Economics and Finance Review Vol. 5(02) pp. 14 – 23, June, 2017 ISSN: 2047 - 0401
Available online at http://www.businessjournalz.org/efr

INFLUENCE OF INTEREST RATE RISK ON PERFORMANCE OF COMMERCIAL BANKS IN KENYA

Maniagi Musiega (Corresponding Author)
Phd Student Jomo Kenyatta University Of Agriculture And Technology
E-mail: *mmaniagi@gmail.com*

Dr. Tobias Olweny
Lecturer Jomo Kenyatta University Of Agriculture And Technology
E-mail: *tolweny@jkuat.ac.ke*

Dr. Clive Mukanzi
Lecturer Jomo Kenyatta University Of Agriculture And Technology
E-mail: *cmukanzi@gmail.com*

Dr. Mbithi S Mutua
Lecturer Jomo Kenyatta University Of Agriculture And Technology
E-mail: *smbithi@jkuat.ac.ke*

ABSTRACT

The main objective of the study was to determine the influence of interest rate risk on performance of commercial Banks. Despite the banking sector stability and resilience in 2015, two non-systemic banks, were placed in receivership by the Central Bank of Kenya this was attributed to liquidity risk and failure to owner debt, lack of adequate provision for non-performing loans. Secondary data from the banks website and from the central bank of Kenya were used in the study. The population were the 44 commercial banks in Kenya of which 2 were under receivership and one under statutory management. Panel data for 30 commercial banks that had data for 10 year period from 2006 to 2015 were used. Descriptive statistics and correlation analysis were used, for regression random and fixed effects were applied using E-views software. The findings were interest income to total loans had a significant positive relationship with performance

1. INTRODUCTION

Financial risk management has been the core determinant for most investment decisions made by investors. Most investors perceive that option prices convey the degree of risk that the market reflects about an investment. When predicting average return, option prices are silent to this respect especially where conventional wisdom is applied (Peter &Jimings, 2012). In Ross (2011) the Black and Scholes paradigm is found to be startling as an investor value options without having knowledge of expected return, Standard finance theory postulates that rational investors tend to balance risk and expected return, leading to positive correlation between risk and expected return which investors can use to make judgments based on fundamental information(Weber &Nosic, 2012).

In Kenya there are 44 commercial banks of which ten of them are registered on the Nairobi Securities Exchange (NSE) as per central bank of Kenya report 2015, of which 28 banks are locally owned and14 are foreign owned (CBK, 2015). Kenyan banking sector has been ahead of its neighbours, it has been acredited for its size and diversification (Muteti 2014). Kenya's standard indicator for financial development stood at 23.7% in 2008, Tanzania had 12.3% Uganda 7.2% and relative to a median of 12.3% for Sub-Saharan Africa (Ngumi, 2013).

The International Monetary Fund (2011) highlighted that banks failed in the 2007 financial crisis due to poor risk management and over reliance on short-term wholesale funding, which quickened the failure of a number of banks. Despite the banking sector stability and resilience in 2015, two non-systemic banks, Dubai Bank Limited and Imperial Bank Limited, were placed in receivership by the Central Bank of Kenya (CBK) in the second and third quarters of 2015 for Dubai bank this was attributed to financial risk thus liquidity risk and failure to owner debt and interest for bank of Africa (CBK 2015). Bankruptcies of banks can cause damage to the entire economy this justifies the necessity to regulate the entire banking system. It is also necessary to regulate and supervise the financial sector by checking information asymmetry (Palvia & Patro, 2011).

1.1 Objectives

I. To establish the influence of interest rate risk on financial performance of commercial banks in Kenya.
II. To determine the influence of bank size as a control variable on financial performance of commercial banks in Kenya

1.2 Hypothesis

I. H_{a1} : Interest rate risk has significant influence on financial performance of banks in Kenya.
II. H_{a2} :Bank size as a control variable has significant influence on financial performance of banks in Kenya

2. LITERATURE REVIEW

Interest rate risk management comprises actions, policies, and techniques that a bank uses to minimize the risk of reduction of its net equity due to adverse changes in interest rates. Interest rate risk factors that have adverse effects on both a bank's earning and its economic position are estimated in each currency which banks have interest-rate-sensitive on and off-balance sheet positions are used to assess the interest risk exposure (Opoku-Adarkwa, 2011).Interest rate risk is the potential for changes in interest rates that reduces bank's earnings.An investor may lose potential return if interest rates rise after committing to particular interest or interest rate. When interest rates change it affects the value of the instrument BCBS (2000).

