The Effect of Market Liquidity Dimensions on the Use of Financial Derivatives in Interest Rate Risk Management among Commercial Banks in Kenya.

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

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DEDICATION

I dedicate this work to my parents ,the late Dr.Y.Otsyula ,and Mrs Rhodah Otsyula for instilling in me the value of education,my husband and children for giving me easy moments during my studies.

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ABBREVIATIONS AND ACRONYMS

ACI	Association Cambiste Internationale
BIS	Bank for international settlements
C.B.K	Central Bank of Kenya
CMA	Capital Markets Authority
ETP	Electronic Trading Platform
FRA	A Forward Rate Agreement
ILO	International Monetary Fund
IRR	Interest rate risk
IRS	Interest rate swap
LIBOR	London Interbank Borrowing rate
LSE	London stock exchange
MNL	Multinomial logit
N.B.K	National Bank of Kenya
NSE	Nairobi Securities Exchange
NYSE	New York Stock Exchange
OICU- IOSCO	International Organization of securities Commission
OTC	Over the counter derivatives
SACCO'S	Savings and Credit Cooperative Societies
STD	Standard Chartered Bank

OPERATIONAL DEFINITION OF TERMS

Financial Derivatives: These refer to instruments that derive their value from a single or several underlying financial assets. As a form of securities index, or a combination involving different securities indexes, and commodities, the fundamental instrument could be security (Balvinder, 1995 as cited by Ngugi et al, 2013).

Interest rate risk: Interest rate risk (IRR) is a risk resulting from interest rate fluctuations (Dhanani, 2007)

Interest rate risk Management: This is a set of approaches and techniques effected by banking organizations to identify, measure and monitor the movement of interest rate to restrain and avoid the unfavorable risk's impacts and may be making use of fluctuation of yield curve to obtain new opportunities. Raghavan (as cited by Hien.C.D,2013)

Market Breadth: This refers to the presence of various and huge in volume orders with insignificant effect on costs (Silva, 2013).

Market Depth: This refers to the quantity of orders on the sell side and the buy side of the market, that is, above and below the market price (Silva, 2013).

Market immediacy: Immediacy typically refers to the time it takes to complete a transaction. Immediacy is measure by Number of market makers, Number of market participants, Availability of quotes and Number of 'zero-trading days' (PricewaterhouseCoopers, 2015).

Market liquidity: Market liquidity implies the cost-reasonability of trading with promptness and in volume. A market is viewed as liquid when a dealer can arrange a value near the market cost, rapidly and for a sizeable amount (Bank for International Settlement,2016)

Market makers: Market makers, broadly speaking, are individuals or institutions that are willing to buy or sell a particular

derivatives product at any given time and profit from serving as intermediaries in a derivatives market. (Technical Committee of the International Organization of Securities Commissions, 2011).

Market tightness: Refers to that market with narrow bid-ask spreads. The difference between buy and sell prices, for example the bid-ask spread in a quote-driven market.

ABSTRACT

Capital Markets are undertaking the ongoing rollout of Derivatives/commodities Futures Exchange to provide more financial products to facilitate growth in the Kenyan economy. Hopefully, commercial banks will manage their exposures on the bond market with highly leveraged balance sheets and high interest rate risk exposures. Price behavior and market viability depend on the trading mechanism to match sellers and buyers 'trading desires, and this matching process involves providing market liquidity. Bond markets structuring include bond dealers and electronic exchanges like Reuters, Bloomberg and Citivelocity. The objective of this research was to establish market makers' perceptions of the effects of market liquidity parameters on interest rate risk management using financial derivatives in Kenya. Specifically, the study established the effect of market immediacy towards the Interest Rate risk management with Financial Derivatives; determined market depth effect on the Interest Rate risk management with Financial Derivatives, determined market breadth effect on the Interest Rate risk management with Financial Derivatives, and assessed market resiliency effect on the Internet Rate risk management with Financial Derivatives in Kenyan commercial banks. This research incorporated a descriptive research design. The target population comprised of 44 commercial banks in Kenya. The study gathered data from 108 market makers from 39 commercial banks using email or drop-and-pick method questionnaires. The analysis of data was undertaken using descriptive (percentages, frequencies and means) as well as inferential statistics such as Pearson correlation and also regression analysis. The study's findings reveal that in managing interest rate risk using financial derivatives, market resilience and market breadth were more important. According to the study, market immediacy and interest rate risk management using financial derivatives, were positively associated. The depth and breadth of the market have a positive and significant effect on the management of interest rate risks using financial Derivatives. Market resiliency had an insignificant positive effect on the use of financial Derivatives on interest rate risk management. There is a positive correlation between market tightness and risk management of interest rates using financial derivatives. The study recommends that Kenya's commercial banks should increase their active participation in the market for interest rate derivatives as the results of the study have shown a huge presence of market makers. The government should consider strengthening the market makers system in the country. The study also recommends that market manufacturers in commercial banks need to increase the use electronic trading platforms such as Bloomberg and Citivelocity to provide core services to support the real economy.

CHAPTER ONE

INTRODUCTION

This chapter provides background information for developing an understanding of the concept of the effect of market liquidity dimensions on the use of financial derivatives in interest rate risk management among commercial banks in kenya.The chapter also explains the statement of the problem,objectives of the study,the hypotheses,justification of the study and scope of the study.

1.1 Background of the study

The globalization phenomenon has continuously upset the various economies in the world, which are large developing economies and transition economies. According to Zekos (2005), increased globalization affects economies in various ways. These include increased trade in services and merchandise, product and technology licensing, foreign direct investment, and a broader portfolio of international investment. In the past, investment banks relied predominantly on traditional risk management to manage their risk (Barton, Shenkir & Walker, 2002). This approach, however, has a limited capability, that is explained by Hoyt et al (2008), which has already given room for the full exploitation of new trading platform technology.

Barton, Shenkir, and Walker (2002) demonstrate that the conventional approach is managed only in silos, making it completely inconclusive. In practical terms, the slow but steady adoption of a comprehensive risk management notion has resulted in the integration of Enterprise Risk Management by most financial institutions. Derivative exchanges have been on the rise in both the developed as well as the emerging market economies (Al Janabi, 2006). For example, emerging markets have the ability to register significant benefits from futures trading activities that include the ability to shift risks, lessen counterparty risk, and publicly related technical information accessibility. The achievement associated with a derivatives market, however, depends on the completeness of the foundations upon which it was

designed, the structure adopted and the different traded securities (Tsetsekos & Varangis, 2000).

Starting in the late 1990s, technology was actually introduced that made it possible for traders to interpret and implement real - time prices on a screen, enhancing accountability and transparency in both pre- and post - trade. Trading platforms are less developed in the Middle East and North Africa regions compared to other developed countries in the world. Essentially, the first - mover effect in these nations is likely to have stronger influence in comparison to trading platform choices, such as electronic trading and open outcry trading, in determining how financially successful comparable product introductions can be. Based on the elaboration above, Al Janabi (2008) contends that new derivative trades using electronic trading platforms and offering competing versions of existing derivative contracts are likely to encounter success difficulties.

The existence of electronic platforms today is expected to make interest rate management using derivatives an effective exercise. The stock market's vibrancy has attracted numerous platforms for electronic trading, including Bloomberg, Thomson Reuters, and Citivelocity. The Thomson Reuters currently offers smart information service on the Nairobi Stock Exchange for both businesses and professionals and, in particular, local shilling currency benchmarks. The implementation of this system resulted in the abandonment of the traditional manual telephone system in lieu of a much more automated analysis that upholds integrity as well as transparency in terms of the rates involved (Kariuki *et al,* 2013).

1.1.1 Market Liquidity Dimensions

In various ways and contexts, many scholars and researchers have attempted to explain the aspect of market liquidity. Keynes (1930) and Hicks (1962) defined economic market liquidity as a market's feature whereby an individual or firm can quickly purchase or sell an asset without causing a drastic change in the asset's price., while Bagehot (1971) defined market liquidity in terms of adverse selection and information asymmetry issues. That is to say, liability side liquidity is also referred to

as ' funding liquidity. Second, liquidity is a component of an asset, also referred to as 'asset liquidity ' or ' market liquidity, ' depending on whether the balance sheet or the market is focused.

Market Liquidity describes the marketability or ease of trading an asset from the perspective of an investor. Over the past thirty years, the concept of market or trading liquidity has been attributed primarily to a single tradable security and has therefore been defined as the quality that enables agents to purchase or sell a security quickly, anonymously at a market price equal to its fair value and with a small price impact (Liu, 2006).

Elliott (2015) describes market liquidity as the ability of securities buyers and sellers to operate efficiently and is measured by the speed at which large purchases and sales can be made and the trading costs incurred. In monetary terms, liquidity of any asset refers to the combination of the degree of ease with which it can be sold (or purchased) in a reasonable time frame and the level of risks associated with that sale, either in terms of transaction costs or in terms of accepting a lower price in order to find a buyer in a reasonable amount of time.

In a study by Marrison (2002), a categorization is provided of liquidity risk into two categories, that is, liquidity risk in trading and liquidity risk in funding. Funding liquidity risk is considered as a part of the asset liability management framework, which is related to the financial institution’s balance sheet and the possibility that the financial institution (such as a bank) drains out its liquidity to repay the debt (Marrison, 2002). The liquidity risk in trading is also known as market liquidity risk. Different from the balance sheet liquidity, the liquidity risk in trading arises from the characteristics of the market, such as: atomicity of participants, free entry and exit at no cost, transparent information (Bervas, 2006). A liquidity in trading is also called asset liquidity, which is the asset’s ability to be transformed into another asset without loss of value (Warsh, 2007).

The level of market liquidity based on three aspects namely: tightness, depth and resilience (Kyle, 1985). An improved categorization by scholars Silva (2013) and

Olbrys & Mursztyn (2017) in later years reveals five parameters that are now well reported in literature: tightness, immediacy, depth, width, and resilience. These facets of market liquidity reinforce a market's microstructure, including depth, tightness, resilience, breadth, and immediacy. In short, market participants recognize a security as liquid if they are able to sell large amounts of security rapidly without affecting their price.

Market - wide indicators are mathematical formulas, which measure advancing and declining issues to calculate the amount of market turnout (Chen, 2018), they are effective tools for technical analysis that measure market direction and help traders determine whether it is bullish, bearish or neutral. The Advance / Decline Line is the most basic market bandwidth indicator, however, there are several other hugely popular bandwidth indicators such as On Balance Volume (OBV), the McClellan Summation Index and the Arms Index (TRIN).

According to Kenton (2018), market depth is the market's ability to sustain relatively large market orders without affecting the price of the security. Market depth considers the overall level and breadth of open orders and usually refers to trading within an individual security. Alam et al (2007) describes an ideal environment with numerous buyers and sellers on the market as an indicator of market depth at the Dhaka Stock Exchange (DSE). It is a situation where progressive price changes are prevented and can be measured by observing the ratio of transaction values from total market capital. If this ratio is high, the market will also indicate that its depth is high.

The study by Heron (2015) on market immediacy demonstrated that, for example, in a stock market, the speed at which a large purchase or sell order can be fulfilled. It means that an order can be done quickly without spending time queuing up buyers or sellers beforehand. Immediacy can be used to gauge a market's liquidity. There is a gap between consumer sales and service expectations through digital channels and the ability of a company to deliver. Trimming just a few hours off a customer request for information or complaint response time, or making it much easier to find or buy a store, could dramatically improve the bottom line of a business.

Market resilience is associated with the market's ability to correct order asymmetries, which tend to shift the price away from the inherent value of the security (Olbrys & Mursztyn, (2017). Order imbalance is a situation that results from an excess of buying or selling orders on a trade exchange for a specific security, making it impossible to match the orders of buyers and sellers. The actual value of all expected future cash flows, discounted at the appropriate discount rate, is the intrinsic value of a security.

Market tightness is a market liquidity dimension. It is evaluated by the overall cost of a transaction regardless of market price. Tightness relates to transaction costs that are reduced. The tightness in a single market is the consequence of severe competition. Agrawal (2010) in India noted that call rates hover around the reverse repo repo rate in times of excess visible liquidity, while call rates hover around the repo rate in times of tight liquidity.

Market liquidity understanding is crucial because it affects investor returns. By assessing how many securities are rising or falling in prices, and how many trading investors are placing on these securities, broad indicators can show whether overall market sentiment is bullish or bearish. Most of the data available do not fully match these dimensions, which complicates measurement. Liquidity measurements can be classified into transaction cost measures capturing financial asset trading costs, volume - based measurements that distinguish liquid markets by volume of transactions to price variability, balanced price - based measurements, and market impact measurements (Sarr & Lymbek, 2002).

1.1.2 Interest Rate Risk Management

There are a number of ways of measuring the size of the exchange-traded and over the counter derivatives (OTC) markets, including by turnover, notional outstanding and number of contracts. When measured by either notional turnover or notional outstanding, interest rate derivatives are the largest category - representing approximately three-quarters of total derivatives notional outstanding and traded. This means that changes in the total notional size of the derivatives markets will be

largely shaped by the amount of trading in interest rate derivatives. ((International Organization of securities Commission (OICU-IOSCO), 2013)).

According to OICU - IOSCO (2011), in the second quarter of 2010, the Bank for International Settlements (BIS) estimated global exchange turnover traded futures and an option was $ 554.6 trillion. 86.5 percent of this turnover is estimated to be interest rate derivatives, 11.5 percent to be equity index derivatives, and 2.1 percent to be foreign exchange derivatives. BIS also has estimated that the total OTC derivatives outstanding as of June 2010 was $583 trillion, of which 77.5% was interest rate derivatives, 9.1% was foreign exchange derivatives, 5.2% credit derivatives, 1.1% equity derivatives, 0.5% commodity derivatives and 6.6% was other or unknown.

The Bank for International Settlements has estimated that the daily turnover of global OTC interest rate derivatives was $2.08 trillion in April 2010, while the daily turnover of exchange traded interest rate derivatives was $8.14 trillion. Between April 2007 and April 2010, BIS found that trading activity in OTC interest rate derivatives had grown by 24%, which was slower than the 64% growth rate (OICU-IOSCO), 2013).

Dhanani (2007) argues that Interest Rate Risk (IRR) is one of the key financial risk forms encountered by businesses. For several primary reasons, IRR management has gained prominence in the corporate sector in recent years. First, the volatility of interest rates has significantly increased in recent years. Second, the use of corporate debt in companies with firms financing more of their financing requirements through short - term borrowing rather than equity has increased dramatically.

In addition, there has been a large increase in the number of highly leveraged transactions such as management buy - outs and takeover transactions in some industries. Third, financial institutions now frequently use interest rate - based covenants in their corporate financing arrangements, making the effects of interest rate fluctuations a pressing issue for firms. In conclusion, in recent corporate governance codes such as the Cadbury Report (1992) and the Turnbull Report

(ICAEW, 1999), the emphasis on financial risk has significantly increased the transparency of corporate risk and risk mitigation practices on the external market.

1.1.3 Using Financial Derivatives to Manage Interest Rate Risk

Traditional ways used by bank management in measuring and managing interest rate risk included gap analysis, duration analysis, simulation analysis and scenario analysis (Schaffer, 1991). Gap analysis refers to the maturity gap between assets and liabilities. Duration analysis refers to account's weighted average time to repricing, where the weights are discounted components of cash flow. Simulation analysis refers to the modeling of changes in the bank's profitability and value under alternative interest rate scenarios. Analysis of the scenario involves selecting interest rate scenarios to examine investment portfolio effects. Financial theory innovation and computerization increase, along with changes in foreign exchange markets, credit markets, and capital markets over time, have contributed significantly to financial derivatives growth (Beets, 2004).

Financial derivatives are instruments whose value is derived from one or more underlying financial assets. Financial security, a securities index or some combination of securities, indices and commodities may be the underlying instruments (Sangha, 1992). According to Gyntelberg and Upper (2013), financial futures contracts, forward rate agreements, interest rate swaps, interest rate options, interest rate caps and interest rate floors are the main financial derivatives used by commercial banks to manage interest rate risk. This is done in a market liquidity framework that is ever - dynamic. Commercial banks have become market makers (intermediaries) in products for interest rate risk management, such as futures contracts, forward rate agreements, interest rate swaps, and options such as caps, collars, and floors.

Interest rate risk (IRR) is a risk occasioned by fluctuations in interest rates. Financial derivatives are instruments whose value is derived from the security that is delivered when a derivative contract is entered into. Financial derivatives are so effective in reducing risks that they enable financial institutions to hedge**,** that is, engage in a

financial transaction that reduces or eliminates risk. When a financial institution buys an asset it takes a long position and when it sells an asset it takes a short position. These transactions expose the financial institution to risk given that the returns to the asset are uncertain. Financial derivatives can be used to reduce risk through hedging (Mishkin *et al,* 2012).

Kenyan Commercial Banks operate in an environment that makes it difficult for them to hedge against interest rate risk, particularly due to variations in foreign exchange rates. Furthermore, an increase in the average domestic rate compared to foreign interest rates and an increase in foreign price lead to an appreciated exchange rate. (Kamau *et al* (2013). In the discussion on interest rate determinants and risks in Kenya, Ndung'u & Ngugi (1999) introduced a different perspective, pointing out that high inefficiency on the financial market in the country has seen interest rates remain out of control even with the government's efforts to liberalize its financial and monetary market. Therefore, this point to a major risk faced by local commercial banks with regard to their hedging interest rate risks. The inefficiency in the money market makes it difficult for banks to properly assess and predict their imminent risks.

Commercial banks and other financial institutions are middlemen with highly leveraged balance sheets; banks have high interest rate, commodity, and currency risk exposures, and need efficacious ways to manage such exposure levels. Derivatives provide an important and efficient tool for off - balance sheet risk management as they provide an easy means of hedging (managing) the residual risk from commercial operations (Nguyen and Faff (2002).

Most banks in Kenya are involved in secondary markets where they invest in fixed - income securities to buy and sell Treasury Bonds before they reach maturity and thus earn interest income. However, most of these bank profits are declining owing to the dwindling value of bonds held for sale because of the changing market interest rates. Stutz (2004) argues that the larger banks are highly likely to employ the use of risk management derivatives and thus reduce the chances of financial distress.

1.2 Statement of the problem

The banking sector's profitability increases with interest rate hikes. Increases in the interest rate directly increase the yield on this cash, and the proceeds go directly to earnings. Financial derivatives are often used to lessen a commercial bank's exposure to significant increases in the market interest rate. Interest rate management is critical because an increase in the market interest rate lowers the value of an asset such as a bond, banks can use a derivative to hedge against any losses. The fear of a repeat of the global economic crisis in 2008, which led to the collapse of several financial institutions, makes commercial banks see the need of adopting appropriate strategies in managing interest rate risk (Ngalawa & Ngare, 2014).

In Kenya lending interest rates is not stable as it fluctuates depending on the Central bank Rate that monetary policy Committee has settled on. In 2010, average annual lending interest rate was 15.05%, in 2011 average lending interest rate was 15.05% while annual lending interest rate was 20.04%,and in 2012 average lending interest rate for March, June, September and December was 20.34% ,20.30%,19.73% and 18.15 respectively. In 2013 average lending interest rate for March, June, September and December was 17.73%, 16.97%, 16.86% and 16.99%. While in 2014 average lending interest rate for March, June, September and December was 16.91%, 16.36%, 16.04% and 15.99 respectively. Lending interest rate declined in 2014 as Central bank Rate was retained at 8.5% throughout the year (Central Bank of Kenya, 2010-2014). Moreover, increasingly exposed to increased risks with Exchange rate fluctuations and interest rate fluctuations being just some of the financial risks banks face, therefore the management of these risks has become paramount for commercial banks.

While there are many market liquidity studies in Kenya's commercial banks, there is limited research on the dimensions of individual market liquidity and their impact on interest rate risk management. The dimensions of market liquidity concerned include immediacy, depth, breadth, tightness and resilience. In the advent of globalization and technological shift, witnessing the era of electronic trading platforms, these market liquidity dimensions have been reported to affect the use of financial

derivatives to manage interest rate risk in financial institutions around the globe. However, in the case of commercial banks in Kenya, scanty information available makes it difficult to draw conclusions as to the effect of these market liquidity dimensions on the management of interest rate risk using financial derivatives.

The Central Bank of Kenya's Monetary Policy Committee (2012) Bi - Annual Report revealed that the rise in short - term interest rates was transmitted to the interest rates of commercial banks due to tight liquidity conditions. The average commercial banks' lending rates increased from a maximum interest rate of 14 per cent for most of the year, from highs of up to 25 per cent before the rates cap (Mwaniki, 2017). Commercial Banks in the bond market are exposed to market risk (Association Cambiste Internationale Singapore, 2010). It is not clear that derivatives are used in emerging markets on the Treasury bond market. The risks on the bond market in Kenya are on the rise as evidenced by the banks' decline in profit. This is due to sharp increase in interest rates as a result of revaluation of the trading book thereby causing mark-to-market unrealized losses in the bond trading portfolio .(Standard Chartered Bank, 2011; National Bank of Kenya, 2011).

Past studies reveal gaps in the utilization of subsidiaries to support financing cost hazard over the world. Dhanani *et al* (2010) analyzed the management practices related to interest rate risk of UK organizations. In particular, the study examined five theories that have been advanced in the literature to explain why companies hedge: tax and regulatory arbitrage; under-investment, volatility of earnings and future planning; financial distress; managerial self-interest; and economies of scale. The research findings confirmed that all five theories of financial risk management have some support in practice.

Ameer (2010) documents determinants of corporate hedging practices in Malaysia and found out that only a few listed Malaysian firms have appropriate understanding of the derivatives instruments to mitigate risks. Ngugi *et al* (2013) points out to the factors influencing development of financial derivatives markets in Kenya. Okumu (2013) conducted a research on impact of microstructure changes on market efficiency at the Nairobi Securities Exchange focusing on market efficiency before

and after market automation. While these studies address broadly the prevalence of use of derivatives and the impact of market microstructure in the world there exists a gap on the existing literature specifically focusing on market liquidity dimensions' effect on in the Interest Rate Risk management using Financial Derivatives in Kenya.

According to an outlook of Capital Markets in Kenya (2012/2013), Kenya through Vision 2030, is geared to become an international financial center and to achieve this goal deepening of the bond market provides opportunities for investment in Kenya to introduce new Trading Platforms. It remains unclear how market immediacy, depth, breadth and resilience affect Interest Rate Risk management using Financial Derivatives in Kenya given the existence of electronic trading platforms.

1.3 Objectives of the Study

1.3 .1 The General Objective of the Study

The general objective of the study was to examine the effect of market liquidity dimensions on the use of financial derivatives in interest rate risk management in commercial banks in Kenya

1.3.2 Specific objectives

The specific objectives of the study were to:

1. To establish the effect of market immediacy on the use of financial derivatives in interest rate risk management in commercial banks in Kenya.
2. To determine market depth effect on the use of financial derivatives in interest rate risk management in commercial banks in Kenya.
3. To find out market breadth effect on the use of financial derivatives in interest rate risk management in commercial banks in Kenya.
4. To assess market resiliency effect on the use of financial derivatives in interest rate risk management in commercial banks in Kenya.
5. To assess market tightness effect on the use of financial derivatives in interest rate risk management in commercial banks in Kenya.

