varepsilon$.....STEP ONE

Where;

PD is price discovery

MIR is trading information risk

ε = Error Term

The results of the simple linear regression analysis are as presented in Tables 5.3 (a), 5.3 (b) and 5.3 (c) in the sections that follow.

Table 5.3 (a): Model Goodness of Fit on the effect of Market Information Risk on Price Discovery

Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	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

Source: Author, 2020

The results of analysis as presented in the model summary in Table 5.3 (a) revealed the values of R and R^2 to be .542 and .294 respectively. Market information risk which is the predictor variable explains 29.4% variation in price discovery, which in the model is the outcome variable. The change in the R-square value is .294 simply because there was only a single predictor variable considered in the simple linear regression analysis.

Table 5.3 (b): Model Overall Significance on the effect of Market Information Risk on Price Discovery

ANOVA[a]						
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

Source: Author, 2020

The results of analysis of variance (ANOVA) are presented in Table 5.3 (b). The ANOVA results were used to test the overall statistical significance of the R^2 value of .294 in Table 5.2 (a). The results revealed that the model was a good fit based on the F-test statistic which had value of 163.923 with a p-value of 0.00; F=163.923, P-value < 0.005. This result implies that the population R^2 is significantly greater than zero.

Table 5.3 (c): Regression Coefficients on the Effect of Market Information Risk on Price Discovery

Coefficients[a]					
	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.
1 (Constant)	2.653	.152		17.407	.000
Market information risk	.511	.040	.542	12.803	.000

a. Dependent Variable: Price discovery

Source: Author, 2020

Table 5.3 (c) presents the constant and both unstandardized and standardized Coefficients of the independent variable in the model. The results indicate that the model's constant is 2.653 with a p-value of .00. The intercept of 2.653 represents the conditional mean of price discovery when market information risk value is zero. The standard error of coefficient recorded a value of .04. The unstandardized Coefficient (β) value in the regression model is .511 based on the raw panel data.

The results presented in Tables 5.3 (a), 5.3 (b) and 5.3 (c), revealed that market information risk significantly influence price discovery with coefficient of determination R^2 of .294 and p-value<0.05. This implies that 29.4 % variation in price discovery is attributed market information risk as measured by bid-ask spread. The bid-ask spread is derived from the inside quote for each during for each interval during the sample period. The overall model is also significant with F-value of 163.923 and p-value<0.05. The results also showed that there is a significant (t-value = 12.803) and a positive relationship (β = 0.511), suggesting that MIR has a significant effect on PD.

The *second step* in the process of establishing existence or absence of mediation entailed testing the relationship between market information risk (MIR) and a mediating variable, Trading Volume (TV). This step is based on the equation below.

$TV = a + \beta MIR + \varepsilon$ .....STEP TWO

Where;

MIR = Market Information Risk

TV = Trading Volume

a represents intercept of the equation

ε is corresponding residuals in the equation

β = Regression coeffcient

Table 5.3(d): Model Goodness of Fit on the Relationship between Market Information Risk and Trading Volume

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.152[a]	.023	.021	1.973017
a. Predictors: (Constant), Market information risk				

Source: Author, 2020

Table 5.3 (d) presents model summary of the linear relationship between market information risk as the predictor and trading volume as the outcome variable. The regression coefficient of determination (R^2) is .023 and a standard error of estimate of 1.973017. 2.3 % Variation in trading volume in this equation is only explained by the predictor variable.

Table 5.3(e): Model Overall Significance on the Relationship between Market Information Risk and Trading Volume

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	36.087	1	36.087	9.270	.002[b]
	Residual	1533.761	394	3.893		
	Total	1569.848	395			

a. Dependent Variable: Trading volume
b. Predictors: (Constant), Market information risk

Source: Author, 2020

In table 5.3 (e) the test for the significance of coefficient of determination in table 5.2 (d) is presented. The F-Test shows a significance level as per the value of F-Statistic and p-value. The F-statistic is given as 9.270 with a critical value of .002, F=9.270, P < .05).

Table 5.3(f): Regression Coefficients on the Relationship between Market Information Risk and Trading Volume

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.573	.193		13.313	.000
	Market information risk	.154	.051	.152	3.045	.002

a. Dependent Variable: Trading volume

Source: Author, 2020

Based on the raw panel data, the regression unstandardized coefficient showed a positive relationship between the predictor and outcome variable. The beta coefficient is positive .154 with a standard error of .051. The test of significance was based on the critical value of the t-statistic. The t-value is 3.045 with p-value of .002 which is less than .005. This means that market information risk contributes useful information when explaining trading volume.

The results in Tables 5.3 (d), 5.3 (e) and 5.3 (f) show that market information significantly influence trading volume with coefficient of determination R^2 of .023 and p-value<0.05. This is interpreted to mean that 2.3% variation in the outcome variable (Trading volume) is explained by market information risk. The overall model has a good fit and is also significant with F-value of 9.270 and p-value<0.05. The finding further reveal that MIR has an effect on TV with the results showing a significant (t-value = 3.045) and a positive (β = 0.154) relationship between these two constructs with the *p-value* being less the 0.05(p-*value=0.002).*The results in step one and two show that there is non-zero order relationship that exists among the variables of study and this permitted analysis in step three.

Step three of the mediation testing process involved the testing the effect of the trading volume on price discovery based on the following equation.

$PD = a + \beta TV + \varepsilon$.....STEP THREE

where;

PD = Price Discovery

TV = Trading Volume

a = Intercepts of the equation

ε = Corresponding residuals in each equation

β = Regression coeffcients

Table 5.3 (g): Model Goodness of Fit on the Effect of Trading Volume on Price Discovery

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.279[a]	.078	.076	1.77775

a. Predictors: (Constant), Trading volume

Source: Author, 2020

The results of linear regression analysis between trading volume and price discovery in Table 5.3 (g) indicate that R^2 value .078 which translates to 92.2% of the variation in price discovery which is explained by variables not considered in the model. Based on the regression results, the R^2 value is a relative measure that gives an indication of how well the model fits the sample data. This implies that including those variables in this model would generally improve its predictive power.

Table 5.3 (h): Model Overall Significance on the Effect of Trading Volume on Price Discovery

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	105.405	1	105.405	33.352	.000[b]
	Residual	1245.192	394	3.160		
	Total	1350.596	395			

a. Dependent Variable: Price discovery
b. Predictors: (Constant), Trading volume

Source: Author, 2020

The ANOVA of regression model documented in Table 5.3 (h) produced F-significance value of 33.352 and a p-value of .000 F= 33.352, P-value < .05]. This means that the null hypothesis is rejected suggesting that the population R-Squared is significantly greater than zero. Thus the model was significant.

Table 5.3 (i): Regression Coefficients on the Effect of Trading Volume on Price Discovery

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.531	.164		21.463	.000
	Trading volume	.259	.045	.279	5.775	.000
a. Dependent Variable: Price discovery						

Source: Author, 2020

In Table 5.3 (i), the standard error of coefficient which measures precision of estimates was found a lower value of .045. The intercept of the model was found to be 3.531 with a t-value of 21.463 and significance critical value of .000. Trading volume appears to be a determinant of price discovery on the significance of coefficient. The regression beta coefficient value is .259 with a t-value of 5.775 and p-value of .000 which is less than 0.05. Other factors held constant, it therefore means that an increase in the intensity of trading volume would cause price discovery to increase by .259 units holding other factors constant.

The results of regression analysis in tables 5.3 (g), 5.3(h) and 5.3 (i) show that trading volume significantly influence price discovery with coefficient of determination R^2 of .078 and p-value<0.05). The predictor variable trading volume explains only 7.8% variation in the dependent variable, price discovery with 92.2% explained by other factor or variables not included in the model. The overall model was also significant with F-value of 33.352 and p-value<0.05. There is also a significant (t-value = 5.775) and a positive (beta = 0.259) relationship between TV and PD. Based on results reported in steps 1-3, further analysis was undertaken in step 4.

