EFFECT OF MARKET MAKER LIQUIDITY RESILIENCY ON THE USE OF FINANCIAL DERIVATIVES IN INTEREST RATE RISK MANAGEMENT AMONG COMMERCIAL BANKS 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 Ph.D.
College of Human Resource and Development,
Jomo Kenyatta University of Agriculture and Technology

Professor. Willy Muturi Ph.D.
College of Human Resource and Development,
Jomo Kenyatta University of Agriculture and Technology


ABSTRACT
The prime objective of this research was to establish the effect of market resiliency on the use of financial derivatives parameters in interest rate risk management among commercial banks in Kenya. In order to request information, this research incorporated a descriptive research design. The study gathered data from 108 market makers from 39 commercial banks using email or drop-and-pick method questionnaires. Employing the use of statistical package (SPSS version 21), the analysis of data was undertaken using descriptive (percentages, frequencies and means) as well as inferential statistics for instance Pearson correlation and also regression analysis towards the determination of the relationship connecting the variables (that is the independent and dependent variables). Based on the study’s findings, it is clear that in managing interest rate risk using financial derivatives and market resilience were more important. The findings of the study revealed that market resiliency has a positive and significant effect on interest rate risk management using financial derivatives ($\beta = 0.376$, $t = 2.659$, $p = 0.003$). 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.

Key Words: Market Resiliency, Electronic Trading Platforms, Interest Rate Risk Management and Financial Derivatives


Introduction

Together with extensive financial volatility that occurs in the form of a high-frequency currency crisis, 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. More so, the concept of ‘traditional risk management’ lacks complete integration, which is requisite for many financial institutions. 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).

Statement of the Problem
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 and Ngare, 2014). Moreover, little data on the interest rate risk for banks is available. While there are many market liquidity studies in Kenya's commercial banks, there is limited research on the dimensions of market resiliency liquidity and its impact on interest rate risk management. 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 market resilience 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 and derivatives (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 resilience affect Interest Rate Risk management using Financial Derivatives in Kenya given the existence of electronic trading platforms.

Research Objectives
The general objective of the study was to establish the effect of market resiliency on the use of financial derivatives parameters in interest rate risk management among commercial banks in Kenya.

**Research Hypothesis**

**H01**: Market resiliency lacks any significant financial derivatives use effect in management of interest rate risk in Kenyan commercial banks.

**Literature Review**

**Theoretical Review**

**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 maker 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. This
theory instigates the forth research hypotheses, $H_04$: There is no significant difference in the effect of market resiliency on the Interest Rate risk management using Financial Derivatives in Kenya.

**Conceptual Framework**

**Market resiliency**
- Pre trade information transparency
- Availability of market makers

**Electronic trading platforms**
- Bloomberg Trading platform
- Autobahn Trading platform
- Citi velocity Trading platform

**Dependent Variable**
- Interest rate risk management using financial derivatives
  - Number of contracts for:-
    - Interest rate forwards
    - Interest rate swaps
    - Interest rate options

**Moderating Variable**

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**Figure 1: Conceptual Framework**

**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.

**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).

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).

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).

i. 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.

ii. 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 cooper, 2010). Over ten years ago, Deutsche Bank set up Autobahn's electronic trading platform.

iii. 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).
Interest rate risk
According to Bank for International Settlements Basel Committee on Banking Supervision (2004), “Interest rate risk is the exposure of the financial condition of a bank to adverse interest rate movements. 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 affect the earnings of a bank by changing its net interest income and other interest-sensitive income and operating expenses. Changes in interest rates also affect the underlying value of the bank’s assets, liabilities, and off-balance sheet (OBS) instruments as the present value of future cash flows (and in some cases the cash flows themselves) changes when interest rates change (Bank for International Settlements Basel Committee on Banking Supervision, 2004).

Re-pricing risk
The main and most frequently discussed form of interest rate risk arises from timing differences in asset, liability, and off-balance sheet (OBS) positions’ maturity (for fixed rate) and re-pricing (for floating). While such re-pricing discrepancies are fundamental to the banking business, they may expose the income and underlying economic value of a banking institution to unforeseen fluctuations. Yield curve risk 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).

Basis risk
This is due to the imperfect correlation in the rate adjustment earned and paid on different instruments with similar re-pricing characteristics. These differences may result in unexpected changes in the cash flow and earnings spread between assets and liabilities and off-balance sheet (OBS) instruments of similar maturities or re-pricing frequencies when interest rates change (Bank for International Settlements Basel Committee on Banking Supervision, 2004).