6.To establish the moderating role of Electronic trading platforms on the effect of market liquidity dimensions on the use of financial derivatives in interest rate risk management in commercial banks in Kenya

1.4 Research Hypotheses

To establish how each of the independent variables influences the dependent variables the study sought to test the following hypothesis.

H_{01}: Market Immediacy does not have a significant effect on the use of financial derivatives in interest rate risk management in commercial banks in Kenya.

H_{02}: Market depth does not have a significant effect on the use of financial derivatives in interest rate risk management using Financial Derivatives in commercial banks in Kenya.

H_{03}: Market breadth does not have a significant effect on the use of financial derivatives in interest rate risk management using Financial Derivatives in commercial banks in Kenya.

H_{04}: Market resiliency does not have a significant effect on the use of financial derivatives in interest rate risk management using Financial Derivatives in commercial banks in Kenya.

H_{05}: Market tightness does not have a significant effect on the use of financial derivatives in interest rate risk management using Financial Derivatives in commercial banks in Kenya.

H_{06} Electronic trading platforms do not have a significant effect of market liquidity dimensions on the use of financial derivatives in interest rate risk management in commercial banks in Kenya

1.5 Justification of the Study

The study intended to determine market liquidity dimensions effect on the Interest Rate Financial Derivatives Market of Kenyan Commercial Banks. This research is expected to add value to the liquidity aspects of the various financial derivatives used to manage interest rate risk and the liquidity characteristics of the electronic trading platforms currently on the market for commercial banks in Kenya. This could result in more participants entering the derivatives trade in the same place of execution as the current participants and thus increasing competition. This could in turn lead to a more efficient pricing and lower transaction costs as well as reducing the concentration of derivatives trading activity to a limited number of market participants. Moreover, effective monitoring and the provision of sufficient liquidity and transparency to market is important if the nation is to achieve the set SDGs and Kenya's Vision 2030. Many obstacles can hinder the mobilization of financial resources for the SDGs, and these include market failures. Knowledge on the dynamics of market liquidity dimensions would help in informing the development of effective capital markets. The failure to develop deep and efficient capital markets may have important consequences; growing empirical evidence suggests that financial is not just correlated with a healthy economy; it actually causes economic growth and has positive impact on poverty alleviation and income distribution as well.

The findings are expected to add value to students of finance and other related disciplines. The study makes empirical contribution to the field of derivatives trading and particularly to the liquidity of financial derivatives used in managing interest rate risk. The research findings are expected to provide useful information to Capital Markets Authority when making strategic decisions on whether to build or buy new systems and are also expected to be useful when coming up with the regulatory framework for the trading of interest rate derivatives on the Kenyan financial market.

1.6 Scope of the Study

The study was conducted among treasurers, senior dealers and dealers in Kenya's commercial banks in the 210 market makers. A sample of 117 was used in the study. The selected treasurers and dealers were preferred as they were strategically positioned to provide the searched study information. The study focused on market makers perceptions of market liquidity measurements on interest rate risk management using financial derivatives focusing specifically on Kenya's commercial banks. Whereas in Kenya the total number of commercial banks is forty - four, the questionnaire has been administered to only thirty - nine banks; three banks have been excluded as they are either under statutory management or receivership. The study lasted two years, which is from November 2017 to November 2018.

1.7 Limitations of the study

The study relied heavily on the questionnaire as the main data collection instrument. Using the instrument, the study was likely to suffer from the disadvantages of questionnaires, which include inability to detect when a respondent is untruthful in his or her response. To overcome these questionnaires were properly validated with the help of University supervisors and boosted their reliability tests using the Cronbach alpha tests. Sample results might not give a true picture on how cheating is done and generalization might not be a true picture for all the Commercial banks in Kenya in general.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed literature on electronic trading platforms and market liquidity dimensions. The review discussed market immediacy, market resiliency, market depth, market breadth and market tightness and their effect on interest rate risk management using financial derivatives in Kenya. A conceptual framework has been used to show how these variables are related. A review of theories is also discussed. Finally this chapter discusses the research gaps and critiques the current literature.

2.2 Theoretical Framework

This section specifically focuses on the theoretical foundation of the study, where the key purpose is to underscore all the important theories that help bring to light theeffect of market liquidity dimensions on the use of financial derivatives in interest rate risk management in commercial banks in Kenya. Theoretical literature generally focuses more on the theories and hypotheses involving the concept being studied, but does not necessarily include practical application. A theory is “an integrated set of concepts, formed into propositions, that explains particular conditions or events in the world around us’’ (Schneider, 2006).

2.2.1 Transaction Cost Theory

Transaction Cost Theory was postulated by Ronald Coase in 1937. Transaction cost theory aims to answer the question of when activities would occur within the market and when they would occur within the firm (Williamson, 1991). More specifically, transaction cost theory predicts when the governance forms of hierarchies, markets, or hybrids (e.g., alliances) will be used. Engle and Lange (1997) propose the theory of transaction costs as to whether a market with sound liquidity should be a zero - cost market for transaction execution. In fact, the low transaction - cost market is

considered liquid, while the high transaction - cost market is considered illiquid. Grossman and Miller (1988) come up with immediacy, which indicates that liquidity refers to any scale transactions that can be executed immediately at the market price expected. Black (1986) characterizes the market with good liquidity as follows: quotes of bid and ask always exist; meanwhile, the bid-ask spread is small enough to allow the immediate execution of small-amount trades; and the market price is slightly influenced large-amount transactions can be realized at a price close to an average market price within a certain period.

For Glosten (1987), the liquidity of the market is the ability to execute transactions immediately while keeping prices dramatically from fluctuating. The theory is relevant in that interest rates are a function of transaction costs and it is therefore necessary to manage those costs. This is also in line with Demsetz's order processing model (1968) which showed that the transaction / trading costs that occur during trading can be divided into two different types of costs that are brokerage fees and the bid / ask spread. The bid/ask spread can be seen as the price for immediacy for executing an order by the market maker. Because the market maker has an intervening role in these markets the cost of standing ready to buy and sell securities is reflected in the bid/ask spread. Frequently traded stocks have a more consistent order flow so the bid/ask spread is small. Stocks that are not traded heavily are therefore compensated by a larger bid/ask spread to ensure that the market maker does not bear too much risk. The market maker is prepared to buy the security for the bid price and sell the security for the ask price.

The model of Demsetz which, is also pegged on the understanding of the transaction costs focuses on determination of the bid-ask spread charged by the market maker as the cost of supplying immediacy, the risks to the market maker inbuilt in the stock especially due to insider trading, the degree of competition, the depth of the market, the price per share and volume of trading (volume of trading is a measure of breadth). The market maker stands ready to execute orders that have an influence on his inventory level and liquidity. This theory instigates the first, second and third research hypotheses. The model relates well to the eefect of Market Immediacy,

Market depth and Market breadth on the use of financial derivatives in interest rate risk management in commercial banks.

2.2.2 Information based model (Copeland and Galai , 1983)

Information based model was developed by Copeland and Galai in 1983. The model has an important role for information concerning the development of the bid/ask spread. The basis of Copeland & Galai (1983) model is on the concept of information costs and analyzes the market maker's one-time price-setting problem dealing with informed traders and uninformed traders. This model reveals the bid/ask spread in a monopoly situation for the market maker and in a competitive market situation. A market maker's main objective is to maximize his profits, which are the outcome of the bid and ask price setting. Besides, the bid or ask spread will occasion market marker revenue from engaging with liquidity-motivated traders while conversely, due to the fact that he also deals with informed traders, he will encounter losses. The liquidity motivated traders are willing to pay a price for immediacy which results in a profit for the market maker because he sets a bid/ask spread that is suboptimal for the liquidity motivated traders. The informed traders will due to their superior information cause losses to the market maker because they are able to in a way to beat the market maker. If the market maker chooses a narrow bid/ask spread he will gain from trading with liquidity traders, but it will be more likely that he will endure losses to informed traders.

A narrow bid/ask spread encourages trades for both sides being the bid traders and ask traders this will result in a profit for the market maker because of his intervening role in this situation and receiving fees for doing this. If the market maker chooses a wide bid/ask spread then he will lose revenues from the liquidity motivated trader and lower his potential losses to the informed trader. The optimal bid/ask spread should therefore be a trade-off between losses to informed traders and gains from liquidity-motivated traders. Once a trader arrives at the market the models assume a price offer from the trader. The market maker will then consider what his expected costs and revenues are and will set his bid and ask price. The potential losses to informed traders depends on the probability that the next trader will be informed, the

knowledge of the market maker concerning the stochastic process around price changes and the setting of the bid and ask price

This model of Copland & Galai (1983) is used in asymmetric of information and generally is based on the concept of information costs and it analyzes the price setting problem of the market maker (dealer) of one period of time that is dealing with informed traders and uninformed traders. If the trader is informed, the market maker can expect to lose If the true price supersedes the ask price then the informed trader will decide to buy, making the market maker to incur losses. If the true price is below the bid price the informed trader will sell, with loss to the market maker

Comparing order processing costs and the scale of information asymmetry between dealer and markets, Copland & Galai (1983) as well as Glosten & Milgrom (1985)show that, even if inventory and order processing costs are neglected, the resulting bid-ask spread should be positive due to information costs. Pre trade information is an indicator of market resiliency**.**

2.2.3 Equilibrium Theory

The theory dates to the 1870s, particularly the work of French economist Léon Walrasin his pioneering 1874 work Elements of Pure Economics (Leon, 1974). In a market system, the prices and production of all goods, including the price of money and interest, are interrelated. The importance of the general equilibrium theory is that it shows how markets coordinate the choice of capital structures, banking sectors, so that risk and equity capital are optimally allocated between the this sector (Stracca, 2005). According to the equilibrium theory, liquidity provider could mean dealer, specialist, investor, or even financial institution, all of which are considered market makers. Market makers engage in trade activity with investors as well as supply liquidity through placing limit orders or closing all transactions. As a result, market makers suffer losses because of opportunity costs, search costs, and inventory. These costs may be dismissed as less significant in normal times although they potentially lead to financial crises in the presence of information treatment and/or order-processing costs; the (unique) equilibrium price process is characterized by

stochastic volatility. Meantime, investors post market orders and also face increased trading losses in terms of higher bid–ask spreads.

Agents strategically choose their trading times in the presence of trading costs and dynamic information. Because at trading times new (constant volatility) information is released on the market, stochastic volatility does not characterize the price process sampled at trading times.. Nevertheless, as trading and calendar times differ, the calendar time price process is the time change in the price process at trading times, such as price movements on the calendar time scale are characterized by stochastic volatility. The theory thus informed the study of the critical influence in interest rate risk management of tightness, depth, and resilience.

The theory is also backed with the Hedging theory, which is pegged on the idea that the application of derivatives by firms is mainly for the sake of risk reduction. As Sinkey and Carter (2000) explain, the derivative activities of banks can occasion an increased firm value through lowering the costs of financial distress that are expected either for the case of the bank itself or the client firms or both. The banks achieve this through a myriad of ways, including cutting down the expected taxes, lowering the agency costs, raising the bank fees and improving bank-customer relationships. Nonetheless, there exist theories that equally predict derivatives use by firms' owners purposely to amplify firm riskiness.

2.3 Conceptual Framework

Sevilla *et al* (2007) defines a conceptual framework as a set of interrelated constructs, definitions and propositions that present a systematic view of phenomena by specifying relations among variables. Damon et al (2010), suggests that a conceptual framework is a novel framework developed by a researcher that links concepts from the literature. From the literature reviewed in this study, the independent variables investigated are market immediacy, market resiliency, market depth, market tightness and market breadth. The dependent variable was interest rate risk management using financial derivatives in Kenya. The moderating variable was electronic trading platforms as shown in figure 2.1.

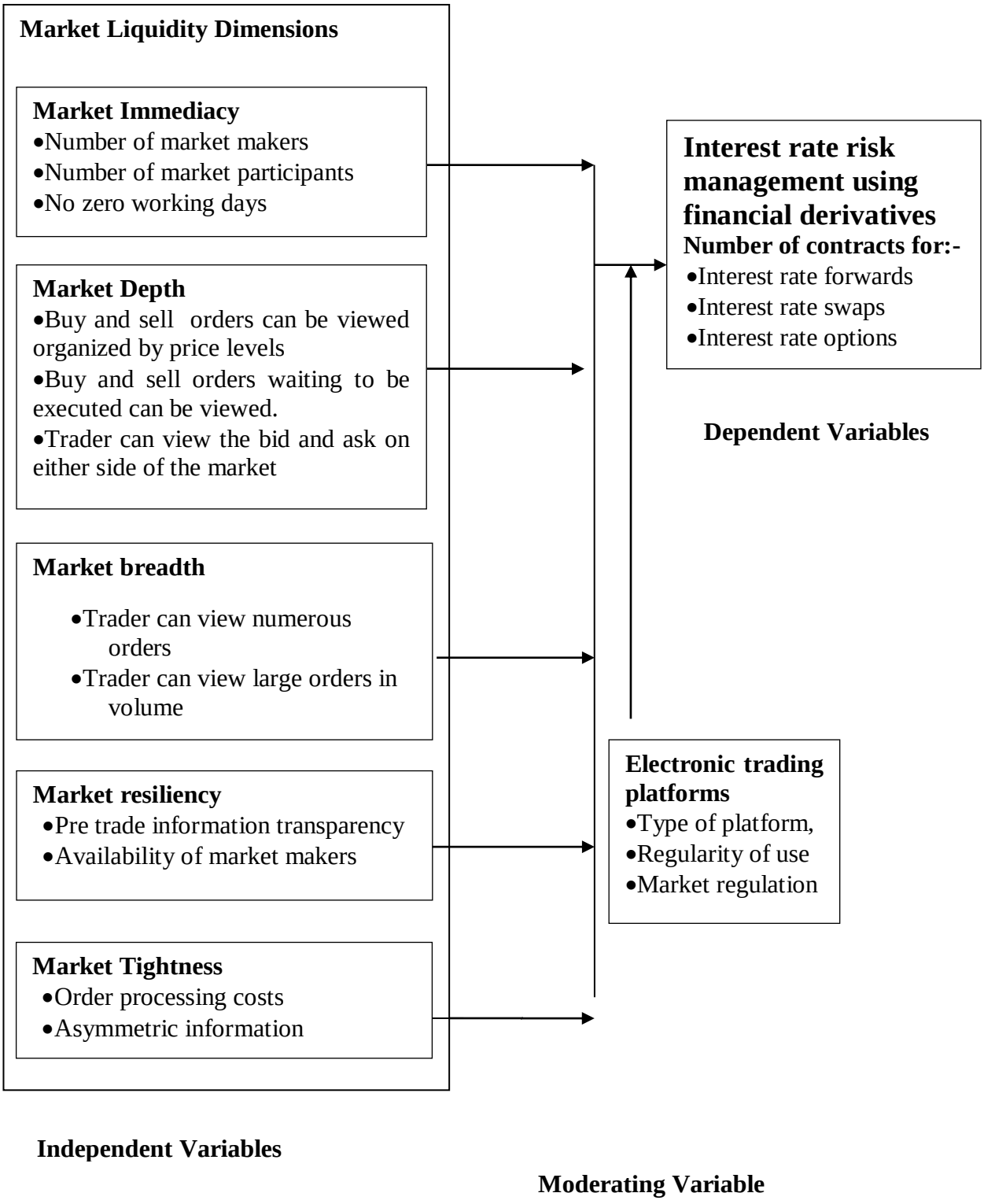

Figure 2.1: Conceptual Framework

The study conceptualizes that market liquidity dimensions such as Market Immediacy, Market Depth, Market breadth, Market resiliency and Mark
(idependent variables) have an effect on Interest rate risk management using financial derivatives (dependent variable). However, this effect is subject to the moderating effect of Electronic trading platforms, and this is measured through the type of trading platform, regularity of use and market regulation.

2.3.1 Market Liquidity Definitions

Market liquidity dimensions are the independent variables in this study. According to Crockett (R'o'sh, 2012), liquidity is easier to recognize than to define. In actual sense, "liquidity' as a word carries more elaborate meaning that can be applied in place of asset liquidity, institution liquidity, financial market liquidity, and even asset market liquidity.

Asset liquidity reflects the quickness and ease with which an asset can convert into cash; institution liquidity reflects the manner in which an institution can engage in financial market transaction, control its asset-liability mismatches, as well as settle its obligations. Financial market liquidity reflects the substitutability of different assets that are traded in the market, including the liquid extent of the assets. Finally, asset market liquidity reflects the easiness through which large asset volumes can either be acquired or disposed off through selling at reasonable prices. This is on the basis of unavailable new information capable of influencing the basic price of the asset (Reserve Bank of India Central Office Mumbai, 2012). Market liquidity dimensions are explained as follows.

2.3.2 Market immediacy

Immediacy typically refers to the time it takes to complete a transaction. Market makers are a constant source of immediacy. Under an agency trading system, finding a trading match/partner depends on frequency of transactions and constant depth of trading interest in the security by investor (R'osh, 2012).Immediacy is measure by

Number of market makers, Number of market participants, Availability of quotes and Number of 'zero-trading days' (PricewaterhouseCoopers, 2015) ; Chow et al 2016).

Market immediacy often is determined by the costs incurred for market making and competition extent among market makers (Chacko, Jurek& Stafford, 2008). This effectively makes its demand both urgent and sustained, a fact that brings forth the need for either an intermediary or a market maker to readily transact in the event of order imbalances.

In a perfect competition market, the determination of the price of immediacy is considered as marginal cost of immediacy supply (Chacko, Jurek& Stafford, 2008). On the contrary, the search - based model introduced by Duffie, Garleanu, and Pedersen (Gârleanu & Pedersen, 2005) illustrates an imperfect market situation, which assumes that all agents are symmetrically informed. Further, the model also assumes that the market makers do not face any inventory risk owing to the existence of perfect interdealer markets.

This, therefore, makes it costless to market. However, as investors need to look for viable trading counterparties, market makers can manage to extract some of the difference or variance between the reservation prices of investors, on the one hand, and fundamental value, on the other (Faubus, 2010). This is done to ensure immediacy, which in turn stimulates the spread of a bid - ask.

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In a wrong competition market, the determination of the price of immediacy is considered as marginal cost of immediacy supply (Chacko, Jurek& Stafford, 2008). On the contrary, an imperfect market situation is based illustrated by the search-based model introduced by Duffie, Garleanu, and Pedersen (Gârleanu& Pedersen,

2005), which assumes that all the agents are symmetrically informed. Further, the model also assumes that the market makers do not face any inventory risk owing to the existence of perfect interdealer markets.

This, thus, renders market making costless. Nonetheless, since investors need to look for trading counterparties that are viable, the market maker can manage to extract part of the difference or variance between investors' reservation prices, on the one hand, and fundamental value, on the other hand (Faubus, 2010). This is done to provide immediacy that in turn stimulates a bid-ask spread.

2.3.3 Market Depth

The market depth is defined as the sell side quantity of orders and the buy side of the market, i.e. above and below the market price. The higher the number of orders purchased and sold at each price, the higher the market depth. In the narrow sense depth is the largest volume of order that will still not move the market price (Nie, 2016).

Market depth equally is associated with the liquidity stimulus, particularly as it relates to trading activity. A direct linkage between market depth and volatility exists, which essentially influence interest shocks (Tissaoui, Ftiti & Aloui, 2015). In an evaluation of the linkage between open interest and volatility, Dennis, Mayhew, and Stivers (2006) establish a negative volatility in relation to open interest, although the volatility itself lacks predictive power in as far as open interest is concerned.

Overall, futures markets enhance market depth while at the same time lower volatility owing to a reduced cost of the informed traders responding to mispricing (Guru, 2010). According to Ahn, Bae and Chan (2001), market depth is enlarged when more market-wide information is rapidly disseminated, in addition to the existence of futures market's makers, as well as cash market.

In other words, Ahn, Bae and Chan's (2001) explanation indicate equality between price change variance and the rate at which the information flow happens. Essentially, this means that the asset price volatility will in this case increase with the increase of the rate of information flow. In this regard, if futures intensify the flow of information where arbitrage opportunity is absent, the spot price volatility must change (Citanna & Schmedders, 2005).

2.3.4. Market breadth

Market Breadth refers to the existence of numerous and large in volume orders with minimal impact on prices (Silva, 2013). Market breadth refers to the sum total of firms competing actively in the market (Ametefe, Devaney & Marcato, 2016). Essentially, market breadth, as a feature of liquidity, influences the interest rates financial derivatives market in the sense that it determines market entry.

Based on this argument, for instance, it is understandable that thicker and deeper market imply ease of entry for firms, which in turn guarantees plenty of substitutes (Hachmeister&Schiereck, 2010). On the other hand, a market described as thin or shallow may be faced by informational or even technological barriers, which could in turn act as a limit to entry, and limited substitution.

2.3.5 Market resiliency

Market resiliency reflects how quickly the liquidity supply is replenished and the price moves back to equilibrium after a large uninformed liquidity demand has been filled (International Monetary Fund, 2015). Resiliency is a function of liquidity suppliers (makers) monitoring intensity, the fee structure at the trading venue and the fraction of liquidity suppliers (International Monetary Fund, 2015). Market resilience as a whole refers to a vital functioning of the economy that provides essential services needed by borrowers and savers (Adam, 2009). Financial institutions equally rely on market resilience as a mechanism of intermediating credit to both households and companies.

Achieving market resilience especially when the economy is facing increased volatility in price and a deteriorating liquidity condition, the market practices need to promote transparency (Johnson, 2009). Furthermore, the legal strength of trades, efficient and reliable information provision regarding risk-management systems, and the proficient management of counterparty credit risks need to be prioritized (Kavussanos, Visvikis&Goulielmou, 2007).

A resilient and operational financial system allows corporates to cope with business risks, including interest rates, currency, or commodity price risks. Besides, market liquidity also plays an important role in preserving the financial markets resiliency when faced with stress (Lastrapes & McMillin, 2004). According to Viswanathan& Wang (2004), frictions within the inter-dealer markets lower the ability of dealers to share risk or even manage their inventories. This results in higher trading cost above what can be clarified by funding costs and collective uncertainty.

2.3.6 Market Tightness

Kenton (2018) defines market tightness as that market with narrow bid-ask spreads. Tightness refers to the difference between buy and sell prices, for example the bid-ask spread in a quote-driven market. In other words bid-ask spreads, are a key dimension of market tightness. According to the scholar, a tight market for a security or commodity is characterized by abundant liquidity and frenetic trading activity. Intense price competition on both the buyers' and sellers' sides leads to tight spreads, the hallmark of a tight market.

Most blue-chip stocks have tight markets, since there is plenty of interest from buyers and sellers at any point in time. Occasionally, however, tight market conditions may be disrupted by a sudden change in the market environment (due to a geopolitical development, for example) or the occurrence of a stock-specific event (such as an earnings warning). When this occurs, bid-ask spreads may widen as liquidity dries up, until there is more clarity to the situation. Tight market conditions will generally return once the situation has been resolved and normalcy has been restored (Kenton, 2018).

