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The Influence of Market Risk on Profitability of Microfinance Institutions in Tanzania: A Case of FINCA Microfinance Bank

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Abstract: This study assessed the influence of market risk on the profitability of microfinance institutions (MFIs) in Tanzania. Market risk is divided into interest rate risk and foreign exchange rate risk whose indicators were net interest margin and foreign exchange gains or losses respectively while having Gross Domestic Product (GDP), inflation, and money supply as control variables. The profitability of microfinance institutions (MFIs) was measured by ROAA. The study employed a quantitative research approach and time-series research design. Secondary data was used in the course of this study, which was generated from the quarterly audited financial statements of FINCA microfinance bank from 2010 to 2020. In the analysis of data, the study employed descriptive statistics, pairwise correlation matrix, unit root and Johansen test for co-integration. Autoregressive Distributed Lag (ARDL) model and Error Correction Model (ECM) were used to determine both short-run and long-run effect of interest rate and foreign exchange rate on profitability respectively. The results of the co-integration test indicated that there is no long-run relationship between interest rate, foreign exchange rate and profitability. Interest rate and lag of GDP have a statistically significant positive short-run effect on profitability. Lastly, foreign exchange risk has a negative significant association with profitability in the long run while it has no statistically significant influence on profitability in the short run. Macroeconomic variables have no significant influence on the profitability of MFIs both in the short run and in the long run. It is recommended that the MFIs in Tanzania especially the locally owned need to find ways to mitigate the effect caused by market risk factors on their profits including the use of financial derivatives and asset securitization.

Keywords: Market Risk, Interest Rate Risk, Foreign Exchange Rate, Profitability, Microfinance Institutions, Tanzania

1. Introduction

According to Bank of Tanzania [3] Microfinance Institutions (MFIs) offer banking services to people of low living standard and who have no access to formal financial services. For instance MFIs offer microcredit, non-collateral loans and low amount of savings, unlike commercial banks which offers loans based on collateral, higher amount of savings and higher cost of capital [15]. In 1976 Prof. Muhammad Yunus developed the Grameen model which postulated that low income earners could still be served profitably and enable them to improve their standards of living [31]. In the recent decades the banking industry including the MFIs has witnessed significant changes in the market [11]. The changes being attributed by the advancement of technology (ATMs, mobile banking, internet banking and agent banking), changes in the government regulations and policies that affect the banking industry positively or negatively, the increased customer awareness of what to expect from banking services and lastly the significant economic changes (GDP, unemployment rate and inflation rate) in various countries across the globe [11, 30]. These changes in the external environmental factors affect the operations and profitability of financial institutions including MFIs [8], which arose the need of researchers and investors to analyze the influence of market risk as a great indicator of the vulnerability of a financial institution to the external environment [11]. Having evolved from non-profit

non-government organizations to profit oriented institutions, MFIs have become more concerned with profitability [23]. According to Kipesha [18] MFIs in Tanzania are experiencing low profitability on average in spite of having good management teams and staff as well as control systems, due to the influence of factors from the external environment in which they operate [4]. Market risk factors are used as a great measure of the vulnerability of financial institutions to the external environment [4, 23]. Thus, it is vital for MFIs to be aware of how sensitive their profitability is towards the external market risk factors so as to be able to formulate strategies that will help to reduce their vulnerability to the external environment and achieve stable profits [26]. In addition market risk factors indicate to the investors and other stakeholders the stability of the financial institutions to the external environment [23]. Low sensitivity to market risk factors helps to attract investors and increase credit worthiness of the MFI, thus increasing the chances for high profitability [18].

Previous studies have been conducted on the influence of market risk on profitability of commercial banks [8, 11, 19, 24]. However, the effect of market risk factors on profitability of MFIs has received little attention [4]. Given the distinctive nature of MFIs compared to commercial banks there is need to investigate the effect of market risk factors on profitability of MFIs. In addition previous studies conducted with respect to commercial banks [8, 11, 24] failed to control the effect of macroeconomic variables such as GDP, inflation and money supply. Macroeconomic variables as part of the external market environment [11] also influence the profitability of MFIs, this is justified by [16] and [23] whose studies indicated that macroeconomic variables such as inflation, GDP and money supply which are also part of the external market environment have influence on the profit generated by MFIs.

According to Kablan [17] MFIs do not experience the same degree of risk and returns as other types of financial institutions. In different economies financial institutions tend to react differently towards market risk factors [17]. Therefore, distinctive reaction of profitability of MFIs towards market risk factors is anticipated. Lack of empirical evidence leads to the management, investors, funders and other stakeholders to have less information on the current status of an MFI and its vulnerability to the changing market risk factors, which makes the MFIs to be reactive rather than proactive to the changing market risk factors [12]. This study aimed to address this concern by conducting a critical analysis on the influence of market risk on profitability of MFIs in Tanzania, while controlling the effect of macroeconomic variables (GDP, inflation and money supply). The general objective of the study is to analyze the influence of market risk on profitability of MFIs in Tanzania. The specific objectives of the study were to analyze the long run relationship between interest rate, foreign exchange rate and profitability of MFIs in Tanzania, to analyze the effect of changes of interest rate on profitability of MFIs in Tanzania and to measure the effect of changes of foreign exchange rate on profitability of MFIs in Tanzania.