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).

**Interest rate financial derivatives**

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

**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).

**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).

**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).
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).

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)

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).

Empirical Review
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).

**Research Methodology**

The study adopted a descriptive research design and targeted 168 market makers spread across the 44 commercial banks in Kenya. The study adopted Mugenda (2008) sampling formula to derive a sample of 39 commercial banks and 117 market makers comprising of three respondents from each commercial bank namely the treasurer, senior dealer and dealers. The study adopted questionnaires to collect quantitative data. Upon completion of the data collection exercise, all completed questionnaires were assembled, coded, summarized, entered into the computer; and analyzed using the statistical package for social science (SPSS) version 21.0. The data was analyzed using descriptive and inferential statistics. Descriptive statistics include percentages, frequency tables, means, and standard deviations. The study applied inferential statistics by conducting ANOVA, regression, B-coefficient and correlation analysis. To establish the relationship between study variables, the study used a multivariate regression analysis below.

\[ Y = \alpha + \beta_1 X_1 + e \]

Where: \( Y \)=Interest rate risk management using financial derivatives, \( X_1 \)= Market resiliency, \( e \)=Error term, \( \alpha \)= constant, and \( \beta \)=coefficient of independent variable. Diagnostic tests were conducted to ensure adherence to assumptions of ordinary least square regression model.

**Results**

In this study, the researcher administered a total of 117 questionnaires. A total of 108 questionnaires were filled and returned. This represented a response rate of 92.3%. The response rate fit with Kothari's argument (2004) that for a descriptive study a response rate of 50% or more is adequate.

**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.
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 1.

Table 1: Descriptive results for Market resiliency

<table>
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<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Skewness Stat</th>
<th>Kurtosis Stat</th>
<th>Std. Error</th>
<th>Std. Error</th>
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</thead>
<tbody>
<tr>
<td>Market participants’ access published quotes and orders for interest rate forwards.</td>
<td>108</td>
<td>3.2130</td>
<td>1.03265</td>
<td>-.181</td>
<td>1.438</td>
<td>.461</td>
<td></td>
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<td>Buyers and sellers are present in the interest rate forwards.</td>
<td>108</td>
<td>3.5093</td>
<td>1.08942</td>
<td>-.378</td>
<td>-1.103</td>
<td>.461</td>
<td></td>
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<td>Buyers and sellers are present in interest rate swaps market.</td>
<td>108</td>
<td>3.3148</td>
<td>.94373</td>
<td>-.333</td>
<td>-.977</td>
<td>.461</td>
<td></td>
</tr>
<tr>
<td>Market participants’ access published quotes and orders in interest rate swaps market.</td>
<td>108</td>
<td>3.2593</td>
<td>.98939</td>
<td>-.249</td>
<td>-1.234</td>
<td>.461</td>
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<td>There is presence of buyers and sellers of interest rate options in the market.</td>
<td>108</td>
<td>3.4722</td>
<td>1.05422</td>
<td>-.413</td>
<td>-1.049</td>
<td>.461</td>
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<td>Published quotes and orders can be accessed by market participants in interest rate options.</td>
<td>108</td>
<td>3.3611</td>
<td>.99961</td>
<td>-.438</td>
<td>-1.127</td>
<td>.461</td>
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<tr>
<td>Buyers and sellers are present in interest rate options market.</td>
<td>108</td>
<td>3.3148</td>
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</tbody>
</table>

The findings in Table 1 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.
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 2:

Table 2: Descriptive results of Financial Derivatives Used to Manage Interest Rate Risk

<table>
<thead>
<tr>
<th>Interest rate swaps</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Skewness Stat</th>
<th>Skewness Std. Error</th>
<th>Kurtosis Stat</th>
<th>Kurtosis Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>The bank uses financial derivatives to swap from fixed rate to floating rate debt</td>
<td>108</td>
<td>3.2778</td>
<td>1.01238</td>
<td>-0.199</td>
<td>0.233</td>
<td>-1.216</td>
<td>0.461</td>
</tr>
<tr>
<td>The bank uses financial derivatives to swap from floating rate to fixed rate debt</td>
<td>108</td>
<td>3.3148</td>
<td>0.93377</td>
<td>-0.462</td>
<td>0.233</td>
<td>-1.042</td>
<td>0.461</td>
</tr>
<tr>
<td>The bank uses financial derivatives to fix in advance the rate (spread) on new debt</td>
<td>108</td>
<td>3.2963</td>
<td>0.93987</td>
<td>-0.354</td>
<td>0.233</td>
<td>-1.035</td>
<td>0.461</td>
</tr>
</tbody>
</table>