Banks encounter interest rate risk in different ways including re-pricing risk which is the primary and most common form of interest rate risk which arise from timing differences in the maturity of banking corporation assets, liabilities (BCBS, 2000). Secondly Yield curve risk which arises due to unanticipated shifts of the yield curve which have adverse effects on a banking corporation's income The yield curve may likely shift due to changes in relationships between interest rates for different maturities of the same index. Basis risk arises from imperfect correlation in the changes of interest rates in different financial markets. Differences in interest rate changes gives rise to unexpected changes in the earnings spread between assets, liabilities of similar maturities (Kolopo&Dapo, 2015).

Khawaja and Musleh (2007) in their research found out that increase in interest rate depress borrowers and depositors but increases performance. Thus when banks charge high interest rate they gain high return from borrower and at the same time discourage depositors by giving them low returns as they have no options but to accept the prevailing rate given by the bank. This is consistent to Waseem and Abdul, (2014) whose research used five major commercial banks in Pakistan panel data for four years 2008 to 2012 and the findings showed a significant negative correlation between interest rate risk and performance.

Zairy and Salina (2010) in their research paper on analysis of Islamic banks exposures to rate of return and risk the panel data for 2007-2008 the study found that Islamic banks show a strong positive correlation between rate of return risk and performance. This is inconsistent to Kolopo and Dapo (2015) their research for the period 2002 to 2011 in Nigeria a sample of tier one capital banks, using fixed effects regression analysis method where interest rate had insignificant effect on banks performance.

Zagonov, Kiswani and Mash (2009) took their study to determine how banks regulate the interest rate risk, the findings were performance was negatively correlated to interest rate risk this can be explained by the fact that management failed to hedge the risk this is consistent to Matthias (2012) in their research impact of loan growth and business model on bank risk in 15 EU countries found higher level of interest rates reduce bank's exposure to leverage risk

3. RESEARCH METHODOLOGY

3.1 Research Design

According to Upagade and Shende, (2012) research design is the arrangement of conditions from collection to analysis of data in a way that will aim to combine relevance of research purpose with economic implication. Sekaran and Bougie, (2011) views it as a blueprint that guides the process of research from the formulation of the research questions and hypotheses to reporting the research findings The research philosophy that was adopted for this research is that pursued by positivists who believe reality is stable and hence can be observed from an objective viewpoint positivists argue that a phenomena can be isolated and observations can be duplicated (Creswell, 2006). This involves manipulation of reality with variations in independent variable in order to identify regularities and form relationships between constituent elements of the social world (Wilfred, 2006). Positivists' researchers assume a controlled approach in conducting research by identifying a research topic, research hypotheses and a suitable methodology. Positivism enable one to apply statistical techniques in testing hypotheses to analyse research data collected using quantitative research techniques.

The study adopted mixed research design which comprised descriptive survey research design and correlational research design which assumes world view and several world views (Creswell, 2006). Sekaran and Bougie (2011) argue that descriptive survey design helps one to understand the characteristics of a group in a given situation and assists in systematic thinking about aspects of a given situation.The correlational research design aims at discovering associations between different variables (Cooper & Schindler, 2011). Thomson, Diamond,

mcwilliams and Snyder (2005) argue that correlational evidence gives more information as regards to measurements, avoiding common analysis errors, quantifying effects and when using confidence intervals to show range of possible effects and the precision of estimates

3.2 Target Population

Zikmund*et al.*, (2010), Kothari (2004), all concur that population is all items in any field of inquiry or 'universe'. Polit and Beck (2003) refer to population as the aggregate of those conforming to a set of specifications.Sekaran and Bougie (2011) defines population as the entire group of people, events or objects of interest that the researcher is to investigate.Lavrakas (2008) explain that a population is any finite or infinite collection of individual objects. For secondary data the target population was 44 commercial banks in Kenya (CBK, 2014), which account for two thirds of assets of financial system. Central Bank identified 14 banks, whose ownership was foreign, which account for 32.2% net assets and the rest are local.