2. Literature Review

2.1. Theoretical Literature Review

Arbitrage pricing theory (APT) is a multi-factor asset pricing model that assumes an asset's returns can be predicted using a linear relationship between the asset's expected return and multiple external market environment factors that capture systematic risk [28]. It is a useful tool for analyzing portfolios from the standpoint of value investing in order to identify securities that may be temporarily mispriced. Arbitrage pricing theory (APT) predicts asset returns by establishing a linear relationship between a set of external business environment variables and asset expected returns that account for systematic risk [28]. Ross [28] created the APT model, which extended the Capital Asset Pricing Model (CAPM). The APT model is a multi-factor model for determining stock market returns, whereas the CAPM model uses only one factor, this makes APT model to be more suitable to the study.

2.2. Empirical Literature Review

According to the research conducted by Ekinci [8] on the influence of credit and market risk (interest rate and foreign exchange rate) on profitability of commercial banks two general conclusions were generated. First, credit risk has an inverse relationship with the bank's ability to generate profit, foreign exchange rate has positive correlation with bank's profitability and interest rate has negligible effect on the profitability of banks. The study was conducted on the bank profitability with reference to the banking environment of Turkey. The study employed weekly data from 18/01/2002 to 30/10/2015 and autoregressive conditional heteroscedastic approach was applied.

The study conducted by Namasake [24] examined the effect of market risk on financial performance of commercial banks in Kenya for the period 2010-2015. The independent variables under market risk included interest rate, financial leverage and foreign exchange rate. Whereas the financial performance as a dependent variable was measured by ROE. The study used balance sheets and financial ratios of 43 registered commercial banks in Kenya. The generated results indicated that interest rate, financial leverage and foreign exchange rate have a negative and substantial correlation with bank profitability.

Another study was also conducted by Gathigia [11] in Kenya on the influence of market risk on profitability of commercial banks for the years 2010 to 2015. The parameters used to measure the effect of market risk were interest rate, foreign exchange rate and degree of financial leverage. However, financial performance of the bank was measured by one profitability ratio which is ROE. The study was also carried out with the case of 42 commercial banks in Kenya and data was generated from the annual audited financial reports. A pairwise correlation was carried out in

the analysis of data and the findings indicated that financial leverage, interest rate and foreign exchange rate have negative and significant correlation with the bank's profitability. From the finding commercial banks were advised to engage actively in derivative markets in attempt to reduce the risk of interest rate and foreign exchange rate.

Gachua [10] conducted a study on the influence of foreign exchange rate on a firm's financial performance with reference to 32 companies listed in the Nairobi Stock Exchange for the years 2001 to 2010. The data used in the study was generated from the income statements and balance sheets of the respective companies. The results generated indicated that foreign exchange rate gains and losses have the potential to affect the net income of the companies. Previous research has been conducted by Ngalawa [25] with the aim of analyzing the rate of exposure of commercial banks to interest rate risk. The study was carried out with reference of 10 listed commercial banks in Kenya from 2008-2012. The researchers came into conclusion that commercial banks in Kenya have a high exposure of interest rate risk.

A study conducted by Gietzen [12] addressed the exposure of MFIs to financial risk. Gietzen [12] aimed to measure the extent to which MFIs are exposed to three components of financial risk which are liquidity risk, interest rate risk and foreign exchange rate risk. The sample under study was 309 largest MFIs worldwide. The researcher employed manually collected data from financial reports of those MFIs. From the study it came to be known that the microfinance sector is subjected to low liquidity risk and foreign exchange rate but high interest rate. The researcher also associated the exposure to risk as depending on the individual characteristics of the MFI. The generated results indicated that legal status and regional affiliation have a positive relationship with the rate of exposure of risk by a MFI. However this study did not address the extent to which the market risk factors affect the ability of MFIs to generate profits and the extent to which each factor of market risk (interest rate risk and foreign exchange rate risk) affects the generated profit.

Muriu [23] also conducted a study with the aim of analyzing the reasons behind the low profitability of MFIs in Africa. This was the first empirical study conducted with reference to Africa's MFIs. The issues under study comprised of capital, credit risk, size, age, efficiency and gearing ratio. The second group comprised of per capita Gross National Income (GNI), money supply and inflation. The study also employed panel data of 210 MFIs from 32 countries between the years 1997 to 2008. The research findings indicated that credit risk and efficiency have inverse relationship with profitability whereas gearing ratio, GNI, money supply and age had no significant relationship with profitability. This study did not address market risk factors as one of the factors affecting the profitability of MFIs.

In Tanzania a study was conducted by Kipesha [18] with the aim of evaluating the performance of microfinance institutions in Tanzania while integrating both financial and non-financial metrics. The study employed the balance score card approach as a way to evaluate the performance of MFIs. Both primary and secondary data were employed in the study, secondary data was obtained from the mix market, bank scope data base and Bank of Tanzania while primary data was obtained through structured questionnaires issued to a sample of 30 respondents from each of the 29 selected MFIs. Four indicators were used to measure financial performance which are ROA, Operating self-sufficiency (OSS), yield on gross loan and borrowers per staff. The results indicated low average financial performance among selected MFIs meaning that MFIs were non-sustainable with low relative productivity and low profitability. In addition the results indicated that MFIs have high performance in non-financial measures. The following are the hypothesis based on literature.

Hypothesis 1 (H_1): Interest rate and foreign exchange rate have long run relationship with the profitability of MFIs.

Hypothesis 2 (H_2): Changes in interest rate has statistically significant effect on profitability of MFIs.

Hypothesis 3 (H_3): Changes in foreign exchange rate has statistically significant effect on profitability of MFIs.

