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Effect of Financial Innovations on Banks' Return on Assets and Equity: A Case of Commercial Banks in Kenya

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Abstract

Purpose: The study sought to investigate the effect of financial innovation on banks' return on assets and return on equity in Commercial Banks in Kenya. The main problem was that banks have implemented financial innovations, but the influence it has on financial performance has not been exhaustively and extensively evaluated especially in the emerging LDC markets. The effect it has on Return on Assets and Return on Equity remains unclear.

Methodology: This study adopted Pragmatic research philosophy. The choice of philosophy was determined by the research problem. The study was based on correlational research design. The study area was Kenya, focused on its Commercial banks. The target population comprised of all of the 42 commercial banks licensed by the Central Bank of Kenya. Purposive sampling technique was used to obtain a sample of 12 CMA / NSE listed banks. Secondary data from individual bank level, CMA and the CBK for the period 2007 to 2017 was used. The data analysis was based on fixed effect, random effect models or pooled regression of panel data analysis.

Results: The findings of the study indicated that financial innovations had higher correlation with, and influence on ROA as indicated by overall R-squared of 0.5134. This means that the financial innovations under study had 51.34% influences on return on assets, holding all other factors constant. The overall R-squared for ROE was 0.2077. This means that on financial innovations studied had 20.77% influence on return on equity. Thus, there is positive and significant effect between financial innovations and Return on Assets and Return on Equity. Positive effect is an indication that if commercial banks in Kenya increased their asset and equity levels, their profitability as measured by ROA and ROE would improve. The study therefore finds the relevance of technology in improving performance of commercial banks in the country. Based on the findings, the study concluded that it is important for commercial banks in Kenya to continue investing in cost- effective technology to remain competitive in the industry.

Unique contribution to theory, practice and policy: The study recommended that Commercial banks should implement effective financial innovations that would positively influence ROA and ROE. The findings of this study shall assist commercial banks and related financial institutions to monitor outcomes including effects of financial innovations with projections for profits as well as higher returns on ROA, ROE. It shall guide academic reference and policy making.

Keywords: *Financial Innovations, Financial Performance, Return on Assets, Return on Equity, Commercial Banks.*

1.0 INTRODUCTION

1.1 Introduction

The fundamental shifts in business environment which have led to new challenges, opportunities, and risks for the managers have been brought about by increasing globalization, changes in technologies, shifting demographics and greater regulatory oversight (Owuori, Ngala, & Obwatho, 2020). In this unpredictable market, competition is causing both demand and supply to fluctuate more rapidly, widely, and often than they used to (Lu & Ramamurthy, 2011). The capability to sense and respond to market threats and opportunities with speed and surprise has become essential for survival of organizations (Huang, Ouyang, Pan, & Chou, 2012). Innovative ideas include the use of IT to create new markets and gain a competitive advantage through greater interactivity, cheaper transactions, and direct communication with partners and clients (Hoque, Mohammad, Albar, & Bao, 2016; Zhu, Zou, & Zhang, 2018). Innovation in the financial sector is the arrival of a new or a better product and/or a process that lowers the cost of producing existing financial services (Iman, 2020).

Financial innovation has become an essence in providing new products by banks to better suit different circumstances of time and market. (Al-Dmour, Al-Dmour, & Rababeh, 2021). According to Qamruzzaman and Jianguo (2018) banks have been forced to cut costs and improve efficiency through automation and price rationalization due to competitive market forces. Financial innovation holds the key to a tremendous capacity for growth through saving and investment. Saula, Akinlabi, and Makinde (2023), states that innovation is a vital element for competitiveness of an industry in addition to economic progress of a country. Once the innovative performance improves, production and marketing performances will also increase and then through the banks' mediation, the financial performance will start to improve (Pradhan, Arvin, Hall, & Nair, 2016).

A bank's profitability indicates its ability to expand its mediation and investment activities and the allied risks. Return on equity (ROE) and Return on Assets (ROA) are some of the main indicators of financial leverage (Equity/Total Assets) (Frame, Wall, & White, 2018). Profitability is a measure of financial performance, it is the principal objective of both public and private sector profit driven organizations (Saksonova & Kuzmina-Merlino, 2017). In commercial

banking, the return on equity is a measure of the profitability of a business in relation to the equity, also known as net assets (Iman, 2020). It is a measure of how well a company uses investments to generate earnings growth. It is arrived at by dividing annual return by shareholders' equity (Qamruzzaman & Jianguo, 2018).

