EFFECT OF MARKET DEPTH LIQUIDITY DIMENSION ON INTEREST RATE RISK MANAGEMENT USING FINANCIAL DERIVATIVES IN KENYA

Mary Zeresh Otsyula
College of Human Resource and Development,
Jomo Kenyatta University of Agriculture and Technology
P. O. Box 62000, 00200 Nairobi, Kenya
Corresponding Author email: mzotsyula@gmail.com

Dr. Florence. S Memba
College of Human Resource and Development,
Jomo Kenyatta University of Agriculture and Technology
P. O. Box 62000, 00200 Nairobi, Kenya

Dr. Willy Muturi
College of Human Resource and Development,
Jomo Kenyatta University of Agriculture and Technology
P. O. Box 62000, 00200 Nairobi, Kenya

CITATION: Otsyula, M., Z., Memba, F., S., Muturi, W. (2017). Effect Of Market Depth Liquidity Dimension On Interest Rate Risk Management Using Financial Derivatives In Kenya. *International Journal of Economics and Finance.* Vol. 6 (6) pp 20 – 38.

ABSTRACT

Kenya, through the 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. Ongoing roll out of Derivatives/Commodities Futures Exchange with the goal of providing more financial products to facilitate growth in the Kenyan economy is being undertaken by the Capital Markets .Whereas there are several trading platforms available for trading of financial derivatives aimed at managing interest rate risk, the effect of market liquidity dimension on the interest rate risk management using financial derivatives in Kenya and how electronic trading platforms affect them is not clear. The purpose of this study was to carry out empirical test on the effect of market depth liquidity dimension on the interest rate risk management using financial derivatives in Kenya. The study population include all the Commercial Banks licensed by the Central Bank of Kenya. Primary Data was collected using questionnaires. The study findings indicated market depth liquidity dimension significantly affects interest rate risk management using financial derivatives. The study recommends that commercial bank dealers who are designed to provide clients services that require principal risk taking, a function which 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.

Key words: *Market depth, Interest rate risk management, financial derivatives, Commercial Banks*

Background of the study

Increased globalization, according to Zekos, (2005) affects economies through various ways. These include expanded trade in services and merchandise, licensing of product and technology, foreign direct investment, and general greater international investment portfolio. Derivative exchanges have been on the rise in both the developed as well as the emerging market economies (Al Janabi, 2006). The emerging markets, for instance, are able to capture important benefits derived from the derivatives trading activities that include the ability to move risks, reduce transaction costs and accessibility of public related information. 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).

According to Kamau et al (2013), Kenyan Commercial banks operate in an environment that makes it difficult for them to hedge against interest rate risk, especially owing to the variations in the foreign exchange rates. Additionally, an increase in the average domestic rates as compared to the foreign interest rates as well as rise in foreign price result in appreciated exchange rate (Kamau et al (2013). Ndung'u & Ngugi (1999) introduced a different perspective in the discussion about interest rates determinants and risks in Kenya, pointing out that high inefficiency in the country's financial market has seen interest rates remain out of control even with the government's efforts to liberalize its financial and money market. This, therefore, points at a major risk being faced by the local commercial banks as far as their hedging of interest rate risks is concerned (Ngugi, 1999). The inefficiency in the money market makes it difficult for the banks to evaluate and predict correctly their impending risks.

Derivatives provide an efficient tool for off-balance sheet risk management since they provide an easy means to hedge (manage) the residual risk from commercial operations (Nguyen and Faff (2002). In Kenya most banks participate in the secondary markets where they invest in fixed income securities to buy and sell Treasury Bonds before they reach maturity and thus make interest income. However most of these bank profits decline due to the decline in value of bonds held for sale following changes in market interest rates hence impacting negatively on the Bank's profitability. Stutz (2004) asserts that larger banks are more likely to use derivatives for risk management and thus reduce the probability of financial distress. A market can be a physical location or an electronic platform that allows potential buyers and sellers to interact. This study is aimed at identifying measures to determine market liquidity with a view to measure if a market can be described as liquid.

Statement of the Problem

Whereas there are several trading platforms available for the trading of financial derivatives aimed at managing interest rate risk, it is not clear how these platforms affect the quality of the markets in which these derivatives are traded. It is not clear how they affect the immediacy, depth, breadth and resiliency of these markets. According to the Bi-Annual Report prepared by the members of the Monetary Policy Committee of the Central Bank of Kenya (2012) the rise in short term interest rates due to tight liquidity conditions were transmitted to the commercial banks interest rates. The average

commercial banks' lending rates increased from 15.21 percent in October 2011 to 20.34 percent in March 2012 before dropping slightly to 20.22 percent in April 2012. Commercial Banks in the bond market are exposed to market risk (Association Cambiste Internationale Singapore, 2010). Use of derivatives in the Treasury bond market in emerging markets is not clear. In Kenya the risks in the bond market are on the rise as evidenced by the decrease in the profit of the banks. This is due to sharp increase in interest rates which resulted in the revaluation of the trading book thereby causing mark-to-market unrealized losses in the bond trading portfolio and derivatives (Standard Chartered Bank, 2011; National Bank of Kenya, 2011).