Step four in the path analysis evaluated the influence of the mediating variable (TV) on the relationship between MIR and PD based on the sobel z-test.

$$\text{sobel} \quad = S_{\beta_2\beta_5} = \sqrt{S_{\beta_2}{}^2\beta_3{}^2 + S_{\beta_3}{}^2\beta_2{}^2}$$

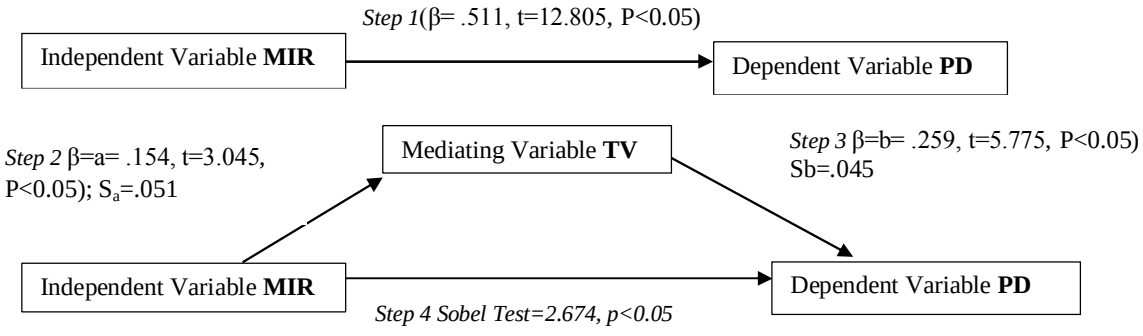
Table 5.3 (j): Calculation for the Sobel Test of Significance on the Mediation effect of Trading Volume

	Input:		Test statistic:	Std. Error:	*p*-value:
a	.154	Sobel test:	2.674	0.014	0.007
b	.259	Aroian test:	2.642	0.015	.0082
s_a	.051	Goodman test:	2.706	0.014	.0068
s_b	.045				

Source: Author, 2020

Sobel test table showed that the relation between the independent variable, MIR and the dependent variable, PD, was affected by the introduction of the mediating variable, TV. The relationship between MIR and PD was mediated to the extent that the relationship p-value falls below the alpha value of 0.05 and therefore mediation effect is significant which confidence < 1.96 @ 95% confidence. This means that when trading volume was introduced, the indirect effect of MIR on PD reduces and as such trading volume is a mediator. The revised mediation effect model was as shown in Figure 5.2(b).

Figure 5.2 (b): Mediation Results of Trading Volume on the Relationship between Market Information Risk and Price Discovery



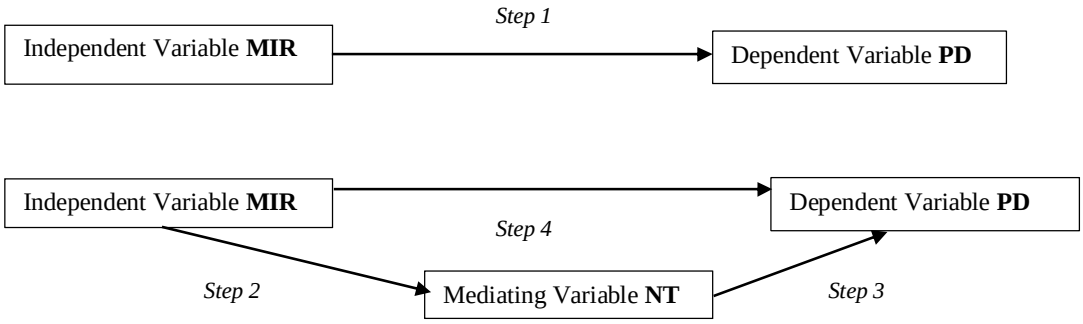
5.3.3 Number of Transactions, Market Information Risk and Price Discovery

The study further determined further whether number of transactions (NT) significantly mediates the relationship between market information risk and price discovery. The hypothesis tested was;

H_{2b}: There is no significant mediating effect of Number of Transactions on the relationship between market information risk and price discovery

The mediation effect was assessed using a four-step process as per (MacKinoon, 2007; Sobel, 1990 and Schultheis, 2016) (Schultheis, 2016), as shown in Figure 5.3 (a).

Figure 5.3 (a): Mediation Process of Trading Volume on the Relationship between Market Information Risk and Price Discovery



Step one assessed the significance and nature of the relationship that market information risk (MIR) on Price Discovery (PD). The results of the tests are presented the table below. This step was based on the following simple linear regression equation and therefore it entailed simple regression analysis.

$PD = a + \beta MIR + \varepsilon$.....STEP ONE

where;

PD = Price Discovery

MIR = Trading Information Risk

a = Intercept of the equation

ε = Error term

β = Regression coeffcient

Table 5.4 (a): Model Goodness of Fit on the Relationship between Market Information Risk and Price Discovery

Model Summary									
					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	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

Source: Author, 2020

Linear regression analysis results as shown in model summary in table 5.4 (a) provided a R^2 value of .294 and Std. Error of the Estimate of 1.55588. The significance of the observed R^2 value in the model summary is presented in table 5.4 (b) through the analysis of variance.

Table 5.4 (b): Model Overall Significance on the Relationship between Market Information Risk and Price Discovery

ANOVA[a]						
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

Source: Author, 2020

Table 5.4 (b) presents the regression results of the analysis of variance which were useful in testing the statistical significance of the R^2 value in the model summary. The

ANOVA results indicate significance F=163.923, P < 0.05] which suggests that the population R^2 is significantly greater than zero. If the predictor variables in the regression were more than one, statistical significance would then mean that at least of the regression coefficients is not equal to zero.

Table 5.4 (c): Regression Coefficients on the Relationship between Market Information Risk and Price Discovery

Coefficients[a]					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model	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					

Source: Author, 2020

Table 5.4 (c) documents the results of coefficients of the independent variable used in the model and which was used to assess the degree of relationship with the dependent variable. The results indicate that the model constant is 2.653 with a t-value of 17.407 and p-value of .000. The constant value of 2.653 represents the value of price discovery when the independent variable is zero. Market information risk has a positive significant influence on price discovery with based on a beta coefficient of .511, t-value of 12.803 and p-value < 0.05.

The results in tables 5.4 (a), 5.4 (b) and 5.4 (c) show that market information risk significantly influence price discovery with coefficient of determination R^2 of .294 and p-value<0.05). The overall model is also significant with F-value of 163.923 and p-value<0.05. The results further showed that there is a significant (t-value = 17.407) and a positive relationship (beta value = 0.542), suggesting that MIR has an effect on PD. The move to step two.

Step two of the process then tested the relationship between market information risk (MIR) and the mediating variable, Number of transactions (NT). This test was based on the following equation;

$NT = a + \beta MIR + \varepsilon$.....STEP TWO

where;

NT = Number of transactions

MIR = Trading Information Risk

a = intercept of the equation

ε = Residuals of the equation

β Regression coeffcient

Table 5.4 (d): Model Goodness of Fit on the Effect of Market Information Risk on Number of Transactions

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.200[a]	.040	.037	13.773568

a. Predictors: (Constant), Market information risk

Source: Author, 2020

The model summary presented in Table 5.4 (d) shows the results of the predictive power of the model based on R^2. The R-Squared value from the regression results is .040. This means that 4.0% of the total variation in market information risk is attributed to the total number of transactions. The standard error of estimate is 13.774.

Table 5.4 (e): Model Overall Significance on the Effect of Market Information Risk on Number of Transactions

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3102.874	1	3102.874	16.356	.000[b]
	Residual	74746.208	394	189.711		
	Total	77849.082	395			

a. Dependent Variable: Number of transactions

b. Predictors: (Constant), Market information risk

Source: Author, 2020

The ANOVA results in Table 5.4 (e) reveals that the um of squares for the regression and residual is 3102.874 and 74746.208 respectively. Based on the F-statistic and p-value, the results show that the R^2 value is statistically significant F= 16.356, P < 0.05 and this implies that the population R-Squared is significantly greater than zero.

Table 5.4 (f): Regression Coefficients on the Effect of Market Information Risk on Number of Transactions

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	7.103	1.349		5.264	.000
	Market information risk	1.430	.354	.200	4.044	.000
a. Dependent Variable: Number of transactions						

Source: Author, 2020

In Table 5.4 (f), the intercept of the regression equation in step two is 7.103 and it represents the value of total number of transactions when value for market information risk is zero. Furthermore, market information risk is useful in the prediction of number of transactions based on the positive beta coefficient of 1.430 with a t-value of 4.044 and p-value < 0.05. Thus move to step three

The results shown in Tables 5.4 (d), 5.4 (e), and 5.4 (f) indicate that market information risk significantly influence number of transactions with coefficient of determination R^2 of .0400 and p-value<0.05). Market information risk explains 4% variation in number of transactions. The overall model is also significant with F-value of 16.356 and p-value<0.05. The finding further reveal that MIR has an impact on NT with the results showing significance (t-value = 4.044) and a positive (beta = 1.430) relationship between these two variables and p-value<0.05.

In the causal stages approach, *Step three* of the process entailed testing the effect of the mediating variable NT on PD as shown in the equation under step three.

$PD = a + \beta NT + \varepsilon$.....STEP THREE

where;

NT = Number of transactions

PD = Price Discovery

a = Intercept of the equation

ε = Residuals of the equation

β Regression coeffcient

Table 5.4 (g): Model Goodness of Fit on the Relationship between Number of Transactions and Price Discovery

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.013[a]	.000	-.002	1.85131
a. Predictors: (Constant), Number of transactions				

Source: Author, 2020

The results in Table 5.4 (g) show that total variation in price discovery is not explained by the regression. The R-Squared value is .000 and this implies that the model does not have a predictive power. Number of transactions accounts for 0.00% variation in price discovery.