1.2 Problem Statement

The dynamic and fast changing economic situation, globalization, regulation, competitive market environment, privatization among others demands efficient and effective management of commercial banks through consistent effective use of financial innovations (Muia, 2017). Financial innovation holds the key to a tremendous capacity for growth through saving and investment (Al-Dmour et al., 2021). It can be used to improve intermediation and confidence building in the formal financial system for macro-economic stability (Lee, Wang, & Ho, 2020). This rapidly changing market demand exposes commercial banks to operational challenges and exposes inefficiencies in their intermediation. Without prompt uptake of new technology, the sector remains comparatively passive (Pradhan et al., 2016).

The global markets, stiff competition, emergence of new technologies, products, processes and more demanding markets places pressure on the commercial banks to engage necessary skills and resources to remain relevant and attain competitive advantage (Ngumi, 2014). Studies related to financial innovation, ROE, and ROA have been done. However, they have produced mixed results about the effect of financial innovations on bank's financial performance. Study by Saluja and Wadhe (2015) on influence of e-banking on profitability of commercial banks in India found that there exists positive association between e-banking and both private and public sector banks' profitability. They however found negligible association between number of bank branches and banks profitability. Cheruiyot (2010) did a study on impact of internet banking on financial performance of commercial banks in Kenya. The study found that internet has a small positive influence on Return on Equity (ROE) and Return on Assets (ROA). This study is limited given that it used a single financial innovation's effect on only two measures of performance ROE and ROA and completely ignored the effect of a host of other innovations already in use by the banking institutions as well as intervening variables.

Even though there is extensive literature on financial innovation, there is lack of empirical studies focused on financial innovation and its effect on ROA and ROE, more so on emerging LDC markets. Most of the existing empirical works have focused on the same handful of financial service innovations. Many studies focused on process innovation as opposed to product and financial services innovation. In terms of methodology, most of the past studies took a general approach of innovation-performance relationship, ignoring the effect of both internal and external intervening factors that definitely affect these relationships. This leaves gaps for further studies in order to discover what, for example, these innovations have on banks based in developing economies like Kenya. This study sought to fill this gap by determining the effect of

financial innovation on banks' return on assets and return on equity in Commercial Banks in Kenya.

1.3 Specific Objectives

1. To determine the effect of financial innovation on banks' return on assets.
2. To examine the effect of financial innovation on the banks' return on equity.

1.4 Significance of the study

It is hoped the study shall reveal how commercial banks should implement effective financial innovations that will positively influence ROA and ROE. The findings of this study shall assist commercial banks and related financial institutions to monitor outcomes including effects of financial innovations with projections for profits as well as higher returns on ROA, ROE. It shall guide academic reference and policy making.

2.0 LITERATURE REVIEW

2.1 Theoretical Review

The study was anchored on Assets Buffer Theory, Constraint – induced financial innovation theory and Capital Asset Pricing Model.

2.1.1 Constraint – Induced Financial Innovation Theory

Constraint – induced financial innovation theory states that the purpose of profit maximization of a financial institution is the key reason for financial innovation. There are some restrictions (including external and internal handicaps) in the process of pursuing profit maximization, which guarantee the stability of management but reduce efficiency, so financial institutions strive toward casting them off (Silber,1983). The internal and external handicaps in this study are the intervening variables namely industry dynamics (environmental and organizational context factors- operational and legal frameworks) and technological advances. Constraint-induced innovation theory discusses financial innovation from microeconomic view, so it is economy originated and representative therefore appropriate for bank units. Commercial banks in Kenya are faced with constraints like non- performing loans, higher intermediation costs, loss of initiative and entrepreneurship, rise of labor unions, privatization and deregulation, all of which affect performance (Saksonova & Kuzmina-Merlino, 2017).

This theory has it that, the constraints endured by organizations generate innovations aimed at winning degrees of freedom, which is hoped to translate into better financial performance of the banks. According to Silber (1975), regulations imposed by monetary authorities are actually the main drivers of financial innovation. According to White (2000), regulation is two faced and certain forms of regulation must prohibit some innovations. Other innovations, however, can spring from failed regulatory efforts, in order to bypass this regulation. It is therefore, impossible to award a positive or negative sign to the relationship between the rigor of regulation and the

dynamism of financial innovation- hence the need for more studies to ascertain the overall effect of these innovations.