3. Methodology

3.1. Research Design

According to Kothari [20] research design is a plan on how the research will be carried out. The research design provides a roadmap through which the research should be conducted. This study adopted a time series research design. According to Gujarati [14] time series research design is the type of research design where by a single unit is examined repeatedly over a certain period of time to detect any changes that might occur in that period of time and the effect of those changes. Time series research design can also be viewed as an exemplar of longitudinal designs [14]. This corresponds to the study as the study involved repeated analysis of one MFI (FINCA Microfinance bank) for eleven years period, with the aim of detecting any changes of the market risk factors and their associated influence to profitability. In the course of this study quantitative research was applied since numerical data was used in the study and quantitative analysis of data was carried out. Quantitative research can be defined as the research approach that focuses on gathering numerical data and generating numerical findings on a given phenomenon [5]. In addition quantitative research focuses on objective measurement and statistical or numerical analysis of data [20].

Secondary data was employed in this study, with reference to similar studies conducted on commercial banks like Gathigia [11] and Namasake [24]. The data of all variables was generated from quarterly audited financial statements and balance sheets of FINCA Microfinance Bank while covering the period of 2010-2020. The reason for the selection of the period from 2010-2020 is because FINCA microfinance bank began publishing its financial information to external users from 2010. Time series data is collected because the study involves the data from one unit of analysis (FINCA Microfinance Bank) over a series of time period that is eleven

years consecutively [14]. The quantitative data generated was analyzed in two aspects that is preliminary analysis and main analysis. Preliminary analysis involved descriptive statistics, optimal lag length selection, unit root test and co-integration test. The main analysis was carried out through two econometric models which are Error Correction Model (ECM) and Autoregressive Distributed Lag (ARDL) [14]. STATA software was used as a tool of analyzing the data.

3.2. Analytical Models

3.2.1. Autoregressive Distributed Lag Model (ARDL)

Autoregressive Distributed Lag Model is the approach where by value of the dependent variable is determined based on its own past lag values in conjunction with the current and past values of the independent variables [14]. The model is widely used to determine the relationship existing between variables through the use of a single equation set up [29]. The Autoregressive Distributed Lag Model usually begins with general dynamic models, thereafter altering its variables and reducing its mass through linear and nonlinear restrictions [29]. Due to the general to specific nature of the ARDL model, it is possible for the model to address the econometrics problems such as autocorrelation and misspecification, thus generating an accurate and interpretable model [14]. In the course of this study the Autoregressive Distributed Lag (ARDL) model was applied in the analysis of the second objective addressing the influence of change of interest rate on the profitability of microfinance institutions. This was so because the time series was non-stationary at level form but upon first differencing the same order of integration was achieved and there was no co-integration among the variables.

3.2.2. Error Correction Model (ECM)

Error Correction Model (ECM) was applied upon measuring the influence of change in foreign exchange rate on the profitability of MFIs. The reasons behind the use of Error Correction Model is that, it is an approach more theoretically accurate and suitable for performing both long term and short term estimations of the effect of one time series on another [14]. Thus proved to align with the context and objectives of the study. The error correction model is the standard way to model time series equations and helps dealing with non-stationary time series while separating the long run and short run estimations [29]. In the course of this study error correction model was applied in the analysis of the third objective, since the results indicated presence of co-integrated relationship between foreign exchange rate, ROAA, inflation rate, money supply and GDP [29]. According to the Granger theory, when a group of variables for instance Y_t and X_t are co-integrated, therefore a valid error correction representation of the data exists [9, 13].

Mathematical presentation of the relationship between variables

The study assumed that the independent variable and the dependent variables have a multiple linear relationship which is shown in equation 1 below.

$$Y_t = \beta_0 + \beta_1 IR_t + \beta_2 FR_t + \beta_3 GDP_t + \beta_4 IFL_t + \beta_5 MS_t + U_t \quad (1)$$

Where by Y_t stands for ROAA proxy of Profitability of MFIs, β_0 stands for Intercept, β_{1-5} represents parameters to be estimated, IR_t represents interest rate, GDP_t stands for Gross Domestic Product, IFL_t stands for Inflation Rate, MS_t stands for Money Supply, and U_t represents error term.

4. Results and Findings

4.1. Preliminary Results

4.1.1. Descriptive Statistics

From Table 1 money supply has a mean value of 14,403,713, its standard deviation is 4582107.5 which indicates a wide variation from the mean. The maximum and minimum values of money supply are 6835606.9 and 22064309 respectively. GDP has a mean value of 6.507 and standard deviation of 1.854. The minimum and maximum values of GDP are 2.9 and 10.2 respectively. N. I. M has a mean of 9.332 and standard deviation of 19.717 indicating high deviation from the mean. The minimum value of Net Interest Margin is -9.17 and the maximum value is 55.73. Foreign exchange gains or losses have a mean of 8586954.5 and standard deviation of 48849709 indicating high deviation from the mean. The minimum value of foreign exchange gains or losses is -9.17 and the maximum value is 55.73. Inflation rate has a mean of 7.279 and a standard deviation of 4.537. Its minimum value is 3 and the maximum value is 19.367. The natural logarithm of money supply has a mean value of 16.428 and a standard deviation of 6.344, the minimum value is 15.738 and the maximum value is 16.909. ROAA mean is -498, the standard deviation is 4.009. The minimum and maximum values of ROAA are -16 and 5.38 respectively.

Table 1. *Descriptive Statistics.*

Variable	Obs	Mean	Std. Dev.	Min	Max
MS	44	14403713	4582107.5	6835606.9	22064309
GDP	44	6.507	1.854	2.9	10.2
N I M	44	9.332	19.717	-9.17	55.73
FXEGL	44	8586954.5	48849709	-1.100e+08	1.860e+08
Inflation Rate	44	7.279	4.537	3	19.367
LnMs	44	16.428	6.344	15.738	16.909
ROAA	44	-.498	4.009	-16	5.38

Source: STATA output, 2021.