Table 5.4 (h): Model Overall Significance on the Relationship between Number of Transactions and Price Discovery

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.215	1	.215	.063	.802[b]
	Residual	1350.381	394	3.427		
	Total	1350.596	395			
a. Dependent Variable: Price discovery b. Predictors: (Constant), Number of transactions						

Source: Author, 2020

Table 5.4 (h) presents the results of significance of R^2 value of .000 obtained in table 5.4 (g). The results indicate statistical insignificance based critical value of the F-statistic which revealed a value of .063 and p-value of .802 which is greater than .05,

F= .063, p > .05. These results therefore indicate that the probability of the regression model giving false information is 100%.

Table 5.4 (i): Regression Coefficients on the Relationship between Number of Transactions and Price Discovery

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	4.309	.122		35.451	.000
	Number of transactions	.002	.007	.013	.251	.802
a. Dependent Variable: Price discovery						

Source: Author, 2020

Regression coefficients in Table 5.4(i) reveal an intercept of 4.309 with a t-value of 35.451 and p-value of .000. The value 4.309 represents the conditional mean of price discovery when total number transactions are zero. Number of transactions is not useful in the prediction of price discovery based on p-value. The Unstandardized Coefficients from the analysis was found to be .002 with a t-value of .251 and p-value of .802 which is greater than .05. The t-tests were therefore to reach at the conclusion that number of transactions does not carry useful information in the prediction of price discovery.

In summary, the results in Tables 5.4 (g), 5.4 (h) and 5.4 (i) show that number of transactions does not significantly influence price discovery with coefficient of determination R^2 of .000 and p-value>0.05). The overall model is also not significant with F-value of 0.063 and p-value>0.05.

The findings showed that there is an insignificant (t-value = .251) and a positive but minimal (beta = 0.002) relationship between NT and PD. Step one and two are aimed establishing that zero-order relationship among variables of study exists. The results

of step one and two clearly indicate that the indirect effect of MIR on PD when number of transactions is introduced to the path is almost by a small margin same as the total effect and this is an indication that no mediation took place. In the event that one or more theses relationship is non-significant, the conclusion is that mediation is unlikely. The insignificant values at step three therefore terminated the process of mediation and thus conclude that number of transactions does not significantly mediate the relationship between market information risk and price discover. The study result fails to reject the null hypothesis that there is no significant mediating effect of number of transactions on the relationship between market information risk and price discovery. Therefore, the total number of transactions as an indicator of trading activity is not a mediator. Riordan, Storkenmaier, Wagener and Zhang (2013) argues that information arrival is influence highly by adverse selection costs and that intensity of trading is increased with the availability of information and where investors are believed to possess different information market reaction is induced leading to significant drop in trading intensity and volume.

5.4 The Relationship between Organizational Characteristics, Market Information Risk and Price Discovery

The third objective was to establish the moderating effect of organizational characteristics on the relationship between market information risk and price discovery. The moderating variable (organizational characteristics) in this study has got two indicators namely ownership concentration and stock return volatility. Hierarchical multiple regression analysis was used to assess the moderation effect. The study as well tested the individual sub variables of organizational characteristics which in this study are ownership concentration (OC) and stock return volatility (SRV). The interaction term was obtained by multiplying the predictor variable with

each of the indicators of the moderating variable. The standardized interaction term was then arrived as follows;

Interaction term = Market Information Risk * Organizational characteristics

The regression coefficient for interaction term provides an estimate of moderation effect which could either come in the form of enhancement, buffering or antagonistic dampening of the relationship between MIR and PD. Consequently, the analysis therefore sought to establish whether the magnitude and direction of effect of market information risk on price discovery depended on overall organizational characteristics before investigating either stock return volatility or ownership concentration on a standalone basis as indicators of OCH.

5.4.1 Moderating Effect of Organizational Characteristics on the Relationship between Market Information Risk and Price Discovery

This was achieved through testing the following hypothesis;

H_{03}: There is no significant moderating effect of organizational Characteristics on the relationship between market information risk and price discovery

Based on the ideas proposed by Ley (1972), that a composite variable should ideally be meaningful to the context and objective of the study guided by the discipline and predetermined algorithm. In this regard, combination of stock return volatility and ownership concentration using the averaging method was done to create a composite which permitted the creation of a variable that allowed investigation of overall moderation effect. The process of establishing moderation involved hierarchical. In step one; market information risk was regressed on price discovery. In step two, market information risk was regressed on organizational characteristics. In step three the interaction term between MIR and OCH was introduced.

The overall moderation equation was presented as follows;

$PD=a+\beta_1 MIR+\beta_2 OCH+\beta_3 MIR*OCH+\varepsilon$

Table 5.5 (a): Model Goodness of Fit on Moderation of Organizational Characteristics on the Relationship between Market Information Risk and Price Discovery

Model Summary[d]

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	.546[b]	.298	.294	1.55542	.003	1.775	1	392	.184	
3	.601[c]	.361	.356	1.48601	.063	38.473	1	391	.000	1.412

a. Predictors: (Constant), market information risk
b. Predictors: (Constant), market information risk, Organizational characteristics
c. Predictors: (Constant), market information risk_ Organizational characteristics, interactions
d. Dependent Variable: Price discovery

Source: Author, 2020

In model one where market information risk was the only predictor, the reported R^2 value was .295 meaning that 29.5% of total variation in price discovery is explained by MIR. In the second model, market information risk and organisational characteristics account for 29.8% variation in PD. In model three, R^2 value obtained was .361 meaning that 36.1 % of the total variation is explained by the equation. Third model had MIR, OCH and interaction term as the predictor variables.

Table 5.5 (b): Model Overall Significance on Moderation of Organizational Characteristics on the Relationship between Market Information Risk and 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	402.191	2	201.095	83.120	.000[c]
	Residual	948.377	392	2.419		
	Total	1350.568	394			
3	Regression	487.149	3	162.383	73.535	.000[d]
	Residual	863.419	391	2.208		
	Total	1350.568	394			

a. Dependent Variable: Price discovery
a. Predictors: (Constant), Market information risk
b. Predictors: (Constant), Market information risk, Organizational characteristics
c. Predictors: (Constant), Market information risk_ Organizational characteristics, interactions

Source: Author, 2020

Table 5.5 (b) documents the results of analysis of variance (ANOVA). The analysis of variance of the regressions shows that model 1, 2 and 3 are significant. The F-statistic value in model 1 is 164.142 and p – value of 0.00 [$F= (1,393) = 164.142$, $p < 0.05$]. In model two, the results produced an F-significance value of 83.120 [$F= (2,392) = 83.120$, $p < 0.05$]. In model 3, the F-statistic is also significant based on the p-value [$F= (3,391) = 73.535$, $p < 0.05$].

Table 5.5 (c): Regression Coefficients on Moderation of Organizational Characteristics on the Relationship between Market Information Risk and Price Discovery

Coefficients[a]								
		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	2.652	.153		17.385	.000		
	Market information risk	.513	.040	.543	12.812	.000	1.000	1.000
2	(Constant)	2.919	.252		11.598	.000		
	Market information risk, Organizational characteristics	.510	.040	.540	12.748	.000	.998	1.002
3	(Constant)	2.006	.282		7.114	.000		
	Market information risk, Organizational characteristics interaction	.435	.040	.460	10.837	.000	.906	1.103

a. Dependent Variable: Price discovery

Source: Author, 2020

Table 5.5 (c) presents regression coefficients of the market information risk, organizational characteristics and interaction term as the predictor variables used in each model. In model 1 where market information risk was regressed against price discovery, the constant value reported is 2.652. Market information risk has a positive influence on price discovery with unstandardized coefficients value of 0.513, t-value of 12.812, p-value < 0.05. In model 2, the coefficient for organizational characteristics resulting from the analysis is .510 with significant t-value of 12.748. In model 3

where the interaction term was introduced, the reported coefficient is .435 with a t-value of 10.837 and *p*-value of 0.000 which is less than .05.

In summary, the result in Table 5.5 (a), 5.5 (b) and 5.5 (c) on the moderating effect of organizational characteristics on the relationship between market information risk and price discovery was computed using three steps. Model one presents the association between market information risk and price discovery which was strong and significant (R= .542[a,] R^2=0.294, F=164.142, P-value<0.05). In model two (R= .546[a,] R^2=.298, F=83.120, P-value<0.05) which was positive and significant and in model three (R= .601[a,] R^2=0.361, F=73.535, P-value<0.05) which is strong and significant. This suggests that there is moderation going on when OCH is introduced.