2.1.2 Capital Asset Pricing Model

This study is annexed to Capital Asset Pricing Model (CAPM) for the ROA and ROE by virtue of both falling under its sphere in terms of investment. The model describes the relationship between the expected return on a security (investment). It shows that the expected return on a security is equal to the risk-free return plus a risk premium, which is based on the beta of that security. (Treynor, 1962). In this study CAPM's expected return on security is representative of ROA and ROE.

The CAPM formula is;

$$R_a = R_{rf} + [B_a \text{ x } (R_m - R_{rf})]$$

Where R_a = Expected return on a security

R_{rf} = Risk- free rate

B_a = Beta for the Security (stock/equity's market risk)

R_m = Expected return of the market

$R_m - R_{rf}$ = Risk premium

The CAPM formula is used for calculating the expected ROA/ROE. It is based on the idea of a systematic (non-diversifiable) risk that investors need to be compensated for in the form of a premium (Sharpe, 1964). The study adopted this model because it is vital in calculating the weighted average cost of capital (WACC) just as it computes the cost of equity. It is used in financial modeling and can be used to find the net present value (NPV) of the future cash flows of an investment and to further calculate its enterprise value and finally its equity value.

2.0 LITERATURE REVIEW

2.2 Empirical Literature Review

From their study on European countries, comparing effect of different online banking models (Arnaboldi and Claeys (2010) found out that internet banks performed better in terms of average returns to assets, with minimal operation costs for the income they generated. According to Dawood (2014) a negative relationship exists between profitability and cost efficiency. When the cost efficiency increases, profitability decreases. Athanasoglou (2005) suggests that enhanced managerial and scale efficiency leads to higher profitability.

Shirley and Sushanta (2006) from their study on the impact of innovation on banking industry in the USA found out that innovation might lead to cost saving. They also found that the

relationship between innovation expenditures and bank's financial performance is subject to network effect. They concluded that expenditures are likely to; increase revenue and profit, increase market share and reduce payroll expenses.

A study by Bavaneshwari et al, (2014) in Ponmolai area at Tricky, established that there is a positive relationship between mobile banking and bank performance. In order to increase profitability through mobile banking service, the study recommended that banks should update publish, explain, simplify and, fortify services to attract more customers and to become more competitive in the market. The following researchers were of the opinion that innovations had both positive and negative effect on the performance of banks; Adu (2019), Sullivan (2000), Lang and Noelle (2002), Stiroh and Rumble (2004). They variously argue that bank benefits from financial innovation internet banking, depends on size and urban location, ATMs benefit bigger banks, diversification worsens risk return trade off in US but achieves the opposite in Europe.

In a related study done by Grzelonska (2005) in America on the benefits of branch networks on deposits and performance, it was found that the expected distance to branch is a significant factor in explaining consumers' choices of depository institutions and that dispersing the convenience of a branch by merely 0.26% may lead to decrease of total depositing by 6%. This clearly underlines the importance of branch networking of a bank to its financial performance. Arnaboldi and Claeys (2010) add that client relation management systems, bank management technologies, and various other technologies are among the major changes in internal banking systems that also have exercised a positive influence on banking performance and profitability

3.0 RESEARCH METHODOLOGY

This study adopted a pragmatic research philosophy. The choice of philosophy was determined by the research problem. The study was based on correlational research design. The target population comprised of all of the 42 commercial banks licensed by the Central Bank of Kenya. Purposive sampling technique was used to obtain a sample of 12 CMA / NSE listed banks. Secondary data from individual bank level, CMA and the CBK for the period 2007 to 2017 was used. The principal explanatory variables were Branch networking, Mobile banking, Electronic funds transfer, Total assets and Internet/agency banking. However, during data collection and data analysis, ROA, Loans and ROE were confirmed to have statistically significant explanatory tendencies on all other variables including themselves. Therefore in line with Bhandary (2020) and Thomas (2020), the three (ROA, Loans and ROE) were therefore adopted as alternating/ multi-level independent variables in the study.

The study used secondary data which was log transformed before analysis. Data analysis was based on fixed effect, random effect models or pooled regression of panel data analysis. Diagnostic tests were done to check stationarity and reliability of data before analysis to ensure that spurious results were not obtained. These included panel data root test and Hausman test which was specifically used to discriminate among the three models.

The model took the following format for the first objective;

$$Y_{1it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + \beta_6 X_{6it} + \beta_7 X_{7it} + \upsilon_{1it}$$

Where Y_{it} is the dependent variable (ROA) at year t

$X_{1it}, X_{2it} \ldots X_{7it}$ are vectors of explanatory variables as outlined in table 1below.