3.3 Sampling and Sample Size

According to Kombo and Tromp (2009) it is a finite part of a statistical population whose properties are studied in order to gain generalized information representing the whole universe. It enables one to draw conclusion generalized to the population of interest (Sekaran&Bougie, 2011). Lavrakas (2008) defines a sample in a survey research context as a subset of elements or objects drawn from a larger population. Kombo and Tromp (2009) describe a sample as a collection of representative units chosen from the universe. There are various methods used in sample selection but vary in cost, effort, and skills required. The quality of the sample depends on whether it represents the population with respect to the variables in the study (Zikmund*et al.*, 2010). For secondary data all the 44 commercial banks were included on condition that they have published accounts for the years 2006 to 2015.

3.4 Data Collection Instruments

The research utilized both secondary and primary data. Secondary data was collected from Central Bank of Kenya and various databases of the banks for financial statement for the period 2006 to 2015. Dawson (2009) defines secondary research as collecting data using information from studies of other researchers in an area or subject. According to Ember and Ember (2009) secondary data is one collected by other people. Audited income statements, balance sheets and cash flow statements were collected from the central bank of Kenya (CBK) and commercial banks websites. The requirement was that the bank was in operation and has published accounts for ten year period from 2006 to 2015.

3.7Data Collection Procedures

Secondary data was collected from banks website and the Central Bank of Kenya where financial statements were used. Ratios were computed and used during analysis. (insert table 1)

3.5 Data Analysis and Presentation

Data analysis involved both descriptive and inferential statistics where model specification estimation and rationale of variables was done. The data was tested for normality and transformed into natural logarithm before regression undertaken as illustrated below.

3.5.1 Descriptive Statistics

Descriptive statistics were used to determine the statistical properties of the model in order to select the proper functional form of the model, statistical analysis technique was used and mean, standard deviation, standard errors, maximum and minimum values of the variables overtime were calculated for secondary data using E-views software. Correlation analysis was used to check which variables were highly correlated so as to avoid the problem of multi-collinearity which is a common problem in time series data.

3.5.2 Model Specification and Rationale of Variables

This study adopted a panel data regression where Ordinary Least Squares (OLS) method was used. The data included time series and cross-sectional data that were pooled into a panel data set. This was estimated using panel data regression. Multiple regressions were conducted and the data converted to their natural logs to deal with the problem of large numbers and eliminate heteroscedasticity. The reason to stationarize data was to obtain a meaningful sample mean, variance which can show future behaviour if series is stationary. But if series is consistently increasing then will underestimate the mean (Jaroslava& Martin 2005).

Unit Root Test

This paper employs multiple panel unit root tests that can be arranged in groups by cross section dependence or independence homogenous, or heterogeneous unit roots that are defined by (Levin Lin & Chu.2002, Im,

Pesaran& Shin 2003, Maddala& Wu, 1999, Phillips-Perron 2000). Individual unit root has limited powers hence the probability of rejecting null hypothesis when it's false is present. The unit roots used in this study are as illustrated below.

Levin Lin and Chu Test (2002)
Levin, Lin and Chu assume that the three models below produce the stochastic term Y_{it}

Model 1 $Y_{it} = \rho_I y_{I,t-1} + \varepsilon_{I,t}$ (3.2)

Model 2 $Y_{it} = \alpha_i + \rho_I y_{I,t-1} + \varepsilon_{I,t}$ (3.3)

Model 3 $Y_{it} = \alpha_i + \alpha_{it} + \rho_I y_{I,t-1} + \varepsilon_{I,t}$ (3.4)

The null and alternative hypothesis for model 1 may be written as $H_O\ \rho_1 = 1$, and $H_O\ \rho_1 < 1$. The null hypothesis is that the panel data contain unit root while the alternate hypothesis the panel is stationary the assumption for model 2 and 3 will be $\alpha_i = 0$ the error term is distributed independently across individuals and is stationary for each individual.

The Im Pesaran and Shin IPS (2003)
This test for presence of unit roots in panels and it combines information from time series dimension and cross section dimension, thus fewer time observations are required to make the test to have power. IPS test has been found by researchers to have superior test power in analyzing relationships in panel data, this research employed this procedure. IPS specifiesADF regression for a cross-section with individual effects and no time trend as in :

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t\ 1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{i,t\ j} + \varepsilon_{it} \quad (3.5)$$

where $i = 1, \ldots, N$ and $t = 1, \ldots, T$

IPS use separate unit root tests for the N cross-section units. Their test is based on the Augmented Dickey-fuller (ADF) statistics averaged across groups.