Empirical studies find lapses in the use of derivatives to hedge interest rate risk across the world. Dhanani et al (2010) examined the interest rate risk management practices of United Kingdom companies. 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 the Effect of Electronic Trading Platforms in the Interest Rate Risk management using Financial Derivatives in Kenya.

According to An outlook of Capital Markets in Kenya (2012/2013) Kenya, through the 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. Whereas there are several trading platforms available for trading of financial derivatives aimed at managing interest rate risk, the effect of electronic trading Platforms in the Interest Rate Risk management using Financial Derivatives in Kenya and how market depth liquidity dimension affect the financial derivatives markets they operate in is not clear.

Specific objectives

1. To establish the effect of market depth liquidity dimension on the Interest Rate risk management using Financial Derivatives in Kenya.
2. To investigate the moderating effect of Electronic trading platforms on the relationship between market depth liquidity dimension and the use of financial derivatives in interest rate risk management.

Research Hypotheses

1. **H_{01}**: There is no significant effect market depth on the Interest Rate risk management using Financial Derivatives in Kenya.

2. **H_{02}**: Electronic trading platforms do not moderate the relationship between market depth liquidity dimensions and the use of financial derivatives in interest rate risk management

Theoretical Review

Agency theory

The Agency Theory traces its origin back to 1976, following initial study works on structure and ownership by Jensen and Meckling (Walkling, 2011). Corporate decisions are made by managers on behalf of principals. The agency problem arises when agents' interests are not aligned with principals' interests. Conflicts between managers and shareholders can arise on issues such as firm value, investment decisions and compensation contracts (Jensen and Meckling, 1976; Jensen and Smith, 1985).

Agency theory has been used to analyze the twin notion of managerial self-interest and managerial risk aversion by Dhanani et al (2007); who pointed out that the labor market revises its opinions about managers' ability based on the performance of the company where they work. By using derivatives to hedge interest rate risk, executives can smooth the earnings of the company and influence the labor market's perception of their talents. Managers (agents) decide upon hedging policy rather than shareholders (principals) and hedge to maximize their expected lifetime utility by reducing the possibility that they might be compelled to leave the firm, and are likely to try and take advantage of the difference in their expectations differ from the market or where they believe that they can take advantage of market trends (Dhanani et al, 2007).

Order processing model (Demsetz, 1968)

The model was put forth by Demsetz (1968) who indicated that the transaction costs that occur during trading can be divided into two different kinds of costs that is brokerage fee 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 main goal of a market maker is to maximize his profits which are the result of the price setting of the bid and ask price. The bid/ask spread will on one hand bring the market maker revenues from dealing with liquidity motivated traders and on the other he will encounter losses due to the fact that he is also dealing with informed traders. 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.

Conceptual Framework

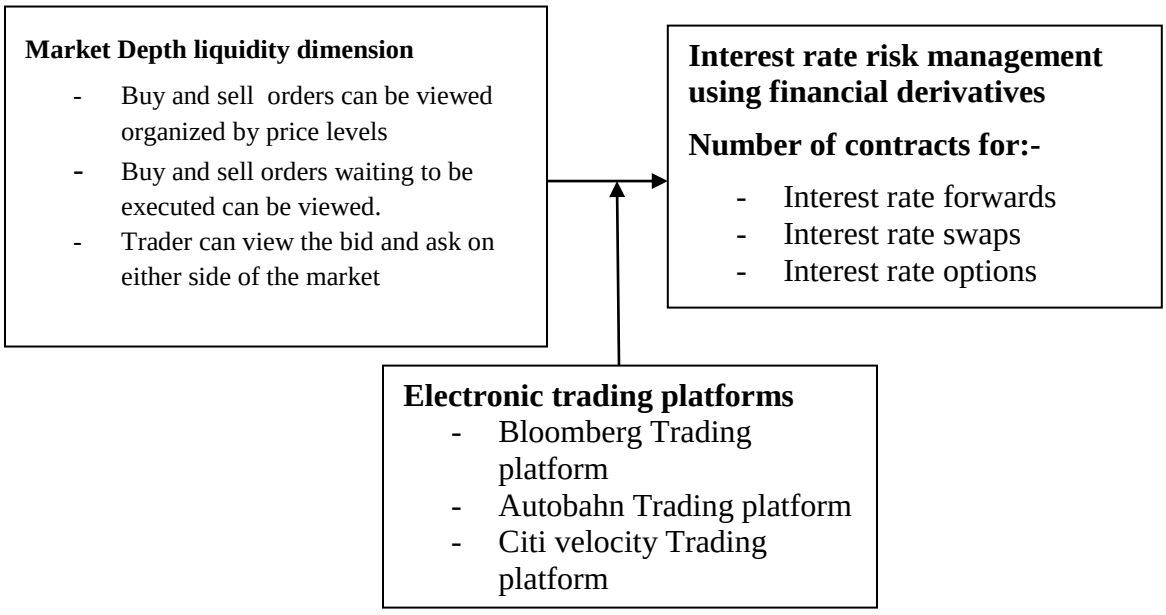

Figure 1 Conceptual Framework

Market depth

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.