$\beta_1, \beta_2 \ldots \beta_7$ are parameters to be estimated.

υ_{it} is the error term.

The model took the following format for the second objective;

$$Y_{2it} = \eta_0 + \eta_1 X_{1it} + \eta_2 X_{2it} + \eta_3 X_{3it} + \eta_4 X_{4it} + \eta_5 X_{5it} + \eta_6 + X_{6it} + \eta_7 X_{7it} + \lambda_{2it}$$

Where Y_{2it} is the dependent variable ROE at year t

$X_1, X_2 \ldots X_7$ are vectors of explanatory variables as outlined in table 1below.

$\eta_0, \eta_1 \ldots \eta_7$ are parameters to be estimated.

λ_{2it} = error term.

Table 1: Explanatory variables

Symbol	Abbrev.	Variable	Unit of Measure in Ksh.
X_1	BN	Branch networking	Millions (Ksh)
X_2	MBS	Mobile banking services	Millions (Ksh)
X_3	EFT	Electronic funds transfer	Billions (Ksh)
X_4	TA	Total Bank Assets	Billions (Ksh)
X_5	IB	Internet/Agency Banking	Thousands (Ksh)
X_6	ROA	Return on Assets (Alt.)	%
X_7	LN	Loans (Alt.)	Millions (Ksh)
X_8	ROE	Return on equity (Alt.)	%

Note: Alt. means Alternating, thus X_6, X_7 and X_8 were applied as explanatory variables at multi- level.

4.0 RESULTS AND DISCUSSIONS

4.1 Effect of Financial Innovations on Return on Assets

The study intended to determine the effect of financial innovation on banks' return on assets, and to examine the effect of financial innovation on the banks' return on equity. The descriptive statistics includes the mean, standard deviation, maximum and minimum values of the data set as shown in table 1 below.

Table 2: Descriptive statistics of the study variables

Variable	Obs	Mean	Standard deviation	Min	Max
Return on Asset	132	3.744471	1.696728	-2.07	7.7
Electronic Fund Transfer	132	36.95451	13.72557	12.75	116.431
Mobile Banking Services	132	44.17228	32.31779	1.347	120.23
Internet /Agency banking	132	5799.955	2526.484	1830	15848
Total assets	132	126248.9	114976.2	587	555630
Branch networking	132	6035.523	6505.473	-1434	28482
Return on Equity	132	25.50092	9.975976	-16.9	56
Loans advanced	132	78148.26	71881.8	3342	411666

Source: Own Compilation from Data used in the study

Table 1 presents the results of descriptive statistics for the dependent variables and the independent variables as used in the study. Return on assets, in the study, is a measure of the income generated by the assets owned by commercial banks in Kenya for a particular year. The mean value of return on assets was 3.74 percent with a standard deviation of 1.697. The mean value of 3.74 implies that on average, the banks in Kenya made a profit of 3.74 percent during the study period. The maximum value was 7.7 per cent and a negative minimum value equivalent to 2.07 percent.

The mean of total assets owned by the banks during the study period was Ksh.126248.9 billion with a standard deviation of Ksh.114976.2 billion. The big disparity in the assets can be used as one of the explanations for why there was a huge difference in the amount of profits earned by

the various commercial banks in the country over the study period. The big difference between the maximum Ksh.555630 billion and minimum Ksh.587 billion is indicative of; multinational banking corporations with access to large offshore capital; small and struggling indigenous banks operating against hard economic times as well as; high competition in the financial sector. This has always necessitated mergers, buyouts or exit. The mean value of return to equity was estimated as 25.58198 per cent with a standard deviation of 9.99 percent. This is a clear indication of high returns to the owners of the various commercial banks on their investments attributed to impact of financial innovations. The standard deviation (9.9962 percent) also indicates that there were huge disparities in the returns for the various years attributable to rapid progress in financial innovations in the Kenyan banking industry.

Panel unit root test

A unit root test was carried out using Im Pesaran Shin (IPS) panel unit root test. The test was necessary to ensure that all study variables were stationary before any other analysis was done so as to avoid getting spurious results. Where the results were not stationary at level, differencing was carried out to achieve stationarity. The results of this test are shown on table 2 below.