The value of the interaction term (MIR * OCH) had a significant influence (β= .435, t=10.837, P<0.05) thus confirming a moderation effect of OCH and this leads to rejection of the null the hypothesis that OCH has a no significant moderating influence on the relationship between MIR and PD for stocks at the NSE.

$$PD=a+\beta_1 MIR+\beta_2 OCH+\beta_3 MIR*OCH+\varepsilon$$

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

Y= 2.006 + .513 MIR+ .510 OCH+ .435*MIR*OCH*
Where;
PD= Price discovery
MIR=Market information risk
OCH=Organizational characteristics
*MIR*OCH=Market information risk_organizational characteristics interaction*

The results show that organizational characteristics are significant in moderating market information risk and price discovery relationship. It is evidenced that a unit change in market information risk results to .510 changes in price discovery and when an interaction term is subjected in to the equation performance further changes by

.435 implying a significant moderation of organizational characteristics since the significance value also showed significance at 0.05 thresholds.

Further the study considered the moderating effect of each of the individual sub variables of ownership concentration and stock return volatility.

5.4.2 Ownership Concentration, Market Information Risk and Price Discovery

The test for moderation was done through stepwise regression analysis method. In step one; market information risk was regressed against price discovery. In step two, market information risk was regressed on ownership concentration. In step three the interaction term between MIR and OC was introduced (MIR*OC). The moderation effect is confirmed when coefficient of interaction term is statistically significant. The respective variables were first subjected to centering process before estimation of the product term so as to solve the problem of possible multicollinearity. The sub hypothesis that was testes is;

H_{03a}: There is no significant moderating effect of Ownership concentration on the relationship between market information risk and price discovery

The results of the analysis of the three models are as presented in Table 5.6 below.

Table 5.6 (a): Model goodness of Fit on the Moderation of Ownership Concentration on the Relationship between Market Information Risk and Price Discovery

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					
					R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.542[a]	.294	.292	1.55588	.294	163.923	1	394	.000	
2	.544[b]	.296	.293	1.55532	.002	1.286	1	393	.258	
3	.552[c]	.304	.299	1.54830	.008	4.568	1	392	.033	1.132

a. Predictors: (Constant), Market information risk

b. Predictors: (Constant), Market information risk, Ownership concentration

c. Predictors: (Constant), Market information risk, Ownership concentration interactions

d. Dependent Variable: Price discovery

Source: Author, 2020

In table 5.6 (a), regression results of goodness of fit of model 1, 2 and 3 is presented. In model 1, market information risk was regressed against price discovery. Based on the results, 29.4 % of the total variation in outcome variable is explained by the regression in model 1. In model 2, the results reveal R Square value of 0.296 which means that 29.6 % variation in the outcome variable can be attributed to market information risk and ownership concentration. The regression results in model three indicate that the R^2 value 0.304 meaning that taken together, market information risk, ownership concentration and the interaction term are individually useful in the prediction of price discovery.

Table 5.6 (b): Model Overall Significance on the Moderation of Ownership Concentration on the relationship between Market Information Risk and Price Discovery

ANOVA[a]						
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			
2	Regression	399.927	2	199.964	82.664	.000[c]
	Residual	950.669	393	2.419		
	Total	1350.596	395			
3	Regression	410.877	3	136.959	57.132	.000[d]
	Residual	939.719	392	2.397		
	Total	1350.596	395			

a. Dependent Variable: Price discovery

b. Predictors: (Constant), Market information risk

c. Predictors: (Constant), Market information risk, Ownership concentration

d. Predictors: (Constant), Market information risk Ownership concentration interactions

Source: Author, 2020

Table 5.6 (b) presents the ANOVA results. The analysis of variance regressions show that model 1, 2 and 3 are significant. The F-statistic value in model 1 is 163.923 and p – value of 0.00 [$F= (1,394) = 163.923$, $p < 0.05$]. In model two, the results produced an F-significance value of 82.664 [$F= (2,393) = 82.664$, $p < 0.05$]. In model 3 where the F-statistic is also significant based on the p-value [$F= (3,392) = 57.132$, $p < 0.05$].

Table 5.6 (c): Regression Coefficients on the Moderation of Ownership Concentration on the Relationship between Market information Risk and Price Discovery

Coefficients[a]							
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
Model	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	2.653	.152		17.407	.000		
Market information risk	.511	.040	.542	12.803	.000	1.000	1.000
2 (Constant)	2.667	.153		17.449	.000		
Market information risk, Ownership concentration	.518	.040	.549	12.842	.000	.981	1.019
3 (Constant)	2.767	.159		17.382	.000		
Market information risk, ownership concentration interaction	.530	.041	.562	13.073	.000	.960	1.041

a. Dependent Variable: Price discovery

Source: Research, 2020

Table 5.6 (c) presents regression coefficients of the predictor variables used in each model. In model 1 where market information risk was regressed against price discovery, the intercept value reported is 2.653. Market information risk has a positive influence on price discovery with Unstandardized Coefficients being 0.511, p-value < 0.05. In model 3 where the interaction term was involved, the reported coefficient is 0.530 with a t-value of 13.073 and p-value of 0.000.

The result in Table 5.6 (a), 5.6 (b), and 5.6 (c) on the moderating effect of ownership concentration on the relationship between market information risk and price discovery was done using three steps.

In model one (1), the result shows that the association between market information risk and price discovery was strong and significant (R= .542[a,] R^2=0.294, F=163.923, P-value<0.05) with the model having sound predictive ability. The results show a positive and a significant relationship between MIR and PD. The R^2 of .294 indicate that 29.4% variation in PD is accounted for by MIR.

In model two (2), market information risk and ownership concentration was regressed against price discovery which was positive and significant (R= .544[a,] R^2=.296, F=82.664, P-value<0.05) but moderately significant. The overall model based on F-statistic is significant. The R^2 was .296 which implies that 29.6% variation in PD is explained by predictor variables considered in the model and which are OC and MIR. Coefficient of determination (R^2) in model 2 is 0.002 larger than the one derived in model 1.

In the third (3) model, the moderating effect of organizational characteristics (ownership concentration denoted as OC), on the relationship between MIR and PD was tested through the introduction of the interaction term (MIR*OC). The coefficient of determination (R^2) is .304 which means that MIR, OC and the interaction term explain 30.4% variation in the dependent variable. The model output, (R= .552[a,] R^2=0.304, F=57.132, P-value<0.05) is strong and significant, suggesting presence of moderating effect in the third model after the interaction term is introduced. The value of the interaction term (MIR * OC) had a significant influence (β= .530, t=13.073, P<0.05) thus confirming a moderation effect of ownership concentration. The results therefore do not support the null sub hypothesis that ownership concentration has a no significant moderating influence on the relationship between MIR and PD.

5.4.3 Stock Return Volatility, Market Information Risk and Price Discovery

In order to determine whether stock return volatility is a moderator, the tests were done through stepwise regression analysis method. In step one; market information risk was regressed on price discovery. In step two, market information risk was regressed on stock return volatility. MIR and SRV was introduced in the third step. The sub hypothesis was:

H_{03b}: There is no significant moderating effect of Stock return volatility on the relationship between market information risk and price discovery. . Results are presented in Table 5.7 (a), (b) and (c).

Table 5.7 (a): Model Goodness of Fit on Moderation of Stock Return Volatility on the Relationship between Market Information Risk and Price Discovery

Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.542[a]	.294	.292	1.55588	.294	163.923	1	394	.000
2	.565[b]	.320	.316	1.52897	.026	14.989	1	393	.000
3	.574[c]	.330	.323	1.52150	.010	2.934	2	391	.054

a. Predictors: (Constant), Market information risk
b. Predictors: (Constant), Market information risk, Stock return volatility
c. Predictors: (Constant), Market information risk_ Stock return volatility interaction

Source: Author, 2020

In table 5.7 (a), regression results of goodness of fit of the models are presented. In model 1; market information risk was regressed against price discovery. Based on the results, 29.4 % of the total variation in outcome variable is explained by the regression. In model 2; the results reveal R Square value of 0.320 which means that 32.0 % variation in the outcome variable can be attributed to market information risk and stock return volatility. The regression results in model three indicate that the R^2

value 0.330 meaning that taken together, market information risk, stock return volatility and the interaction term are individually provide useful information as regards the outcome variable.

Table 5.7 (b): Model Overall Significance on Moderation of Stock Return Volatility on the Relationship between Market Information Risk and Price Discovery

ANOVA[a]						
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			
2	Regression	431.858	2	215.929	92.366	.000[c]
	Residual	918.738	393	2.338		
	Total	1350.596	395			
3	Regression	445.442	4	111.361	48.104	.000[d]
	Residual	905.154	391	2.315		
	Total	1350.596	395			

Source: Author, 2020

Table 5.7 (b) documents the ANOVA results. The analysis of variance of the regressions shows that model 1, 2 and 3 are significant. The F-statistic value in model 1 is 163.923 and p – value of 0.00 [$F= (1,394) = 163.923, p < 0.05$]. In model two, the results produced an F-significance value of 92.366 [$F= (2,393) = 92.366, p < 0.05$]. In model 3, the F-statistic is also significant based on the p-value [$F= (4,391) = 48.104, p < 0.05$].