Electronic trading platforms

An electronic trading platform (ETP) is a subset of an electronic trading system. An electronic trading system is a facility which provides some or all of the following services: order routing (from computer to computer); order execution ("click-and-trade"); credit risk management (central counterparty trading); automated trade settlement (straight-through processing); and dissemination of pre-trade and post-trade information (Gemloc Advisory Services, 2013). ETP is an electronic trading system which provides a matching engine to pair buyers and sellers as a computer ranks orders by price levels and timing of inputs, which further facilitates trading between multiple

parties. When orders are matched, the execution of a trade can either require a manual intervention (click and trade) or be automatic (cross-matching) (Gemloc Advisory Services, 2013). In any case, an ETP requires a market regulation, detailing who can access the ETP, which instruments can be traded, the trading rules and the supervision of the market. An ETP is often referred to as a multilateral trading facility (MTF). ETPs are generally self-regulated organizations (Gemloc Advisory Services, 2013)

Interest rate financial derivatives

According to Amattamsir (2011) & Association Cambiste Internationale Singapore, 2010, 2010 derivatives used interest rate derivatives are SWAP, forwads and options. 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). A forward rate agreement (FRA) is an off balance sheet instrument to fix future borrowing or lending rates. It does this through a cash settlement in the future. An FRA is an agreement to pay or receive on an agreed future date the difference between an agreed interest rate and the interest rate prevailing on that future date based on an agreed notional principal amount (Amattamsir , 2011).

An option contract is defined as "an agreement between two parties in which one party, the writer, grants the other party, the purchaser, the right, but not the obligation, to either buy or sell a given security, asset, or commodity at a future date under stated conditions" 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.

Research Methodology

Saunders (Muturi, 2012) postulates that combining different designs in one study enable triangulation and increases the validity of the findings. For this reason, two types of research design were used in this study. First, descriptive design was used to establish the cause and effect relationship between the independent variable (market depth dimension) and the dependent variable (Interest rate risk management using financial derivatives). Second, since descriptive designs do not signify causation relationships, a cause-effect design was used to determine in a more rigorous way the effect of market depth dimension on the interest rate risk management using financial derivatives in Kenya. The population comprised of all the forty two banks registered by the Central Bank of Kenya. The study conducted a census of all the forty two banks licensed by Central Bank of Kenya as at the year 2016 instead of adopting a sampling methodology. This was justified on the basis that the number of banks are few. Three commercial banks were not eligible for inclusion in the study as they were under statutory management. The study targeted three respondents from each commercial bank namely the treasurer, senior dealer and dealers. The study adopted a semi structured questionnaire as the main instrument for collecting primary data. A semi structured questionnaire utilized both open and closed ended questions structured in accordance with the conceptual framework and

empirical literature. The study analyzed the data using descriptive analysis entailing frequencies, mean and standard deviation. Inferential techniques involved the use of correlations and regression analysis. A linear regression model was used to test the significance of the effect of market resiliency dimension on the interest rate risk management using financial derivatives in Kenya.

$$\mathbf{Y = \alpha + \beta_1 X_1}$$

Where:

Y = Interest rate risk management using financial derivatives

X_1= Market depth liquidity dimensions

e= Error term and α= constant

β= coefficient of independent variables

In testing for the moderating effect of electronic trading platform, the study adopted the Moderated Multiple Regression (MMR) analysis. The main effects of the predictor (X) and the hypothesized moderator (Z) are estimated using regression.

$$Y = \beta 0 + \beta X_1 Z + \mu$$

Y= Interest rate risk management using financial derivatives

X_1 = Market depth liquidity dimensions

Z = Moderating variable (Electronic trading platform)

e= Error term and α= constant

β= coefficient of independent variables

Prior to running the regressions, diagnostic tests were conducted to ensure the assumptions of classical linear regression were not violated. The normality of the dependent variable was established using one-sample Kolmogorov-Smirnov Test (KS).

RESEARCH FINDINGS AND DISCUSSIONS

The results for response rate are as indicated in Table 1.The number of questionnaires that were administered was 117. A total of 108 questionnaires were filled and returned. This represented an overall successful response rate of 92.3% as shown on Table 4.2. This is in agreement with Babbie (2004) who assert that return rates of 50% are acceptable to analyze and publish, 60% is good and 70% is very good. Based on these assertions from renowned scholars 92.3% response rate is adequate for the study. The high response rate was facilitated by 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.

Table 1 Response Rate

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

Results of Pilot Test

The study conducted a pilot test to test for the instrument reliability. The participants in the pilot test were not included in the final study. Reliability of this 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 2

Table 2 Reliability Coefficient

Variables	Cronbach's Alpha	Comment
Market depth	0.905	Accepted
Bloomberg	0.984	Accepted
Autobahn	0.995	Accepted
Citi-velocity	0.905	Accepted
Financial derivatives	0.919	Accepted

The summary of findings indicate that all the variables 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. 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.