4.1.2. Test for Optimum Lag Length

With regard to the nature of the study a test for optimal lag length was carried out, since the lag length is required in carrying out unit root test and co-integration test. In the attempt to acquire the optimal lag length several lag selection criteria were used including FPE, AIC, HQIC, and SBIC [2]. However, in the course of this study HQIC was used as the most appropriate lag selection criteria. The optimal lag is the minimum value with reference to each criterion [1]. According to Amemiya [2] HQIC and SBIC are more accurate theoretically over FPE and AIC. Also HQIC tends to be more accurate with quarterly data having 40 to 60 observations where as SBIC tends to be more accurate with larger sample sizes [22]. Therefore

with a sample of 44 observations used in this study HQIC a more appropriate lag selection criteria to be used. Table 2 below indicates the selection of the lag length under four lag length selection criteria which are FPE, AIC, HQIC and SBIC. According to HQIC, the optimal lag length for money supply is 4 which is the same with all other selection criteria (FPE, AIC and SBIC). The optimal lag length for ROAA is 1 according to HQIC and SBIC. The lag length of foreign exchange gains or losses has conflicting results, whereas according to FPE and AIC the lag length is 4. According to HQIC and SBIC the lag length is 2 and 0 respectively. Since HQIC is proved to be the most appropriate lag selection criteria in the course of this study [2], therefore the optimal lag length of foreign exchange gains or losses is 2. The optimal lag length of inflation rate is 4 according to HQIC criteria which is also the same with FPE and AIC criteria. The optimal lag length of GDP is 4 according to HQIC which is the same with FPE, AIC and SBIC. Lastly the lag length of Net Interest Margin proxy of Interest rate risk has conflicting results. According to FPE and AIC the optimal lag length net interest margin is 4 and according to HQIC and SBIC the lag length is 1. Since HQIC and SBIC have more theoretical accuracy than FPE and AIC [22]. Therefore the optimal lag length for net interest margin is 1 according to HQIC and SBIC. Since the optimal lag length of money supply, inflation rate and GDP is 4 therefore the current values of money supply, inflation rate and GDP are affected by their 4 years previous values respectively. The current value of ROAA is influenced by 1 year's previous value of the same variable since the optimal lag length is 1. Foreign exchange gains or losses are influenced by 2 years previous values of the same variable. Lastly N. I. M is influenced by only one previous value since its optimal lag length is 1. In addition to this the lag length values were used in the software upon carrying out unit root test and co-integration test.

Table 2. *Lag length selection for the market risk factors and macroeconomic indicators.*

Variable	Lag	FPE	AIC	HQIC	SBIC
Money supply	0	0.08921	0.421106	0.436372	0.463328
	1	0.000319	-5.21256	-5.18203	-5.12812
	2	0.000326	-5.19116	-5.14536	-5.06449
	3	0.000309	-5.24416	-5.18309	-5.07527
	4	.00026*	-5.4186*	-5.34227*	-5.20749*
ROAA	0	17.0078	5.67154	5.68681	5.71376
	1	13.5561	5.44463	5.47516*	5.52907*
	2	13.6566	5.45182	5.49762	5.57848
	3	13.5226*	5.44157*	5.50263	5.61045
	4	14.1667	5.48746	5.56379	5.69857
FXEGL	0	2.60E+15	38.3506	38.3659	38.3928*
	1	2.60E+15	38.318	38.3485	38.4024
	2	2.40E+15	38.2707	38.3165*	38.3973
	3	2.40E+15	38.2672	38.3283	38.4361
	4	2.4e+15*	38.2587*	38.335	38.4698
Inflation rate	0	20.5919	5.86276	5.87803	5.90498
	1	2.51016	3.75814	3.78867	3.84258
	2	2.02785	3.54457	3.59037	3.67124*
	3	2.13124	3.59391	3.65497	3.7628
	4	1.91528*	3.48643*	3.56276*	3.69754
Gross Domestic product	0	3.69378	4.14452	4.15978	4.18674
	1	3.336	4.04257	4.0731	4.12701
	2	3.50763	4.09253	4.13833	4.2192
	3	3.3388	4.04282	4.10388	4.2117
	4	2.7272*	3.83984*	3.91617*	4.05095*
N_I_M	0	424.16	8.88798	8.90324	8.9302
	1	210.307	8.18636	8.21689*	8.2708*
	2	211.837	8.19341	8.23921	8.32008
	3	213.989	8.20313	8.2642	8.37202
	4	204.402*	8.15665*	8.23298	8.36776

Note: ROAA: Return on Average Asset; FXEGL: Foreign exchange gains or losses; NIM: Net Interest Margin; * optimal lag length.

4.1.3. Unit Root Test

The unit root test was conducted in the analysis of data, taking note of the nature of data used in this study which is time series. Therefore the unit root test was conducted so as to test for stationarity [27]. Before statistical analysis some of the variables were introduced with logarithm so as to stabilize their mean and variance [29]. In the course of this study ADF test and PP test were used. Upon carrying out the unit root test the null hypothesis was that there is unit root or the variables are non-stationary while the alternative hypothesis was there is no unit root meaning the variables are stationary [21]. To avoid spurious results it is important for the estimated data to be stationary [21]. As seen in Table 3 below the results obtained from ADF test and PP test indicated that all variables were non-stationary at level form, with evidence of having test statistic values less than the critical value at 5% level of significance. Therefore first difference was carried out in each of the test and the results indicated that there is no unit root or all the variables are stationary. This is evident through the

achievement of test statistics greater than the critical value at 5% level of significance both in ADF test and PP test. Therefore the null hypothesis stating that there is unit root or non-stationarity was rejected at 5% level of significance and therefore implying that all variables of interest are integrated of order one (1). The results obtained from the unit root test above favor the Johanssen test of co-integration. This is because under both ADF test and PP test the variables were non-stationary at level form and the order of integration is the same across both ADF test and PP test [6, 7].