Table 5.7 (c): Regression Coefficients on Moderation of Stock Return Volatility on the Relationship between Market Information Risk and Price Discovery

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.653	.152		17.407	.000
	Market information risk	.511	.040	.542	12.803	.000
2	(Constant)	2.216	.188		11.818	.000
	Market information risk	.457	.042	.484	10.960	.000
	Stock return volatility	.202	.052	.171	3.872	.000
3	(Constant)	2.324	.194		11.990	.000
	Market information risk, Stock return volatility interaction	.472	.043	.500	11.077	.000

a. Dependent Variable: Price discovery

Source: Author, 2020

Table 5.7 (c) presents regression coefficients of the predictor variables used in each model. In model 1 where market information risk was regressed against price discovery, the intercept value reported is 2.653. Market information risk has a positive influence on price discovery with unstandardized coefficients value of 0.511, t-value of 12.803, p-value < 0.05. In model 3 where the interaction term of market information risk and stock return volatility was introduced, the reported coefficient is .472 with a t-value of 11.077 and *p*-value of 0.000 which is less than .05.

The results of regression analysis in steps one, two and three as presented in tables 5.7(a), 5.7(b) and 5.7(c), on the moderating effect of stock return volatility on the relationship between market information risk and price discovery was computed using three steps.

The results of the first model shows that the association between market information risk and price discovery was strong and significant (R= .542[a,] R^2=0.294, F=163.923, P-value<0.05). In model two market information risk and stock return volatility was

also positive and significant (R= .565[a,] R^2=.320, F=92.366, P-value<0.05) which was strong and significant. In model three (R= .574[a,] R^2=0.330, F=48.104, P-value<0.05) which is strong and significant, suggesting a moderating effect

The value of the interaction term (MIR * SRV) had a significant influence (β= .472, t=11.077, P<0.05) thus confirming a moderation effect of stock return volatility. This leads to the rejection of the null hypothesis that stock return volatility has a no significant moderating influence on the relationship between MIR and PD for stocks at the NSE.

The results show that organizational characteristics proxies have a significant moderating effect on the relationship between market information risk and price discovery. This is same observation that Ali (2018) arrived at where the author observed that there was an explicit mismatch between the inherent values of shares and the book values and this was attributed to poor quality of financial reporting. Furthermore, the mismatch also contributed to extant market information inefficiencies which were then found to influence stock returns implying that relevance and timeliness of market information leads to an increase in stock prices which was also found to be a function of stock return volatility.

5.5 Market information risk, Trading Activity, Organizational Characteristics and Price Discovery

The fourth study objective was to assess the joint effect 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 organisational characteristics were concentrated ownership and stock return volatility. The outcome variable is price discovery measured by weighted price contribution. In order to establish joint effect, a stepwise regression analysis was done to determine how jointly the individual measures of key variables (BAS, TV, NT, OC and SRV) influence price discovery. The hypothesis tested was:

H_{04}: *There is no significant joint effect of market information risk, trading activity and organisational characteristics on price discovery.* Results are presented in Table 5.8 (a), (b) and (c).

Table 5.8 (a): Model Goodness of Fit on the Joint Effect of Market Information Risk, Trading Activity and Organizational Characteristics on Price Discovery

Model Summary[f]

					Change Statistics					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
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

Source: Author, 2020

Table 5.8 (a) 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 considered jointly, the predictor variables explain 36.3 % variation in the dependent variable.

Table 5.8 (b): 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

Source: Author, 2020

Table 5.8 (b) 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 5.7 (a) and to confirm that at least one of the regression coefficient 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-statistic 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 5.8 (c): Regression Coefficients on the Joint Effect of Market Information Risk, Trading Activity and Organizational Characteristics on Price Discovery

Coefficients[a]								
		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		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

Source: Author, 2020

Table 5.8 (c) presents results 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 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 an 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, $p < 0.05$).

The results as shown in Table 5.8 (a), 5.8 (b) and 5.8 (c) 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, MIR is regressed against price discovery. The results show that 29.5 % variation in price discovery 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 PD (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 were included and regressed against the outcome variable. The joint effect was 36.3% (R^2 = .363) which was higher in comparison to individual effects of individual variables. When 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 joint effect market information risk, trading activity and organizational characteristics on price discovery was statistically significant. These findings support the alternative hypothesis that 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 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 shown in the next page.

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 the null hypothesis is rejected. The rejection of null hypothesis implies presence of a significant joint effect. 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.

5.6 Summary of Statistical Tests of Hypotheses

In this section, a summary of statistical tests of hypotheses and interpretation of results is presented.

Table 5.9: Summary of Statistical Tests of Hypotheses and Interpretation of Results

Objective	Hypothesis Sub Hypothesis	Results	Remarks
Objective one: Determine the effect of market information risk on price discovery	$H_{01:}$ There is no significant effect of market information risk on price discovery This hypothesis ($H_{01)}$ is further translated into sub-hypotheses H_{01a} and H_{01b} as presented below	Market information risk had a positive and a statistically significant effect on price discovery. R^2=.294 Overall model was fit and significant (F=163.92, P<0.05) (t-value=12.803, β=0.511, P<0.05)	Null hypothesis rejected implying that there is a statistically significant relationship between market information risk and price discovery
	$H_{01a:}$ *There is no significant effect of bid price on price discovery*	Bid price had a positive and a statistically significant effect on price discovery. R^2=.125 Overall model was fit and significant (F=56.299, P<0.05) (t-value=7.503, β=9.333, P<0.05)	Null hypothesis rejected implying that there is a statistically significant relationship between bid price risk and price discovery
	H_{01b}*: There is no significant effect of ask price on price discovery*	Ask price had a positive and a statistically significant effect on price discovery. R^2=.023 Overall model was fit and significant (F=9.379, P<0.05) (t-value=3.063, β=4.107, P<0.05)	Null hypothesis rejected implying that there is a statistically significant relationship between ask price risk and price discovery
Objective Two: Establish the effect of trading activity on the relationship between market information risk and price discovery	$H_{02:}$ There is no significant mediating effect of trading activity on the relationship between market information risk and price discovery	<u>Step one:</u> Market information risk had a positive statically significant effect on price discovery. R^2=.294 Overall model was fit and significant (F=163.92, P<0.05) (t-value=12.803, β=0.511, P<0.05) <u>Step two</u>	The study rejects the null hypothesis and concludes the mediating effect of Trading Activity on relationship between market information risk and price discovery is

	The hypothesis (H_{02}) is further translated into sub-hypotheses H_{02a} and H_{02b}.	Market information risk significantly influences Trading Activity. (R^2=.092, p<0.05), (F=39.923, p<0.05), (t-value=6.318, β=0.247, P<0.05) Step three Trading Activity has a positive and statistically significant effect on price discovery. (R^2=.164, p<0.05), (F=77.364, p<0.05), (t-value=8.796, β=0.470, P<0.05) Step Four Sobel z-test=5.153, p-value= 0.00026 which is less than α=0.05	statistically significant
	H_{02a}: There is no significant mediating effect of trading Volume on the relationship between market information risk and price discovery	Step one: Market information risk had a positive statically significant effect on price discovery. R^2=.294 Overall model was fit and significant (F=163.92, P<0.05) (t-value=12.803, β=0.511, P<0.05) Step two Market information risk significantly influences trading volume. (R^2=.023, p<0.05), (F=9.27, p<0.05), (t-value=3.045, β=0.154, P<0.05) Step three Trading volume has a positive and statistically significant effect on price discovery. (R^2=.0078, p<0.05), (F=33.352, p<0.05), (t-value=5.775, β=0.259, P<0.05) Step Four Sobel z-test=2.674, p-	The study rejects the null hypothesis and concludes the mediating effect of Trading Volume on relationship between market information risk and price discovery is statistically significant

		value= 0.0075 which is less than α=0.05	
	$H_{02b:}$ There is no significant mediating effect of Number of transactions on the relationship between market information risk and price discovery	Step one: Market information risk had a positive statically significant effect on price discovery. R^2=.294 Overall model was fit and significant (F=163.92, P<0.05) (t-value=12.803, β=0.511, P<0.05) Step two Market information risk significantly influences number of transactions. (R^2=.04 p<0.05), (F=16.356, p<0.05), (t-value=4.044, β=1.43, P<0.05) Step three Number of transactions had no significant effect on price discovery. (R^2=.000, p>0.05), (F=0.063, p>0.05), (t-value=0.251, β=0.002, P>0.05) The outcome of step three show insignificant effect. Therefore, it was concluded that the process ends at this stage. Consequently, there was no need of running sobel tests.	The study fails to reject the null hypothesis and concludes that Number of transactions does not mediate relationship between market information risk and price discovery
Objective Three: To find out the effect of organizational characteristics on the relationship between market information risk and intraday price discovery	$H_{03:}$ There is no significant moderating effect of organizational Characteristics on the relationship between market information risk and price discovery The hypothesis (H_{03}) is further translated into sub-hypotheses	The coefficient of interaction term (MIR*OCH) is statistically significant. (R^2=.361, p<0.05), (F=73.535, p<0.05), (t-value=10.837, β=0.435, P<0.05) There was also incremental positive change in the coefficient of determination (R^2 from .295 then .298 and	The study rejects the null hypothesis and this implies that organizational characteristics has a statistically significant moderating effect