Demographic Characteristics

Years of experience

The respondents were asked to indicate the period they had worked for the commercial banks. The results are as presented in Figure 1

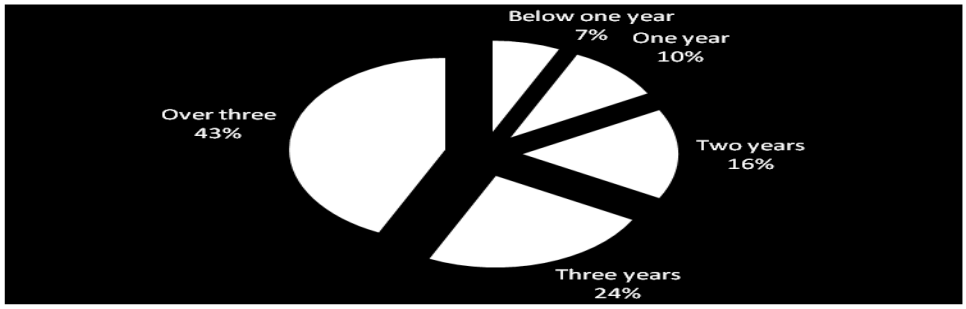

Figure 1: Year of experience

Results in Figure 1 reveal that 33% of the respondents had worked for the commercial banks for a period of 2 years or less, 24% had worked for a period of three years and those who had worked for over three years were 43%. 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.

Age of Respondents

The respondents were also asked to indicate their age. The results are presented in Figure 2.

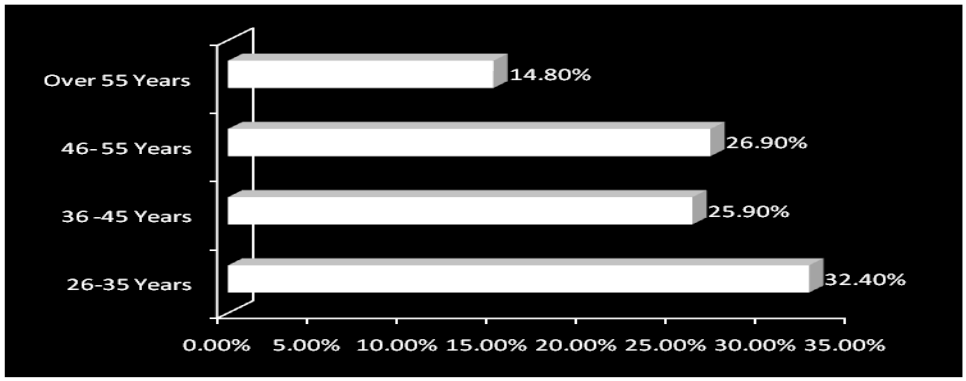

Figure 2: Age bracket of the Respondents

Results in Figure 2 reveal that 14.8% of the respondents were over 50 years, 26.9% were between 46 and 55 years while those who were between 36 and 45 years were 25.9%., 32.4%, were between 26 and 35 years. This implies that majority of the dealers; treasurers and senior dealers are aged between 26 and 35 years.

Academic qualification

The respondents were asked to indicate their level of education. The results are presented in Figure 3.

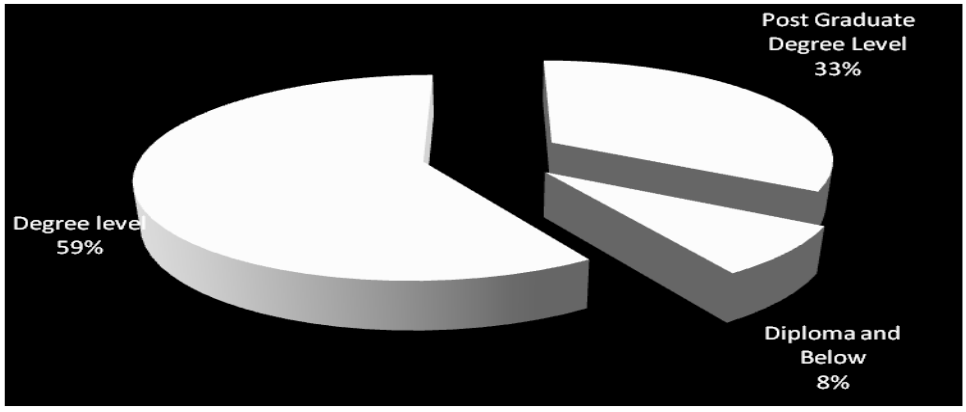

Figure3: Academic qualification

Results in Figure 3 reveal that only 8% of the respondents had education up to the diploma level, 33 % indicated that they had a post graduate level of education while majority, 59% of the respondents indicated that they had attained a degree level of education. 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.

Market depth Liquidity Dimensions

The respondents were requested to indicate their level of agreement or disagreement with statement concerning market depth. The results are as presented in Table 1.

Table 1 Descriptive results for Market depth Liquidity Dimensions

Statement	1	2	3	4	5	Mean	Std Dev
Interest rate forwards market Participants access							
List of buy and sell orders organized by price levels and updated to reflect market activity.	59.10%	6.80%	2.30%	31.80%	00.00%	2.00	0.82
Both buy and sell orders waiting to be executed.	6.80%	53.60%	16.80%	19.70%	3.00%	3.67	0.95
The bid and asks on either side of the market.	54.50%	6.80%	4.50%	34.10%	00.00%	3.67	0.95
Interest rate swap market Participants access a							
List of buy and sell orders organized by price levels and updated to reflect market activity.	4.50%	40.00%	20.50%	25.00%	10.00%	2.67	0.47
Both buy and sell orders waiting to be executed.	4.50%	2.30%	44.50%	12.30%	36.40%	3.67	0.47
The bid and asks on either side of the market.	9.10%	42.30%	20.50%	14.50%	13.60%	3.67	0.47
List of buy and sell orders organized by price levels and updated to reflect market activity.	2.30%	4.50%	80.50%	6.80%	5.90%	2.00	0.82
Interest rate option market Participants' access							
Both buy and sell orders waiting to be executed.	1.4%	8.2%	45.0%	5.9%	39.5%	3.67	0.47
The bid and asks on either side of the market.	10.1%	3.3%	47.6%	23.2%	15.9%	2.00	0.82
Average						**3.00**	**0.69**