Table 3. *Unit root test.*

ADF Test					
Variable	**Level**		**First difference**		**order of integration**
	Test statistics	**Critical value**	**Test statistics**	**Critical value**	
Broad money	-2.331	-2.961	-4.952**	-2.955	I(1)
ROAA	-1.143	-2.955	--4.774 **	-2.958	I(1)
FXEGL	-2.112	-2.952	-8.220**	-2.955	I(1)
Inflation rate	-0.922	-2.958	-5.046**	-2.961	I(1)
GDP	-2.437	-2.961	-3.868**	-2.958	I(1)
N_I_M	-1.877	-2.952	-6.561**	-2.955	I(1)

The PP Test					
Variable	**Level**		**First difference**		**order of integration**
	Test statistics	**Critical value**	**Test statistics**	**Critical value**	
Broad money	-1.148	-13.076	-39.874 **	-13.044	I(1)
ROAA	-11.774	-13.076	-55.310 **	-13.044	I(1)
FXEGL	-12.613	-13.076	-47.300**	-13.044	I(1)
Inflation rate	-5.948	-13.076	-26.978**	-13.044	I(1)
GDP	-10.930	-13.076	-57.317 **	-13.044	I(1)
N_I_M	-9.971	-13.076	-54.158**	-13.044	I(1)

Source: Estimation Results

Note: Broad money: the natural logarithm of money supply; ROAA: the natural logarithm of return on average asset; FXEGL: the natural logarithm of foreign exchange gains or losses; Inflation rate: the natural logarithm of inflation rate; GDP: the natural logarithm of gross domestic product; NIM: the natural logarithm of net interest margin (proxy of interest rate). ** indicate rejection of the null hypothesis of non-stationarity at 5% level of significance.

4.1.4. Pairwise Correlation

Pairwise correlation was also carried out in the analysis of data, this helps to provide details on the strength and direction of the relationship between variables. Table 4 below is a pairwise correlation matrix containing the results of pairwise correlation. The correlation coefficients with the value of 1.000 are said to have perfect relationship. In Table 4 the value 1.000 is seen in a diagonal orientation and this is the case because each variable is perfectly correlated to itself. From Table 4 foreign exchange gains or losses have a positive weak correlation with profitability (ROAA) with the value of 0.169. From Table 4 Net Interest Margin proxy of interest rate has a positive and moderate correlation with profitability (ROAA) with the value of 0.401. Inflation rate has a negative weak correlation or relationship with profitability (ROAA) with the value of -0.395. Inflation rate also has a negative and extremely weak correlation to net interest margin (NIM) with a value of -0.008. From Table 4 money supply (ln MS) has negative weak relationship with ROAA with the value of -0.442. Also as seen from Table 4 money supply has a negative weak correlation with N. I. M with the value of -0.157. Money supply also has negative strong correlation with inflation rate with the value of -0.776 as seen in Table 4. Based on the results similar findings were achieved in the study by Ekinci [8] on commercial banks, which indicated that there is positive weak correlation between interest rate, foreign exchange rate and profitability.

Table 4. *Pairwise correlations.*

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
(1) ROAA	1.000					
(2) FXEGL	0.169	1.000				
	(0.271)					
(3) GDP	-0.095	-0.088	1.000			
	(0.540)	(0.569)				
(4) N_I_M	0.401	0.245	-0.080	1.000		
	(0.007)	(0.109)	(0.606)			
(5) InflationPercent	0.395	0.180	-0.123	-0.008	1.000	
	(0.008)	(0.242)	(0.427)	(0.959)		
(6) lnMS	-0.442	-0.201	-0.078	-0.157	-0.776	1.000
	(0.003)	(0.190)	(0.616)	(0.309)	(0.000)	

Note: ROAA: Return on Average Asset; FXEGL: Foreign exchange gains or losses; ln MS: natural logarithm of money supply; GDP: Gross Domestic Product; N_I_M: Net interest margin.

4.1.5. Diagnostics Test

Diagnostic test was also carried out after estimations so as to assess the adequacy of the model. The diagnostic test includes test for autocorrelation, normality test and test for heteroscedasticity.

(i). Autocorrelation

According to Wooldridge [29] autocorrelation is relationship between variables and previous values of the same variable, especially when the error term are related to each other. This is the case because time series data is influenced by its previous values [29]. Autocorrelation is the extent of correlation of the same variables over two successive time periods [14]. Breusch-Godfrey test also known as Lagrange Multiplier (LM) test was used to test for autocorrelation. Breusch-Godfrey LM test results in Table 5 indicate that there is no autocorrelation at lag order because p-value is greater than 0.05 at 5% level of significance. This means that correct conclusions were drawn from other tests and the models do not suffer from miss-specification problem.

Table 5. *Breusch-Godfrey LM test for autocorrelation.*

Lags(p)	chi2	Df	Prob > chi2
1	0.122	1	0.6783

Source: STATA output, 2021.

(ii). Normality Test

Test for normality is used to determine whether the data is normally distributed [29]. Test for normality was also carried out through JB test [29]. From Table 6 Jarque Bera Test indicates that the residuals are normally distributed, this is evident through the attainment of p-value greater than 0.05 or 5% level of significance. In this regard the data used in the study followed normal distribution over the same period.

Table 6. *JB Test.*

Model	Chi2	Prob>Chi2
Model one	2.807	0.2457

Source: STATA output, 2021.