Table 3: Output of Panel unit root test

Variable	**Level**	**t- statistic**	**P-value**	**Remarks Stationary at;**
LROA	level	-3.0788	0.0010	I (0)
LEFT	level	-1.2878	0.0989	I (0)
LMBS	level	-1.2007	0.8851	I (1)
	1st difference	-4.6892	0.0000	
LIB	level	-1.0236	0.1530	I (1)
	1st difference	-4.6892	0.0000	
LBN	level	-2.4712	0.0067	I (0)
LTA	level	-1.2649	0.1029	I (1)
	1st difference	-3.8745	0.0001	
LROE	level	0.7027	0.7589	

	1st difference	-5.0057	0.0000	I (1)
LA	level	-1.9662	0.0246	I (0)

Critical values for IPS

1% ⇒ -2.100

5% ⇒ -1.920

10% ⇒ -1.830

Criteria: If t-statistic calculated is greater than t-critical, reject H_0 of unit root presence and conclude variable is stationary. Or, using P values; if P-value is statistically significant, reject the H_0 of unit root presence and conclude variable is stationary.

From the output presented in table 2, half of the variables; LROA 0.0010, LEFT 0.0989, LBN 0.0069 and LA 0.0246 were found to be stationary at level while the other half; LMBS 0.0000, LIB 0.0000, LTA 0.0001 and ROE 0.0000 were stationary at first difference. This means that there exists short-run and long-run and/ or constant relationships between the variables, that is, they are stationary and dependent. This paved way for use of the variables for further analysis in the study.

Hausman test

The study conducted Hausman test on the data to determine the appropriate regression model to be used in the analysis of effect of financial innovations on return on assets. The results are presented in table 3 below.

Table 4: Output for Hausman test for ROA model

	Coefficients			
	(b)	**(B)**	**b-B**	**sqrt (diag(V_b_V_B) S.E.**
	Fe	**Re**	**Difference**	
EFT (Electronic Funds Transfer)	-.3351787	-.4216465	.0864678	.1411925
MBS (Mobile Banking Service)	.0483214	.0518425	-.0035211	.
BN (Branch Networking)	.2810697	.3725221	-.0914523	.0293908
TA (Total Assets)	.1064143	.1299753	-.023561	.

ROE (Return on Equity)	-.2184155	-.2233705	.004955	.
LA (Loans Advanced)	-.1857467	-.2107666	.0250199	.0391536

b consistent under H_0 and H_a; obtained from xtreg

B = consistent under H_a, efficient under H_0; obtained from xtreg

Test: H_0: difference in coefficients not systematic

Chi2 (6) = (b-B) ' [(V_b-V_B) ^ (-1)] (b-B)

= 8.34

Prob>chi2 = 0.2140

(V_b-V_B is not positive definite)

The results indicate that the estimates were insignificant therefore random effects model was selected for use in analyzing and presenting the panel data (regression analysis) on return on assets.

Table 5: Output for Multicollinearity test for ROA

	ROA	**BN**	**MBS**	**EFT**	**TA**	**IB**
ROA (Return on Assets)	1.000					
BN (Branch Networking)	0.6418 0.0000	1.0000				
MBS (Mobile Banking Service)	0.1775 0.0148	0.3547 0.0000	1.0000			
EFT (Electronic Funds Transfer)	-0.0271 0.0075	0.0433 0.0062	0.3904 0.0000	1.0000		
TA (Total Assets)	0.4989 0.0000	0.7620 0.0000	0.4561 0.0000	0.0907 0.0301	1.0000	
IB (Internet Banking)	0.3812 0.0000	0.5892 0.0000	0.2854 0.0009	-0.0629 0.0473	0.6640 0.0000	1.0000

*Correlation coefficients- first row.

*P-values - second row.

All P-values were noted to be equal to or below 0.05. The null hypothesis was therefore rejected. The correlation coefficients shown in Table 4 also indicate low levels of multicollinearity therefore ruling out the problems of multicollinearity. According to Gujarati (2009), multicollinearity is regarded high if the correlation coefficient is more than 0.8. From the results presented in table 2, the correlation coefficients had values less than 0.8 and therefore, no variable had high correlation with another variable. This paved way for use of the variables with no further transformations.

Regression output for Effect of finnovs on Return On Assets

To estimate the effect of banking sector innovations on return on assets for commercial banks, the study started by estimating three regression models.