The descriptive findings indicated that on average, respondents neither agreed nor disagreed with the statements on market depth. The results also indicate that there was a small variation in the responses as shown by a standard deviation of 0.69. The study findings 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

Electronic trading platforms

The second objective of the study was to establish the moderating effect of Electronic trading platforms on the relationship between market depth dimensions and the use of financial derivatives in interest rate risk management. The electronic trading platforms adopted for the study were Bloomberg, citi-velocity and Autobahn. The descriptive results for each electronic trading platform were established. The respondents were requested to indicate their level of agreement or disagreement with statement concerning Bloomberg as an electronic trading platform. The findings indicated that on average, the respondents neither agreed nor disagreed with statements concerning Bloomberg as shown by the overall mean. The respondents neither agreed nor disagreed that Bloomberg Platform has many liquidity providers for interest rate forwards, swaps and options as well as eligible liquidity takers for interest rate forwards, swaps and options.

Table 2 Descriptive results for Bloomberg

Statement Bloomberg has:	**1**	**2**	**3**	**4**	**5**	**Mean**	**Std Devi**
Many liquidity providers for interest rate forwards.	6.5%	22.2%	24.70%	16.1%	30.50%	3.00	0.82
Many eligible liquidity takers for interest rate forwards.	2.2%	4.3%	44.30%	24.7%	24.50%	3.00	0.82
Huge transactions on interest rate forwards	6.8%	8.9%	44.0%	24.2%	16.10%	3.00	0.82
The approximate number of interest rate forwards per is more than 10 in number.	4.3%	22.9%	26.50%	12.3%	24.10%	3.33	0.47
Many liquidity providers for interest rate swaps.	20.00%	6.50%	32.20%	15.50%	25.90%	3.00	0.82
Many eligible liquidity takers for interest rate swaps.	8.60%	40.00%	16.50%	14.70%	20.20%	3.00	0.82
Huge transactions on interest rate swaps product are	5.40%	18.60%	35.40%	13.30%	27.30%	3.33	0.47
The approximate number of interest rate swaps per is more than 10 in number.	5.40%	10.00%	31.50%	15.80%	17.30%	3.33	0.47
Many liquidity providers for interest rate options.	5.40%	3.20%	45.40%	11.60%	34.40%	2.67	1.25
Many eligible liquidity takers for interest rate options.	11.80%	22.80%	31.50%	21.0%	12.90%	2.67	1.25
Huge transactions on interest rate options product are	3.20%	44.30%	21.50%	8.60%	12.40%	2.67	1.25
The approximate number of interest rate options per is more than 10 in number.	30.40%	10.40%	40.00%	9.10%	10.00%	2.67	1.25
Average						**2.97**	**0.88**

The respondents also neither agreed nor disagreed that huge transaction on interest rate forwards, swaps or options product are done on Bloomberg Platform. Furthermore, majority of the respondents neither agreed nor disagreed that the approximate number of interest rate forwards, swaps and options per day on Bloomberg trading platform is more than 10 in number.

The respondents were further requested to indicate their level of agreement or disagreement with statements concerning citi-velocity as an electronic trading platform. The results are as presented in Table 3.

The findings showed that on average, the respondents agreed on statements concerning citi-velocity. Majority of the respondents agreed that Citivelocity Platform has many eligible liquidity takers for interest rate forwards, options and swaps. The respondents also agreed that huge transactions on interest rate forwards and swaps product are done on Citivelocity Platform. The approximate number of interest rate forwards and swaps per day on Citi-velocity trading platform is more than 10 in number. Concerning interest rate options, majority of the respondents disagreed that huge transactions on interest rate options product are done on Citivelocity Platform.

Table 3 Descriptive results for Citi-velocity

Statement	**1**	**2**	**3**	**4**	**5**	**Mean**	**Std Dev**
Citivelocity Platform has :-							
Many liquidity providers for interest rate forwards.	23.7%	15.8%	26.3%	15.8%	18.4%	3.00	1.64
Many eligible liquidity takers for interest rate forwards.	6.3%	13.7%	14.2%	35.3%	30.5%	4.00	0.82
Huge transactions on interest rate forwards	8.9%	8.4%	13.7%	35.3%	33.7%	4.00	0.82
The approximately more than 10 interest rate forwards per.	10.5%	6.3%	8.4%	38.9%	35.8%	4.00	0.82
Many liquidity providers for interest rate swaps.	9.5%	15.8%	11.6%	35.3%	27.9%	4.00	0.82
Many eligible liquidity takers for interest rate swaps.	11.1%	8.9%	11.1%	38.4%	30.5%	4.00	0.82
Huge transactions on interest rate swaps product	6.3%	13.7%	13.7%	27.9%	38.4%	4.00	0.82
The approximately more than 10 interest rate swaps	6.3%	13.7%	14.2%	35.3%	30.5%	4.00	0.82
Many liquidity providers for interest rate options.	12.1%	14.2%	51.1%	20.0%	2.6%	3.33	0.47
Many eligible liquidity takers for interest rate options.	2.1%	6.3%	48.9%	20.0%	22.6%	3.67	0.47
Huge transactions on interest rate options	13.7%	8.9%	24.2%	25.3%	27.9%	3.33	0.47
The approximately more than 10 interest rate options	39.5%	2.6%	23.7%	5.3%	28.9%	3.33	0.47
Average						**3.72**	**0.77**