2.3.7 Electronic trading platforms

In this study, electronic trading platforms moderate the study variables. Electronic trading platform (ETP) forms a subset of electronic trading system. Generally, a system of electronic trading provides some or all services that range from order routing (computer to computer), credit risk management (trading involving central counterparty), order execution (click-and-trade), pre-trade and post-trade information dissemination, and automated trade settlement (Straight-through processing) (Gemloc Advisory Services, 2013).

As an electronic trading system, ETP offers a database server through which buyers and sellers are paired as a computer uses input timing and price levels as criteria to rank orders and thus making trading easier where multiple parties are involved. If orders get matched, trade execution may need manual intervention (click-and-trade) or automatic intervention (cross matching) (Gemloc Advisory Services, 2013).

An ETP requires certain standards, such as market regulation, a clear illustration of individuals who can gain access to the ETP, the exact tools that can be traded, as well as rules on trading and market supervision. Electronic trading platforms are often referred to as Multilateral Trading Facility (MTF). In general, ETPs are entities that are self-regulated (Gemloc Advisory Services, 2013).

2.3.8 Types of Trading Venues

A market makes up a perfectly matched process where a dealer and a purchaser are expected to get in touch and come to an agreement as regards the price needed to make a transaction conclusive. The issues that correlate include determination of the trading venues as well as trading models that best enhance market liquidity.

A trading place defines the manner in which the parties meet up. A trade model defines the manner in which market prices are formulated. Financial instruments trading can be done in different locations. Stock exchanges (SE) and across the counter markets (OTC) form the two ends on the spectrum, where other trading

locations lie in between. The main examples that make up such venues include ETPs and inter-dealer brokers. In general, a business model reflects market prices that are being formed, compared, executed and settled. The establishment of prices within the OTC market is by bilateral agreements. In terms of quotes, orders, or a mix of the two, formation of market prices can be through multilateral trade facilities. An adopted trading model will define the types of market participants (Gemloc Advisory Services, 2013).

Table 2.1: Types of trading models

Order-driven •continuous auction •periodic auction; •single auction	**Central order book (COB)** •Quoting of prices can be by any participant. •There are no market makers that exist. •Call market
Quote-driven •global; •tiered	**Market making** •The quoting of prices can only be by market makers. For the other participants, their trading can only happen on the basis of the quoted prices by market makers (price takers). •Market makers' continuous quotes can be affected by the participants in the trading (including other market makers). •Market makers downsize only one firm's prices to another. Quotes by customer are determined only on the basis of a quote request (RFQ).
Hybrid •specialist market; •global market	**COB and market making combination** •COB and one market maker. A single market maker competes with customers that can also quote prices themselves. •Combination of COB and market maker models. Market makers are competing with each other and with customers who can both hit the constantly quoted two - way prices of the company and quote the company's own orders.

At the moment, the ETP market seems to be fundamentally a two-tiered market structure that is Quote-driven ETP: global vs. tiered. An ETP that is global quote-driven has all market participants (including price takers and market makers) trading on a similar platform. The development of this trading model is by Reuters and Bloomberg. In a system that is tiered quote-driven, the segmentation of activity depends on the kind of market participants that are involved: the banks that make up the sell side and the final investors that make up the buy side match business-to-business as well as business-to-customer platforms. The two structures, in practice, are connected in such a way that a dealer lifted on a particular platform may wish that they cover their position on the other platform (Bank for International Settlements, 2016).

When it comes to Business-to-Business (B2B), the accessibility of ETP is restricted to financial intermediaries that include banks or securities firms referred to usually as sell side. Majority of the B2Bs limit their membership to market makers only. B2B platforms often post corporate prices along with typically anonymous trading. The disclosure of counterparties' identities is done only after the conclusion of a deal. B2C's three main single dealer systems types include single dealer system which constitutes one bank posting prices on a screen. Access to the screen may be either selective to the bank's customers only or it may be open altogether. The indicative nature of the prices in the first case is always illustrated. However, in the second case quantity prices indicated may be firm (Bank for International Settlements, 2016).

With respect to multi-dealer system, several banks post prices one screen, with the posted prices being indicative and RFQ. The RFQ represents a specific B2C type of multi-dealer. Customers are allowed to call several dealers simultaneously and ask for a firm price of a particular transaction. The firm price that is requested can either be one-way or two-way price (Gemloc Advisory Services, 2013).

An electronic trading venue can enhance market quality due to the so-called liquidity externality. Concentrating a trade at one place and time reduces search costs and intensifies competition over price .Rochet and Tirole (as cited by Bank for

International Settlements, 2016) .Electronic venues can bring together a large and diverse participant pool and hence reduce the need for intermediaries that match demand and supply between segmented traders. Also, they can lower operational costs by automating processing, settlement and record-keeping (Bank for International Settlements, 2016).

2.3.9. Bloomberg trading platform

Essvale Corporation Ltd (2011) suggest that Bloomberg L P is the provider of business data, news and analytics for financial ,business and governments in the United States of America and even internationally. It offers Bloomberg's professionals, an online market data on fixed assets, equities, derivatives, commodities, foreign exchange, mutual funds and exchange traded funds as well as offering news, analytics, communications, charts, liquidity, functionalities and execution services.

One of the company's service offerings is an enterprise - class package of services, applications and data that allows firms to use the same data and technology that supports Bloomberg professionals for internal applications and processes; multi - asset electronic trading platforms for real - time compliance checks and trading, equity clearing and settlement solutions, future options and foreign exchange tools for institutional traders, brokers, hedge fund managers, market managers and portfolio managers (Essvale Corporation, 2011).

Bloomberg's market - standard model suite and risk management analytics provide an advantage for foreign exchange, interest rate, inflation, credit, equity and commodity derivatives, as well as convertibles and structured notes (Bloomberg Finance, 2015). Within a single platform (Bloomberg Finance, 2015), the Bloomberg Professional Service helps put insight into action quickly and accurately, from structuring and pricing to commercial communication and execution, including regulatory compliance.

2.3.10 Autobahn trading platform

Autobahn is the electronic platform for foreign exchange trading for Deutsche Bank. Designed by traders and leveraging the technical expertise of Deutsche Bank, it provides user - friendly trading features with executable streaming prices and double - click execution. Deutsche Bank's profound experience with automated pricing is the foundation of autobahn FX (Deutsche Bank, 2014).

Their pricing engine has been used within the Deutsche Bank global network for Years, allowing them to provide electronic pricing to a large audience of external users simultaneously (Deutsche Bank, 2014). Autobahn is an Internet-based interactive service accessible through a proprietary application. Interest Rate Swaps can executed over autobahn in a variety of currencies, tenors and payment frequencies (for fixed or floating legs).In addition, there are many execution capabilities that can match the most demanding trading strategies.

Trading Options Users can trade options in multiple ways: Options Liquidity Window (LW) with live streaming volatility, Options Request For Quote (RFQ) can pricing specific vanilla options and Options Pricing Tool can pricing and structuring vanilla or striking options (Deutsche Bank, 2014; Price water house coopers, 2010). Over ten years ago, Deutsche Bank set up Autobahns electronic trading platform.

2.3.11 Citi velocity trading platform

Citigroup has recently launched its own Citi Velocity electronic trading platform It provides e - commerce and execution services not only for corporate bonds but also for securitized investment vehicles, credit derivatives, foreign exchange and equity (Pricewaterhousecoopers, 2010).

2.3.11.1 Interest rate risk

According to the Basel Committee on Banking Supervision of the Bank for International Settlements (2004). Interest rate risk is a vulnerability of a bank's financial situation to adverse fluctuations in interest rates.Acceptance of this risk is a

normal part of banking and can be a major source of profitability and value for shareholders. Excessive interest rate risk, however, may pose a significant threat to the earnings and capital base of a bank.

Interest rate changes influence the profit of a bank by changing its net premium salary and other premium - delicate pay and working costs. Changes in financing costs likewise influence the fundamental estimation of the bank's benefits, liabilities, and off - monetary record (OBS) instruments as the present estimation of future incomes (and now and again the incomes themselves) changes when loan costs change (Bank for International Settlements Basel Committee on Banking Supervision, 2004). Accordingly, an effective risk management process that maintains interest rate risk within prudent levels is essential to the safety and Soundness of banks.' Bank for International Settlements Basel Committee on Banking Supervision (2004) suggest the following as Sources of Interest rate risk:

2.3.11.2 Re-Pricing Risk

The primary and most often talked about type of loan fee hazard emerge s from timing contrasts in resource, risk, and off - monetary record (OBS) positions development (for fixed rate) and re - evaluating (for skimming). While such re - estimating disparities are principal to the financial business, they may uncover the pay and fundamental monetary estimation of a financial foundation to unexpected vacillations

2.3.11.3 Yield Curve Risk

Re-pricing mismatches can also render a banking institution to changes in the slope and shape of the yield curve. In finance, the yield curve is a curve showing several yields or interest rates across different contract lengths (2mths, 2yrs, 20yrs etc) for a similar debt contract (Bank for International Settlements Basel Committee on Banking Supervision, 2004).

The curve shows the relation between the (level of) interest rate (or cost of borrowing) and the time to maturity, known as the term of the debt for a given borrower in a given currency. Formal mathematical descriptions of this relation are often called term structure of interest rate. Yield curves are used by fixed income analysts, who analyze bonds and related securities, to understand conditions in financial markets and to seek trading opportunities. Economists use the curves to understand economic conditions (Bank for International Settlements Basel Committee on Banking Supervision, 2004).

2.3.11.4 Basis Risk

This is because of the blemished connection in the rate alteration earned and paid on various instruments with comparative re - estimating attributes. These distinctions may bring about surprising changes in the income and profit spread among resources and liabilities and reeling sheet (OBS) instruments of comparable developments or re - estimating frequencies when loan costs change (Bank for International Settlements Basel Committee on Banking Supervision, 2004).

2.3.11.5 Optionality risk

An extra and progressively critical source of interest rate risk is the options embedded in the assets, liabilities and OBS position of many banking institutions. In non - trading activities, instruments with embedded options are usually the most important.. They include various types of bonds and notes calling for or putting provisions, loans that enjoy the right of borrowers to prepay balances and various types of non - mature deposit instruments that enjoy the right of depositors to withdraw funds at any time, often without sanctions (Bank for International Settlements Basel Committee on Banking Supervision, 2004). .

If not properly managed, the asymmetric payoff characteristics of instruments with optional features may pose significant risk, especially to those who sell them, as the options held both explicitly and embedded are generally exercised to the advantage

of the holder and the disadvantage of the seller (Amattamsir, 2011). 2.3.4Interest rate financial derivatives

According to Amattamsir (2011) & Association Cambiste Internationale Singapore, 2010, 2010 derivatives used interest rate derivatives are as follows:

2.3.11.6 Interest rate Swaps (IRS)

An interest rate swap (IRS) is an instrument that allows a counter party to exchange one set of cash flows for another for example from floating to fixed. Their exposures to interest rates fluctuate in opposite directions. Loeys (Humphrey, 2011; Association Cambiste Internationale Singapore, 2010).

One party has long-term assets that yield a fixed rate of return and on the other hand is liabilities with interest payments based on a floating interest rate. When interest rate rises unexpectedly, the firms lose because the interest cost of its liabilities rises above the revenue of its assets. When there is a drop in the interest rate the firm will gain accordingly (Humphrey, 2011).

2.3.12.1 Forward Rate Agreements

A forward rate agreement (FRA) is an instrument of off - balance to fix future borrowing or loan rates. It will do this in the future through a cash settlement. An FRA is an agreement to pay or receive the difference between an agreed interest rate and the interest rate on that future date on the basis of an agreed notional principal amount on an agreed future date (Amattamsir, 2011).

2.3.12.2 Interest Rate Options

An option contract is defined as an agreement between two parties in which one party, the writer, grants the other party, the buyer, the right, but not the obligation, to buy or sell a given security, asset or commodity on a future date under the conditions stated" Poitras (Amattamsir , 2011). An important note is that an option contract confers the owner a right to enforce the contract because it is most often subjected to

an upfront payment, a premium. The maximum loss of this contract is that of the premium while the potential gain is limitless. Interest Rate Options are options of which the payoffs depend on the level of the interest rates and are traded in the over-the-counter market.

There are three types of contract options: American option; here the buyer is entitled to exercise the option at any time before and on the contract's expiry date. European option; option to be exercised only on the contract expiry date, option Bermuda; option to be exercised only on the pre - specified contract duration dates. Faure (as cited by Amattamsir, 2011) Furthermore options are categorized in: Call option; the buyer has the right to purchase the underlying asset or commodity from the option seller at a given price. Poitras (as cited by Amattamsir, 2011) put option; the buyer has the right to sell the underlying asset or commodity to the option seller at a given price Poitras (as cited by Amattamsir, 2011).

In accordance to the option purchasers and sellers' market position they can further be classified as having a long or short position. In a long position the buyer of the contract will benefit from the option if the contract is enforced. The enforcement will be at a strike price as long as it is beneficial to the buyer. There is a premium for the buyer to pay in the long position. In a short position the seller of the contract, while receiving the premium, has the obligation to perform the contract accordingly Faure (as cited by Amattamsir, 2011).

2.3.12.3 Interest Rate Caps

In an Interest rate Cap the seller pays the buyer at expiration date of the contract. The seller pays the excess of the prevailing market index over a cap rate which is based on the agreed notional principal amount. The market index rate is usually a short term rate such as a LIBOR rate. Interest rate caps provide assurance against rising of the interest rate on the floating rate note above a certain level (Cap rate). A cap makes it possible for a firm to hedge against rising interest rates. By paying a premium the firm attains a ceiling (maximum) interest rate to pay. For example, a company buys a 2-year, 4% cap on three-month LIBOR with a notional amount of

US$ 100 million. In three months, the LIBOR rate is set at 4.50%. Six months into the life of the cap, the company receives a payment equal to US$ 100 million x (4.50%-4.00%) x 90/360 days or US$125,000. Faure (as cited by Amattamsir, 2011).

2.3.12.4 Interest Rate Floors

An interest rate floors is the opposite of the interest rate cap. It is an option that pays the holder when the underlying interest rate falls below the agreed floor level. Hereby the floor provider, often a borrower in the floating rate debt market, agrees to make payments to the purchaser when the reference rate falls below the stated floor. A floor is used when the firm expect that the future interest rate will fall and so to lock in a certain return on its investments. Poitras (as cited by Amattamsir, 2011)

2.3.12.5 Interest Rate Collar

This is a combination of both the interest rate cap and the interest rate floors. The objective is to purchase/sell a cap and a floor simultaneously. The firm enters into a collar that effectively limits its floating rate to a specified high and low range over a specified time period (Amattamsir, 2011).

2.4 Empirical literature

2.4.1 Market Liquidity

Recently, a number of researchers defined market liquidity as the ability of an asset to be traded promptly without significant price movement and at a price close to its value, i.e. no significant haircut can be incurred to achieve immediacy. Recent empirical studies such as Chordia, Sarkar, & Subrahmanyam (2003) referring to New York Staff's Federal Reserve Bank, Vermaelen (1981) and Brunnermeier & Pedersen (2009) highlighted the significant market liquidity characteristics. Researchers reported that market liquidity is strongly correlated with both market dynamics and market volatility; is susceptible to flight to quality and may therefore dry up unexpectedly; and is the same for all securities traded in the market.

In their study on the implementation of a transfer - pricing fund model with stochastic interest rates, Danielsson and Tajvidi (2014) observed that market liquidity is based on the notion that the current market price is the fair price at any given time at which a liquid asset should be traded at that time. When the traded price of an instrument is deviating from this market price the instrument is said to be traded with a liquidity premium (or illiquidity premium). However, scholars such as Hibbert (2009) observed that it is not self-evident how the liquidity of an asset shall be measured.

Deutshe Bundesbank (2008) points out those market participants endogenously determine transaction costs by their supply and demand behaviour. Furthermore, transaction costs are a key determinant of market liquidity and are usually subdivided into the following four essential components: The *tightness of the market,* which is calculated using bid-offer spread and which determines the price of unwinding a position at short notice; the *depth of the market,* which is closely related to the notion of liquidity or liquid market. This is an evaluation of which transaction volume may be realized instantaneously without distressing prices. The *resiliency of the market,* which refers to the velocity at which market prices return to equilibrium after a sizable transaction. The *notion of immediacy,* which is the measure of time from the initiation of a market transaction to its completion.

According to Nikolaou (2008) there are two types of market liquidity banking institutions namely; (i) liquidity in the interbank market, for trading liquidity among banks and (ii) liquidity in the asset market where financial agents (banks) trade assets among themselves. In both cases the five essential components of market liquidity, that is, immediacy, breadth, tightness, resiliency and depth were found to be precursors to market liquidity effectiveness in the management interest rate risk in financial institutions.

Olbrys and Mursztyn (2017) studied the Dimensions of Market Liquidity the Polish Stock Market. The researcher noted that the order ratio (OR) is employed as a proxy of market depth, while market tightness is approximated using the relative spread (RS).

Pricewaterhouse Coopers (2015) analyzed liquidity on global financial markets. The study collected secondary information from previously published financial market liquidity studies; and market data across financial markets on liquidity indicators. The participants of the market were spoken to validate and interpret the findings. The findings indicated that a vanilla swap involving the exchange of cash flows at a pre - agreed fixed rate with another at a floating rate is generally traded over the counter in interest derivatives, and that vanilla swaps tend to be more liquid than tailor - made instruments such as floating rate reference indices. Liquidity on the interest rate derivatives is mostly provided for by banks and the counterparties tend to be investors such as corporate and non-bank financial institutions (PricewaterhouseCoopers, 2015).

In terms of depth and resilience, the volumes of trading have failed to keep pace with the notional outstanding amount of growth. There is a trend of liquidity division across different currencies in terms of breadth. There is a trend in the division of liquidity across different currencies (PricewaterhouseCoopers, 2015). Rösch (2012) focused on market liquidity and conducted an empirical analysis of the financial crisis impacts, ownership structures and insider trading. During the financial crisis, the researcher also focused on the dynamics and drivers of market liquidity, the relationship between market liquidity and concentration of ownership, the effect of different types of block holders on liquidity and the liquidity impact of insider trading activity.

The study found that when liquidity declines stock markets implying a positive relationship between market liquidity and liquidity risk, insider block holders have a deadly effect on market liquidity and appear to trade on very active days, liquidity tightness increases liquidity cohesion leading to complete market liquidity dryness. The study also demonstrated a positive relationship between credit and liquidity risk and high ownership concentration is negatively related to market liquidity (Rösch, 2012).

Rouetbi *et al* (2014) studied Measuring Liquidity in an Emerging Market: The Tunis Stock Exchange .Secondary data was collected from the quoting at the continuous

session of stock quoted on the Tunis Stock exchange all along the year 2006, Different specifications were used to measure liquidity characteristics. Estimates demonstrated that liquidity is a critical variable of securities behavior and its characteristics are inseparable due to its multi-facets.

Odongo (2008) looked at the effects of the level of liquidity on stock returns. Based on secondary data collected from Nairobi Securities Exchange comprising weekly stock prices and trading volume on Nairobi Securities shares quoted on the 20-share index and found out tha--t there is no relationship between liquidity and stock returns on companies quoted on the 20-share.

Salvati (2006) analyzed market microstructure: electronic trading versus open outcry trading in the United States of America's. Treasury 10-year interest rate futures market .The primary focus of the research was on the price variance and BAS (Bid/Ask spread) present in each market. The methodology was a collection of Secondary data collected from the daily trading files of the Chicago Board of Trade's (CBOT) Liquidity Data Bank (LDB) and Bloomberg Financial Services. Trade data from the Chicago Board of Trade was from January 1, 2005 to June 30, 2005 and was used to compare the market efficiency of electronic platforms and open outcry (pit) trading. The significance of these trading dates was simple. The dates provided a 59 cross sectional period to observe the trading of one lead contract, the June 2005 U.S. Treasury 10-year interest rate futures contract.

Data was analyzed using a three equation structured model. The findings of the study indicated that there was a positive relationship between BAS, trading volume, and price. The results also identified a large difference in the volume of trading in electronic markets compared to open outcry markets (Salvati, 2006). Ighe (2014) carried out a study on Micro Structure in the Indian Stock Market. This study tried to find out the critical areas in Indian stock market microstructure and its impact on the trading process and the findings where that Electronic trading has reduced frictions in stock market but still some areas require improvement.

2.4.2 Market Immediacy

Kalle (2012) studied the effects of various structural parameters on the stock's liquidity, return reversal pattern, liquidity premium, volatility, the costs of immediacy to transitory investors, and market makers' returns from providing immediacy. The results revealed that the cost of immediacy suffered by the infrequent investors is non-monotonic in several structural parameters of the model. The results indicate that the demand of immediacy of traders may cause jumps in stock returns. Market makers and other immediacy suppliers synchronize the short-term supply and demand by increasing or decreasing their inventories, but they do this only if they can earn returns from providing immediacy. Their counterparties, immediacy demanders, suffer from costs of immediacy when they want to execute their trades immediately instead of waiting for arrival of other investors willing to trade. Grossman and Miller (1988) come up with immediacy, which indicates that liquidity refers to the transactions of any scale that can be immediately executed at the expected market price. Shi *et al* (2010) noted that when assessing immediacy, trading frequency is times of transactions executed per unit time, such as, number of transactions completed per unit time, and thus it can reveal liquidity from the dimension of immediacy (the time needed to complete one transaction). Compared with the time length of completing one transaction, it is easier to obtain trading frequency, so this paper adopts trading frequency to reflect immediacy. With higher frequency, the market is regards as more active and liquid. However, it has been verified empirically by Jones *et al.* (1994) that frequency is also positively related to volatility, which makes it a weak proxy of liquidity

2.4.3 Market Depth

The modern definition of depth is the ability to buy or sell a certain amount of an asset without affecting the quoted price. Market depth is just an indicator which shows at what price are people buying and selling, if investors are quoting a very low bid price , then the sellers have to lower their ask price where share price will come down. Ranaldo (2004) found that the willingness of patient traders to submit orders changes accordingly with the state of limit order book. The patient traders become more aggressive when the depth of theirs side increases or the depth of the opposite side decreases. That makes part of limit orders possible market orders, thus changes the orders arrival rate.

Fleming (2003) discusses quote size as a market depth measure. Quote size refers to the volume of trade that corresponds to the price quoted by market makers, measuring liquidity from the market depth dimension. The researcher noted that traders are willing to take large positions as they can easily handle positions in a liquid market; but when the market becomes less liquid, traders will charge a higher bid - ask spread. Trade size is another liquidity proxy of market depth. It is the quantity of trade executed per unit time, and the larger trade size always represents the better liquidity. Similar to quote size, it also underestimates market depth (Fleming, 2003). He proposes that trade size also underestimates market depth as the quantity traded is often less than the quantity that could have been traded at a given price. Another indicator of market depth is turnover ratio. Trade volume being divided by the absolute value of monthly net positions, where the denominator is expressed as the average amount of beginning and ending inventory of the corresponding month, which is analogous to the definition of inventory turnover (Weygandt *et al.,* 1996).