Phillips-Perron (2000) Unit Root Test:
The test proposed non-parametric transformation of t- statistics from original Duckey Fuller regressions. Thus under null hypothesis unit root, the transformed statistics have DF distribution.
The test regression for the PP test is

$Y_{it} = \alpha_i + \rho_I y_{I,t-1} + \varepsilon_{I,t}$ (3.6)

$t = 1, 2, \ldots\ldots T$

where $\varepsilon_{I,t} = 1$ or 0 may be heteroscedastic.

One advantage of the PP tests over the ADF tests is that the PP tests are robust to general forms of heteroscedasticity in the error term $\varepsilon_{I,t}$ also it does not need to specify a lag length for the test regression If the individual unit root tests are Augmented Dickey-Fuller tests (ADF) then the combined test performed is referred to as Fisher-ADF test. If instead the individual tests are Phillips-Perron test of unit root (PP), then the combine test perform is referred to as Fisher-PP test in E-Views. (Hossain 2014)

$Y_{it} = \alpha_i + \sum_1^t \rho_I y_{I,t-1} + \varepsilon_{I,t}$ (3.7)

In this test Augument Dickey Fuller ADF for each cross section regression is then followed to obtain residues which are then standardised before OLS regression undertaken. The Im et al. (2003), the Fisher-ADF and PP tests allow for individual unit root processes so that may vary across cross-sections. The tests are characterized by combining individual unit root tests to derive a panel-specific result. The regression analysis was run using E-views 7 data analysis software for secondary data as shown in the regressions 3.8 to 3.9.

Regression Equation of ROA without size of firm

$Ln\_ROA_{it} = \alpha + \beta_1 Ln\_IR_1 + \beta_2 Ln\_IR_2 + \mu$ (3.8)

Regression Equation of ROA with size of firm as a control variable

$Ln\_ROA_{it} = \alpha + \beta_1 Ln\_IR_{it} + \beta_2 Ln\_IR_2 + \beta_3 Ln\_SZ_i t + \mu_{it}$ (3.9)

Where;

Ln = the natural logs of the variables

IR_1 = measures of liquidity risk which were Liquid assets to total assets and Liquid assets to total deposits 2006-2015

IR_2 = measures of interest rate risk which were Loans to assets ratio and Interest income to total loans ratio for the period 2006 -2015
ZS_{it} = Total assets which is a measure of size of bank for period 2006-2015
ROA_{it} = Return on assets for period 2006-2015
ROE_{it} = Return on equity for period 2006-2015

β_1, β_2, β_3, β_4, regression coefficient

3.5. 3 Choice of Model: Testing for the Validity of the Fixed Effects Model
The fixed and random effects were considered in this analysis Panel data analysis has three independent approaches the first one is pooled panels which assumes there are no unique attributes of variables within the measurement set, and no universal effects across time. The second approach is the fixed effects models which assume that there are unique attributes for models which assume the presents of unique, time constant attributes of variables that are the results of random variation which does not correlate with the individual regressors. A random effect model assumes the unobserved difference is not correlated with explanatoryvariables.This model was appropriate when drawing inferences about the whole population. The benefit of using the random effects model is that, regressors allowed time-invariant variables to be included (Greene, 2012) since pooled regression model assumed that all the institutions are the same which is not the case. The two models cater for heterogeneity or individuality among the institutions which allows each institution to have its own intercept value which is time invariant. As to which model between the fixed and random is appropriate, the study used the Hausman test. A Hausman test was used to determine whether to use the fixed effects or random effects model to address objectives of this study.