The findings in Table 2 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 3: Descriptive results of Financial Derivatives Used to Manage Interest Rate Risk

<table>
<thead>
<tr>
<th>Interest Rate Options</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>The bank uses interest rate options that are exercised only on the expiry date of the</td>
<td>108</td>
<td>3.4074</td>
<td>.89690</td>
<td>-.667</td>
<td>.233</td>
</tr>
<tr>
<td>contract.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>108</td>
<td>3.4259</td>
<td>.93931</td>
<td>-.471</td>
<td>.233</td>
</tr>
<tr>
<td>The bank uses interest rate options that are exercised only on the pre-specified dates for the duration of the contract.</td>
<td>108</td>
<td>3.2685</td>
<td>.93335</td>
<td>-.353</td>
<td>.233</td>
</tr>
</tbody>
</table>

Table 3 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.

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.

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 1.
Table 4: Awareness of the functioning of Electronic Trading Platforms

<table>
<thead>
<tr>
<th>Trading Platform</th>
<th>Yes</th>
<th></th>
<th></th>
<th>No</th>
<th></th>
<th></th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percentage</td>
<td>Frequency</td>
<td>Percentage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bloomberg</td>
<td>98</td>
<td>91</td>
<td></td>
<td>10</td>
<td>9</td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Citivelocity</td>
<td>91</td>
<td>84</td>
<td></td>
<td>17</td>
<td>16</td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Autobahn</td>
<td>96</td>
<td>89</td>
<td></td>
<td>12</td>
<td>11</td>
<td></td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: Awareness of the functioning of Electronic Trading Platforms

The findings in Table 4 and Figure 1 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.

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 5.

Table 5: Electronic Trading Platforms affects the Efficacy of Market Liquidity

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>101</td>
<td>94</td>
</tr>
<tr>
<td>No</td>
<td>7</td>
<td>6%</td>
</tr>
<tr>
<td>Total</td>
<td>108</td>
<td>100%</td>
</tr>
</tbody>
</table>
The findings in Table 5 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.

**Correlation Results**
The results for Pearson correlations between Market Resiliency and Interest Rate risk management using financial derivatives were as presented in Table 6.

<table>
<thead>
<tr>
<th>Market Resiliency</th>
<th>Interest Rate risk management using Financial Derivatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>.344**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>108</td>
</tr>
<tr>
<td></td>
<td>108</td>
</tr>
</tbody>
</table>

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

The finding in Table 6 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.

**Regression Analysis**
To determine the relationship between the independent and dependent variables, a regression analysis was calculated. The independent variable of the study was of the study was market resiliency while the dependent variable was Interest Rate risk management using Financial Derivatives.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>.476a</td>
<td>.226</td>
<td>.189</td>
<td>.71872</td>
<td>.476a</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Market Resiliency
In the Model Summary, the R Square value shows the amount of variance in the dependent variable that the independent variable explains. The results show that independent variable 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 the independent variable entered and the dependent variable.

**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 8.

**Table 8: Analysis of Variances (ANOVA)**

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>15.422</td>
<td>5</td>
<td>3.084</td>
<td>5.971</td>
<td>.000</td>
</tr>
<tr>
<td>Residual</td>
<td>52.689</td>
<td>102</td>
<td>.517</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>68.111</td>
<td>107</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: Financial Derivatives
b. Predictors: (Constant) Market Resiliency

The findings in Table 8 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 market resiliency 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 9.

**Table 9: Beta Coefficients and Model for the Commercial Banks**

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>2.032</td>
<td>.302</td>
<td>6.720</td>
<td>.000</td>
</tr>
<tr>
<td>Market Resiliency</td>
<td>.376</td>
<td>.149</td>
<td>.454</td>
<td>2.659</td>
</tr>
</tbody>
</table>

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

The optimal regression model therefore becomes:

**Interest Rate Risk Management Using Financial Derivatives= 2.032+ 3.76(Market Resiliency)**

**Conclusions**

The study arrived at a conclusion 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. 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 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.

**Recommendations**
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. The market maker system should be improved. The government should give market makers support politically, such as providing convenient source of financing, allowing short selling, motivating their enthusiasm and initiative. 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 to lower the requirement of being a market maker to improve the efficiency of trading. 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.

**Acknowledgements**
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**References**