	H_{03a} and H_{03b}.	eventually .361)	
	H_{03a}: There is no significant moderating effect of Ownership concentration on the relationship between market information risk and price discovery	The coefficient of interaction term (MIR*OC) is statistically significant. (R^2=.304, p<0.05), (F=57.132, p<0.05), (t-value=13.073, β=0.530, P<0.05) There was also incremental positive change in the coefficient of determination (R^2)	The study rejects the null hypothesis and this implies that Ownership concentration has a statistically significant moderating effect
	H_{03b}: There is no significant moderating effect of Stock return volatility on the relationship between market information risk and price discovery	The coefficient of interaction term (MIR*SRV) is statistically significant. (R^2=.0.33, p<0.05), (F=48.104, p<0.05), (t-value=11.077, β=0.472, P<0.05) There was also incremental positive change in the coefficient of determination (R^2)	The study rejects the null hypothesis and this implies that Stock return volatility has a statistically significant moderating effect
Objective Four: Determine Effect of market information risk, trading activity and organisation characteristics on price discovery	H_{04}: There is no significant joint effect of market information risk, trading activity and organisational characteristics on price discovery Specifically; *There is no significant joint effect relationship of Bid-Ask Spread, Trading Volume, Number of Transactions, Ownership Concentration and Stock Return Volatility on price discovery*	Considering all the variables, there was significant joint effect. Positive increase in R^2 from .295 to .363. The overall model was fit and significant (F=44.427, p<0.05)	Reject null hypothesis. There is a significant joint effect of Bid-Ask Spread, Trading Volume, Number of Transactions, Ownership Concentration and Stock Return Volatility on price discovery

5.7 Discussion of Findings

The study tested the formulated hypotheses and sub-hypotheses in order to achieve the overall objective of determining the relationship among variables of the study. The overall objective was to establish the interaction among market information risk, trading activity, organizational characteristics and price discovery for stocks listed at the Nairobi Securitises Exchange. Section 5.7.1 presents a discussion on the relationship between market information risk and price discovery. Section 5.7.2 discusses the mediating role of trading activity on the relationship between market information risk, and price discovery. In Section 5.7.3, a discussion of the moderating effect of organizational characteristics on the relationship between market information risk and price discovery is discussed whereas section 5.7.4, discusses the findings of the joint effect of market information risk, trading activity and organizational characteristics on price discovery.

5.7.1 Market Information Risk and Price Discovery

The first objective was to establish the effect of market information risk as measured by bid-ask spread (BAS) derived from inside quote for stock trading at the NSE Market information risk has been found to have a significant positive relationship with price discovery. Bid price, one of the components of BAS was also independently found to have strong and significant influence on price discovery. Ask price on the other hand was weak though significant in explaining price discovery. Further the descriptive summary show that from the operationalized market information risk dimensions, bid price has the highest mean followed by ask price, while the inferential statistics show that there is a significant relationship between market information risk and price discovery. This implies that that information

content of stocks is a critical component that drives the evolution of prices in stock markets. This is largely caused by the degree of disparity of information held by market participants. Furthermore, the findings imply that price discovery accelerates based on the level of disparities of beliefs and information communicated through arrival of buy or sell quotes for each stock trading at the NSE during the continuous trading period. This affirms the notion that bid and asks quotes that are a result of either by private information or liquidity are critical elements that track the price discovery process for each stock listed at the NSE.

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 accessible to all market participants, whereas the private information is a privileged commodity to a of group quasi insiders. Since arbitrage is generated by use of private information, 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. This is evident from the empirical results and the near inverted u-shape of spreads and weighted price contribution. The findings also contradicts with and Lukanima (2014) who does not support significance influence of market information risk by arguing that Information asymmetry generally declines over the day but they does not demonstrate how it influences i price discovery.

The findings further support studies of Barclay and Hendershott (2003) whose findings were based on how market information risks manifest in the stock market.

The perspective in the study was that there exists greater information asymmetry in the pre-open period more than any other time of the day. In the post-close period, there is less informed trading, price discovery than the pre-open and majority of the trades are dealers with large amount of private information. The findings of this study support the idea of short term market clearing prices being driven by the information content of stocks with bias on private information. High frequency bid and asks quotes carry with it some signal which strategic traders can utilize in the formulation and submission of orders.

5.7.2 Market Information Risk, Trading Activity and Price Discovery

The second objective of the study was to examine the mediating effect of trading activity on the relationship between market information risk and price discovery for stocks listed at the NSE. The process of testing mediation involved formulation of hypotheses that captured each indicator and a combination of the two through generation of a composite. The proxies for trading activity were trading volume and number of transactions. Based on Sobel test, the relation between the independent variable, MIR and the dependent variable, PD, was affected by mediating variable, TA. The relationship between MIR and PD was mediated to the extent that the relationship p-value falls below the alpha value of 0.05 and therefore mediation effect is significant (Sobel Z-Sore = 5.153, P-value= 0.00026). Trading activity as measured by the volume to transactions ratio composite variable was therefore found to be mediator. Furthermore, the findings revealed that trading volume mediates market information risk and price discovery relationship significantly (Sobel Z-Sore = 2.674, P-value= 0.0075). However, the study findings show that number of transaction does not mediate the relationship between market information risk and price discovery.

The study supports Grossman and Stiglits (1980) who discussed the problem of possible information heterogeneity in agents' price expectations and therefore trading activity in market could be seen as largely heterogeneous. Further Information based theories also supported by the study findings with the argument that theory lends itself to the analysis of risk neutral, informed and uninformed traders and how price emerge given the trading process in a multi-period setting and also 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 (Glosten & Milgrom, 1985).

These findings are consistent to that of Bacidore and Sofianos (2002) and Solnik et al., (1996) who suggest that price discovery takes place most in the home market and during opening and closing periods because of market depth as measured by volume to transaction ratio. In the same vein Eun and Sabherwal (2003) and Kadapakam et al., (2003) find the foreign market dominating in price discovery and they attribute it to higher percentage of ownership stocks that is responsible for dictating the degree of trading activity in a stock. The findings contradicts with market efficiency theory which argues that prices follow a random walk process and any information available for predicting the stock prices is already incorporated in the prices and error term being only source of uncertainty.

5.7.3 Market Information Risk, Organizational Characteristics and Price Discovery

The third objective was to find out the moderating effect of OCH on the relationship between market information risk and intraday price discovery. Both ownership concentration and stock return volatility which are the indicators of organizational

characteristics significantly moderated the relationship between market information risk and price discovery. The study also tested the overall moderation effect by of organizational characteristics based on the average of the two indicators. The results showed positive statistical significance (R^2=.361, F=73.535, P < 0.05; β = .435, t=10.837, P < 0.05). This study provides significant support for the role of organizational characteristics in this relationship. The magnitude and direction of effect of MIR on PD depends on OCH and as such, organizational characteristics are a moderator

Notably, ownership concentration accelerated the price discovery for stocks listed at the NSE during the considered sample period. It appears from the findings that concentrated ownership in stocks enhance the efficiency of price evolution largely because block holders can evaluate intrinsic values of stocks more randomly than sparsely distributed shareholding. Holden and Subrahmanyam (1992) suggested that the concentrated ownership exert aggressive and intensive competition for profitable trading opportunities which allows prices to absorb information at a high speed. This is also affirmed by Boehmer and Kelley (2009) who suggested that as the cost of acquiring information becomes fixed and the benefits of information are increasing, highly concentrated stocks become more attractive. The concentrated ownership has the capacity to implicitly monitor stocks through gathering of information relevant for appropriate pricing of managerial decisions and hence efficiency of the price evolution process (Bushee, 1998).