4. RESULTS AND DISCUSSION

4.1 Response Rate
There are 44 commercial banks in Kenya as per CBK 2015 report of which two banks were under receivership that is Chase bank limited and imperial bankhence they did not present financial statement for publication for the year, Charter House bank was under statutory management hence did not publish their financial statements for the year. For this thesis 30 banks were as their financial for 10 year period 2006 to 2015 were available giving a response rate of 68%

4.2 Correlation results
From table 2 in appendix 1 Ln_TA had medium positive correlation with Ln_ROA with a coefficient of 0.51. Ln-IR1, Ln_ IR2 had weak negative correlations with Ln_ROA with correlation coefficients of -0.07 and -0.05 respectively meaning that, loans to asset and interest income to total loans have weak negative correlations with return on assets. The correlation results indicate that there is no multicolinearity among independent variable and the dependent variable as the correlations are below 0.9 (Ahmed & Ahmed 2012).

4.3 Descriptive Statistics
From the table 3 in appendix 1, the natural logarithms of return on assets had a mean of 1.04 while there standard deviation was 0.65. The measures of interest rate risk Loans to assets ratio and Interest income to total loans ratio there natural logarithms had a mean of -0.75 and – 2.68 with a standard deviation of 0.43 and 1.05 respectively. The mean value of return on assets (DROA) is significantly positive, thus commercial bank in Kenya are enjoying a healthy profitability.

A distribution is considered normal if the values of skewness and kurtosis are equal to zero. Monte-carlo simulations indicate that skewness of value smaller than 2 and kurtosis value smaller than 7 should be considered normal. Skewness of value 2.0 to 3.0 and kurtosis values 7.0 to 21.0 are considered as non-normal. Skewness of value greater than 3and kurtosis greater than 21 is considered extremely non-normal (Tabor, 2011). From the table above skewnessranges from -2.71 to 6.3 and kurtosis has a range 1.78 to 48 indicating the data is extremely non-normal. Applying the Jarque-Bera test of normality, the value is less than 0.01, which is significant hence a strong support for the hypothesis that the returns and the independent variables do not have normal distribution

4.4 Unit root test
From table 4 in the appendix evaluation of stationarity of the variables in the model, unit root test most is applicable for unbalanced panels. Stationary means the variance, mean and autocorrelation of a variable does not change with time. From the table 4.4 above p-value in parentheses, ** denote rejection of null hypothesis at 1% significance. All panel unit root tests have null hypothesis tests of non-stationary financial risk. It can be seen that the probability of Levin, Lin and Chu statistic for all the variables has a value < 0.01 which is

significant at 1% level of significance hence usingLevin, Lin and Chu test (2002) it rejects the null of unit root this shows that the variables are stationery and has no unit root.Im, Pesaran and Shin unit root test (2003),Augmented Dickie-Fuller ADF-Fisher Chi-square (1999), Phillips-Perron-Fisher Chi square, (2000) were also implemented most confirm stationary data hence no unit test except for natural logarithm of assets where Im, Pesaran and Shin unit root test ,Augmented Dickie-Fuller ADF-Fisher Chi-square andPhillips-Perron PP unit root tests both fails to reject natural logarithm total assets (Ln_TA) at both 1% and 5% level respectively. Due to presence of unit root as shown by the above data, first difference treatment was implemented on the data to be used in this thesis as illustrated table 5. From the table 5 in appendix 1 after the first difference both Levin, Lin and Chu test (2002) and Phillips-Perron(2000) Im, Pesaran and Shin unit root test (2003), Augmented Dickie-Fuller ADF-Fisher Chi-square rejects the null of unit root this shows that all variables are stationery and has no unit root.

4.5 Regression Results

This section presents the results for multiple regression analysis the first being financial performances represented by return on assets and return on equity against financial risks together followed by second with size of the bank as a control variable. Random and fixed effects model was used. In this research the natural logarithms of the actual values of the variables to deal with the problem of large numbers and eliminate Heteroscedasticity were calculated using the e-views software

4.5.1 Hausman Test

The Hausman test statistic is a transformation of difference between the parameter estimates from fixed effects and random effects estimation that becomes asymptotically χ2chi- square distributed under null hypothesis. The basic idea is that under the null hypothesis both OLS and GLS are consistent while under alternate hypothesis is not consistent. For this paper the values were then differenced (1st difference) to ensure the data is stationary but before regression, a Hausman test was done to determine whether to use the fixed effects or random effects model to address objectives of this study.

From the table 6 in the appendix 1 The Hausman test is distributed as chi-square with 1 degree of freedom. It had a probability of 0.5377 which is greater than 0.05 this shows that it's appropriate to adopt random effects model.