Lastly, the respondents were requested to indicate their level of agreement or disagreement with statements concerning Autobahn as an electronic trading platform. The results are as presented in Table 4.

Table 4 Descriptive results for Autobahn

Statement Autobahn Platform has:	1	2	3	4	5	Mean	Std Dev
Many liquidity providers for interest rate forwards.	10.4%	13.2%	13.9%	30.8%	31.7%	4.00	0.72
Many eligible liquidity takers for interest rate forwards.	14.7%	18.9%	53.7%	10.0%	2.6%	3.00	0.82
Huge transactions on interest rate forwards	2.1%	16.3%	16.3%	22.6%	42.6%	4.44	0.60
The approximate number of interest rate forwards per day is more than 10 in number.	18.4%	13.2%	28.9%	15.8%	23.7%	3.68	1.12
Autobahn Platform has many liquidity providers for interest rate swaps.	4.7%	18.9%	13.7%	20.0%	42.6%	4.00	0.82
Many eligible liquidity takers for interest rate swaps.	2.1%	6.3%	16.3%	32.6%	42.6%	4.00	1.22
Huge transactions on interest rate swaps	18.4%	13.2%	38.9%	15.8%	13.7%	3.32	0.82
The approximate number of interest rate swaps per day is more than 10 in number.	8.9%	9.5%	16.3%	35.3%	30.0%	4.12	0.46
Autobahn Platform has many liquidity providers for interest rate options.	6.8%	11.6%	40.5%	13.2%	27.9%	3.89	0.82
Many eligible liquidity takers for interest rate options.	8.9%	6.8%	23.2%	30.5%	30.5%	4.00	0.78
Huge transactions on interest rate options	13.6%	28.9%	25.8%	15.8%	15.8%	3.67	0.47
The approximate number of interest rate options is more than 10 in number.	6.8%	20.6%	30.5%	13.2%	18.9%	3.66	0.44
Average						**3.81**	**0.76**

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 5.

Table 5 Descriptive results of Financial Derivatives Used to Manage Interest Rate Risk

Statement	1	2	3	4	5	Mean	Std Dev
The bank uses financial derivatives to:							
Swap from fixed rate to floating rate debt	9%	41%	21%	8%	21%	2.33	1.25
swap from floating rate to fixed rate debt	14%	40%	20%	13%	13%	2.33	1.25
Fix in advance the rate (spread) on new debt	3%	38%	32%	13%	14%	3.00	1.42
The bank uses interest rate options that							
: Are exercised only on the expiry date	28%	38%	11%	8%	15%	2.00	1.42
The purchaser has the right to exercise the option at any time before and on the expiry date of the contract.	40%	30%	4%	13%	13%	1.00	0.12
Specified dates for the duration of the contract.	18%	46%	3%	11%	12%	2.00	1.42
Average						**2.11**	**1.13**

The findings indicated that the respondents disagreed with most of the statements regarding interest rate risk management using financial derivatives as indicated by an overall mean of 2.11. Majority of the respondents disagreed that the bank uses financial derivatives to Swap from fixed rate to floating rate debt, swap from floating rate to fixed rate debt, the bank uses financial derivatives to Fix in advance the rate (spread) on new debt, the bank uses interest rate options that are exercised only on the expiry date of the and 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. Majority of the respondents further disagreed that the bank uses interest rate options that are exercised only on the pre-specified dates for the duration of the contract.

Normality Test

The normality of the dependent variable was also tested using Kolmogorov Smirnova test to show whether there was presence of extreme values. The dependent variable should be normally distributed. The results for the KS test of normality are as presented in Table 6.

Table 6: Kolmogorov- Smirnova test of normality

Tests of Normality

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Interest rate risk management using financial derivatives	0.272	108	0.056	0.765	108	0.056

a Lilliefors Significance Correction

The null hypothesis that the dependent variable is normally distributed is not rejected at 5% level of significance since the level of significance that is, 0.056 for KS test in (Table 6) is not significant (more than 0.05). This implies that the data met the statistical requirements to be used in a regression model.

Correlation Analysis

A correlation was used to establish the association between market depth dimension and interest rate risk management using financial derivatives.

Table 7 Correlation Results

Correlations		Market depth	Interest rate risk management using financial derivatives
Market depth liquidity dimension	Pearson Correlation	1	
	Sig. (2-tailed)		
Interest rate risk management using financial derivatives	Pearson Correlation	.333**	1
	Sig. (2-tailed)	0.000	
** Correlation is significant at the 0.01 level (2-tailed).			