Table 7. *Breusch Pagan Test.*

Test for Heteroscedasticity			
Source	**chi2**	**Df**	**P**
Heteroscedasticity	37.030	27	0.095
Skewness	12.970	6	0.044
Kurtosis	1.2800	1	0.259
Total	51.270	34	0.029

Source: STATA output, 2021.

(iii). Homoscedasticity

Homoscedasticity refers to the even spread of the time series data [29]. Heteroscedasticity refers to the uneven spread of data and with no constant variance [14]. Heteroscedasticity is not appropriate because regression assumes all results are generated from the data that has constant variance [29]. Test for homoscedasticity was also carried out through Breusch Pagan test which is more accurate over White test [14]. From Table 7 it is seen that there is no heteroscedasticity since p-value is greater than 0.05 or 5% level of significance.

4.2. Main Results

This section presents results based on the specific objectives.

4.2.1. The Long Run Relationship Between Foreign Exchange Rate, Interest Rate and Profitability of MFIs

Before the analysis of the long run relationship between interest rate, foreign exchange rate and profitability by Johansen co-integration test, preliminary analysis was carried out which included descriptive statistics, lag selection, unit root test, pairwise correlation and diagnostic check. Similar results from the preliminary results above were obtained.

Co-integration test was also carried out with the essence of determining the long run relationship between interest rate, foreign exchange rate and return on average asset (ROAA) [14]. This test was carried out after having determined the optimal lag length of each variable with the help of FPE, AIC, HQIC and SBIC as lag selection criteria [1]. Also the unit root test was carried out prior to carrying out the co-integration test so as to test for stationarity of the variables [29]. In this study co-integration test was carried out through Johansen Test. Johansen test provides results in two statistics which are trace statistics denoted by λ_{trace} and maximum eigen value statistics denoted by λ_{max} [14]. The results of co-integration test are as seen in Table 8 below. From the results it is seen that both Trace statistics and Maximum Eigen statistics have accepted the null hypothesis of no co-integration (r=0) over the alternative hypothesis. This is proved through the achievement of trace statistics which are less than the critical value at 5% level of significance. From Table 8 the value of trace statistics and Maximum Eigen statistics at r=o which are 83.3717 and 32.27 are less than the critical values 94.15 and 39.37 respectively. The results imply that the two non-stationary time series are not integrated together and they can deviate from equilibrium in the long term.

Table 8. *Co-integration test results.*

Null Hypotheses	Trace Statistics	Critical Value	Max-Eigen Statistics	Critical Value
$r = 0$	83.3717*	94.15	32.27	39.37
$r \leq 1$	51.1017	68.52	18.8966	33.46
$r \leq 2$	32.2051	47.21	14.3847	27.07
$r \leq 3$	17.8205	29.68	10.3728	20.97
$r \leq 4$	7.4477	15.41	5.0681	14.07
$r \leq 5$	2.3796	3.76	2.3796	3.76

Note: r: represents co-integrating vectors; upon occurrence of conflicting results between trace statistics and max-eigen statistics decision is made with regard to trace statistics. * represents acceptance of the null hypothesis at 5% level of significance.

4.2.2. Analysis of the Effect of Changes of Interest Rate on Profitability of MFIs

Before the analysis of effect of changes of interest rate on

profitability by ARDL model, preliminary analysis was carried out which included descriptive statistics, lag selection, unit root test, pairwise correlation and diagnostic check. Similar results from the preliminary results above were obtained.

(i). Co-integration Test

Co-integration test was also carried out so as to determine the long run relationship between net NIM, GDP, inflation rate, money supply and profitability (ROAA). Johansen test was the one used to carry out co-integration test [14]. The test produces results based on two statistics which are trace statistics and max-eigen statistics [14]. The results of co-integration test are as seen in Table 9 below. From the results it is seen that both Trace statistics and Maximum Eigen statistics have accepted the null hypothesis of no co-integration (r=0) over the alternative hypothesis. This is proved through the achievement of more than two co-integrating vectors with values less than the critical value at 5% level of significance in both trace statistics and max-eigen statistics. From Table 9 the value of trace statistics and Maximum Eigen statistics at r=1 which are 28.2833 and 16.9272 are less than the critical value 29.68 and 20.97 respectively hence no co-integration. The results imply that the two non-stationary time series are not integrated together and they can deviate from equilibrium in the long term.

Table 9. *Co-integration test.*

Null Hypotheses	Trace Statistics	Critical Value	Max-Eigen Statistics	Critical Value
r = 0	46.0263*	47.21	19.743*	27.07
r ≤ 1	28.2833*	29.68	16.9272*	20.97
r ≤ 2	11.3561*	15.41	6.9191*	14.07
r ≤ 3	4.4370	3.76	4.437	3.76

Source: STATA output, 2021.

(ii). Short Run Model

The ARDL model was used to determine the influence of changes of interest rate proxied by NIM on the profitability of MFIs, proxied by ROAA in the short run. The results obtained from co-integration test in Table 9 above indicated that there is no co-integration meaning there is no long run relationship between the interest rate and return on average asset (ROAA). Therefore a short run model was used to determine the influence changes of interest rate on return on average asset (ROAA) proxy of profitability of MFIs in the short run.

From Table 10 the results indicate that there is a statistically significant positive short run relationship between interest rate, lag of GDP and profitability. This is evident through the achievement of p-value less than 0.05 ($p<0.05$). Therefore under ceteris paribus (if all factors remain constant) for each percentage unit increase in N. I. M, on average ROAA will increase by 5.8 percent. In addition each percentage unit increase in lag of GDP on average will result to increase of ROAA by 70.2 percent. From Table 10 it is seen that inflation rate, money supply and GDP have a statistically insignificant relationship with ROAA. This is evident by having p-values greater than 0.05 or 5% level of significance.