Table 6: Regression Results for ROA

Dependent variable: ROA				
Variable	**Coefficient**	**Std error**	**t-statistic**	**P-value**
EFT (Electronic Funds Transfer)	-0.422	0.282	-1.50	0.135
MBS (Mobile Banking Service)	0.052	0.056	0.93	0.050
BN (Branch Networking)	0.373	0.045	8.37	0.000
TA (Total Assets)	0.130	0.053	2.45	0.014
ROE (Return On Equity)	-0.223	0.072	-3.09	0.002
LA (Loans Advanced)	-0.211	0.068	-3.08	0.002
Cons	2.478	1.493	1.66	0.097
Wald chi2 (6) = 98.34 Prob > chi2 = 0.0000 Hausman test: P- value = 0.2140 R-squared: Within = 0.2385				

Between = 0.8466

Overall = 0.5134

From table 5, the probability of the Wald test was found to be 0.000, meaning that it was statistically significant at one per cent level of significance. Table 3 indicates that the overall R-squared was 0.5134. This means that on average, 51.34 percent of all variations in ROA are explained by EFT, MBS, BN, TA, ROE and LA, holding all other factors constant. The coefficient of branch network was found to be 0.373. The coefficient was positive and statistically significant at one percent level of significance. This implies that a one percent increase in branch network would lead to a 0.37 percent increase in ROA holding all other factors constant.

The positive effect is an indication that if commercial banks in Kenya enhance branch network, their return on assets would improve. This would be as a result of more people getting attracted to the accessible banking services leading to more returns. The coefficient of total assets (TA) was found to be 0.130. It is positive and statistically significant at five percent level of significance. This implies that a one percent increase in TA would lead to 0.13 percent increase on ROA *ceteris paribus*. The positive effect is an indication that if commercial banks in Kenya increased their asset levels, their profitability as measured by ROA would improve and thus boost the customer confidence. An increase in the bank's assets signifies an increase in the bank investable funds. It is through these investments that the bank earns higher profits. The coefficient of Return on equity was found to be -0.223. The coefficient was negative and statistically significant at one percent level of confidence. This implies that a one percent increase on ROE would lead to a decrease in ROA equivalent to 0.223 percent holding all other factors constant.

The negative effect implies that if banks in Kenya increases dividend and other investor payouts, the value for ROA invariably decreases, and less would be reinvested therefore financial performance is technically affected negatively in the subsequent periods. The coefficient for loans was found to be -0.211. It was negative and statistically significant at one percent level of confidence. This implies that, holding all other factors constant, a one percent increase in loans by the banks during the study period would lead to a decrease on ROA equivalent to 0.211 percent. The negative relationship is an indicator to banks that loans should be deployed cautiously to surpass risks and to enhance returns/loan performance. The loans variable should be prudently managed to avoid negatively tipping optimal levels of financial operations.

This finding is in agreement with Kadioglu and Ocal (2017) who found that a unit change in branch networking had a corresponding increase in financial performance of commercial banks in Turkey. They argued that branch network in banks was important in enhancing efficiency in operations and therefore reducing the time customers would have spent seeking for banking services in branches other than the branch where their accounts are held. This encourages more people to operate bank accounts, which increase the bank's asset base and thus positively contributing to its profitability. Alhassan, Tetteh, and Brobbey (2016) found positive relationship between bank assets and financial performance of commercial banks in Kenya. An increase in the bank's assets signifies an increase in the bank investable funds.

4.2 Effect of Financial Innovations on Return on Equity

Hausman test: Effect of finnovs on banks' ROE.

The study conducted Hausman test on the data to determine the appropriate regression model to be used in the analysis for ROE model. The results are presented in table 6 below.

Table 7: Output for Hausman Test for ROE model

	Coefficients			**sqrt (diag(V b V_B) S.E.**
	(b)	**(B)**	**b-B**	
	Fe	**Re**	**Difference**	
EFT (Electronic Funds Transfer)	-.7560933	-.8952594	.1391661	.2402863
MBS (Mobile Banking Service)	.0397703	.0459521	-.0061818	.0136878
BN (Branch Networking)	.3057913	.3065267	-.0007354	.0378905
TA (Total Assets)	.1229859	.1303508	-.0073648	.0164852
ROA (Return on Assets)	-.3870828	-.3390896	-.0479932	.0594954
LA (Loans Advanced)	-.344868	-.2818382	-.0630298	.0598661

b consistent under H_o and H_a ; obtained from xtreg

B = consistent under H_a , efficient under H_o ; obtained from xtreg

Test: H_o : difference in coefficients not systematic

Chi2 (6) = (b-B) ' [(V_b-V_B) ^ (-1)] (b-B)

= 2.99

Prob>chi2 = 0.8100

The results indicate that the estimates were insignificant therefore random effects model was selected for use in analyzing and presenting the panel data (regression) analysis for return on equity.