The study findings indicated that market depth and interest rate risk management using financial derivatives were positively and significantly correlated (R=0.333, Sig = 0.000) at 1% level of significance.

Regression Analysis

The study sought to assess the effect of market depth on the interest rate risk management using Financial Derivatives in Kenya. The study sought to establish the effect of each of the three indicators of market depth on Interest Rate risk management using Financial Derivatives in Kenya. This was done in order to establish the indicator which significantly affects Interest Rate risk management using Financial Derivatives. The three indicators were buy and sell orders organized by price, buy and sell orders waiting to be executed and trader viewing the bid and asking on either side of the market. A multivariate regression model of the three indicators and the dependent variable was established. The results for model summary are presented in Table 8.

The findings indicated that the three indicators of market depth that is buy and sell orders organized by price, buy and sell orders waiting to be executed and trader viewing the bid and asking on either side of the market jointly explain up to 83.1% of the changes in interest rate risk management using financial derivatives as indicated by a coefficient of determination of 0.831 as shown in Table 8.

Table 8 Market depth liquidity dimension indicators and Use of Financial derivatives (Model summary)

R	R Square	Adjusted R Square	Std. Error of the Estimate
.911	0.831	0.826	0.435856

The overall relationship between market depth liquidity dimension and the Interest Rate risk management using Financial Derivatives in Kenya was also established. The results for the model summary are as presented in Table 9.

Table 9 Regression model summary (Market depth)

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.655a	0.429	0.423	0.793052
a Predictors: (Constant), Market Depth				

The results indicate that market depth liquidity dimension accounts for up to 42.90% of the changes in interest rate risk management using financial derivatives by commercial banks in Kenya as indicated by a coefficient of determination value of 0.429. The overall significance of the model linking indicators of market depth to interest rate risk management using financial derivatives was also significant in explaining the influence of market depth on interest rate risk management using financial derivatives (Significance of F-statistic = 0.000) as shown on Table 10.

Table 10 Market depth liquidity dimension indicators and Use of Financial derivatives (Model significance)

	Sum of Squares	df	Mean Square	F	Sig.
Regression	96.91	3	32.303	170.043	.000
Residual	19.757	104	0.19		
Total	116.667	107			

The model fitness finding of the overall relationship between market depth and the Interest Rate risk management using Financial Derivatives in Kenya indicated that the regression model linking market depth interest rate risk management using financial derivatives was significant as indicated by a significance vale of 0.000 which is less than 0.05 at 5% level of significance. This implies that the model was significant in predicting interest rate risk management using financial derivatives. The findings are shown in Table 11.

Table 11 Regression model Significance (Market depth)

ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	50	1	50	79.5	.000
	Residual	66.667	106	0.629		
	Total	116.667	107			

a Dependent Variable: Financial derivatives

b Predictors: (Constant), Market Depth

The study regression coefficients in Table 12 indicated that buy and sell orders organized by price have a positive but not significant influence on interest rate risk management using financial derivatives (Beta = 0.011, Sig = 0.999). This finding confirms the argument by Ranaldo (2004) that the main depth characteristics statistics of the limit order book are as follows: 1) Order wait. 2). Buy/sell depth 3). Buy and sell depth in value. Order wait is the elapsed time in seconds between one order and the next, buy/sell depth is the number of shares available at lowest/highest bid/ask and buy/sell depth in value refers to the buy and sell in value.

The study findings also indicated that buy and sell orders waiting to be executed have a positive and significant influence on interest rate risk management using financial derivatives (Beta = 1.199, Sig = 0.000). These findings confirms the argument Sarr and Lymbek (2002) that traders on the limit order book look at both sides of the market (depth at bid and ask side) when deciding upon the order type. The results finally showed that trader viewing the bid and asking on either side of the market have a positive and significant influence on interest rate risk management using financial derivatives (Beta = 1.471, Sig = 0.000). These findings confirms the argument by Wuyts (2007) that traders on the limit order book look at both sides of the market (depth at bid and ask side) when deciding upon the order type.

Table 12 Market depth liquidity dimension indicators and Use of Financial derivatives (Model Coefficients)

Independent variables	B	Std. Error	t	Sig.
(Constant)	-6.706	1.143	-5.864	0.000
Trader viewing the bid and asking on either side of the market	1.471	0.13	11.285	0.000
Buy and sell orders waiting to be executed	1.199	0.16	7.496	0.000
Buy and sell orders organized by price	0.011	0.201	0.001	0.999

Interest risk management using Financial derivatives = 1.026 + 1.471 (Trader viewing the bid and asking on either side of the market) + 1.199 (Buy and sell orders waiting to be

executed) The findings indicated that only Trader viewing the bid and asking on either side of the market and Buy and sell orders waiting to be executed had a significant influence on Interest risk management using financial derivatives. Trader viewing the bid and asking on either side of the market had the largest influence (Beta = 1.471) than buy and sell orders waiting to be executed had (Beta = 1.199). The overall influence of market depth on interest rate risk management using financial derivatives indicated that market depth has a positive (Beta = 2.5) and significant (Sig = 0.000) influence on interest rate risk management using financial derivatives as shown in Table 13.