Significant buyers and sellers are not available in the market and the market liquidity or market depth is very low. As a result, potential buyers and sellers are not found at any time for transaction of any company's share, and dramatic price change cannot be prevented. Alam *et al* (2007) studied market depth and risk return analysis of Dhaka Stock Exchange in Bangladesh. The researcher observed that significant

buyers and sellers are not available in the market and the market liquidity or market depth is very low. As a result, potential buyers and sellers are not found at any time for transaction of any company's share, and dramatic price change cannot be prevented.

McKeon (2017) argues that the act of tokenization does not impact liquidity unless it impacts market depth. The interesting thought experiment is to consider how and why tokenization might increase market depth.

Alam *et al* (2007) mentions that market depth means numerous buyers and sellers are available in the market. Consequently, potential buyers and sellers are easily found at any time for transaction of any company's share. For that reason in the market radical price change is prevented. It can be measured by observing transaction values proportion out of total market capital. If this proportion is high, then the market indicates its depth is also high.

2.4.4 Market Breadth

Chen (2018) defines market breadth as a technique used in technical analysis that attempts to gauge the direction of the overall market. Market breadth indicators analyze the number of companies advancing relative to those declining. Positive market breadth occurs when more stocks are advancing than are declining and suggests that the bulls are in control of the market's momentum.

O'Connell (2018) observes that traders refer to breadth indicators largely in different ways: A security or index that ends the trading day higher is an advancing issue and may be regarded as a bullish market indicator; A security or index that ends the day lower is a declining issue and may be considered a bearish market indicator. Market breadth indicators can also track other key trading criteria, like the number of securities closing the trading session at a 52-week high or a 52-week low.

According to Hill (2019), there are several market breadth indicators for day traders that can influence interest rate changes. These include the TICK Index, TRIN

(ARMS Index), Premium/Discount on S&P Futures, McClellan Oscillator, Absolute Breadth Index, Your Market Scanner, and Comparing Broad Markets. The TICK Index is a measurement of the short-term bias of the overall market and is one of the most important tools for day trading. The index of the ARMS, aka. TRIN index, measure the size of the market and advance issues. Essentially, with volume support, it determines whether the market is moving higher. S&P Futures Premium / Discount is often called the premium or discount. The futures market is said to lead the cash market and an expansion in this spread indicates that the cash market should move higher while a contraction indicates that the market should move lower. The McClellan Oscillator is a measure of the NYSE - wide spread of progressing and declining issues. Hill pointed out that an observation of the impact of market breadth on interest changes revealed that TICK, TRIN and your own market scanner were the best market breadth indicators.

According to Isbitts (2015), breadth refers to how widely stocks are participating in the moves of the broad stock indexes. The scholar pointed out that declining market breadth is a troubling sign. After the financial twin killings of 2000-2002 and 2007-2009, any investor managing for a lifestyle goal (retired or making a good living and want to avoid a big drop in portfolio value at any point) should be taking notice of what is happening. While major indexes advanced, fewer and fewer stocks participated. However, Isbitts' study did not look at how market breadth influences interest rate risk management.

2.4.5 Market Resilience

Kyle's (1985) seminal paper refers to resilience as the speed with which prices recover from a random, informative shock. This is comparable to the interpretation of Obizhaeva and Wang (2012), who recommend a rapid convergence of an asset's price to a new steady state after a market order in a resilient market. Garbade and Garbade (1982) describe a resilient market as one in which ' new orders are promptly released in response to a temporary order imbalance, ' whereas Harris (2002) suggests that ' uninformed traders cannot substantially change prices in such a market. These resilient market interpretations differ somewhat in that the two former

definitions relate to price evolution, while the latter two relate to order replenishment.

Compared to other aspects of modern computer - based and high frequency trading environments, market resilience has received relatively little empirical attention, (Danielsson *et al.* (2018). This is challenging as resilience is of major interest to market participants, both as an overall feature of a well - functioning market and as a dynamic attribute that can change dramatically over time, not least in times of market stress.

The main determinant of resilience is waiting costs, based on Demsetz's intuition (1968). They identify three limit order book (LOB) liquidity resilience regimes, which relate to the proportion of patient and impatient traders (mainly traders submitting limit or market orders, respectively). They find that resilience increases with the proportion of patient traders, while a reduction in tick size reduces resilience.

The resilience of the market can be evaluated in three key dimensions. These include, first, making it time - varying and demonstrating that a substantial part of its variation can be explained by the structure of the LOB ; second, explicitly related to certain interest levels of liquidity ; and third, modeling and forecasting the time required for a market to recover after a liquidity shock. We demonstrate that the state of the LOB is an important determinant of the level of liquidity resilience, whereas previous work by Kyle (1985) and Foucault et al. (2005) considered only relevant exogenous factors (informative asymmetries and waiting costs, respectively).

2.4.6 Market Tightness and Interest Rate Risk Management

Fleming (2003) mentions that market tightness is a key component of market liquidity. The researcher points out that bid-ask spread, an indicator of market tightness reflects the extent that transaction price deviates from true level. The researcher observes that there are mainly two types of spreads, one is absolute bid-ask spread and the other one is relative bid-ask spread. There may be many times of bilateral quotations by different market makers for the same bond within one trading day. Absolute bid-ask spread is the difference between best ask price (the lowest ask price) and best bid price (the highest bid price) of one bond in one day the relative bid-ask spread is absolute bid-ask spread being divided by the average of the best bid price and ask price.

According to Corwin and Schultz (2012), many models of the spread have focused on three main factors in determining the cost components of the quoted spread: adverse selection costs (for example, Glosten and Milgrom, 1985); inventory holding costs (for instance, Ho and Stoll, 1983); and order-processing costs (Brock and Kleidon, 1992). Investors expect financial assets to be liquid, thus, easily traded in large amount without losing their value. These assets are to be characterized by low trading cost, easy trading and timely settlement as well as large trades having a limited price impact.

Beaubrun-Diant and Tripier (2013) in a paper titled Search Frictions, Credit Market Liquidity, and Net Interest Margin Cyclicality found that credit market liquidity, measured by credit market tightness, plays a crucial because it determines the countercyclical behavior of the net interest margin owing to the fact that credit market tightness is time varying. Credit market tightness is assumed to be acyclical by Petrosky-Nadeau and Wasmer (2013) because there is a double free entry condition for entrepreneurs and banks. Petrosky-Nadeau and Wasmer (2013) considered endogenous (exogenous) participation for banks and entrepreneurs (workers).

Bervas (2006) opines that the tightness of the bid-ask spread is an indicator of the cost of a reversal of position (such as cost of trading) and the illiquidity of a market and it reflects the difference between what active buyers must pay and what active sellers receive. Liquid markets are usually characterized by narrow spreads while, on the other hand, illiquid markets by a wide spread. The extant literature epitomizes, inter alia, three main components of the bid-ask spread that emanates either from order processing, adverse information and inventory costs.

According to Stoll (2001), if source of the bid-ask spread was only order processing costs, then a negative serial correlation would be induced in price changes. Given the random arrival of traders and if asymmetric information were the sole source of the spread, trade price changes and quote changes would be stochastic and unpredictable. Finally, if inventory costs were the source of the spread, trade prices and quotes would exhibit negative serial correlation.

Chordia, *et al.* (2008) examined a comprehensive sample of NYSE stocks that traded every day from 1993 through 2002 and pinpoints out that high liquidity facilitates arbitrage and leading to conclusion, that liquidity plays an important role in efficiency creation. Further, market tightness elemental importance is demonstrated by the influence of trading costs on required returns, which implies a direct linkage between liquidity, and corporate costs of capital.

In the period from September 2005 to December 2009, Memmel (2011) investigated a sample of 1562 German banks to seek a relationship between the systematic factor exposure to interest rate risk and the shape of the term structure to clarify which factors determine banks ' interest rate risk exposure and how profitable their term transformation ultimately is to determine whether high - interest - risk banks also reach a high interest margin. The results showed that the methodical factor of interest rate risk exposure (hypothesized to be consistent with past and current term structure of interest rates) moves in line with possible earnings from term transformation, but bank - level specific and regulatory effects are much greater.

2.5 Critique of Literature

Studies have been conducted on the topic of investigation by this study. From the reviewed studies, various conceptual, contextual and methodological knowledge gaps came about; the study by Gemloc Peer Group (2011) was done on the Pilot Peer Group (PGD) member countries following a PGD meeting on this topic and may need to be replicated in a different economic set up.

Salvati's study (2006) used secondary data only, and without collecting primary data, the conclusion from this study may be subjective, so there is a need to undertake further study that involves collecting primary data from the methodology. Research on the impact of market liquidity dimensions on interest rate risk management using financial derivatives needs to be undertaken in Kenya. In addition, the moderating effect of electronic trading platforms on the relationship between the dimensions of market liquidity and interest rate risk management using financial derivatives needs to be considered.

2.6 Research Gaps

In Kenya there are numerous studies on the development and use of derivatives by financial and non-financial companies. Ngugi et al (2013) did a study on Factors influencing development of financial derivatives markets: a survey of listed companies in Kenya. Ithai (2013) studied factors leading to slow adoption of derivatives use in Kenya, a case of commercial banks in Kenya and Mutembei (2013) carried out a study on managerial risk aversion and financial risks hedging practices of non-financial firms which are listed in Nairobi securities exchange. However, these studies remain silent on The Effect of market liquidity dimensions on the Interest Rate Risk management using Financial Derivatives in Kenya. This study sought to explore the effect of market liquidity dimensions on the interest rate risk management using financial derivatives in Kenya.

2.7 Summary of Literature

The chapter reviewed various theories on which the study was anchored on. The study reviewed the Demstez 1968 (inventory model), Copeland and Galai 1983 (information model) and Léon Walrasin 1874 (equilibrium theory). The empirical review of literature indicated various contradictory statements as well as untested hypothesis in the existing knowledge of market liquidity dimensions, which raise questions about the generalization of certain theories. The review also presented conceptual, contextual and methodological research gaps. The conceptual research gaps were present because some of the reviewed studies did not necessarily use related or similar variables used by the current study. Furthermore, contextual research gaps were presented since some of the reviewed studies were conducted in different contexts from the context of the current study. The literature review indicated the need to add more knowledge in the discipline of market liquidity dimensions and interest rate derivatives.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents all the aspects of research methodology that were used in the study. Rajasekar et al (2013) defines Research methodology as a systematic way to solve a problem. It is essentially, the procedures by which researchers go about their work of describing, explaining and predicting phenomena. These include research design, study population, sample and sampling procedures, data collection, processing and analysis procedures.

3.2 Research philosophy

Bajpai (2011) defines research philosophy as belief about the ways in which data about a phenomenon should be collected, analyzed and used. Research philosophy deals with the source, nature and development of knowledge. This study adopted pragmatism research philosophy. Pragmatism research philosophy accepts concepts to be relevant only if they support action. Pragmatics recognize that there are many different ways of interpreting the world and undertaking research, that no single point of view can ever give the entire picture and that there may be multiple realities.

The research approach will be deductive. Deductive Approach (Deductive Reasoning) A deductive approach is concerned with developing a hypothesis (or hypotheses) based on existing theory, and then designing a research strategy to test the hypothesis (Wilson, 2010). It has been stated that deductive means reasoning from the particular to the general. More so, the research will collect both qualitative and quantitative data.

3.3 Research Design

Research design is the arrangement of conditions for collection and analysis of data in a manner that aims at combining relevance of the research purpose with economy

in procedure (Kothari, 2013). The study used the descriptive research design. Mugenda (2008) defines descriptive research design as a process of collecting data in order to answer questions concerning the current status of the subjects in a study. The research was chosen given that much is not known yet about the effect of Market liquidity dimensions on the use of financial derivatives in interest rate risk management in Kenyan commercial banks. The research design helped understand why something happens, by understanding how, when and where it happens. This design was found ideal considering the fact that the study sought the perceptions of market makers on the effect of Market liquidity dimensions on the use of financial derivatives in interest rate risk management. This design allowed the capturing of respondents' opinions on the relationship between the study variables. Econometric techniques were used to relate the causation factors of Market liquidity dimensions on the interest rate risk management using financial derivatives in Kenya.

3.4 Target Population of the Study

Population of a study is the entire set of relevant units of analysis or data (Nachiamis *et al* 2006). According to (Groves et al, 2009; Ott *et al.* 2015) a target population consists of a list of elements or individual members of the overall population from which a sample is drawn. The target population comprised of 44 commercial banks in Kenya (Central Bank of Kenya, 2018). The estimated number of market makers (respondents) was 168 which accessible in the commercial banks.

3.5 Sample

The sample for the study was computed using a formula provided by Mugenda (2008). This was as follows.

$$S = \frac{N\,n}{N + n}$$

Where

N is the population

n is the desired sample size when the population is less than 100,000

The sample was thus calculated as follows:

S = 168 (384) / (168 + 384) = 116.8695, that is 117 market makers. The study sampled 3 market makers from each bank, and thus 39 banks were used for the main study (117/3 market makers). The targeted respondents from each commercial bank were the treasurer, senior dealer and dealers.

3.6 Data Collection Instruments

The study collected both secondary and primary data. Secondary data was collected using a desk survey approach, which involved studying organizational financial documents. The study adopted a questionnaire as the instrument for collecting primary data. The questionnaire utilized closed ended questions structured in accordance with the conceptual framework and empirical literature. The questionnaire was divided into four sections namely Section A:-Capturing general information. Section B through to F captured information related the independent variables, Moderating variables and dependent variables. The respondents were required to rate their perception of the effect of market liquidity on IRR management using a five scale Likert type of rating namely: Strongly Disagree=1; Disagree=4; Moderately Agree=3; Agree=4; Strongly Agree=5. In order to tap as much information as possible on the effect of market liquidity dimensions. The target respondents were treasurer, senior dealer and dealers from each commercial bank on the interest rate risk management using financial derivatives in Kenya.

3.7 Data Collection procedures

Prior to collection of data, an introduction letter from Jomo Kenyatta University of Science and Technology was used (Appendix 1). The primary data used in this study was collected through a questionnaire with the assistance of two research assistants trained by the researcher. The enumeration team personally administered the data collection exercise under the guidance and direction of the researcher. Commercial

banks that that were not reached physically were contacted through email. The information that was sourced from the regulator is mainly the list of all licensed commercial banks.

3.8 Pilot Study

A pilot survey was conducted prior to the actual research; it was conducted on a few respondents conveniently selected from three commercial banks that were not included in the study, making up 6% of the target population, which is 3 banks from which 3 respondents came from each bank. According to Ott (2015), a pilot or pre - test is a means of checking whether the questions can be administered and providing accurate details; more specifically, a pilot study was designed to answer the following questions: were there sufficient directions for those conducting the survey to collect, code and report it? Have the procedures been standardized? Was the necessary information being provided? Were the questions being asked appropriate for the people being surveyed? Was information being obtained consistent? Was consistent information obtained? A pretest was made to determine whether any changes needed to be made to the questionnaire. The instrument was modified on the basis of the responses from the pilot tests.

3.9 Validity of the Research Instruments

The validity of the data collection instrument for the study was checked with the help of university supervisors by first administering it on conveniently selected respondents of three commercial banks in Kenya. The pilot survey was conducted on nine participants from three commercial banks that were not included in the census taken to find out if the respondents could respond to the questions without difficulty.

3.9.1 Reliability of the Instruments

Damon *et al* (2010) states that Cronbach's Alpha is a popular method for measuring internal consistency reliability of a group of items. Cronbach's Alpha was used to test reliability of the instrument (Aiyabei, 2013). Cronbach's Alpha measures how well a set of variables or items measures a single, one-dimensional latent construct. It is essentially a correlation between item responses in a questionnaire and whose values will be high when correlations between the respective questionnaire items are high; Cronbach's Alpha values range from 0 to 1 and in social sciences, values at or above 0.7 is desirable. Therefore, reliability of the Instruments involved computations of piloted instruments to establish Cronbach's Alpha.

The formula for Cronbach's alpha is:

$$\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N-1) \cdot \bar{c}}$$

Where:

N = the number of items.

$\bar{c}$ = average covariance between item-pairs.

$\bar{v}$ = average variance.

Reliability of the instrument was evaluated through Cronbach Alpha, which measures the internal consistency. Cronbach Alpha value is widely used to verify the reliability of the construct. The results are presented in Table 3.1.

Table 3.1: Reliability Coefficient

Variables	Cronbach's Alpha	Comment
Market immediacy	0.856	Accepted
Market resiliency	0.705	Accepted
Market depth	0.905	Accepted
Market breadth	0.991	Accepted
Market Tightness	0.984	Accepted
Financial derivatives	0.919	Accepted

The findings in Table 3.1 indicate that market immediacy, market resiliency, market depth, market breadth, market tightness and financial derivatives had Cronbach's value above the set alpha coefficients cutoff point of 0.7 hence all the study variables were adopted. This represented high level of reliability and on this basis it was supposed that scales used in this study was reliable to capture the variables.

Bagozzi (1994) explains that reliability can be seen from two sides: reliability (the extent of accuracy) and unreliability (the extent of inaccuracy). The most common reliability coefficient is Cronbach's alpha, which estimates internal consistency by determining how all items on a test relate to all other items and to the total test-internal coherence of data. The reliability is expressed as a coefficient between 0 and 1.00. The higher the coefficient, the more reliable is the test. Nunnally's (as cited by Ongore, 2008) suggestion is that a value of not less than 0.7 is acceptable while Sekeran (as cited by Kasomi, 2015) posits that any values between 0.5 and 0.8 are adequate to accept internal consistency. This study adopted a threshold of 0.7 and based on this, the instrument was reliable.

3.9.2 Data Processing and Analysis

This section entails the techniques that were used in this study to analyze and test data. Data collected was mainly quantitative. The data in the questionnaire was first edited to remove inconsistencies. Editing ensured that the responses were complete, accurate and suitable for further processing. The data was then coded and finally electronically analyzed using the Statistical Package for Social Sciences (SPSS) version 21 software. Both descriptive and inferential statistics was used in the data analysis. Primarily, descriptive statistics encapsulated measures of distribution, measures of central tendencies, and measures of variation. On the other hand, inferential statistics constituted correlation and regression analysis. Both descriptive and inferential analysis was conducted. Descriptive analysis entailed frequencies, mean and standard deviation.

3.9.3 Descriptive Statistics

Nachmias and Nachmias (2006) define descriptive analysis as statistical procedures that are used to describe the population one is studying. They also contended that descriptive statistics use graphical and numerical summaries to give a picture of a data set. The study computed descriptive statistics such as frequencies, percentage, mean and standard deviation.

3.9.4 Inferential Analysis

The inferential statistics used in this study included the Pearson correlation and regression analysis. Economic models were applied to evaluate the data more rigorously and highlight the importance of the independent variables towards affecting the dependent variables. The implication of market liquidity dimensions towards the interest rate risk management in Kenya, based on financial derivatives, was tested with a multiple linear regression model. This enabled the researcher to compare the beta strengths for the independent variables.

The multiple linear regression model is as laid below.

Table 3.2: Table of Regression Models

	Objective	Regression Model
$\mathbf{X_1}$	Effect of Market immediacy on the use of financial derivatives in IRR management	$Y = \alpha + \beta_1 X_1 + e$
$\mathbf{X_2}$	Effect of Market depth on the use of financial derivatives in IRR management	$Y = \alpha + \beta_2 X_2 + e$
$\mathbf{X_3}$	Effect of Market breadth on the use of financial derivatives in IRR management	$Y = \alpha + \beta_3 X_3 + e$
$\mathbf{X_4}$	Effect of Market resiliency on the use of financial derivatives in IRR management	$Y = \alpha + \beta_4 X_4 + e$
$\mathbf{X_5}$	Effect of Market Tightness on the use of financial derivatives in IRR management	$Y = \alpha + \beta_5 X_5 + e$
	All Objectives Combined	$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e$

Where:

Y = Interest rate risk management using financial derivatives

X_1 = Market immediacy

X_2= Market depth

X_3 = Market breadth

X_4 = Market resiliency

X_5 = Market Tightness

e=Error term and α= constant

β=coefficient of independent variables

The regression models assumptions were as follows:

i. There must be a linear relationship between the outcome variable and the independent variables. Scatterplots can show whether there is a linear or curvilinear relationship.
ii. Multivariate Normality–Multiple regression assumes that the residuals are normally distributed.
iii. No Multicollinearity—Multiple regression assumes that the independent variables are not highly correlated with each other. This assumption is tested using Variance Inflation Factor (VIF) values.
iv. Homoscedasticity–This assumption states that the variance of error terms are similar across the values of the independent variables. A plot of standardized residuals versus predicted values can show whether points are equally distributed across all values of the independent variables.

3.9.5 Multicollinearity Test

Multicollinearity refers to excessive correlation of the predictor variables. When correlation is excessive (using the rule of thumb, r>0.80), standard errors and beta coefficients become large, making it difficult or impossible to assess the relative importance of the predictor variables. Multicolinearity is less important where the research purpose is sheer prediction since the predicted values of the dependent remain stable, but Multicolinearity is a severe problem when the research purpose includes causal modeling (Ongore, 2008).

The current study relied heavily on modeling to establish nature and strength of relationships between market liquidity dimensions on one hand, and interest rate risk management using financial derivatives on the other. The study used a correlation matrix to determine the presence of multicollinearity among the independent variables before running the regression model. A Pearson correlation value greater than 0.8 indicates presence of Multicollinearity (Ongore, 2008).

3.10 Normality Test

3.10.1 Test for Assumptions of Ordinary Least Squares

The assumptions of Ordinary Least Squares (OLS) method, that is, independence of the error terms, normality of the data, multicollinearity, linearity of the variables, and heteroscedasticity was tested using Durbin Watson test, skewness and kurtosis, Variance Inflation Factor (VIF), Pearson correlation coefficient, and White test respectively, so as to make the data amenable to regression analysis.

One-Sample Kolmogorov-Smirnov Test (KS) was conducted to test the normality of the dependent variable. The Kolmogorov-Smirnov test (also known as the K-S test or one sample Kolmogorov-Smirnov test) is a non-parametric procedure that determines whether a sample of data comes from a specific distribution, such as normal, uniform, Poisson, or exponential distribution. The null and alternative hypotheses are stated below.

H_o: The data is normally distributed (Not different from a normal distribution)

H_1: The data is not normally distributed (Different from a normal distribution)

The rule is that if the p-value is greater than 0.05 (Not significant), H_o is not rejected and H_1 is rejected, if the p -value is less than 0.05 (Significant), H_o is rejected and H_1 is not rejected.