4.5.2 Random and fixed effects results

From the table 7 in the appendix 1 the model is significant at 5% level as the probability value is 0.0449 which less than 0.05. The Durbin- Watson value is 2.3029 indicating that there is no autocorrelation problem (Alsaeed, 2005). The value of R-squared was 0.0247 showing that interest risk proxies explain 2.47% variance in performance indicator return on assets.

Interest income to total loans (DIR2) had a coefficient 0.2657 with a p value of 0.0175 the relationship is positive and significant at 5% level. Zairy and Salina (2010) in a similar research on Islamic banks exposures to rate of return and risk found that Islamic banks had a significant positive correlation interest rate risk and performance.Loans to total asset ratio (DIR1) has a coefficient of 0.01962 which is not significant as the p value is greater than 0.05. Kolopo and Dapo (2015) found similar results in research for the period 2002 to 2011 in Nigeria a sample of tier one capital banks, using fixed effects regression analysis method interest rate had insignificant effect on banks performance.

4.5.3 Random and fixed effects results with control variable

From the table 8 in the appendix 1 Loans to total asset ratio (DIR1) had a coefficient of 0.0077 which is not significant as the p value is greater than 0.05 the value has remained insignificant similar to previous regression without bank size as a control variable. Similarly Interest income to total loans (DIR2) had a coefficient 0.2439 with a p value of 0.0347 the relationship is positive and significant at 5% level. The coefficient for bank size was -0.1231 thus a negative relationship with return on assets but not significant. It can be concluded that bank size has no control effects on the model

5. CONCLUSION

The measure of interest rate risk that is interest income to total loans had a positive relationship with performance using panel data regression results. This implies that commercial banks increase profits when interest rates risk increase, thus most of the interest rate variability favors the commercial banks. The availability of credit, financial markets and government activities such as credit squeeze through central bank is likely to have impact on performance. It can be concluded that there exists a positive and significant relationship

between interest rate risk and performance of commercial banks in Kenya. This implies that interest rate risk was statistically significant in explaining performance of commercial banks in Kenya

6. RECOMMENDATION

The results from the panel data the correlation values were very low this showed that there was no multicolinearity in values of proxies of Interest rate risk. Measured by liquid assets to total loans was positively correlated to return on assets as a measure of performance thus as interest rate risk increases performance increase. Thus the variability in interest rate favors performance positively. This means that commercial banks in Kenya could focus on hedging and forecasting the macroeconomic factors that determine interest rates rather than the focusing on interest rates themselves this will enable them to project profitable business.

7. AREAS FOR FURTHER RESEARCH

This study did not consider banks investments and sources of funding further study should be done on influence of financial risk management on sources of funding and investments. Thus establishing how the mix of funding affects the level of financial risk determining how financing mix impact on financial risk of financial firms, the size of the size of the firm can be taken as a moderating variable. A detailed study can also be undertaken on influence of operational risk on financial performance of commercial banks in Kenya as this type of risk has been recognised by Basel ll. Further research can be done to include non-financial factors, such as ownership structure, physical locations number of customers as moderating variables to determine their moderating effects on the relationship between banks' performance and financial risk. Also further research can be done to determine the influence of interest capping on financial performance.

REFERENCES

BCBS, (2000). *Principles for the management of the management of credit risk* CH – 4002 Basel, Switzerland Bank for International Settlements. Retrieved from http://www.bis.org/publ/bcbs75.

Dawson, C. (2009). *Introduction to Research Methods:* A practical guide for anyone undertaking a research project. How to Books Ltd, 3 Newtec Place, United Kingdom.

CBK (2015) BANK supervision report

Creswell, J. W. (2009). Research design: Qualitative, quantitative, and mixed methods approaches (3rd ed.). Thousand Oaks, CA: Sage

Ember, R. and Ember.M. (2009). Cross-Cultural Research Methods, 2nd edition. AltaMira/Roman & Littlefield

Hossain A..(2014) *A Panel Cointegration Analysis of the Euro area money demand.* (Master thesis) Department of Statistics Lund University Retrieved from https://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=1712211&fileOId=1712243.