Brockman et al. (2009) in a study found a no influence supporting the idea that block holders have no impact on information costs and access. Concentrated ownership according to the authors has no significant effect on bid ask spreads and information

content of stocks. This is a parallel to findings by Jacoby & Zheng (2010) who found a significant influence of block holders on market liquidity implying that concentrated owners seemingly have access to private and other relevant information which is in agreement with the findings of this study where ownership concentration was found to have a significant positive effect on market information risk which was quantified using bid ask spread. This is also in line with Pham et al. (2003) and Dang et al. (2019) who concluded that the degree of dispersion of ownership in a company influences trading activity and subsequently the level of liquidity for a stock.

The study extends the work of Murinde (2006) found that with institutional changes, market efficiency and liquidity improved while volatility reduced in the three exchanges. The researcher proposed a model for investigating institutional changes and microstructure characteristics pre and post reforms and its impact on stock efficiency, liquidity and volatility.

5.7.4 Market Information Risk, Trading Activity, Organizational Characteristics and Price Discovery

The fourth objective was to determine joint effect of market information risk, trading activity and organizational characteristics on price discovery. The hypothesis that was tested stated that there is a no significant joint effect relationship of market information risk, trading activity and organizational characteristics on price discovery. In establishing joint effect BAs, TV, NT, SRV and OC indicators 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. The implication of the findings points at the existence of a group of market participants who are privileged and are able to aggregate private information useful for execution of a trade taking into account the microstructure frictions at the NSE during the continuous trading period. It appears therefore that the in-formativeness of a price series at any given time and which is responsible for emergence of equilibrium prices can be attributed to market information risk, organizational characteristics and level of activity for each stock trading at the stock market.

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. The findings are also consistent with that of Barclay and Hendershott (2003) 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 period immediately after the market opens at NSE reveals high intensity of trading activity and greater incorporation of information into prices as evidenced by results which are averagely not close to zero. The pre-halt and post-halt represent pre-open and closing period respectively and the time period have got a distinct market clearing mechanism. It could therefore be inferred that that there is accumulation of relevant news and information during this period relevant for generation of trades. The study by Hendershott (2003) 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 that would have allowed for comparison. The findings are also 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 measure adopted by Barclay and Hendershott (2008).

Locally, Ngugi (2002) 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. This supports the complex nexus of how trading activity jointly with other factors drive both interval returns based on transactional prices and open-to-close returns that are largely based on average volume weighted prices.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter presents summary of the findings, conclusion as well as the recommendations of the study findings. These are presented relative to the findings of the previous chapter evaluating the influence of Market information risks, trading activity and organizational characteristics on price discovery for stocks listed at NSE.

6.2 Summary of Findings

The general objective was to determine the relationship among market information risk, trading activity, organizational characteristics and price discovery of stocks listed at the NSE. The design that guided this study was correlational descriptive research design since the study sought to offer description of study variables of market information risk, trading activity, organizational characteristics and price discovery besides offering description of the characteristics of the target population, the objective was to establish relationships among the study variables. The unit of analysis therefore was stocks listed at the NSE and the period for this was six months and secondary data of each stock was obtained from five intervals during the prescribed continuous trading period whose design and mechanism is distinct from the pre-open or post –close period.

The first objective was to determine the relationship between market information risk and price discovery for stocks listed at NSE. The explanatory variables were bid-ask spread where bid price was measured by establishing the highest price the stock can sell to a buyer and ask price measured by determining the lowest price a buyer can pay for the stock. Further price discovery was measured by WPC computed by

deriving 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. Both bid price and ask price showed positive and significant influence on price discovery with bid having a strong relationship and ask price showing weak though significant at statistical level. The bid and ask quotes were found to play a key role in tracking the path to efficient price formation.

The second objective was to assess the mediating effect of trading activity on the relationship between MIR and price discovery. Trading activity was measured by two variables namely; trading volume and total number of transactions in each interval where they 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. It is established that trading volume has a significant mediating effect on the relationships between market information risk and price discovery. However, total number of initiated buy and sell transactions did not mediate the relationship between market information risk and price discovery. The act of trading in itself generates the volume and number of transactions in the market. Through trading, information is somehow revealed to the market participants and this enhances price discovery. Further, volume to total number of transaction ratio composite variable was found to have a significant mediation effect. The composite ratio measured the depth of the market and the results reveal that trading activity conveys valuable information especially in provision of leads for the disagreement in expectations and beliefs by market participants which by inference influenced the size

of spreads and hence the magnitude of relationship between market information risk and the stochastic speed of price discovery for stocks in the study sample.

The third objective was to establish the moderating effect of OCH on the relationship between market information risk and price discovery. Organizational characteristics were measured by ownership concentration in terms of institutional and individual stocks. To establish the moderating effect, Hierarchical Multiple Regression Analysis model was employed and results revealed that the proxies for organizational characteristics which were ownership concentration and stock return volatility had a statistically significant moderating effect on the relationship between market information risk and price discovery for stocks listed at NSE. The overall moderation effect of organizational characteristics was also investigated. In this regard, combination of stock return volatility and ownership concentration using the averaging method was done to create a composite which permitted the creation of a variable that allowed investigation of overall moderation effect. The results show that organizational characteristics are significant in moderating market information risk and price discovery relationship. It appears from the findings that concentrated ownership in stocks enhance the efficiency of price evolution largely because block holders can evaluate intrinsic values of stocks more randomly than sparsely distributed shareholding

The fourth objective was to analyse the joint effect of market information risk, trading activity and organizational characteristics on price discovery for stocks listed at NSE by jointly investigating the indicators of each variable. Using a stepwise regression analysis, the study established significant independent effects of market information risk, trading activity, organizational characteristics indicators on price discovery and

further it was established that the joint effect had a higher significance as compared to individual effects.

6.3 Conclusions

The study determined the effect of market information risk on price discovery. The study found a strong relationship between market information risk and price discovery. Coefficient of determination indicated that market information risk explained 29.4 % of variation in price discovery. Further the overall model was significant as depicted by F value. The significant relationship was further manifested by the significant t-value in the coefficient table. This therefore depicts that market information risk is key in determining price discovery for stocks listed at the Nairobi Securities Exchange and thus the hypothesis that there is no significant influence of market information risk on price discovery is rejected. On determining the effect of individual measures of market information risks that is bid price and ask price on price discovery, it was found relationship between bid price and price discovery is moderate and the overall model was significant. However the study found a weak but significant relationship between ask price and price discovery. 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 no significant influence of ask on price discovery is rejected.

The second objective examined the effect of trading activity on the relationship between market information risk and price discovery. Sobel test table found that the relation between the independent variable, MIR and the dependent variable, PD, was affected by the introduction of the mediating variable, trading activity as measured by volume to total number of transactions variable. The relationship between MIR and

PD was mediated to the extent that the relationship p-value falls below the alpha value of 0.05 and therefore mediation effect is significant which confidence < 1.96 @ 95% confidence. Sobel test also revealed that the relation between the independent variable, MIR and the dependent variable, PD, was affected by the introduction of the mediating indicator of trading activity, trading volume. The relationship between MIR and PD was mediated to the extent that the relationship p-value falls below the alpha value of 0.05 and therefore mediation effect is significant which confidence < 1.96 @ 95% confidence. Trading volume, an indicator of trading activity is a mediator. Further, number of transactions as another indicator of trading activity was subjected to the path analysis (steps one to three) for mediation. In the third step, the results of regression analysis revealed that number of transactions does not significantly influence price discover (path coefficient "b") and this ruled out proceeding to next step of computing the sobel z-test. This therefore meant that number of transactions does not mediate the relationship between market information risk and price discovery. The observed relationship between trading activity composite variable and price discovery is evidence of the nature of intraday stochastic process of price evolution.

Based on the findings, it shows that the process of price evolution is dependent on the intensity of trading process and level of activity. However, it is not apparently clear how the learning process occurs for stocks that exhibit varying degree of trading intensity.

The third objective was to establish the moderating effect of organizational characteristics on the relationship between market information risk and intraday price discovery. The proxies for organizational characteristics were ownership

concentration (OC) and stock return volatility (SRV). Hierarchical Multiple Regression Analysis was used to assess the moderation effect. The result was computed using three steps. Model one showed that the association between market information risk and price discovery was strong and significant. In model two it was moderate and significant whereas in model three, it was strong and significant and this confirmed presence of moderating effect in model three after an interaction term is introduced. The value of the interaction term (MIR * OC), (MIR * SRV) and (MIR * OC/SRV composite) had a significant influence thus confirming a moderation effect of organizational characteristics and consequently supporting the hypothesis that organizational characteristics has a significant moderating influence on the relationship between MIR and PD for stocks at the NSE. The null hypothesis was therefore rejected.

The fourth objective 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 alternative as opposed to the null hypothesis.