3.10.2 Hypothesis testing

The hypothesis was tested by running an ordinary least square regression model for the combined sub-constructs of each independent variable against the combined measures of the dependent variable. The acceptance/rejection criteria was that, if the p value is greater than 0.05, the null hypothesis was not rejected but if it is less than 0.05, the null hypothesis was rejected.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

This chapter comprises of data analysis and findings on the basis of which further analysis was undertaken to test the study hypotheses and interpretation. The chapter presents the response rate, pilot study results, descriptive statistics that is mean and standard deviation, findings of data diagnostics namely: reliability, normality and multicollinearity tests, inferential statistics was done through correlation and regression analysis, Results were presented in tables and diagrams. The analyzed data was arranged under themes that reflect the research objectives. The study findings were compared with the findings of previous studies and the implications established.

4.2 Response Rate

The results for response rate are as indicated in Table 4.1. The number of questionnaires that were administered was 117. A total of 108 questionnaires were filled and returned.

Table 4.1: Response Rate

Response	Frequency	Percent
Returned	108	92.30
Unreturned	9	7.70
Total	**117**	**100**

As shown in Table 4.2, this was an overall successful response rate of 92.3 percent. They fit with Kothari's argument (2004) that for a descriptive study a response rate of 50 percent or more is adequate. Babbie (2004) also claimed that 50 percent return rates are acceptable for analyzing and publishing, 60 percent is good, and 70 percent

is very good. 92.3 percent response rate is adequate for the study based on these assertions made by renowned scholars.

A personal introduction letter, an introduction letter obtained from Jomo Kenyatta University and persistent follow up by the researcher through reminder emails and phone calls, facilitated the high response rate.

4.3 Demographic Characteristics

This section analyzes the demographic characteristics of the respondents. This section presents the descriptions of the respondents in terms of their age, academic qualification and years of experience captured as the duration of working for the commercial bank.

4.3.1Years of experience

The respondents were asked to indicate the period they had worked for the commercial banks. The results are as presented in Figure 4.1.

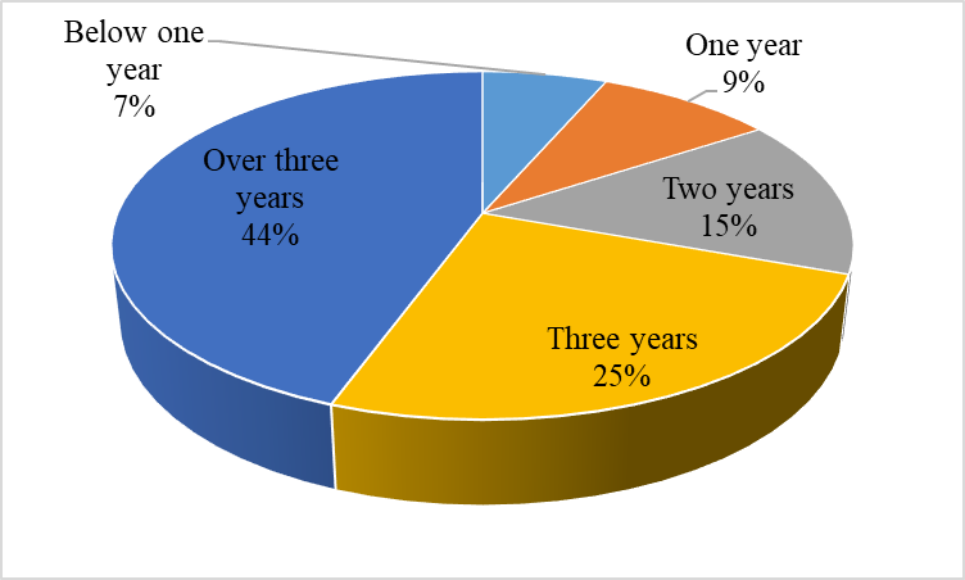

Figure 4. 1:Years of Experience

Results in Figure 4.1 reveal that 31% of the respondents had worked for the commercial banks for a period of 2 years or less, 25% had worked for a period of three years and those who had worked for over three years were 44%. This implies that the rate of turnover in the banking sector in Kenya is low. The findings also imply that the respondents had more experience and information and were eligible to respond to the questionnaires. This improved the reliability of the information given.

These findings agree with the findings of a study by Bunderson& Sutcliffe (2002) that as people gain more experience in an industry, the rate of turnover decreases. As employees increase their experience, so do they reduce the turnover rate. Tenure increases, the breadth of knowledge, perspectives, experience, and capabilities that the overall team can bring to bear in a decision situation and because of this, there is reduced turnover rate. The findings also agree with the argument by (Carpenter et al., 2004) that labor experience in a company leads to low turnover.

4.3.2 Age of Respondents

The respondents were also asked to indicate their age. The results are presented in Figure 4.2.

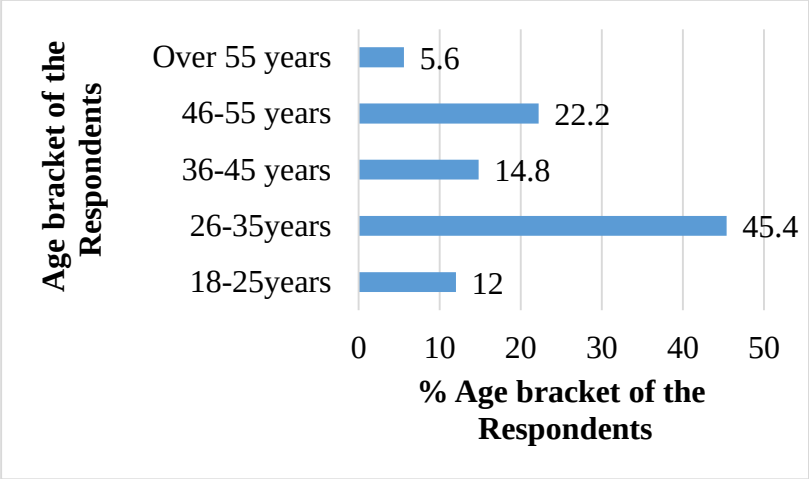

Figure 4. 2:Age bracket of the Respondents

Figure 4.2 shows that 5.6% of respondents were over 55 years of age, 22.2% were between 46 and 55 years of age, while those between 36 and 45 years of age were 14.8%. Most of the respondents, 45.4%, were between 26 and 35 years. This implies that majority of the dealers; treasurers and senior dealers are aged between 26 and 35 years.

4.3.3 Academic qualification

The respondents were asked to indicate their level of education. The results are presented in Figure 4.3.

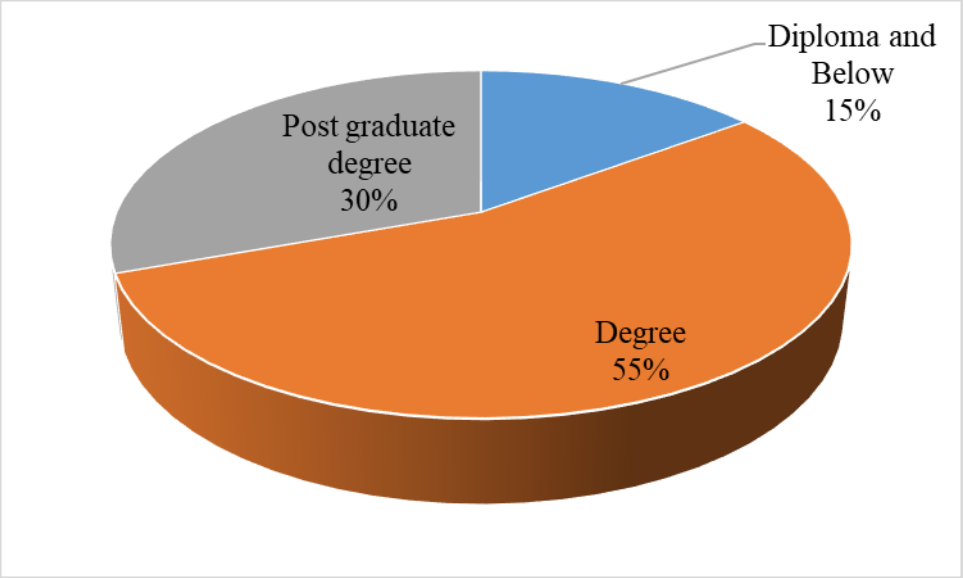

Figure 4.3: Academic Qualification

Results in Figure 4.3 reveal that only 15% of the respondents had education up to the diploma level or below, 30 % indicated that they had a postgraduate level of education while majority, 55% of the respondents indicated that they had attained a degree level of education.

This implies that dealers, senior dealers and treasurers at commercial banks in Kenya are educated. It also implies that majority of the respondents (59%) had university qualification, and a few others had diploma level of education as well as post graduate degree. The education level can also be linked to high quality of

information regarding the financial derivatives markets as indicated by a high reliability of the pilot results.

The findings agree with the findings of researchers (Kinuu *et al*, 2012; Kasomi, 2015) who have linked high educational attainment with greater knowledge and skills as well as the findings of a study by Carpenter and Fredrickson (2013) who noted that one of the socio-cognitive capacities related to educational level is greater information-processing abilities.

4.4 Descriptive results

The respondents were asked to indicate their level of agreement or disagreement with statements on all the study variables. The results were rated on a five point Likert scale ranging from strongly disagrees to strongly agree. A mean response was used to establish the score. Standard deviation was also established to show the variation in the responses. The results are discussed per objective as indicated.

4.4.1 Descriptive Statistical Results for Statements on Market Immediacy

The respondents were requested to indicate their level of agreement or disagreement with statement concerning market immediacy. The results are as presented in Table 4.2.

Table 4.2: Descriptive results for Market Immediacy

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Interest rate forwards Market has a large number of market makers.	108	3.4352	.91991	-.613	.233	-.664	.461
Interest rate forwards Market has many market participants.	108	3.3519	.98886	-.464	.233	-1.132	.461
In the Interest rate forwards Market we work continuously without any break	108	3.4074	.96709	-.585	.233	-.939	.461
Quotes are available on the Interest rate forwards Market	108	3.4259	1.01580	-.558	.233	-.831	.461
Valid N (listwise)	108						

The interpretation for standard deviation was that a value above 0.5 is considered high, a large variation in the responses.

The results in Table 4.2 show that the statement implying that Interest rate forwards Market has a large number of market makers recorded a mean score of 3.4352. This score was higher than the neutral mean score of 3.0. The skewness was = -0.413 with a standard error of 0.461, giving a value for skewness of -0.413 /0.461 = -0.89587. Kurtosis is -0.664 with a standard error of 0.293, giving a value of -0.613/0.461 = -1.329718. The rule is that if either or both the skewness and kurtosis of these values

is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0. This implied that on average the majority of the market makers thought that interest rate forwards market has a large number of market makers. The implication was that the large number of market makers in the forwards market helped minimize the risk associated with interest risk.

The study also found that the statement stating that interest rate forwards market has many market participants recorded a mean score of 3.3519. This score was higher than the neutral mean score of 3.0. This implied that according to most of the market makers, interest rate forwards market has many market participants. The skewness was = -0.464 with a standard error of 0.461, giving a value for skewness of -0.464 /0.461 = -1.0065. Kurtosis is -1.132 with a standard error of 0.461, giving a value of -1.132/0.461 = -2.45553. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0. The market makers play an important role in the secondary market as catalysts, particularly for enhancing stock liquidity and, therefore, for promoting long-term growth in the market. The presence of many market participants helps minimize the interest rate risk. According to Hill (2018), the presence many market participants facilitates a smooth flow of the financial markets.

The statement implying that in the interest rate forwards market, the market markers worked continuously without any break recorded a mean score of 3.4074. This score was higher than the neutral mean score of 3.0. The implication was that the flow of work was neither high nor low. Thus showing that the interest rate forwards market was not much volume of work. This also means that market makers were not committed to work in the interest rate forwards market. This was worrisome, given that as Kenton (2018) states, the market maker's commitments include continuously quoting prices at which it will buy or bid, and sell or ask for securities.

The statement suggesting that Quotes are available on the interest rate forwards market recorded a mean score of 3.4259. This mean-score value was higher than the neutral mean score value of 3.0. This implied that according to most of the market makers, quotes were available on the interest rate forwards market. The usefulness and available of quotes cannot be ignored. Kenton (2018) asserted that for a quote for specific stock provides information, such as its bid and ask price, last-traded price and volume traded.

For all the items the skewness value was between -0.613 and -0.464. When divided by the standard error of 0.461, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.132 and –0.664. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0.

Table 4. 3: Descriptive results for Market Immediacy

	N	Mean	Std. Deviation	Skewness		Kurtosis	
			Statistic	Stat	Std. Error	Stat	Std. Error
Interest rate swaps Market has a large number of market makers.	108	3.4815	.99983	-.520	.233	-.846	.461
Interest rate swaps Market has many market participants.	108	3.2778	.94556	-.383	.233	-1.146	.461
In the Interest rate swaps Market we work continuously without any break	108	3.5278	1.01814	-.564	.233	-.812	.461
Quotes are available on the Interest rate swaps Market	108	3.4352	.90969	-.829	.233	-.682	.461
Valid N (listwise)	108						

The interpretation for standard deviation was that a value above 0.5 is considered high, a large variation in the responses.

The findings in Table 4.3 show that the statement implying that interest rate swaps market has a large number of market makers recorded a mean score of 3.7315. This mean score value was higher than the neutral mean score value of 3.0. This implied that according to the majority of the market makers quite a big proportion of market makers focused on interest rate swaps market.

The statement implying that the interest rate swaps market has many market participants recorded a mean score of 3.2778. This mean score value was higher than the neutral mean score value of 3.0. The implication was that there was a high presence of market participants within the interest rate swaps market.

The implication of this statement underscored the fact that market makers work endlessly with no any break in the Interest rate swaps market recorded a mean score of 3.5278. This score was higher than the neutral score at 3.0. This implies that according to majority of the market makers did work continuously in the interest rate swaps market.

For all the items the skewness value was between -0.829 and -0.383. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.146 and -0.682. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0.

Table 4.4: Descriptive results for Market Immediacy

Interest rate options Market	N	Mean	Std. Deviation	Skewness		Kurtosis	
			Statistic	Statistic	Std. Error	Statistic	Std. Error
Has a large number of market makers.	108	3.3704	.99148	-.512	.233	-1.112	.461
Has many market participants.	108	3.4074	.96709	-.585	.233	-.939	.461
We work continuously without any break	108	3.3519	.98886	-.464	.233	-1.132	.461
Quotes are available on the Interest rate options Market	108	3.4074	.96709	-.585	.233	-.939	.461

The interpretation for standard deviation was that a value above 0.5 is considered high, a large variation in the responses.

The findings in Table 4.4 show that the statement implying that interest rate options market has a large number of market makers recorded a mean score of 3.3704. This score was higher than the neutral score at 3.0. This implied that on average most of the market makers felt that interest rate forwards market has a large number of market makers.

The statement implying that Interest rate options market has many market participants recorded a mean score of 3.4074. This score was higher than the neutral score at 3.0. This implied that according to most of the market makers, interest rate options market has many market participants.

A mean score of 3.3519 was recorded in the statement that market makers work continuously without breaking off from the interest rate options market. The 3.3519

mean score exceeded the neutral score 3.0 neutral score. This implied that they continued working on the interest rate options market, as per the market makers.

The findings in Table 4.4 revealed that the statement showing that access to both buy and sell orders waiting to be executed by participants on the interest rate option market recorded an average score of 3.4074. The recorded mean score was higher than the neutral value at 3.0. This implied that quotes are available on the interest rate options market according to most of the market makers. For all the items the skewness value was between -0.585 and -0.464. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.132 and -0.939. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0.

The finding are in line with the argument by PricewaterhouseCoopers (2015) who indicated that the proportion of zero working days as a percentage of days on which clearing exists remained around 70%. Quotes are obtainable on the Interest rate forwards, as well as on swaps and options Market, interest rate swaps market has a large number of market makers, interest rate swaps, options and forwards market has many market participants.

According to the Federal Reserve Bank New York (2012), the market composition as well as trading relationship of interest rate derivatives consists of trading activity separated from market participants. These participants traded with more than one dealer mostly with several dealers which is similar to the findings on market participants of this study.

4.4.2 Descriptive Statistical Results for Statements on Market depth

The respondents were requested to indicate their level of agreement or disagreement with statement concerning market depth. The results are as presented in Table 4.5.

Table 4. 5: Descriptive results for Market Depth

	N	Mean	Std. Deviation	Skewness		Kurtosis	
			Stat	Stat	Std. Error	Statistic	Std. Error
On the interest rate forwards market							
Participants access a list of buy and sell orders organized by price levels and updated to reflect market activity.	108	3.3241	1.00307	-.409	.233	-1.229	.461
Participants access both buy and sell orders waiting to be executed.	108	3.3519	1.10492	-.188	.233	-1.343	.461
Participant access the bid and asks on either side of the market.	108	3.2870	.92777	-.249	.233	-1.236	.461
Participants access a list of buy and sell orders organized by price levels and updated to reflect market activity.	108	3.3981	.95643	-.617	.233	-.942	.461

The findings in Table 4.5 show that the statement implying that on the interest rate forwards market participants access a list of buy and sell orders organized by price levels and updated to reflect market activity recorded a mean score of 3.3241. The mean score value was higher than the neutral mean score value of 3.0. This implied that according to most of the market makers market participants access a list of buy and sell orders organized by price levels and updated to reflect market activity.

The statement implying that on the interest rate forwards market, participants are able to access both buy and sell orders waiting to be executed recorded a mean score

of 3.3519. This means that the score value was higher than the neutral mean score value of 3.0. The implication was that participants access both buy and sell orders waiting to be executed, according to most market makers, with regards to this market.

The statement asserting that on the interest rate forwards market participant access the bid and asks on either side of the market recorded a mean score of 3.2870. This value was higher than the set neutral mean score at 3.0. The implication was that according to most of the respondents (market makers), market participant access the bid and asks on either side of the market.

The same arguments can be put forward in respect to the Interest Rate swap market, where the statements in Table 4.5 scored as follows. Market participants access a list of buy and sell orders organized by price levels and updated to reflect market activity recorded a mean score of 3.3981. Market participants access both buy and sell orders waiting to be executed, recorded a mean score of 3.1759 and Market participants' access the bid and asks on either side of the market (3.4167). All these statements recorded a mean score above the 3.0 neutral mean score showing that most of the market makers were in agreement with the assertions of the selected dimensions of market depth.

All the items recorded a skewness value between -.617 and -0.107. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.476 and -0.881. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the hypothesis of normality is discarded. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0.

Table 4.6: Descriptive results for Market Depth

	N	Mean	Std. Deviation	Skewness	Kurtosis

			Stat	Stat	Std. Error	Stat	Std. Error
Participants' access a list of buy and sell orders organized by price levels and updated to reflect market activity.	108	3.3148	.93377	-.392	.233	-.985	.461
Participants' access both buy and sell orders waiting to be executed.	108	3.1944	1.02728	-.190	.233	-1.488	.461
Participant's access the bid and asks on either side of the market.	108	3.3704	.93321	-.598	.233	-.937	.461
Valid N (listwise)	108						

The interpretation for standard deviation was that a value above 0.5 is considered high, a large variation in the responses.

The findings in Table 4.6 show that the statement implying that on the interest rate option market participants' access a list of buy and sell orders organized by price levels and updated to reflect market activity, recorded a mean score of 3.1944. This score was higher than the neutral score at 3.0. This implied that on average most of the market makers on this market, felt that participants' access a list of buy and sell orders organized by price levels and updated to reflect market activity.

The statement implying that on the interest rate option market participants' access both buy and sell orders waiting to be executed, recorded a mean score of 3.4074. This score was higher than the neutral score at 3.0. This implied that according to the market makers, participants' access both buy and sell orders waiting to be executed. The statement implying that on the interest rate option market

participant's access the bid and asks on either side of the market recorded a mean score of 3.3704. This mean score was higher than the neutral score at 3.0. The implication was that according to the market makers, participant's access the bid and asks on either side of the market.

All the items recorded a skewness value between -0.598 and -0.190. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.488 and -0.985. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0.

The study findings in Table 4.5 indicated that on the interest rate forwards and swaps market participant's access both buy and sell orders waiting to be executed. Furthermore, on the interest rate forwards and options, market participants access the bid and ask on either side of the market. Majority of the respondents disagreed that on the interest rate option market participants' access a list of buy and sell orders organized by price levels and updated to reflect market activity.

Descriptive results for Market Depth (Interest Rate Option Market) show that all indicators had a value slightly higher than the 3.0 neutral value, with distribution of scores within the normal range. This can be construed to mean that the market in commercial banks had aspects that made interest rate management tenable.4.3.3 Descriptive Statistical Results for Statements on Market Breadth

The respondents were requested to indicate their level of agreement or disagreement with statement concerning market breadth. The results are as presented in Table 4.7.

Table 4. 7: Descriptive results for Market Breadth

	N	Mean	Std. Deviation	Skewness		Kurtosis	
			Statistic	Statistic	Std. Error	Statistic	Std. Error
Interest rate forward Market has numerous orders	108	3.0278	.99022	.120	.233	-1.409	.461
Interest rate forward Market has large in volume orders.	108	3.1667	.90171	-.104	.233	-.981	.461
Interest rate swap Market has numerous orders.	108	3.2407	.90554	-.268	.233	-.980	.461
Interest rate swap Market has large in volume orders.	108	2.9907	1.05454	-.079	.233	-1.179	.461
Interest rate options Market has numerous orders.	108	3.2593	.92089	-.323	.233	-1.047	.461
Interest rate options Market has large in volume orders.	108	3.2222	.93061	-.248	.233	-1.123	.461
Valid N (listwise)	108						

The findings in Table 4.7 show that the statements relating to the Interest rate forward Market recorded the following mean scores. Interest rate forward Market has numerous orders (3.0278), and Interest rate forward Market has large in volume orders (3.1667). All the indicators had a slightly higher value than the neutral mean score at 3.0. The implication is that according to most of the market makers the interest rate forward market has numerous orders and large in volume orders.

The findings in respect to the interest rate swap market shows that the mean scores were as follows. Interest rate swap market has numerous orders (3.2407), a value higher than the neutral mean score at 3.0. Interest rate swap market has large in volume orders (2.9907), a value lower than the neutral mean score at 3.0. This market had numerous orders and not so large in volume orders.

The findings in respect to the interest rate options market shows that the mean scores were as follows. Interest rate options Market has numerous orders (3.2593) and Interest rate options Market has large in volume orders (3.2222). All the indicators had a slightly higher value than the neutral mean score at 3.0. This implied that according to most of the respondents (market makers), the interest rate options market has numerous orders and large in volume orders.

All the items recorded a skewness value between -0.323 and -0.079. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.409 and -0.980. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0. 4.3.4 Descriptive Statistical Results for Statements on Market resiliency

The respondents were also requested to indicate their level of agreement or disagreement with statement concerning market resiliency. The results are as presented in Table 4.8.