IMF (2011) report

Khawaja, I., & Musleh, D. (2007). Determinants of Interest Spread in Pakistan. *The Pakistan Development Review.* 46 (2) 129-143

Kolapo, T., & Dapo, F. (2015). The influence of interest rate risk on the performance of deposit money banks in Nigeria. *International Journal of Economics, Commerce and Management,* 3 (5), 1219- 1229.

Kombo, D., & Tromp, D. (2009). *Proposal and Thesis Writing: An Introduction. Paulines Publications Africa*, Don Bosco Printing Press, Nairobi Kenya.

Kothari, C. (2004). *Research Methodology: Methods & Techniques. (*2nd ed.). New age International Publishers, New Delhi, India.

Lavrakas, P. (2008). Encyclopedia of Survey Research Methods. *Sage Publications*, 1, 784-785.

Matthias, K. (2012). Which banks are more risky? The impact of loan growth and business model on bank risk-taking Discussion Paper Deutsche Bundes bank.

Muteti, R. (2014). *Financial risk management and financial performance of commercial banks in Kenya*. (Unpublished Master thesis) School of Business, University of Nairobi.

Ngumi, P. (2013). *Effect of bank innovations on financial performance of commercial banks in Kenya*. (Doctoral thesis), Jomo Kenyatta University of Agriculture and Technology. Nairobi.

Opoku-Adarkwa, R., (2011). Risk management and bank performance. A case study of first Atlantic Merchant Bank Ghana limited. Unpublished master's thesis, Kwame Nkrumah University of Science and Technology.

Palvia, A, & Patro, D, (2011). *Re-Examining the Role of Market Discipline for Bank Supervision: Evidence from the Subprime Crisis*., working paper series.

Ross, S. (2011). Recovery theorem. *Journal of finance* 1, 1-60.

Sekaran, U., & Bougie, R. (2011). *Research Methods for Business: A Skill Building Approach. (*5th ed.). Aggarwal printing press, Delhi.

Upagade, V., & Shende, A., (2012). *Research methodology*. 2nd edition. S.Chad and Company Ltd. Ram Nagar, New Delhi.

Waseem, A., & Abdul, S. (2014). Impact of interest rate changes on profitability of four major commercial bank in Pakistan. *International journal of accounting and financial reporting*, 4 (1), 142-155

Weber, M., Weber E., & Nosic, A. (2012).Who takes risk and why: Determinants of changes in investor risk taking," *The Review of Finance*, 2, 70-79.

Wilfred, C. (2006). Philosophy, Methodology and Action Research. *Journal of Philosophy of Education.* 40 (4), 421-436.

Zagonov, M., Keswani, A., & Marsh, I. (2009).*Bank Regulations and Interest Rate Risk. London:* Cass Business School

Zairy, Z., & Salina H. (2010). Analysis of Islamic banks exposures to rate of return and risk. *Journal of economic cooperation and development*, 31 (1), 51-84.

Zikmund, G., Babin, J., Carr, J. & Griffin, M.(2010). *Business Research Methods* 8th ed. South-Western, Cengage Learning, Natorp Boulevard mason.

Appendix 1

Variable	Nameof Variable	Operationalisation	Measurement
Dependent variables	Financial Performance of commercial banks	Return on assets (ROA).	Net profit after tax/ total assets
	Interest Rate Risk	i. Net loans/total assets ii. Interest income/ Total assets	The higher the ratio the higher risk
Control variable	Size of firm	Total assets	Natural logarithms of total assets

Table 1 Measurement of Study Variables

	LN_ROA
LN_ROA	1.000000
LN_IR1	-0.073478
LN_IR2	-0.047050
LN_TA	0.507486

Table 2: Correlation of ROA with Independent Variables

	LN_ROA	LN_IR1	LN_IR2	LN_TA
Mean	1.04	-0.75	-2.68	23.88
Median	1.18	-0.66	-2.82	23.55
Maximum	2.34	0.11	2.64	26.87
Minimum	-2.30	-3.49	-4.71	20.31
Std. Dev.	0.65	0.43	1.05	1.40
Skewness	-1.10	-3.58	3.41	0.22
Kurtosis	5.02	22.25	16.84	1.87
JarqueBera	106.37	5028.9	2835.	17.53
Probabilit	0.00	0.00	0.00	0.00
Sum	296.60	-213.3	-765.	6829.4
Sum Sq. Dev.	121.40	51.95	314.9	558.95
Observations	286	286	286	286