The findings obtained from Table 10 on influence of change of interest rate on profitability are the same with the results achieved by similar studies conducted on commercial banks. For instance the studies conducted by Ekinci [8] and Gachua [10] also indicated there is a statistically significant positive relationship between interest rate and profitability, though it wasn't expressed in the long run or short run. However the findings are also different from other studies conducted on commercial banks such as Gathigia [11] and Namasake [24] which indicated presence of negative relationship between interest rate and profitability.

Table 10. *ARDL model for change of interest Rate and profitability.*

ARDL (1,0,0,0,1) regression				**Number of obs = 44**		
Sample: 2010q2 - 2020q4				**F (6, 36) = 4.97**		
				Prob > F = 0.0008		
				R-squared = 0.4531		
				Adj R-squared = 0.3619		
Log likelihood = -107.69274				**Root MSE = 3.2361**		
ROAA	**Coefficient**	**Std. Err.**	**t**	**P>t**	**[95%Conf.**	**Interval]**
ROAA L1.	0.300	0.158	1.9	0.066	-0.021	0.621
N_I_M	0.058	0.028	2.08	0.045*	0.001	0.114
Inflation Rate	0.074	0.194	0.38	0.704	-0.318	0.466
Ln MS	-2.838	2.634	-1.08	0.288	-8.181	2.504
GDP	-0.426	0.31	-1.38	0.178	-1.054	0.202
GDP L1.	0.702	0.293	2.4	0.022*	0.108	1.296
_cons	43.339	45.131	0.96	0.343	-48.192	134.869

Note: ROAA: Return on Average Asset; N_I_M: Net interest margin (proxy of interest rate); Ln MS: Natural logarithm of money supply; GDP: Gross Domestic Product. L1: Lag of GDP; * represents statistical significance at 5% level of significance.

4.2.3. To Analyze the Effect of Change of Foreign Exchange Rate on Profitability of MFIs

Prior to the analysis of effect of changes of foreign exchange rate on profitability by ECM, preliminary analysis were carried out which included descriptive statistics, lag selection, unit root test, pairwise correlation and diagnostic check. Similar results from the preliminary results above were obtained.

(i). Co-integration Test

Co-integration test was also carried out so as to determine the long run relationship between foreign exchange rate, GDP, inflation rate, money supply and profitability (ROAA) [29]. Johansen test was the one used to carry out co-integration test, the test produces results based on two statistics which are trace statistics and max-eigen statistics [14]. The results of co-integration test are as seen in Table 11 below. From the results it is seen that Trace statistics has rejected the null hypothesis of no co-integration (r=0) over the alternative hypothesis. This is proved through the achievement of trace statistics which are greater than the critical value at 5% level of significance. Max Eigen statistics first two co-integrating vectors (r=0, r ≤ 1) accept the null hypothesis of no co-integration, since their values are less than the corresponding critical value at 5% level of significance [29]. In addition the last two co-integrating vectors in Max-Eigen statistics (r ≤ 2, r ≤ 3) reject the null hypothesis of no co-integration, due to having values less than the critical value at 5% level of significance [29].

In this kind of situation where there are conflicting results from the two statistics, Trace statistics is to be selected as the one with the best decision [14]. Therefore the co-integration test conducted between foreign exchange gains or losses, return on average asset (ROAA), money supply, inflation and Gross Domestic Product (GDP) indicate the presence of a long run relationship. These results may have been different from the ones obtained in the earlier to objectives due to confounding effect [29]. From Table 11 the value of trace statistics at r=o is 68.5086 which is greater than the critical value 47.21 implying that there is co-integration relationship. The results imply that the two non-stationary time series are integrated together and they cannot deviate from equilibrium in the long term.

Table 11. *Co-integration test results.*

Null Hypotheses	Trace Statistics	Critical Value	Max-Eigen Statistics	Critical Value
r = 0	68.5086*	47.21	26.6616	27.07
r ≤ 1	41.8471*	29.68	19.9668	20.97
r ≤ 2	21.8803*	15.41	14.8183**	14.07
r ≤ 3	7.0619*	3.76	7.0619**	3.76

Note: r: indicates co-integrating vectors; ** indicates rejection of the null hypothesis.

(ii). Long Run Model

After carrying out co-integration test and finding out that there is long run relationship between foreign exchange gains or losses, return on average asset (ROAA), money supply, inflation and Gross Domestic Product (GDP), the next step Error Correction Model (ECM) was used to determine the influence of foreign exchange gains or losses on profitability (ROAA) in the long run with the three macroeconomic indicators (inflation, money supply and GDP) acting as control variables. The results of influence of foreign exchange gains or losses on return on average asset (ROAA) are as shown in Table 12. From Table 12 it is seen that foreign exchange gains or losses as a measure of change in foreign exchange rate has a negative significant association with ROAA proxy to profitability, this is because of having a p-value less than 0.05 or 5% level of significance [14]. Therefore it is seen from the results that under ceteris paribus (all factors held constant) one percentage increase in foreign exchange gains or losses, on average will result to a decrease in return on average asset (ROAA) by -1.70E-07 percent. From Table 12 Inflation rate has a statistically insignificant negative influence on ROAA in the long run, since it has p-value greater than 5% level of significance. The coefficient of inflation is -0.33446, the negative sign indicating a negative relationship with ROAA and a percentage increase in inflation will decrease ROAA by -0.33446. Money supply and GDP also have a statistically insignificant association with return on average asset (ROAA), since they have p-value greater than 5% level of significance. The coefficients of money supply and GDP are 0.042639 and 0.0959945 respectively and they are positive in nature indicating a positive relationship with ROAA and therefore each percentage increase of money supply and GDP will result to increase of profitability (ROAA) by 0.042639 and 0.0959945 respectively. The results on the influence of foreign exchange rate on profitability in the long run is similar to the findings of the study by Gathigia [11] conducted on commercial banks in Kenya and concluded that foreign exchange rate in the long run have negative significant influence on profitability.