Multicollinearity test: Effect of finnovs on banks' ROE

The study employed Pairwise correlation analysis to test for Multicollinearity. The results of the analysis are summarized in table 7 below.

Table 8: Multicollinearity output table for ROE

	ROE	BN	MBS	EFT	TA	IB
ROE (Return on Equity)	1.000					
BN (Branch Networking)	0.5591 0.0000	1.0000				
MBS (Mobile Banking Service)	0.0545 0.0500	0.3547 0.0000	1.0000			
EFT (Electronic Funds Transfer)	0.0242 0.0078	0.0433 0.0062	0.3904 0.0000	1.0000		
TA (Total Assets)	0.3334 0.0001	0.7620 0.0000	0.4561 0.0000	0.0907 0.0011	1.0000	
IB (Internet Banking)	0.1813 0.0375	0.5892 0.0000	0.2854 0.0009	-0.0629 0.0473	0.6640 0.0000	1.0000

*Correlation coefficients- first row.

*P-values - second row.

P-values were noted to be equal to or below 0.05.The null hypothesis was therefore rejected. The correlation coefficients shown in Table 4.10 also indicate low levels of multicollinearity therefore ruling out the problems of multicollinearity. From the results presented in table 7 the correlation coefficients had values less than 0.8 and therefore, no variable had high correlation

with another variable. This paved way for use of the variables in regression analysis with no further transformations.

Regression output: Effect of finnovs on Return on Equity

To estimate the effect of banking sector innovations on return on equity for commercial banks, the study started by estimating three regression models, pooled regressions, the random effect model and the fixed effect model.

For ROE, the appropriate model was Fixed Effects model. This is because the P-value of the Hausman test was found to be 0.8100 which was statistically insignificant for all conventional statistical significance levels. This implies that the null hypothesis that the preferred model is the RE model could not be rejected. Rather, the hypothesis was accepted and therefore Table 8 presents the results of the FE model.

Table 9: Regression Results for ROE

Dependent variable: ROE				
Variable	**Coefficient**	**Std error**	**t-statistic**	**P-value**
EFT (Electronic Funds Transfer)	-0.895	0.339	-2.64	0.008
MBS (Mobile Banking Service)	0.046	0.071	0.65	0.016
BN (Branch Networking)	0.307	0.064	4.81	0.000
TA (Total Assets)	0.130	0.068	1.93	0.050
ROA (Return on Assets)	-0.339	0.111	-3.05	0.002
LA (Loans Advanced)	-0.282	0.083	-3.41	0.001
Cons	5.035	1.807	2.79	0.005
Wald chi2 (6) = 29.62 Prob > chi2 = 0.0000 Hausman test: P- value = 0.8100 R-squared: Within = 0.2027 Between = 0.2862 Overall = 0.2077				

From table 8, the probability of the Wald statistic was found to be 0.000, and statistically significant at one per cent level of significance. This means that the coefficients of the variables in the model were jointly different from zero implying that EFT, MBS, BN, TA, ROA and LA were jointly important in explaining ROE. The overall R-squared was 0.2077 meaning on average, 20.77 percent of all variations in ROE were explained by EFT, MBS, BN, TA, ROA and LA *ceteris paribus*. The coefficient of BNT was found to be 0.307, positive and statistically significant at 1percent level implying 1percent increase in branch network would lead to a 0.307 percent increase in ROE *ceteris paribus.* This means if commercial banks in Kenya enhance BNT, their ROE would improve due to more people enrolling in the accessible banking services leading to more equity returns. This finding is in agreement with Kadioglu *et al* (2017) who found that a unit change in branch networking had a corresponding increase in financial performance of commercial banks in Turkey. The coefficient of ROA was -0.339, negative implying that a 1 percent increase in ROA led to a decrease in ROE equivalent to 0.339 percent *ceteris paribus.* The negative relationship is contrary to conventional expectation where higher incomes lead to higher dividends. The outcome corroborates Nzoka (2015) whose study on Kenyan commercial banks found that assets quality alone can't solely determine the financial performance of commercial banks. The coefficient for loans advanced was -0.282, implying a one percent increase in loans by the banks would lead to a decrease on ROE equivalent to 0.282 percent. This finding supports Kadioglu et al (2017) and Amooko (2015) who found existence of significant negative relationship between non-performing loans and bank profitability in Turkey and Ghana respectively both calling for prudent management.