Table 1: Descriptive Statistics Table

VARIABLES	Levin, Lin & Chu Stat (Prob.)	Im, Pesaran& Shin (Prob.)	Augmented Dickie-Fuller (ADF) (Prob.)	Phillips-Perron (Prob.)	Integration Level
LN_ROA	-17.3650** (0.0000)	-5.61010** (0.0000)	128.228** (0.0000)	136.681** (0.0000)	I(0)
LN_IR1	-7.39139** (0.0000)	-2.35889** (0.0092)	99.6348** (0.0010)	143.562** (0.0000)	I(0)
LN_IR2	-7.60608** (0.0000)	-2.73885** (0.0031)	96.1649** (0.0021)	122.715** (0.0000)	I(0)
LN_TA	-6.52055** (0.0000)	1.53162 (0.9372)	67.6310 (0.2329)	76.5499 (0.0735)	I(0)

Table 4: Unit Root Tests

VARIABLES	Levin, Lin & Chu Stat (Prob.)	Im, Pesaran& Shin (Prob.)	Augmented Dickie-Fuller (ADF) (Prob.)	Phillips-Perron (Prob.)	Integration Level
DROA	-18.9620** (0.0000)	-8.10319** (0.0000)	182.205** (0.0000)	258.141** (0.0000)	I(1)
DIR1	-17.9893** (0.0000)	-9.09546** (0.0001)	205.675** (0.0000)	278.257** (0.0000)	I(1)
DIR2	-15.0990** (0.0000)	-6.93500** (0.0000)	170.975** (0.0000)	234.684** (0.0000)	I(1)
DTA	-19.9461** (0.000)	-7.68182** (0.0000)	173.821** (0.0000)	202.289** (0.0000)	I(1)

Table 2: Unit Root Tests for First Difference
Notation;
D - First difference ** sig at 1% level Values in parenthesis are probability values.

	Return on assets (DROA)
Chi-Sq. Statistic	7.965140
Prob.	0.5377

Table 3: Correlated Random Effects - Hausman Test

Dependent Variable: DROA
Method: Panel EGLS (Cross-section random effects)
Date: 03/07/17 Time: 11:42
Sample (adjusted): 2007 2015
Periods included: 9
Cross-sections included: 30
Total panel (unbalanced) observations: 251
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIR1	0.019624	0.155327	0.126342	0.8996
DIR2	0.265714	0.111040	2.392955	0.0175
C	0.036183	0.032937	1.098540	0.2730

Weighted Statistics

R-squared	0.024710	Mean dependent var	0.038635
Adjusted R-squared	0.016845	S.D. dependent var	0.496043
S.E. of regression	0.491848	Sum squared resid	59.99468
F-statistic	3.141719	Durbin-Watson stat	2.302948
Prob(F-statistic)	0.044933		

Unweighted Statistics			
R-squared	0.024710	Mean dependent var	0.038635
Sum squared resid	59.99468	Durbin-Watson stat	2.302948

Table 7: Regression of ROA and Interest Rate Risk Proxies.

Dependent Variable: DROA
Method: Panel EGLS (Cross-section random effects)
Date: 05/27/17 Time: 18:35
Sample (adjusted): 2007 2015
Periods included: 9
Cross-sections included: 30
Total panel (unbalanced) observations: 251
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIR1	0.007704	0.156247	0.049309	0.9607
DIR2	0.243920	0.114848	2.123850	0.0347
DTA	-0.123121	0.163982	-0.750822	0.4535
C	0.056635	0.042760	1.324485	0.1866

Effects Specification	S.D.	Rho
Cross-section random	0.000000	0.0000
Idiosyncratic random	0.504422	1.0000

Weighted Statistics			
R-squared	0.027042	Mean dependent var	0.038635
Adjusted R-squared	0.015225	S.D. dependent var	0.496043
S.E. of regression	0.492253	Sum squared resid	59.85124
F-statistic	2.288350	Durbin-Watson stat	2.296210
Prob(F-statistic)	0.079074		

Unweighted Statistics			
R-squared	0.027042	Mean dependent var	0.038635
Sum squared resid	59.85124	Durbin-Watson stat	2.296210

Table 8: Regression of ROA with bank size as control.

Appendix 2
Fig 1 Conceptual frame work