It is worth observing that inefficient process by which prices emerge may bring with it some unhealthy consequences. The stochastic nature in which price emerge should ideally follow the martingale principle. Inefficient prices trigger turbulences in the market besides being a potential catalyst for eroding investor confidence which leads to the loss of societal welfare, retarded development of financial system and stagnated economic growth. As documented in the findings of this study, investors rely on order flow, price data and information in formulating trading strategies which are eventually reflected in the manner in which orders are placed. As such, the extent to which price evolution is efficient is critical for construction of portfolios, the economy and shareholder wealth because effects of market design can sometimes manifest in the most destructive way. The market architecture in place and the attendant microstructure frictions shape investor belief systems and the platform for risk sharing

6.4 Contributions of the Study Findings

The findings from this study are valuable and it makes great contribution the area of the influence of market information risk, trading activity and organizational characteristics on price discovery. This section highlights the study findings contribution to knowledge, regulators and benefits to NSE listed companies in Kenya on managerial policies and practices.

6.4.1 Contributions to Knowledge

The results of this study add to existing knowledge in the area of price discovery for stocks listed at NSE in three main ways: First and foremost, this study has contributed to empirical literature on market microstructure of an emerging market, NSE as a plausible explanation for the evolution of short term stock prices. This study brought into light the relevant factors that are important in shaping price discovery for

stocks listed at the Nairobi Securities Exchange. Although various indicators including bid-ask spread were used to operationalize market information risk, results of panel data analysis indicate that stocks are relying more on trading activity information with examining the effect of trading mechanisms on stock price behaviour using data from NSE. The results and findings of the study as presented in chapter five invaluably provide a basis and direction for future research.

The study in a way has immensely contributed to the market microstructure theory in that it supports the postulations of the theory especially the information based models. In this study, price discovery was investigated and its relationship with other variables. The inclusion on MIR, OCH and TA and the documentation of the resultant association among the variables is a contribution the theory underpinning the study microstructure of stock markets. Furthermore, the findings of the study provide a real confrontation of the stochastic and transient nature of intra-day market regularities. This undoubtedly pushes the debate forward in regard to formulation of a single unifying theory of market microstructure.

Studies on price discovery have so far concentrated on price discovery and improving market efficiency by way documenting evidence on how market trading system affect key variables. There are however limited empirical evidence on the factors that either enhance or impede price evolution besides the trading system in place. From the metha -analysis of empirical literature, there is no study in the area that had attempted to determine the appropriate indicators of price discovery and the contribution of market information risk, trading activity and organizational characteristics. This study contributes in the study of market information risk and price discovery by

application of weighted price contribution and by decomposing market information risks into bid-ask spread which were found to have statistically significant effects.

The other contribution of this study is the mediating effect of trading activity with respect to trading volume and number of transactions on the relationship between market information risk and price discovery. The results reveal that stocks listed at the Nairobi Securities Exchange price discovery are highly dependent on market information risk and trading activity. This could partly have been caused by past trading decisions especially on the contribution of volume of trading as well as transactions volume. This could perhaps imply that stocks listed at the Nairobi Securities Exchange find difficulty in price discovery process, hence being other underlying factors like trading activity require careful analysis if stocks have to gain from efficiencies impacting on the pricing. Furthermore, there was the test of the moderating influence of organizational characteristics on the relationship between market information risk and price discovery. The findings of this study indicate that ownership concentration as a proxy of organizational characteristics and MIR has a significant interaction effect on price discovery.

Lastly, the documented empirical evidence has helped reduce 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 also ask price which are the proxies of bid-ask 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 elements and price discovery have found mixed findings. 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 NSE. The findings contributes 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.

6.4.2 Contributions to Managerial Policy and Practices

The findings 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. The empirical results of this study has policy issues as to how a particular design addresses issues in regard to intensity of volume and trading, consolidation and fragmentation of trades and issues of transparency. Therefore, it is particularly valuable to regulators in their attempt to continuously design efficient trading systems and hence stock market. Stockholders should as well be consumers of empirical evidence by leveraging on the results in the formulation of trading strategies given the market structure in place.

Based on the results of this study, it is recommended that the government through Capital Markets Authority (CMA) and other stakeholders in the NSE sector should develop appropriate policies in an attempt to organize the debt capital market to enable investor's bodies get access to information pertaining how to improve their ability to discover prices during trading. It is important to establish appropriate trading rules and mechanisms to improve the efficiency of trading to reduce the cost of price discovery.

The findings of this study are expected to guide managerial practitioners in the NSE firms to appreciate the integration of the various price discovery factors in the face of a challenging economic environment, and management of firm core processes in order to support entrepreneur spirit in the country. The government on the other hand has an obligation to provide stability of the economic environment which provides organizational characteristics through interventions that support investors to make dividends on stocks invested. This causes the value of the firm to increase through a higher share price arising from higher dividends to shareholders.

6.5 Limitations of the Study

This study like any other agenda in the enterprise of scientific research had some limitations and every effort and Precaution was undertaken to deal with them and ensure that they did not significantly affect the findings of the study. First, this study zeroed down on the organizational characteristics in terms of ownership concentration and stock return volatility. There are other organizational characteristics as outlined in chapter one such as age, size, leverage, capital structure, analysts following a stock, market capitalization, liquidity, and managerial competence which could also come into play as indicators that might influence the relationship between MIR and price

discovery either as moderating, mediating or confounding variables. Besides the listed set of organizational characteristics, it is important also to note that there are possibly other factors which may dictate the direction and speed of arriving at short term market clearing prices that were not considered in this study. These factors include but are not limited to research and development budget, market accessibility, rule of law and quality of investors' strategies.

Secondly, this research was limited to an emerging financial market with notably thin trading activity and a relatively low frequency in trading. This would therefore imply that caution should be taken into account when attempting to generalize the findings to a more developed markets in the region and other parts of the world which record high frequency trading. Furthermore, the study focused on stocks listed and trading at the NSE. NSE has got a unique microstructure orientation which shaped the observed pattern of intraday regularities and price discovery. This uniqueness to the local stock market and the findings, might pose some challenges when applying it to the other emerging stock markets with distinct design and structures.

Thirdly, the study presumed existence of a linear relationship between market information risk, trading activity and organizational characteristics on price discovery. There is a possibility of the study variables having a different form of relationship like a curvilinear relationship that the current study did not explore. It is worth noting that besides the analytical techniques adopted in this research, there are possibly other methodologies that can be deployed in microstructure studies not applied in this study. It is acknowledged that this does not in any case water down the findings of the study. The adoption of such other statistical procedures and operationalization of variables could have led to enhanced utility in the understanding of the underlying

mechanisms behind price evolution process. The other methodological limitation lies in the heart of data and data collection which is an extremely expensive process especially in the absence of data bases. In this study, live data streams were observed, captured and recorded in a soft pre-prepared data collection sheet.

Lastly, there was no focus on the different underlying assets like securities, commodities, currencies, precious metals and bonds due to the fact that the target firms mostly traded on stocks listed at the NSE. Therefore, this study could not bring out the differential effect of different assets traded on NSE across market segments. Additionally, there was no attempt to enquire into the stability of prices across time and across firms and how this impacts on trading activity. Although this study had faced such listed limitations, it did not affect the findings of the study.

6.6 Suggestions for Further Research

The focus of this study was to investigate various ways in which market information risk, trading activity, and organizational characteristics determine price discovery. Arising from the findings, a number of suggestions can put forth for future research agenda. Choe, Kho and Stulz (1999) in a study offered some empirical evidence in regard to the central role played by foreign investors and arrived at the conclusion that a large scale of transactions initiated by foreign participants help the market adjust quickly hence speeding the price discovery process. In the emerging stock markets like Kenya, empirical evidence and documentation of the role of foreign investors' active participation on price discovery has not only shed in more insight but also deepened our understanding locally. A further study could therefore be conducted in this particular proposed area. It is further suggested that, other studies could be undertaken using other measures of price discovery for example the information share

(IS) and Variance Ratio (VR). In this study, WPC was utilized as a measure of price discovery.

The context for this study was stocks listed at the NSE and particularly during the continuous trading period as the trading mechanism. Arising from this, the following two areas for further study can be suggested. A study can be conducted by focusing the pre- open period where the dominant trading mechanism is auction as opposed to continuous trading. Besides the pre- open period, a study can conducted to determine price discovery during weekends and public holidays and the behaviour of trading activity as well as market information risk.

Additionally, this study investigated price discovery and its determinants on a sequential basis. However, there are a number of Kenyan stocks listed and trading in other emerging markets within East Africa. A study can be conducted to establish which market contributes more to price discovery and whether participants in the home market are more informed compared to foreign participants.

It is also important to evaluate the influence of market information risks, trading activity and organizational characteristics on other assets, commodities, currencies, precious metals and bonds apart from stocks listed at NSE. These studies can further be done on a sector by sector basis offer more in-depth insight.

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