Table 4. 8: Descriptive results for Market resiliency

	N	Mean	Std. Deviation	Skewness		Kurtosis	
			Statistic	Stat	Std. Err	Stat	Std. Error
Market participants' access published quotes and orders for interest rate forwards.	108	3.2130	1.03265	-.181	.233	-1.438	.461
Buyers and sellers are present in the interest rate forwards.	108	3.5093	1.08942	-.378	.233	-1.103	.461
Buyers and sellers are present in interest rate swaps market.	108	3.3148	.94373	-.333	.233	-.977	.461
Market participants' access published quotes and orders in interest rate swaps market.	108	3.2593	.98939	-.249	.233	-1.234	.461
There is presence of buyers and sellers of interest rate options in the market.	108	3.4722	1.05422	-.413	.233	-1.049	.461
Published quotes and orders can be accessed by market participants in interest rate options	108	3.3611	.99961	-.438	.233	-1.127	.461
Buyers and sellers are present in interest rate options market.	108	3.3148	.94373	-.265	.233	-1.220	.461
Valid N (listwise)	108						

The findings in Table 4.8 shows that the statements relating to the market resiliency recorded the following mean scores. The findings show that the statements implying that market participants' access published quotes and orders recorded mean scores above 3.0 in the three markets (interest rate forwards, interest rate swaps market and interest rate options). The same was the case with the presence of buyers and sellers in three markets.

The implication is that according to most of the market makers, had access to published quotes and interest rate forward orders by market participants, access to published quotes and interest rate options orders, published quotes and interest rate swap orders.. Most of the market makers agreed that there is presence of buyers and sellers of interest rate swaps, and presence of buyers and sellers of interest rate options in the market.

In addition, all the items recorded a skewness value between -0.438 and -0.181. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.438 and -0.977. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0. Therefore, the distribution was normal.

4.4.5 Descriptive Statistical Results for Statements on Market Tightness

The respondents were also requested to indicate their level of agreement or disagreement with statement concerning market tightness. The results are as presented in Table 4.9.

Table 4. 9: Descriptive results for Market Tightness

	N	Mean	Std. Devi	Skewness		Kurtosis	
				Stat	Std. Er	Stat	Std. Er
Interest Rate Forwards Market							
Order processing costs are a source of bid-ask spread	108	3.620	.78201	-1.246	.233	-1.015	.461
Inventory costs are a source of the bid-ask spread	108	3.796	.72032	-1.507	.233	-1.801	.461
Bid-ask spread is influenced by asymmetric information	108	3.435	.93001	-.766	.233	-.752	.461
Interest Rate Swap Market							
Order processing costs is the only source of the bid-ask spread	108	3.194	.93187	-.400	.233	-1.117	.461
Inventory costs is the sole source of the bid-ask spread	108	3.232	.90281	-.478	.233	-.901	.461
Bid-ask spread is influenced by asymmetric information	108	3.194	.90128	-.397	.233	-.946	.461
Source of the bid-ask spread is only order processing costs	108	3.1759	.92553	-.360	.233	-1.106	.461
Inventory cost is the sole source of the bid-ask spread	108	3.3426	.83344	-.719	.233	-.195	.461
Bid-ask spread is influenced by asymmetric information	108	3.4444	.81267	-.882	.233	-.176	.461
Valid N (list wise)	108						

Table 4.9 shows that the statements relating to the market tightness on the interest rate forwards market recorded the following mean scores. Source of the bid-ask spread is only order processing costs (3.620) inventory costs are the source of the spread bid-ask spread (3.796), and asymmetric information is the sole source of the bid-ask spread (3.435). All the three indicators had a higher value than the neutral mean score at 3.0. The implication is that according to most of the market makers order processing costs, asymmetric information and inventory costs were all sources of the spread bid-ask spread in commercial banks in Kenya.

The findings in Table 4.9 show that the statements relating to the market tightness on the interest rate swap market recorded the following mean scores. Order processing costs is the only source of the bid-ask spread (3.194), inventory costs is the sole source of the bid-ask spread (3.232) and bid-ask spread is influenced by asymmetric information (3.194). All the three indicators had a higher value than the neutral mean score at 3.0. The implication is that according to most of the market makers order processing costs, asymmetric information and inventory costs were all sources of the spread bid-ask spread in commercial banks in Kenya.

All the items recorded a skewness value between -1.507 and -0.360. When the skewness value is divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.801 and -0.176. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0. Therefore, the distribution was a normal distribution.

4.4.6 Descriptive Statistical Results for Statements on Financial Derivatives Used to Manage Interest Rate Risk

The dependent variable of the study was financial derivatives used to manage interest rate risk. The respondents were requested to rate statements on financial derivatives

used to manage interest rate risk on a scale of 1 to 5. The descriptive results are presented in Table 4.10.

Table 4.10: Descriptive results of Financial Derivatives Used to Manage Interest Rate Risk

Interest rate swaps	N	Mean	Std. Deviation	Skewness		Kurtosis	
			Statistic	Stat	Std. Error	Stat	Std. Error
The bank uses financial derivatives to Swap from fixed rate to floating rate debt	108	3.2778	1.01238	-.199	.233	-1.216	.461
The bank uses financial derivatives to swap from floating rate to fixed rate debt	108	3.3148	.93377	-.462	.233	-1.042	.461
The bank uses financial derivatives to Fix in advance the rate (spread) on new debt	108	3.2963	.93987	-.354	.233	-1.035	.461
The bank uses interest rate options that are exercised only on the expiry date of the	108	3.4074	.89690	-.667	.233	-.678	.461
The bank uses interest rate options that the purchaser has the right to exercise the option at any time before and on the expiry date of the contract.	108	3.4259	.93931	-.471	.233	-.731	.461
The bank uses interest rate options that are exercised only on the pre-specified dates for the duration of the contract.	108	3.2685	.93335	-.353	.233	-1.099	.461
Valid N (list wise)	108						

The findings in Table 4.10 shows that the statements relating to financial derivatives used to manage interest rate risk recorded the following mean scores. The bank uses financial derivatives to swap from fixed rate to floating rate debt (3.2778), the bank uses financial derivatives to swap from floating rate to fixed rate debt (3.3148), and

the bank uses financial derivatives to fix in advance the rate (spread) on new debt (3.2963). All the items had a slightly higher value than the neutral mean score at 3.0. This shows that most of the respondents agreed that Financial Derivatives were used to swap from fixed rate to floating rate debt, to swap from floating rate to fixed rate debt and to fix in advance the rate (spread) on new debt.

All the items recorded a skewness value between -0.462 and -0.199. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.216 and -1.035. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0.

Table 4.11 shows that the statements showing the use of interest rate options to manage interest rate risk recorded the following mean scores. The bank uses interest rate options that are exercised only on the expiry date of the contract (3.4074). The statement stating that the bank uses interest rate options that the purchaser has the right to exercise the option at any time before and on the expiry date of the contract recorded a mean score of 3.4259. The statement implying that the bank uses interest rate options that are exercised only on the pre-specified dates for the duration of the contract recorded a mean score of 3.2685.

All the items had a slightly higher value than the neutral mean score at 3.0. This implied that most of the market makers observed that the bank was using interest rate options that are exercised only on the expiry date of the contract; and that the purchaser has the right to exercise the option at any time before and on the expiry date of the contract. Most of the market makers had observed that the use of interest rate options that are exercised only on the pre-specified dates for the duration of the contract.

All the items recorded a skewness value between -0.667 and -0.353. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case

with Kurtosis, whose scores range between -1.099 and -0.731. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0.

4.4.7 Descriptive Statistics for Electronic Trading Platforms

This section presents the descriptive statistics related to respondents understanding and perception of electronic trading platforms as a moderating variable in the relationship between market liquidity and the management of interest rate risk using financial derivatives.

4.4.7.1 Awareness of the functioning of Electronic Trading Platforms

The respondents were asked to indicate whether or not they were aware of the three main electronic platforms: Bloomberg, Citivelocity and Autobahn electronic trading platforms and the response was as given in Figure 4.4.

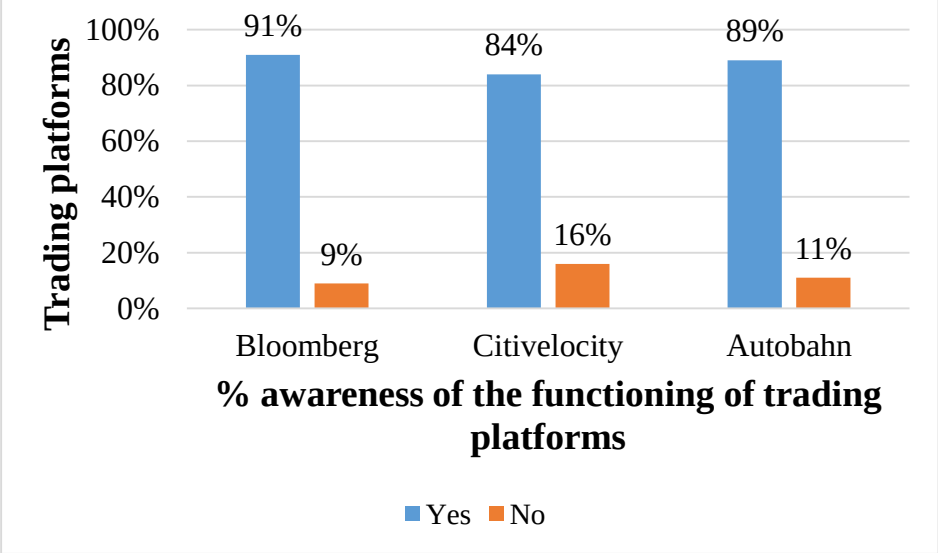

Figure 4. 4: Awareness of the functioning of Electronic Trading Platforms

Table 4. 11: Awareness of the functioning of Electronic Trading Platforms

Trading Platform	Yes		No		Total %
	Frequency	Percentage	Frequency	Percentage	
Bloomberg	98	91	10	9	100
Citivelocity	91	84	17	16	100
Autobahn	96	89	12	11	100

The findings in Table 4.11 and Figure 4.4 show that majority of the respondents were aware of the functioning of Electronic Trading Platforms. Bloomberg registered highest level of awareness among the market makers followed closely by the awareness levels of Citivelocity and Autobahn electronic trading platforms.

4.4.7.2 Experience of Market Makers on the Moderating Aspect of electronic trading platforms

The respondents were asked to indicate whether or not electronic trading platforms influenced the effectiveness of market liquidity in the management of interest rate risk using financial derivatives. The response was as provided in Table 4.12.

Table 4. 12: Electronic Trading Platforms affects the Efficacy of Market Liquidity

Response	Frequency	Percentage
Yes	101	94
No	7	6%
Total	108	100%

The findings in Table 4.14 shows that according to majority of the market makers (94%), electronic trading platforms influenced the effectiveness of market liquidity in the management of interest rate risk using financial derivatives. This implied that the type of electronic trading platform determined how market liquidity dimensions were influencing the management of interest rate risk using financial derivatives.

4.5 Correlations

Kothari (2014) states that the importance of correlation is to determine the extent to which changes in the value of an attribute is associated with changes in another attribute. According to Kothari (2014), the correlation coefficient can range from -1 to +1, with -1 indicating a perfect negative correlation, +1indicating a perfect positive correlation, and 0 indicating no correlation at all. A linearity test was conducted as evidenced by the Pearson Correlation Coefficient, which is an indicator of correlation between two variables. The composite (single) value for interest rate risk management using financial derivatives was arrived at after computing the means of the means for the statements used in section 4.3 descriptive. The summarized results are presented in Table 4.13 while the details were as presented in Appendix VI.

Table 4. 13: Correlation between Market Liquidity Dimensions on the use of Financial Derivatives in Interest Rate Risk Management

		Interest Rate risk management using Financial Derivatives
Market Immediacy	Pearson Correlation	.216**
	Sig. (2-tailed)	0.001
	N	108
Market Depth	Pearson Correlation	.293**
	Sig. (2-tailed)	0.002
	N	108
Market Depth	Pearson Correlation	.293**
	Sig. (2-tailed)	0.002
	N	108
Market Breadth	Pearson Correlation	.370**
	Sig. (2-tailed)	0
	N	108
Market Resiliency	Pearson Correlation	.344**
	Sig. (2-tailed)	0
	N	108
Market Tightness	Pearson Correlation	.345**
	Sig. (2-tailed)	0
	N	108

The findings in Table 4.13 show that the Pearson correlation results between Market Immediacy and Interest Rate risk management using financial derivatives were as follows. There was a positive correlation between market immediacy and risk management of interest rates ($r = 0.216^*$, $p = 0.001$). This demonstrates that market immediacy and interest rate risk management were associated. Given that, the p value (0.001), was less than the test significance level ($p < 0.05$), this relationship is statistically significant. The responses were aslso presented according to the category of respondents in Table 4.14.

Table 4. 14: Correlation results according to Type of Respondents

Correlations[a]		**Financial Derivatives**		
		Teasurers	Senior Dealers	Dealers
Market Liquidity	Pearson Correlation	.404*	.335*	-0.157
	Sig. (2-tailed)	0.015	0.045	0.359
	N	36	36	36
Market Resiliency	Pearson Correlation	.647**	.594**	-0.186
	Sig. (2-tailed)	0.000	0.000	0.277
	N	36	36	36
Market Depth	Pearson Correlation	.565**	.526**	-0.181
	Sig. (2-tailed)	0.000	0.001	0.292
	N	36	36	36
Market Breadth	Pearson Correlation	.601**	.599**	-0.101
	Sig. (2-tailed)	0.000	0.000	0.559
	N	36	36	36
Market Tightness	Pearson Correlation	.415*	.407*	0.132
	Sig. (2-tailed)	0.012	0.014	0.443
	N	36	36	36

The results in Table 4.14 show that the respondents had varied opinions on the effect of the market liquidity dimensions on interest rate risk management using financial derivatives. The results from dealers created an impression that market liquidity, market resiliency, market depth, market breadth and market tightness did not have a positive effect on interest rate risk management using financial derivatives. This was contrary to the opinions of treasurers and senior dealers.

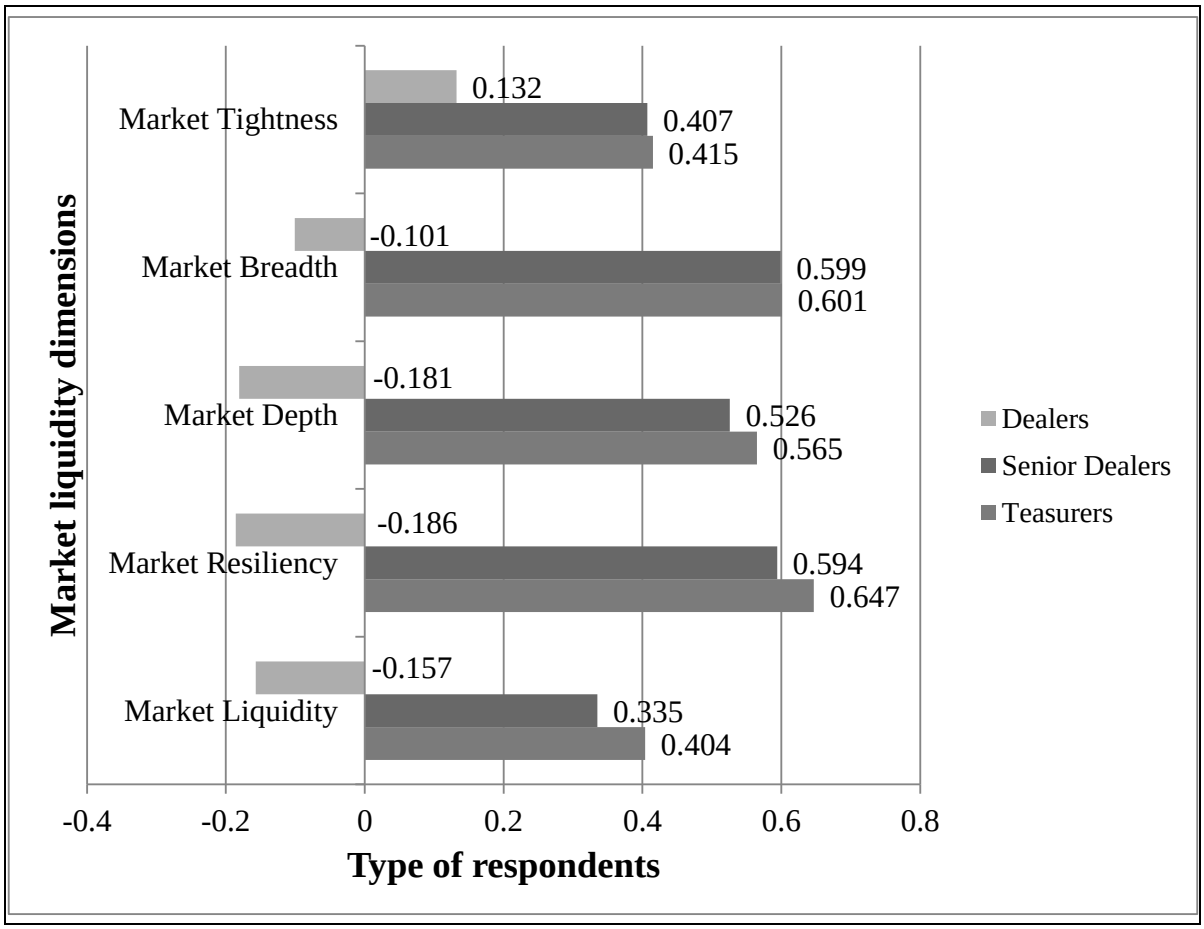

Figure 4. 5: Correlation results according to Type of Respondents

Table 4.14 provides the Pearson correlation results between market depth and interest rate risk management using financial derivatives. A positive correlation between market depth and interest rate risk management was found ($r = 0.293^*$, $p = 0.002$). This shows that market depth and interest rate risk management were associated. Given that, the p value (0.000), was less than the test significance level ($p < 0.05$), this relationship is statistically significant.

Table 4.14 provides the Pearson correlation results between market breadth and interest rate risk management using financial derivatives. There was a positive Pearson correlation between market breadth and interest rate risk management using financial derivatives ($r = 0.370$, $p = 0.000$). This shows that there was an association between market breadth and interest rate risk management. Given that, the p value

(0.000), was less than the test significance level ($p < 0.05$), this relationship is statistically significant.

The finding in Table 4.14 reveal that there was a positive Pearson correlation between market resiliency and interest rate risk management using financial derivatives ($r = 0.344$, $p = 0.000$). This shows that there was an association between market resiliency and interest rate risk management. Given that, the p value (0.000), was less than the test significance level ($p < 0.05$), this relationship is statistically significant.

The finding in Table 4.14 shows that Market Tightness and interest rate risk management using financial derivatives had a positive Pearson correlation at ($r = 0.345$, $p = 0.000$). This shows that there was an association between market resiliency and interest rate risk management. Given that, the p value (0.000), was less than the test significance level ($p < 0.05$), this relationship is statistically significant. The results showing comparison of correlations for all the scores was as provided in Figure 4.5.

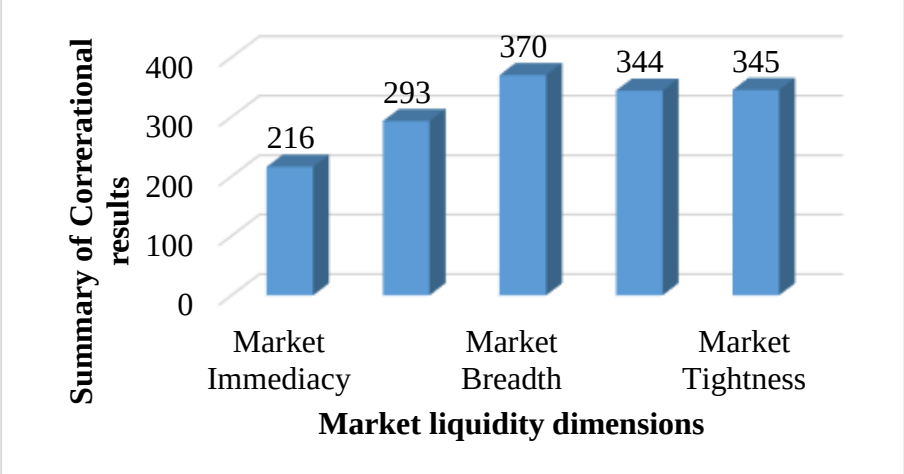

Figure 4. 6: Summary of Correlational Results

From the findings in Figure 4.5, it emerges the correlation between market resiliency and interest rate risk management using financial derivatives was the highest at 0.370

in commercial banks in Kenya. The correlation between market immediacy and interest rate risk management was the lowest at 0.216. The second aspect was market tightness, followed by market resiliency and then market depth. The findings show that interest rate risk management was largely a function of the sum total of firms competing actively in the market. The number of market participants influenced interest rate changes and so was the risk associated.

4.6 Regression Analysis

To determine the relationship between the independent and dependent variables, multiple regression was calculated and the results are presented in this section. . The independent variables of the study were market immediacy, market resiliency, market depth, market breadth and market tightness. The dependent variable was Interest Rate risk management using Financial Derivatives.

Table 4. 15: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
.476[a]	.226	.189	.71872	.476[a]

a. Predictors: (Constant), Market Tightness, Market Resiliency, Market Breadth, Market Immediacy, Market Depth

In the Model Summary table, the R Square value shows the amount of variance in the dependent variable that the independent variables explain. In Table 4.15 shows that, the independent variable of Market Tightness, Market Resiliency, Market Breadth, Market Immediacy, Market Depth accounts for 18.9 per cent of the variability in Interest Rate risk management using Financial Derivatives. The R-value (.476) is the multiple coefficients of correlation between all the independent variables entered and the dependent variable. As the number of variables increases, the Adjusted R Square adjusts for a bias. The Std. Error of the Estimate is a measure of the accuracy of the prediction.

Table 4. 16: Model Summary including Electronic Trading Platforms

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.478a	.228	.183	.72131

a. Predictors: (Constant), Electronic Trading Platforms, Market Resiliency, Market Tightness, Market Breadth, Market Immediacy, Market Depth

When introducing the moderating variable, Electronic Trading Platforms, we note that the R Square increases from 18.9 percent to 22.8 percent. The interpretation of Table 4.16 was that Electronic Trading Platforms is a significant influencer to the relationship between market liquidity dimensions and interest rate risk management using Financial Derivatives.

4.6.1 Analysis of Variances (ANOVA)

Kothari (2014) described ANOVA as a procedure for testing the difference among different groups of data for homogeneity. The findings in respect to the analysis of variances are as provided in Table 4.17.

Table 4. 17: Analysis of Variances (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.422	5	3.084	5.971	.000[b]
	Residual	52.689	102	.517		
	Total	68.111	107			

a. Dependent Variable: Interest rate risk management using financial derivatives

b. Predictors: (Constant), Market Tightness, Market Resiliency, Market Breadth, Market Immediacy, Market Depth

The findings in Table 4.17 show a p value of 0.000. This value is less than the test significant level at 0.05 (Coefficient level). This indicates that the combined effect of all the five independent variables on the dependent variable is statistically significant. This is also confirmed by the F-test whereby the calculated F = 5.971 is

less than the tabulated F (5, 102). The Beta Coefficients with respect to the relationship of the study variables are presented in Table 4.18.