The coefficient of EFT was -0.895, contrary to the apriori expectation of a positive relationship. Studies on the effect of EFTPos on bank performance have yielded mixed results. The findings of Agboola (2006) in Nigeria established a positive relationship while Kiragu (2017), in Kenya insignificant positive EFT influence on financial performance of commercial banks in Kenya. The negative findings are attributed to ignorance and misinformation on EFT by most customers. The coefficient for MBS and TA were 0.046 and 0.130 respectively. They were positive and statistically significant. This implies that an increase in employment of the two would lead to commensurate increase in ROE of the banks during the study period. This finding is in agreement with Nader (2011), Lerner (2006) and Khaled (2019) who found positive gains in ROE due increase in bank assets as well as adoption of MBS.

5.0 CONCLUSIONS AND CONTRIBUTION TO POLICY, PRACTICE AND THEORY

5.1 FINDINGS AND DISCUSSIONS

Summatively from the findings, for ROA the overall R-squared was 0.5134. This means that on average, 51.34 percent of all variations in ROA are explained by EFT, MBS, BN, TA, ROE and LA, *ceteris paribus*. For ROE, the overall R-squared was 0.2077 meaning on average, 20.77 percent of all variations in ROE were explained by EFT, MBS, BN, TA, ROA and LA *ceteris paribus*. The study found that positive effects of finnovs were mostly on ROE while most negative effects were on ROA. Financial innovations had higher correlation with, and influence on ROA as indicated by R-squared of 0.5134 as opposed to R-squared of 0.2077 for ROE.

The findings of the current study confirms those of Kadioglu *et al* (2017), who found that a unit change in branch networking had a corresponding increase in financial performance of commercial banks in Turkey. Kadioglu *et al* (2017) argued that branch network in banks was important in enhancing efficiency in operations and therefore reducing the time customers would have spent seeking for banking services in branches other than the branch where their accounts are held. This finding is in agreement with Mannah–Blackson, (2004) whose study in Ghana found that branch networking offers quicker rate of interbank transactions as the consequence of distance and time are eliminated, productivity per time period is increased and simulated division of labor among bank branches with its associated positive productivity among the branches is realized.

5.2 Conclusion

The study concluded that an increase in the innovation level results to increased financial performance. Based on the findings of this study, it can be concluded that financial innovations significantly determine bank's Return on Assets and Return on Equity. Financial innovations require cautious operationalization owing to high technology based risks.

Based on the study, various dimensions of innovation of commercial banks, significantly affects financial performance. The study therefore finds the relevance of technology in improving performance of commercial banks in the country. It is therefore important for the various banks to continue investing in cost- effective technology to remain competitive in the industry.

5.3 Recommendations

The current study has found that, there are some positive relationships between innovations and performance in the banking sector for example the effect of branch networking and total assets on bank performance have consistently remained positive during the entire study period. This implies that, banks, which adopt various technologies in their operations, register improvements in various aspects of their operations. For this reason, the study recommends that; commercial banks should continue investing in various positive and promising dimensions of technology as a way of improving on financial performance.

It is also noted that financial innovation is a critical factor for sustainable economic growth. Faster and more secure financial transaction systems spur development of business and economic growth in all other sectors in addition to facilitating financial deepening. This evidently is key to attainment of objectives of Kenya's Vision 2030's economic pillar. Based on the above, there is need for more focused and purposeful funding for research and innovation in the financial sector. This initiative calls for commitment of both private and public sectors.

Lastly, the state through the financial sector regulatory authorities like the Central Bank of Kenya and the Capital Market Authority should partake in the financial research and innovation matrix with a purpose to closely monitor and regulate such developments to assure on their integrity, especially the deposit and payment systems. Indeed, the state should spearhead research, innovation and technology transfers in the financial sector and economy wide.

5.4 Areas for Further Studies

The study suggests that further areas of study should focus on current financial innovations, which have been adopted overtime. This would help clarify whether the current technological trends in financial innovation have a change in relationship with financial innovation. Further, since the current study focused only on commercial banks by Nairobi Securities Exchange, there is need for another study to determine the effect of financial innovation on financial performance of non-banking financial institutions in Kenya since they have equally implemented financial innovation. A study to explore financial innovation challenges facing the banking sector in Kenya should also be done.

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