Table 13 Regression model coefficients (Market depth)

Model		B	Std. Error	t	Sig.
1	(Constant)	-5.389	0.845	-6.38	0.000
	Market Depth	2.5	0.28	8.916	0.000

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

Interest rate risk management using financial derivatives = -5.389 + 2.5 Market depth Liquidity Dimension

Moderating effect of Electronic trading platforms

The study sought to establish the moderating effect of Electronic trading platforms on the relationship between market depth liquidity dimension and the use of financial derivatives in interest rate risk management.

$$\mathbf{Y = \beta_0 + \beta_1 X_1 Z + \mu}$$

Where,

Y = Interest rate risk management using financial derivatives, X_1 = Market depth, Z = Moderating variable (Electronic trading platform), *e*=Error term and α= constant, β =coefficient of independent variable. The findings indicated that electronic trading platform significantly moderates the relationship between market depth liquidity dimension and interest rate risk management using financial derivatives (Sig = 0.000 < 0.05).

Table 14 Multiple regression model summary after moderation

Predictor Variable	**B**	**Std. Error**	**t**	**Sig.**
(Constant)	5.645	0.271	20.854	0.000
Depth interaction	0.921	0.053	17.272	0.000

Dependent Variable: Interest rate risk management using Financial derivatives

Conclusion of the Study

The study concluded that 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 study also concluded that market depth has a positive and significant effect on interest rate risk management 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.

Recommendations of the Study

The study recommendations are in line with the objective, findings and conclusions of the study. The study recommended that commercial bank dealers who are designed to provide clients services that require principal risk taking, a function which 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 depth. The study also recommended 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.

ACKNOWLEDGEMENT

My gratitude go to the Almighty God for His mercies and for bringing me this far. I am grateful to my supervisors Dr. Florence S. Memba and Dr. Willy Muturi my excellent guiders in developing the research thesis. I am also grateful to all my PhD lecturers, colleagues and staff of the Nairobi CBD Campus of JKUAT for the assistance extended to me in any way.

REFERENCES

Ahn, H., Bae, K., & Chan, K. (2001). Limit Orders, Depth, and Volatility: Evidence from the Stock Exchange of Hong Kong, *The Journal of Finance, 56*(2), 767-788. http://www.jstor.org/stable/pdf/222582.pdf

Al Janabi, M.A.M. (2006) .On the inception of sound derivative products in emerging markets: Real-world observations and viable solutions. *Journal of Financial Regulation and Compliance 14 (2),* 151-164.

Association Cambiste Internationale Singapore-The Financial Markets Association (2010). ACI Dealing certificate, a study guide. Retrieved from www.acisin.com

Bank for international Settlements (2016).Electronic trading in fixed income markets: Report submitted by a study group established by the markets committee. Retrieved from www.bis.org

Gemloc Peer Group Survey1. (2011).Key Features of Electronic Trading Platforms Gemloc Peer Group Survey1 May 2011.Retrieved from http://siteresources.worldbank.org

Guru, A. (2010). Interplay between Exchange Traded Currency Futures Markets,

Kamau, A., & Were, M. (2013). What drives banking sector performance in Kenya?. *Global Business and Economics Research Journal*, *2*(4), 45-59.

Kasomi, F.M. (2015). Diversity in top management, strategy, top managers' compensation and performance of Kenyan state corporations. *(Unpublished PhD thesis), University of Nairobi.*

Miller, L. (2004). User satisfaction surveys. *Australasian Public Libraries and*

Ndung'u, N. S. , Ngugi, R. W. (2000) .Banking Sector Interest Rate Spread in Kenya: KIPPRA Discussion Paper, Nairobi, KIPPRA, 5, (2000), 4-20.

Nguyen, H., & Faff, R. (2002). On the determinants of derivative usage by Australian companies. *Australian Journal of Management*, 27(1), 1-24.

Nunnally, J.C. (1978). Psychometric Theory. 2nd ed. New York: McGraw-Hill.

Okumu, A. N. (2013).*Impact of microstructure changes on market efficiency at the Nairobi securities exchange.* Unpublished master thesis, Kenyatta University.

Ongore, V. (2008). *The effects of ownership structure, board effectiveness and managerial discretion on performance of listed companies in Kenya.* Unpublished PhD thesis, University of Nairobi, Kenya.

Price water house coopers. (2010). Data gathering and analysis in the context of the MiFID review. Retrieved from bookshop.europa.eu

Spot Markets and Forward Markets: A Study on India, *Indian Economic Review*, *45*(1), 111-130. http://www.jstor.org/stable/pdf/29793956.pdf

Tissaoui, K., Ftiti, Z., &Aloui, C. (2015). Commonality in liquidity: Lessons

Tsetsekos, G, & Varangis, P (2000). Lessons in structuring derivatives exchanges. *The World Bank Research Observer 15(1)*, 85-98

Unpublished PhD thesis, University of Nairobi, Kenya.

Walkling, R. (2011). Pioneers in finance. *Journal of Applied Finance, 21(1)*, 6-17.

Wuyts,G(2007).Stock markets liquidity: Determinants and Implications. Unpublished PhD thesis, University of Kukeuven.Retrieved from https://lirias.Kukeuven