Table 4. 18: Beta Coefficients and Model for the Commercial Banks

Model		Unstandardized Coefficients	Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1	(Constant)	2.032	.302	6.720	.000
	Market Immediacy	-.191	.127	-.216	-1.503	.136
	Market Depth	-.287	.188	-.325	-1.524	.131
	Market Breadth	.272	.126	.304	2.161	.033
	Market Resiliency	.376	.149	.454	2.524	.013
	Market Tightness	.271	.102	.289	2.659	.009

a. Dependent Variable: Interest rate risk management using financial derivatives

Y = Interest rate risk management using financial derivatives

X_1 = Market immediacy

X_2= Market depth

X_3 = Market breadth

X_4 = Market resiliency

X_5 = Market Tightness

The following regression model was used

$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 e$

From the findings, using standardized coefficients, it emerges that market resiliency has the greatest effect on Interest rate risk management using financial derivatives (Beta = 0.454, t = 2.524, p = 0.013). Second in order was market breadth (Beta = 0.304, t = 2.161, p = 0.033). The rest were as follows: Market Tightness (Beta = 0.289, t = 2.659, p = 0.009), Market Immediacy (Beta = -0.216, t = -1.503, p = 0.136), and Market Depth (Beta = -0.325, t = -1.524, p = 0.131). This is also

illustrated in the Histogram provided in Figure 4.7. The t value (t = 6.720, p < .05) for Constant tells us that the intercept is significantly different from zero. The t tests are performed to test the two-tailed hypothesis that the beta value is significantly higher or lower than zero. This also enables us to see which predictors are significant. Interestingly all the variables with (-ve) t values have p values that are higher than the test significant level at 0.05.

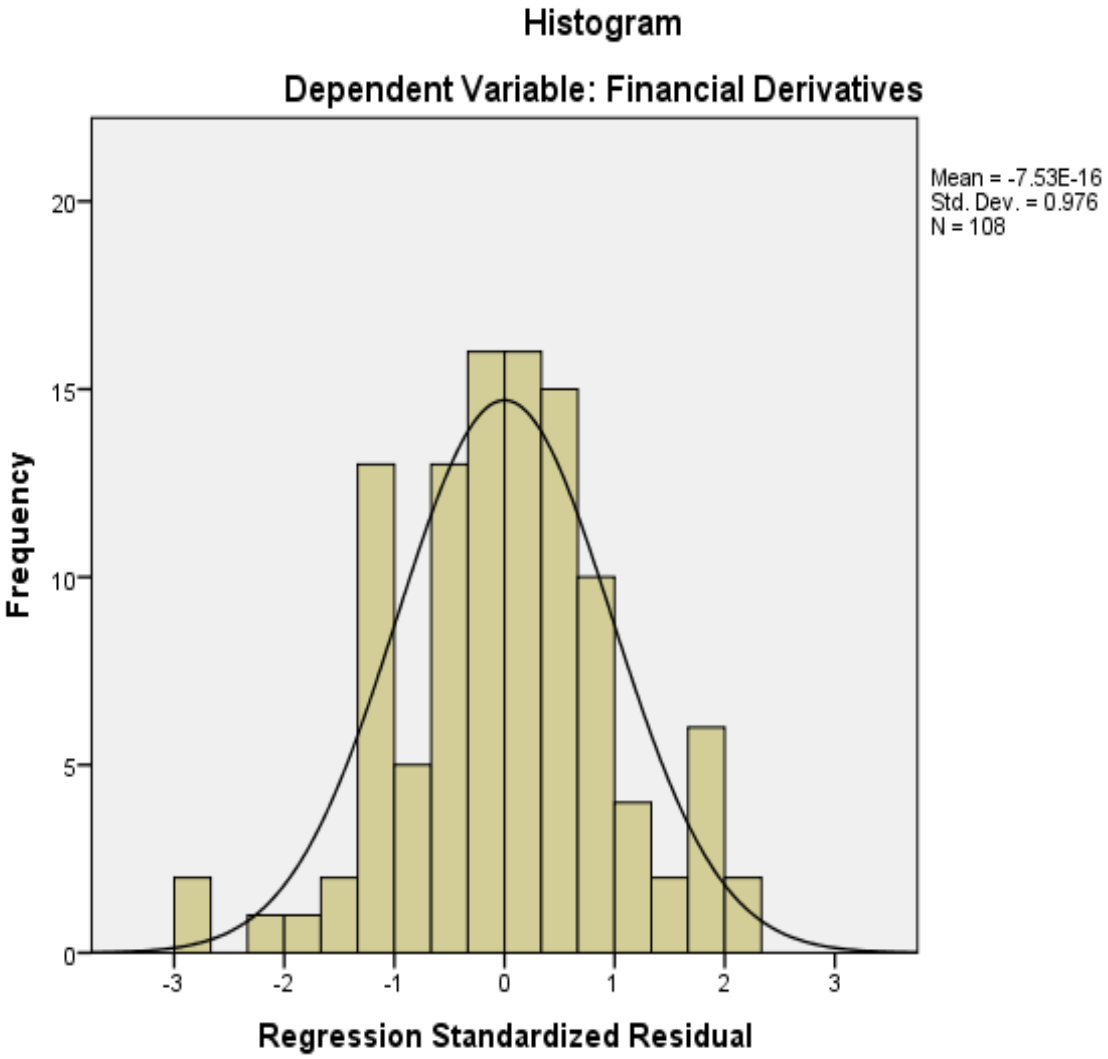

Figure 4: 1: Histogram

The histogram above depicts a normal distribution with the greatest center of distribution being 0 and all values being spread between -0.3 and 0.3. The histogram

output displays the mean, standard deviation, and number of participants (N). The mean amount of independent variables was 7.53 with a standard deviation of 0.973.

4.6.2 Multicollinearity Statistics all the Independent Variables

The results for the multicollinearity statistics all the independent variables were as presented in Table 4.19.

Table 4. 19: Multicollinearity Statistics all the Independent Variables

Model	Collinearity Statistics	
	Tolerance	VIF
Market Immediacy	.368	2.714
Market Depth	.167	6.002
Market Breadth	.384	2.602
Market Resiliency	.234	4.268
Market Tightness	.643	1.556

Table 4.19 checks for multicollinearity in our multiple linear regression model. The golden rule is that Tolerance should be > 0.1 (or VIF < 10) for all variables. The findings show that all the variables had a tolerance value between 0.234 and 0.643, while the VIF statistics ranged between 1.556 and 6.002. Variance Inflation Factor (VIF) is just the reciprocal of the tolerance statistics. A VIF of greater than 10 (ten) is generally considered evidence of Multicollinearity. Therefore, it can be concluded that there is no Multicollinearity in the data since; their respective VIF values obtained were between 1 and 10 (See Table 4.19. Normality of data was also indicated by PP plot of regression standardized residual (See Figure 4.7). Normality assumption states that if the plotted points are fairly close to the straight line drawn from the lower left to the upper right of the graph, then the distribution is normal.

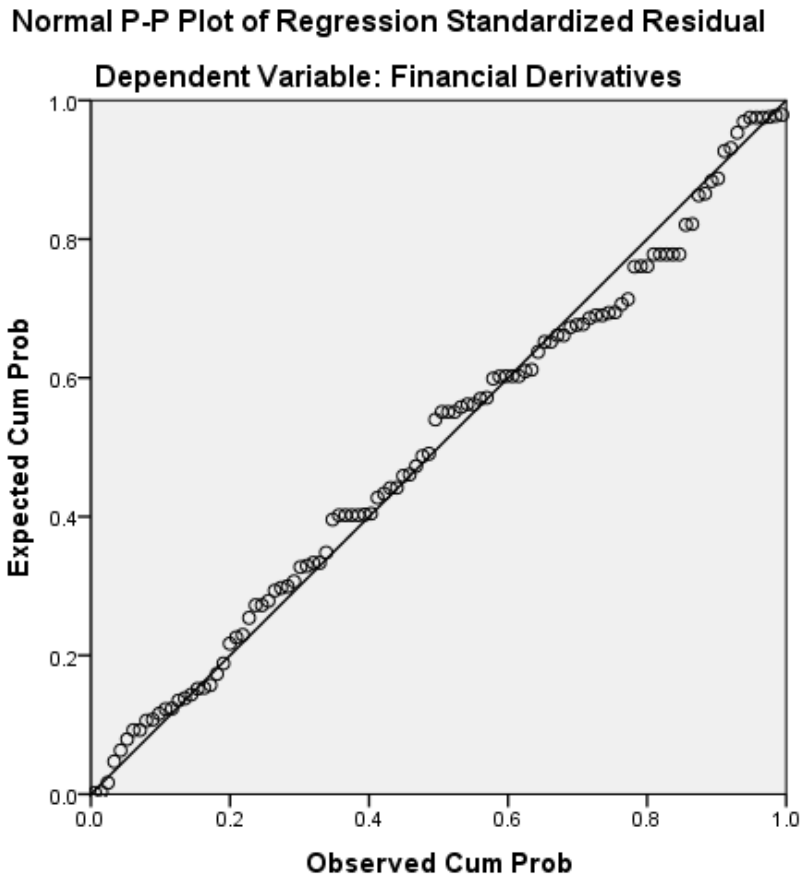

Figure 4. 7: P-P plot of Regression Standardized Residual

The points on this plot, which in this case are between 0.0 and 1.0, form a nearly linear pattern, which indicates that the normal distribution is a good model for this data set. The further the points vary from this line, the greater the indication of departures from normality. This was confirmed by test of normality.

4.6.2.1 Homoskedacity Testing

Figure 4.7 shows the results for the Homoskedacity Testing in a quest of checking for homogeneity of error variances.

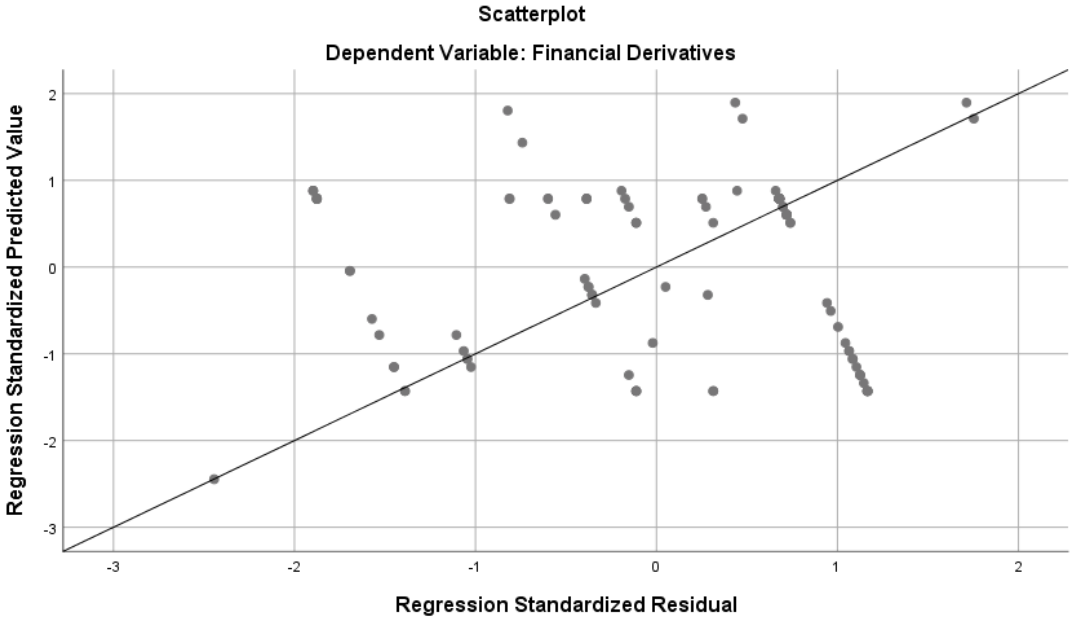

Figure 4. 8: Homoskedacity Testing

The distribution in Figure 4.7 shows that there is no systematic pattern thus implying that there is no homoskedacity. The decision rule is that if there is a systematic pattern then there is no homoskedacity. The points are sparsely distributed away from the line of assumption and do not create any systematic pattern, and thus frees the study from bias associated with distribution of points.

4.6.3 Hypothesis Testing

Using coefficients outputs for Market makers perceptions of Market liquidity dimensions and interest rate risk management using financial derivatives in Table 4.17, the study hypothesis were tested. The decision rule was when $p < 0.05$, you reject the null hypothesis and when $p > 0.05$, then you accept the null hypothesis.

The first hypothesis stated that Ho_1: hypothesis $H_{01:}$ Market Immediacy has no significant effect on the management of interest rate risks using Financial Derivatives in commercial banks. The result show that the relationship has a beta value of -0.191. We argue that even though the p value is 0.131 ($p>0.05$), the study still rejects the null hypothesis H_{01} on the grounding that this dimension has negative beta value.

This therefore means that Market Immediacy has a significant effect on interest rate risk management using financial derivatives in commercial banks.

The second hypothesis $H_{02:}$ stated that "Market depth does not have a significant effect on the use of financial derivatives in interest rate risk management using Financial Derivatives in commercial banks." Table 4.17 shows that Market depth has a beta value of -0.287. Even though the p value is 0.136 ($p > 0.05$), the study rejects the null hypothesis H_{01} on the basis of a negative beta value. This therefore means that Market depth has a significant effect on interest rate risk management using financial derivatives in commercial banks.

The third hypothesis $H_{03:}$ stated Market breadth does not have a significant effect on the use of financial derivatives in interest rate risk management using Financial Derivatives in commercial banks. It is found that market breadth has a beta value of 0.272 and a p value of 0.033. Given that $p < 0.05$, the study rejects the null hypothesis H_{03}. This therefore implies that Market breadth has a significant effect on interest rate risk management using financial derivatives in commercial banks.

The fourth hypothesis $H_{04:}$ stated Market Resiliency does not have a significant effect on the use of financial derivatives in interest rate risk management using financial derivatives in commercial banks. The results in Table 4.17 that market resiliency has a beta value of 0.376 and a p value of 0.013. Given that $p < 0.05$, the study rejects the null hypothesis H_{04}. This therefore implies that market resiliency has a significant effect on interest rate risk management using financial derivatives in commercial banks.

Finally, the fifth hypothesis $H_{04\,-}$ stated, Market tightness does not have a significant effect on the use of financial derivatives in interest rate risk management using financial derivatives in commercial banks. The results in Table 4.17 show that market tightness scored (Beta = 0.289, $p = 0.009$). Given that $p < 0.05$, the study rejects the null hypothesis H_{04}. This therefore implies that market tightness has a significant effect on interest rate risk management using financial derivatives in commercial banks.

4.7 Discussions

The first objective sought to establish the effect of market immediacy towards the Interest Rate risk management with Financial Derivatives in commercial banks in Kenya.

The Pearson correlation results show that there was a positive association between market immediacy and interest rate risk management using financial derivatives. The results show that there was market immediacy had a positive effect on effect of market immediacy towards the Interest Rate risk management with Financial Derivatives in commercial banks in Kenya.

Specifically, analysis of this variable reveals that interest rate forwards market, interest rate options market and the in interest rate swaps market has a large number of market makers and many participants, and this had an influence on trading frequency. This in agreement with a study by Goldstein (1999) who established that there was a positive relation between the number of market makers and trading frequency and that competition among market makers reduces effective bid-ask spreads. Then the paradox emerging was that in these three markets, majority of the market makers did work continuously in the interest rate swaps market. In addition, Alderighi (2017) found that a large number of trading participants limits the adverse effects of liquidity shocks.

The second objective sought to establish market depth effect on the Interest Rate risk management with Financial Derivatives in Kenyan commercial banks. The results show that market depth was a significant factor in the management of interest rate risk using financial derivatives, given that the $p < 0.05$. In addition, the correlation results demonstrate the existence of an association between market depth and the management of interest rate risk management using financial derivatives. In all the three markets: interest rate options market, interest rate forwards market, and the in the interest rate swaps market, market participants access a list of buy and sell orders organized by price levels and updated to reflect market activity. Participants access both buy, and sell orders waiting to be executed, and access the bid and asks on

either side of the markets. This is in line with a study by Alam *et al*. (2017) in Bangadesh, which established that unavailability of significant buyers and sellers affected the efficacy of financial derivatives in the management of interest rate risk.

Objective three of the study was geared at establishing the effect of market breadth on the interest rate risk management using financial derivatives in commercial banks in Kenya. The Pearson correlation results reveal a positive association between market breadth and the management of interest rate risk using financial derivatives. More so, numerous and large in volume orders in the three markets: interest rate options market, interest rate forwards market, and the in interest rate swaps market had a positive effect on the interest rate risk management using financial derivatives in the banks. The findings of study contradict the argument by Sifma (2011) who indicated that Liquidity in rates derivatives is extremely uneven. The interest rate swaps market, the most liquid part of the market is characterized by low volumes in particular buckets for example currency, maturity extra and Highly unpredictable daily trading volumes within particular contracts with comparatively huge transaction sizes and concentrated volumes.

The fourth objective sought to establish the effect of market resiliency on the interest rate risk management using financial derivatives in commercial banks in Kenya. The findings reveal a positive association between market resiliency and the management of interest rate risk with $p < 0.5$. This means that the effect of market resiliency on the interest rate risk management using financial derivatives in commercial banks was statistically significant. This was demonstrated by the fact that according to most of the market makers, market participants' access published quotes and orders for interest rate forwards, access published quotes and orders for interest rate options, published quotes and orders for interest rate swaps market. Furthermore, the presence of buyers and sellers in the interests market also contributed to the resultant positive effect. In such case, the situation created room for a swift convergence of the price of an asset to a new steady state, after a market order. According to Beattie (2018), futures prices are published for every trading session, and previous day prices are reported daily in major newspapers. Information such as open, close, settle, change

open interest as well as volume is made available. Such information is useful in guiding the financial behavior of market makers.

The fifth objective sought to establish the effect of market tightness on the interest rate risk management using financial derivatives in commercial banks in Kenya. The indicator adopted for measuring market tightness includes order processing costs, asymmetric information and inventory costs. The descriptive statistics show that all the indicators favoured interest rate risk management using financial derivatives in the banks. In addition, the study shows that there was a positive association with the interest rate risk management using financial derivatives. This association was significant as shown by $p < 0.5$, showing the significant effect that tightness has on interest rate risk management. This find was in agreement with a study by Ali and Boadu (2016) who found that the portfolio, which comprises of stocks with wide bid-ask spread, has on average higher returns than all other portfolios. The bid and ask prices apply only to limited trade quantities. Market makers therefore provide liquidity in the market by standing ready to buy and sell securities at a prevailing market price. If an investor wants to buy a security for example, the market makers sell. Similarly, if an investor wants to sell a security, the market makers buy. For this service provision, market makers buy at a low bid price, and sell at a high ask price, so that they are likely to profit in the transactions.

4.8 Contribution of the Study to Theory/Existing Knowledge

The study developed a conceptual framework for underpinning future research work on the effect of market liquidity dimensions on interest rate risk management using financial derivatives. The study successfully tested hypothesis related to the original conceptual framework developed in chapter two.

Based on research findings, it was found that future conceptual frameworks should focus on only two market liquidity dimensions that are market immediacy and market resiliency and also the moderating effect of electronic trading platform. It is important to note that electronic trading platform moderates the relationship between market liquidity dimensions and interest rate risk management using financial

derivatives. The study also made a contribution as far as ordering and prioritizations of market liquidity dimensions is concerned. The study noted that in order of their effect on interest risk management using financial derivatives, market resiliency has the greatest effect on Interest rate risk management using financial derivatives commercial banks in Kenya, this was followed by market breadth and then market tightness. These were followed by market depth and finally market immediacy. It emerges from the study that the number of market participants and quotes availability had a great influence on interest rate changes and the resultant risks in the commercial banks in Kenya.

The findings of this study contribute towards transactional cost theory constructively to the in the sense that market interest rates management depended on the banks's ability to manage transaction costs and thus these costs need to be managed. Market immediacy was also key in influencing the market makers readiness to to execute orders that have an influence on his inventory level and liquidity. The findings also strengthen the Information based model by Copeland and Galai (1983) in that it was established that most makers indicated that pre trade information was critical and useful in influencing the bid spread in the forwards market interest rate swap. The Equilibrium theory was found to be in line with the findings in that market tightness positively influenced the management of interest rate risk. Market makers in the commercial banks strategically chose their trading times in the presence of trading costs and dynamic information. The market makers traded with investors and supplies liquidity by either closing all transactions or by placing limit orders. This was informed by the prevailing order processing costs and inventory costs.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the study's summary, conclusions and recommendations. The main objective of the study was to examine the effect of Market makers perceptions of Market liquidity dimensions on the use of financial derivatives in interest rate risk management in commercial banks in Kenya. The chapter also includes a section capturing suggestions for further studies.

5.2 Summary of Findings

This section contains a summary of findings. The summary has been chronologically according to the study objectives of the study. Both the descriptive and inferential results have been indicated. Most of the market makers believed that all the market liquidity dimensions had an influence on the use of financial derivatives in interest rate risk management in commercial banks in Kenya. However, electronic trading platforms had a moderating effect on this relationship as perceived by the market makers.

5.3 Market Immediacy

The first objective of the study was to establish the effect of market immediacy on the Interest Rate risk management using Financial Derivatives in Kenya. The descriptive results indicated that employees work continuously without break in the forward interest rate, swaps and options. The results also indicated that quotes are available forwards on the interest rate, swaps and options market and that there are a large number of market makers including many market participants on the interest rate swaps market.

The correlation results showed that market immediacy and the use of financial derivatives in interest rate risk management were positively and significantly correlated implying that that an improvement in the indicators of market immediacy positively leads to an improvement in interest rate risk management.

Other findings showed that market immediacy has a positive but insignificant effect on interest rate risk management using financial Derivatives in Kenya. This implies that when there is an increase in the selected market immediacy indicators such as number of market makers and market participants, the increase results in an increase in the efficacy of the management of interest rate risk using financial Derivatives by commercial banks in Kenya. The effect is however insignificant.

5.3.1 Market depth

The second objective of the study was to determine the effect of market depth on the Interest Rate risk management using Financial Derivatives in Kenya. Descriptive findings showed that on the interest swaps market and rate forwards participant's access both buy and sell orders waiting to be executed. Additionally, on the interest rate forwards and options, market participants were able to access the bid and ask on either side of the market. Other descriptive results revealed that a list of buying and selling orders organized by price levels and updated to reflect market activity was accessed by market participants on the interest rate option..

Pearson correlation results showed that market depth and interest rate risk management using financial derivatives were positively and significantly correlated. This implied that an improvement in the indicators of market depth for instance accessing a list of buy and sell orders organized by price levels and updated to reflect market activity, accessing both buy and sell orders waiting to be executed and accessing the bid and asks on either side of the market positively leads to an increase in interest rate risk management using financial derivatives.

The regression results revealed market depth was an important predictor in interest rate risk management using financial Derivatives in Kenya. The inference was that an increase in access to a list of purchasing and selling orders organized by price levels and updated to reflect market activity, access to purchasing and selling orders waiting to be executed, and access to the offer and requests on either side of the market lead positively to an increase in interest rate risk management using financial derivatives.