Table 12. *Long run model.*

Beta	Coefficient	Std. Err.	Z	P>z	[95% Conf.	Interval]
FXEGL	-1.70E-07	3.07E-08	-5.53	0.000	-2.30E-07	-1.10E-07
Inflation Rate	-0.33446	0.452504	-0.74	0.460	-1.22135	0.552434
LnMS	0.042639	6.253955	0.01	0.995	-12.2149	12.30017
GDP	0.095945	0.892053	0.11	0.914	-1.65245	1.844337
_cons	0.73811	.	.	.	.	.

Note: FXEGL: Foreign exchange gains or losses; MS: Money supply; GDP: Gross Domestic Product.

(iii). Short Run Model

Estimations were also made through ECM Model on the short run influence of foreign exchange gains or losses on profitability (ROAA) with inflation, money supply and GDP

acting as control variables. The results of the short run model are presented in Table 13. From Table 13 it is seen that foreign exchange rate has no statistically significant influence on profitability (ROAA) in the short run. This is evident through the achievement of p-value greater than 0.05 or 5% level of significance [14]. The coefficient of foreign exchange gains or losses is -6E-09, the negative sign showing negative relationship with ROAA. Inflation rate is also seen to have no statistically significant influence on return on average asset (ROAA) in the short run, due to having a p-value of 0.932 which is greater than 5% level of significance. From Table 13 it is also seen that in the short run, money supply and GDP have no statistically significant influence on profitability (ROAA) of MFIs. This is evident through the attainment of p-values that are greater than 0.005 at 5% level of significance. The p-values of money supply and GDP are 0.238 and 0.383 respectively. Previous value of ROAA (lag of ROAA) has influence on the current ROAA due to having a p-value less than 0.05 at 5% level of significance. Generally all variables except lag of ROAA have no statistically significant influence on ROAA in the short run.

The findings obtained from Table 13 on the influence of change of foreign exchange rate on profitability in the short run are different from the results achieved by similar studies conducted on commercial banks. For instance the studies conducted by Ekinci [8] and Gathigia [11] indicated there is a statistically significant positive relationship between interest rate and profitability. However the findings are also similar to other studies conducted on commercial banks in terms of the direction of the relationship between foreign exchange rate and profitability (ROAA) such as Gathigia [11] and Namasake [24] which indicated presence of negative relationship between foreign exchange rate and profitability of MFIs.

Table 13. *Short run model.*

				Number of obs = 44		
				F (6, 36) = 18.48477		
				Prob > F = 0.0008		
				R-squared = 0.3456		
				Root MSE = 3.57284		
Variable	**Coef.**	**Std. Err.**	**Z**	**P>z**	**[95% Conf. Interval]**	
ROAA L1.	-0.1589	0.0873496	-1.82	0.069	-0.3301	0.01231
ROAA						
LD.	-0.3756	0.1581987	-2.37	0.018	-0.6856	-0.0655
FXEGL						
LD.	-6.05E-09	0.000000013	-0.47	0.641	-3E-08	1.9E-08
Inflation Rate						
LD.	0.025991	0.3052211	0.09	0.932	-0.57223	0.624214
Ln MS						
LD.	35.58977	30.14495	1.18	0.238	-23.4932	94.67278
GDP						
LD.	0.258805	0.2967309	0.87	0.383	-0.32278	0.840387
_cons	-1.441	0.9969705	-1.45	0.148	-3.39502	0.51303

Note: ROAA: Return on Average Asset; FXEGL: Foreign exchange gains or losses; Ln MS: Natural logarithm of money supply; GDP: Gross Domestic Product.

5. Conclusion and Recommendations

The study analyzed the influence of market risk on the profitability of MFIs in Tanzania. The study proved that changes in interest rate and foreign exchange rate have significant influence on the profitability of MFIs. The direction of influence of the two market risk factors (interest rate and foreign exchange rate) being positive and negative respectively. Therefore the concept of one size fits all, meaning that the available knowledge on commercial banks does not necessarily apply in all types of financial institutions including MFIs. MFIs are more likely to be secure from effect of changes in interest rate since they don't engage much in long term investments but rather short term investments and have a high rate of loan recovery through its group lending approach [10, 11]. However MFIs are affected by foreign exchange rate in the long run like any other financial institution. In addition macroeconomic variables don't have any significant influence on the profitability of MFIs both in the short run and in the long run. It is recommended that MFIs in Tanzania especially the locally owned need to find ways to mitigate the effect caused by market risk factors on their profits. For instance through the use of financial derivatives and asset securitization [11]. MFIs also need to quit the dependency on donors for their existence and sustainability, which is also a great source of foreign exchange risk exposure [11, 24]. Limitations of the study include majority of the MFIs in Tanzania are not transparent enough and therefore not ready to share information about their institutions, most especially when it comes to financial data. For further research it is recommended that similar studies need to be conducted in Tanzania and other countries using a larger sample size and a wider time frame. The effect of other types of risks such as liquidity risk, credit risk, operational risk, legal risk and strategic risk on profitability of MFIs could also be an area of interest, and different profitability ratios could be used.

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