5.3.2 Market breadth

The third objective of the study was to find out the effect of market breadth on the Interest Rate risk management using Financial Derivatives in Kenya. Descriptive findings showed that interest rate forward swaps and options market has numerous orders.

Other results for instance, correlation findings indicated that market breadth and interest rate risk management using financial derivatives were positively and significantly correlated which imply that an improvement in the indicators of market breadth for instance volume of orders in the interest rate forwards, swaps and options market positively leads to an increase in interest rate risk management using financial derivatives.

The regression results showed that market breadth has a positive and significant effect on interest rate risk management using financial Derivatives in Kenya implying that an increase in market breadth indicators for instance volume of orders in the interest rate forwards, swaps and options market positively leads to an increase in interest rate risk management using financial derivatives.

5.3.3 Market Resiliency

The fourth objective of the study was to assess the effect of market resiliency on the Interest Rate risk management using Financial Derivatives in Kenya. The study findings revealed that market participants' access published quotes and orders for

interest rate forwards more than quotes and orders for interest rate swaps. Further results indicate that market participants' access published quotes and orders for interest rate options. The presence of buyers and sellers of interest rate options in the market was not confirmed.

Correlation results indicated that market resiliency and interest rate risk management using financial derivatives were positively and significantly correlated implying that an improvement in the indicators of market resiliency positively leads to an increase in interest rate risk management using financial derivatives.

The results also showed that market resiliency has a positive but insignificant effect on interest rate risk management using financial Derivatives in Kenya implying that an increase in market resiliency indicators positively leads to an increase in interest rate risk management using financial derivatives. The effect is however insignificant.

5.3.4 Market Tightness

The fifth objective sought to establish the effect of market tightness on the interest rate risk management using financial derivatives in commercial banks in Kenya. The study found that according to most of the market makers order processing costs, asymmetric information and inventory costs were sources of the spread bid-ask spread in commercial banks in Kenya. The descriptive statistics show that all the indicators favoured interest rate risk management using financial derivatives in the banks. In addition, the correlation results show that that there was a positive correlation between market tightness and interest rate risk management using financial derivatives.

5.3.5 Electronic Trading Platforms

Electronic Trading Platforms is a significant factor influencing to the relationship between market liquidity dimensions and Interest Rate risk management using Financial Derivatives. The regression analysis reported a higher R square at 22.8%,

when ETPs were included in the regression model, compared to 18.9% when the ETPs were excluded from the computation.

5.4 Conclusion

In all cases, even though financial derivatives appear to be effective in managing interest rate risks. The perception of most market makers is the market liquidity plays a critical role in determining the effectiveness of the exercise. Individual dimensions of market liquidity have different effects. Market resiliency and market breadth has the greatest effect on Interest rate risk management using financial derivatives. These point to the fact that, much needed to be done to enhance the efficacy of the other three dimensions. The responses point to fact that market makers may not be empowered enough to comprehend market behavior and are not able to make short selling. They are not very convinced that financial derivatives can be effective considering the ever dynamism of market liquidity dimensions. In addition, the slightly above mean score results in the descriptive is an indication a sizable number of commercial banks in Kenya are not in the interest rate derivatives market

5.4.1 Market Immediacy

The study concluded that quotations are available on the forward interest rate, derivatives and options market and that there are a large number of market makers including many market participants in the interest rate swaps sector. The study also concluded that market immediacy has a positive but insignificant effect on interest rate risk management using financial Derivatives in Kenya. Commercial banks' IRR management as the simultaneous decisions of the magnitude of the duration gap and the use of interest rate swaps. Our empirical findings show that banks predominately use interest rate swaps for hedging purposes as a substitute strategy for managing IRR on the balance sheet. It is thus, concluded that an increase in market immediacy indicators for instance, the number of market makers and market participants leads to an insignificant increase in the interest rate risk management using financial Derivatives by commercial banks in Kenya.

5.4.2 Market depth

Another conclusion made by the study is that on the interest rate forwards and swaps market participant's access both buy and sell orders waiting to be executed. Furthermore, on the interest rate forwards and options, market participants access the bid and ask on either side of the market. The derivatives market enhances greater market depth by enticing investors to trade in the underlying markets. The study also concluded that market depth has a positive and significant effect on the management of interest rate risk using financial Derivatives in Kenya which imply that an increase in the access of a list of buy and sell orders organized by price levels and updated to reflect market activity, access of both buy and sell orders waiting to be executed and access of the bid and asks on either side of the market positively leads to an increase in interest rate risk management using financial derivatives.

5.4.3 Market breadth

The study determined that market breadth had a great effect on the management of interest rate risk using financial derivatives in Kenya. The researcher concludes that an increase in market breadth indicators for instance volume of orders in the interest rate options, swaps and forwards market influenced in a positive way the increase in interest rate risk management using financial derivatives. Market breadth indicators such as volume of orders placed had great effect on the management of interest rate risk using financial derivatives by Commercial Banks in Kenya. In the commercial banks, interest rate swaps and forwards were effective in reducing interest rate risk either by converting a fixed-rate income stream to a variable-rate stream or by converting a variable-rate stream to a fixed-rate stream.

5.4.4 Market resiliency

On market resiliency, the study concluded that interest rate derivatives market participants' access published quotes and orders for interest rate forwards more than quotes and orders for interest rate swaps. The study also concluded that market participants' access published quotes and orders for interest rate options. The study

also concludes that market resilience increases with the proportion of patient traders, while a reduction in tick size reduces resilience. Another conclusion made by the study is that market resiliency has a significant effect on interest rate risk management using financial Derivatives in Kenya implying that when there is an increase in the select market resiliency indicators there is an associated positive significant increase in the management of interest rate risk using financial derivatives.

5.4.5 Market Tightness

The study findings led to the conclusion makers order processing costs, asymmetric information and inventory costs were all sources of the spread bid-ask spread in commercial banks in Kenya. The study also arrived at the conclusion that market tightness in commercial banks in Kenya has a significant effect on the management of interest rate risk using financial derivatives. The study concludes that the markets are characterized by narrow spreads. The study concludes that inventory costs were the source of the spread, trade prices and quotes.

5.4.6 Electronic Trading Platforms

The three electronic trading platforms that is Bloomberg, Citivelocity and Autobahn electronic trading platforms moderates the relationship between all the market liquidity dimensions examined in this study and the use of financial derivatives in interest rate risk management. The utilization of the exchanging stages in the interest rate derivatives advertise affects how market liquidity identifies with interest rate risk management using financial derivatives in Commercial banks in Kenya.

5.6 Recommendations of the Study

The study recommends the following.

i. The management of commercial banks should mobilize resources to raise the level of awareness of the management team and market makers on existing infrastructure for the use of financial derivatives in managing interest rate risk amidst the dynamism of

market liquidity. Lack of knowledge may lead to omissions of risks that ought to be managed.

ii The market maker system should be improved. The government through the Central Bank should put in place a policy that gives market makers support politically, such as providing convenient source of financing, allowing short selling, motivating their enthusiasm and initiative.

iii The findings show that almost half of the market makers show that there are not so many participants and the number is low. Considering that the number of market makers is still insufficient and thus there is also lack of diversity, it is better for the government develops a policy for lowering the requirement of being a market maker to improve the efficiency of trading.

iv Commercial bank dealers who are designed to provide clients services that require principal risk taking, a function that is a vital element of market resilience during volatile events, should adopt increased use of electronic trading platforms like Bloomberg and Citivelocity in providing core services to support the real economy. Such diversity is a necessary and welcome development, and complements the role commercial banks and bank dealers will continue to play in effective market functioning thus affecting market liquidity.

v The study also recommends that commercial banks in Kenya should increase their participation in the interest rate derivatives market as the study findings has indicated huge presence of market makers.

5.7 Suggested Areas for Further Study

The study findings indicated that the five market liquidity dimensions (Market depth, market breadth, market resiliency, market tightness and market immediacy) jointly account for up to 47.6% of the changes in interest rate risk management using financial derivatives in Kenya. This indicates that the remaining 53.0% can be accounted for by other factors other than market liquidity dimensions, which are not in the model adopted by the current study.

Another study can also be conducted to establish why most commercial banks in Kenya are not in the interest rate derivatives market. The findings indicated presence of huge market makers but even though this is the case, few commercial banks in Kenya are not participants in the interest rate derivatives market.

Further studies can aim to find the determinants of participation in the market in the developing countries with Kenya being an inclusion. The study noted that current and future market liquidity is a subject of concern for market participants. There is ongoing rollout of Derivatives/Commodities Futures Exchange by the Capital Markets Authority in Kenya with a goal of facilitating growth in the economy. A study can hence be conducted to review and establish the effects of regulatory initiatives on market liquidity by asset class, and to consider whether upcoming regulatory initiatives could likely aggravate the trends in liquidity.

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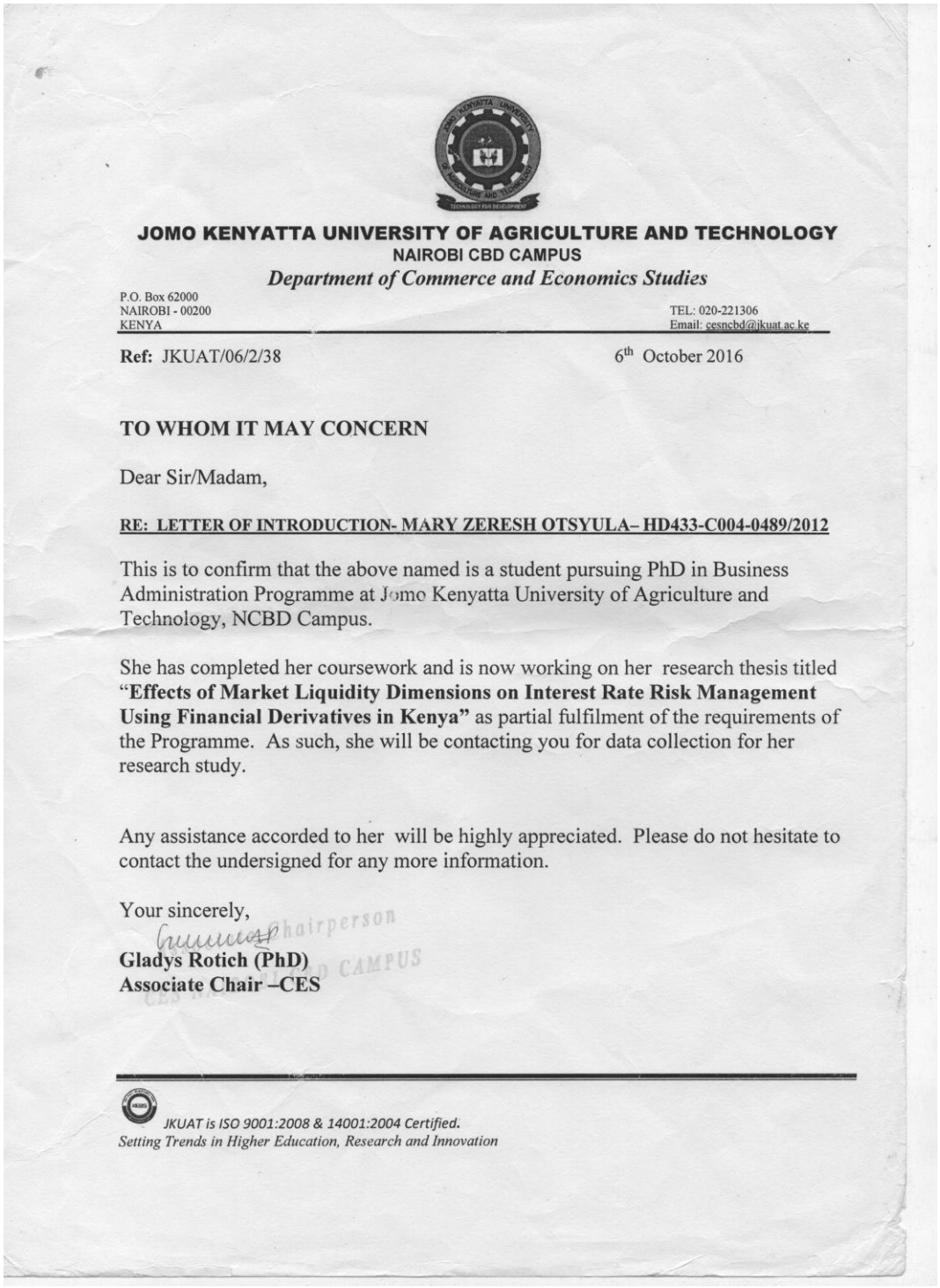
APPENDICES

Appendix I: Introduction Letter from Jomo Kenyatta University of Science and Technology



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Ref: JKUAT/06/2/38

6th October 2016

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

RE: LETTER OF INTRODUCTION- MARY ZERESH OTSYULA– HD433-C004-0489/2012

This is to confirm that the above named is a student pursuing PhD in Business Administration Programme at Jomo Kenyatta University of Agriculture and Technology, NCBD Campus.

She has completed her coursework and is now working on her research thesis titled "**Effects of Market Liquidity Dimensions on Interest Rate Risk Management Using Financial Derivatives in Kenya"** as partial fulfilment of the requirements of the Programme. As such, she will be contacting you for data collection for her research study.

Any assistance accorded to her will be highly appreciated. Please do not hesitate to contact the undersigned for any more information.

Your sincerely,

Gladys Rotich (PhD)
Associate Chair –CES

JKUAT is ISO 9001:2008 & 14001:2004 Certified.
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Appendix II: Researchers Introduction Letter

Mary.Z.Otsyula

JKUAT-CBD

Campus

Nairobi

Dear respondent:

I am Mary Zeresh Otsyula a PhD. Student of Jomo Kenyatta University of Agriculture and Technology carrying out a research on Effects of market liquidity dimensions on interest rate risk management using financial derivatives in Kenya you have been selected together with others to participate in this research. Please be guaranteed that whatever information that will be collected using this questionnaire will be treated with most privacy and will only be used for the purpose of this research. Please do not indicate your name anywhere on this questionnaire.

Thank you.

Mary Otsyula.

Appendix III: Questionnaire

SECTION A: GENERAL INFORMATION

1.Kindly indicate the number of years you have worked in this bank

Below one year ☐ One year ☐ Two years ☐ Three years ☐ Over three years ☐

2. Kindly indicate your age bracket

18-25years ☐ 26-35years ☐ 36-45 years ☐ 46-55 years ☐ over 55 year ☐

3. Academic qualification

Diploma and Below Degree ☐ ost graduate degree ☐

SECTION B: MARKET LIQUIDITY DIMENSIONS

Indicate the level of agreement on the following statements describing the effect of market liquidity dimensions (Market immediacy, Market resiliency, Market depth and Market breadth) on the interest rate risk management using financial derivatives in Kenya.

(i)Market immediacy

No	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
1	Interest rate forwards Market has a large number of market makers.					
2	Interest rate forwards					

No	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
	Market has many market participants.					
3	In the Interest rate forwards Market we work continuously without any break					
4	Quotes are available on the Interest rate forwards Market					
5	Interest rate swaps Market has a large number of market makers.					
6	Interest rate swaps Market has many market participants.					
7	In the Interest rate swaps Market we work continuously without any break					
8	Quotes are available on the Interest rate swaps Market					

No	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
9	Interest rate options Market has a large number of market makers.					
10	Interest rate options Market has many market participants.					
11	In the Interest rate options Market we work continuously without any break					
12	Quotes are available on the Interest rate options Market					

(ii)Market resiliency

No	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
1	Market participants' access published quotes and orders for interest rate forwards.					
2	There is presence of buyers and sellers interest rate forwards.					
3	There is presence of buyers and sellers in interest rate swaps market.					
4	Market participants' access published quotes and orders in interest rate swaps market.					
5	There is presence of buyers and sellers of interest rate options in the market.					
6	Market participants' access published quotes and orders for interest rate options					

(iii)Market depth

No	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
1	On the interest rate forwards market participants access a list of buy and sell orders organized by price levels and updated to reflect market activity.					
2	On the interest rate forwards Market participants access both buy and sell orders waiting to be executed.					
3	On the interest rate forwards Market participant access the bid and asks on either side of the market.					
4	On the interest rate swap market participants access a list of buy and sell orders organized by price levels and updated to reflect market activity.					

No	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
5	On the interest rate swap Market participants access both buy and sell orders waiting to be executed.					
6	On the interest rate swap Market participants' access the bid and asks on either side of the market.					
7	On the interest rate option market participants' access a list of buy and sell orders organized by price levels and updated to reflect market activity.					
8	On the interest rate option Market participants' access both buy and sell orders waiting to be executed.					
9	On the interest rate option Market participant's access the					

No	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
	bid and asks on either side of the market.					

(iv)Market breadth

No	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
1	Interest rate forward Market has numerous orders.					
2	Interest rate forward Market has large in volume orders.					
3	Interest rate swap Market has numerous orders.					
4	Interest rate swap Market has large in volume orders.					
5	Interest rate options Market has numerous orders.					
6	Interest rate options					

No	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
	Market has large in volume orders.					

(v)Market Tightness

No	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
1	On the interest rate forwards market source of the bid-ask spread is only order processing costs					
2	On the interest rate forwards market inventory costs is the sole source of the bid-ask spread					
3	On the interest rate forwards market bid-ask spread is influenced by order processing, adverse information and inventory costs combined					

No	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
4	On the interest rate swap market source of the bid-ask spread is only order processing costs					
5	On the interest rate swap market inventory costs is the sole source of the bid-ask spread					
6	On the interest rate swap market bid-ask spread bid-ask spread is influenced by asymmetric information					
7	On the interest rate options market source of the bid-ask spread is only order processing costs					
8	On the interest rate options market inventory cost is the sole source of the bid-ask spread					
9	On the interest rate options market bid-ask spread is influenced by					

No	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
	asymmetric information					

SECTION C: ELECTRONIC TRADING PLATFORMS

1.Are you were aware of the following electronic platforms?

Bloomberg …… (Yes /No)

Citivelocity …… (Yes /No)

Autobahn electronic trading platforms…… (Yes /No)

2.Do you think electronic trading platforms have an influence on the effectiveness of market liquidity in the management of interest rate risk using financial derivatives?

3.From your experience which of the three electronic trading platforms do you deal with most often? Tick appropriately

Bloomberg ( )

Citivelocity ( )

Autobahn electronic trading platforms ( )

4.How would you describe the influence of electronic trading platforms on the effectiveness of market liquidity in the management of interest rate risk using financial derivatives?

5.

	Very Influential	**Influential**	**Unsure**	**Somehow Influential**	**Not Influential**
	5	**4**	**3**	**2**	**1**
Bloomberg					
Citivelocity					
Autobahn electronic trading platforms					

SECTION D: FINANCIAL DERIVATIVES USED TO MANAGE INTEREST RATE RISK

Indicate the approximate number of contracts the bank has done for the last one year:(2016) Interest rate financial derivative	**2016 quarter 1**	**2016 quarter 2**	**2016 quarter 3**	**2016 quarter 4**
Interest rate Forwards				
Interest rate Swaps				
Interest rate options				

1. Indicate your level of agreement on the following statements describing use of financial derivatives to manage interest rate risk in Kenya

No	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
1	The bank uses financial derivatives to Swap from fixed rate to floating rate debt					
2	The bank uses financial derivatives to swap from floating rate to fixed rate debt					
3	The bank uses financial derivatives to Fix in advance the rate (spread) on new debt					
4	The bank uses interest rate options that are exercised only on the expiry date of the					
5	The bank uses interest rate options that the purchaser has the right to exercise the option at any time before and on the expiry date of the contract.					
6	The bank uses interest rate options that are					

No	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
	exercised only on the pre-specified dates for the duration of the contract.					

Thank you for completing the questionnaire

Appendix IV: Directory of Commercial Banks

1.Victoria Commercial Bank Ltd.

2.UBA Kenya Bank Limited

3.Trans-National Bank Ltd

4.Standard Chartered Bank Kenya Ltd

5.Spire Bank Ltd,

6.Sidian Bank

7.Prime Bank Ltd

8.Paramount Universal Bank Ltd

9.NIC Bank Ltd

10. National Bank of Kenya Ltd

11.M-Oriental Commercial Bank Ltd

12. Middle East Bank (K) Ltd

13. Kenya Commercial Bank Ltd

14. Jamii Bora Bank Limited.

15. Imperial Bank Limited (In receivership)

16.I & M Bank Ltd

17. Habib Bank Ltd

18. Habib Bank A.G Zurich

19. Gulf African Bank Limited

20. Guardian Bank Ltd

21. Guaranty Trust Bank (K) Ltd

22. Giro Commercial Bank Ltd.

23. Fina Bank Ltd

24. Fidelity Commercial Bank Ltd

25. Family Bank Limited

26. Equity Bank Ltd.

27. Ecobank Kenya Ltd

28. Diamond Trust Bank Kenya Ltd.

29. Development Bank of Kenya Ltd.

30. Credit Bank Ltd.

31. Co-operative Bank of Kenya Ltd.

32. Consolidated Bank of Kenya Ltd.

33. Commercial Bank of Africa Ltd.

34. Citibank N.A Kenya

35. Chase bank(in receivership)

36. Charterhouse Bank Limited (under statutory management).

37. CFC Stanbic Bank Ltd.

38. Barclays Bank of Kenya Ltd.

39. Bank of India

40. Bank of Baroda (K) Ltd.

41. Bank of Africa Kenya Ltd.

42. African Banking Corporation Ltd.

Source: Central Bank of Kenya Commercial Banks Directory, 2011

Appendix V: List of Market Vendors

1. Barclays Capital trading platform,
2. Deutsche Bank electronic trading platform called “Autobahn”
3. Citigroup
4. Bond Vision
5. Trade Web
6. Bloomberg
7. EuroTLX
8. MOTMOT (Mercato obbligazionario telematico)
9. LSE
10. ORB
11. Thomson Reuters.

Source: PricewaterhouseCoopers, (2010).

Appendix VI: Correlations

Correlations							
		Market Immediacy	Market Resiliency	Market Depth	Market Breadth	Market Tightness	Financial Derivatives
Market Immediacy	Pearson Correlation	1	.729**	.769**	.660**	.518**	.216*
	Sig. (2-tailed)		.000	.000	.000	.000	.025
	N	108	108	108	108	108	108
Market Resiliency	Pearson Correlation	.729**	1	.864**	.685**	.415**	.344**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	108	108	108	108	108	108
Market Depth	Pearson Correlation	.769**	.864**	1	.771**	.544**	.293**
	Sig. (2-tailed)	.000	.000		.000	.000	.002
	N	108	108	108	108	108	108
Market Breadth	Pearson Correlation	.660**	.685**	.771**	1	.514**	.370**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	108	108	108	108	108	108

Market Tightness	Pearson Correlation	.518**	.415**	.544**	.514**	1	.345**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	108	108	108	108	108	108
Financial Derivatives	Pearson Correlation	.216*	.344**	.293**	.370**	.345**	1
	Sig. (2-tailed)	.025	.000	.002	.000	.000	
	N	108	108	108	108	108	108
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							