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Effects of technology based innovation on listed commercial banks financial performance in Ethiopia: The case of Electronic Banking Services

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Abstract

This study empirically examines the effect of electronic banking services on the financial performance of listed commercial banks in Ethiopia. The study employed quantitative research approach using strongly balanced panel data on nine listed commercial banks covering 2011-2019. Target population of the study were all listed commercial banks in Ethiopia and all the available data were obtained from national bank of Ethiopia and from their audited annual reports. The fixed effect model regression results revealed that automated teller machine and mobile banking services have positive and statistically significant effects on the financial performance of commercial banks. However, the regression result suggests that, POS machine banking services have negative and statistically significant effect.

Keywords: Electronic Banking, Effects of Electronic Banking, Financial Performance, Financial Performance of Ethiopian Banking, Effects of Electronic Banking

1. Introduction

In all over the world, banking sector plays an important role in the economy and always tries to make a sign on the economy of the country. Banking is one of the sectors that the technological progress is implemented, monitored closely and used widespread. Technology based or electronic banking is the use of electronic and telecommunication networks to deliver a wide range of value added products and services to the bank

customers (Steven, 2002). Hence, technology based application such as internet banking, mobile banking, automated teller machine and POS network able to bring significant advantages to the bank and the customers also to the delivery of existing products (Ilyas A, 2015). Now a day as a result of its significant economical effect technology based banking services applications such as internet banking, mobile banking, and ATM and POS network were introduced to Ethiopia in 2001 by the largest government owned bank called commercial bank of Ethiopia and latter widely spread to the other private owned commercial banks (Gardachew, 2010).

Therefore, now a day in Ethiopia the traditional banking services more or less replaced by the technology based banking or electronic banking systems so as to improve the banking performance as well as to attract more customers with more service delivery and satisfaction level. One of the important features of electronic banking is available to every banking products/services with lower operational costs for twenty four hours to seven days and it assists the bank to decline their branch expansion movement at huge rental and related costs. Various studies conducted and theoretical literatures in the area described that technology based banking applications has a significant effect on their financial performance (Okiro & Ndungu, 2013). In addition the implementation of electronic banking can bring about many competitive advantages for banks in today's highly competitive banking market environment in the world as well as in Ethiopia. However, low literacy rate is a serious impediment for the adoption of E-banking in Ethiopia as it hinders the accessibility of banking services. As a result of low literacy rate many of the commercial bank customers always use the traditional branch for their day to day banking need (Gardachew, 2010).

2. Statement of the problem

The financial performance of commercial banks challenging by the rapid advancement in technology based services such as internet banking, mobile banking, ATM and POS network and increased forces of competition. In this comprehensive world, internet banking, mobile banking, ATM and POS network has become an important issue in the banking industry, not only to retain their usual customers but also gaining a competitive advantage, while maintain and growing their overall effectiveness. In the recent digital innovation environment in banking as well as in all financial institutions, excellence in customer services is considered as the most important tool for their sustainable business growth (Noah et al**,** 2019**)**. In Ethiopia the emergency of e- banking services has made many commercial banks to rethink their strategies in competitive market, for achieving higher efficiency, control of operations and reduction of cost by replacing paper based, branch expansion based and labor intensive methods with automated process thus leading to higher productivity and profitability (Gardachew, 2010). On the other hand, according to the Beijing 4th (2004), international conference on electronic business (ICEB), implementations of e-banking services able to reduce operating expenses, such as reduction of customer services staff as customers use more self service functions. Now a day in Ethiopia also implementations of e-banking provides clear and enormous advantages to both the banking industry and to their customers. For instance, from the customer perspective e-banking service has provide 24 banking hours for seven days, more reliable information concerning their bank accounts and it is an alternative for the busy individuals because it saves their time of going geographically to the bank(Lee and Lee, 2000). On the other hand, from the bank perspective e-banking has very low cost transactions compared to human teller banking, less cheque processing costs due to an increase in electronic payments, cost of paper and distributing mails are significantly reduced because bank

statements and other disclosures are presented over the internet. To the best of researcher knowledge various studies have been conducted to examine the effect of e-banking in the developed countries and the findings revealed that mixed and contradicting results on the banks performance. No study have been conducted in Ethiopia to examine the effect of e-banking on the financial performance, therefore, in this empirical study the researcher investigated the effect of various electronic based banking services on the financial performance of Ethiopian commercial banks.

Objectives of the study

The general objective of the study is to examine the effect of electronic banking on the financial performance of commercial banks in Ethiopia. Based on the general objective as stated above the specific objectives of the study indicated as follows.

- To examine the effect of mobile banking on the financial performance of commercial banks in Ethiopia.
- To examine the effect of Automated teller machine on the financial performance of commercial banks in Ethiopia.
- To examine the effect of POS machine on the financial performance of commercial banks in Ethiopia.
- To examine the effect of leverage on the financial performance of commercial banks in Ethiopia

Research hypothesis

In the world, various empirical and theoretical literatures suggest that, performance of banking industry is also a function of technology based innovation implementations (i.e. electronic banking services). Therefore, this empirical study expects e-banking service implementation to play an important role in enhancing banks financial performance. Using the study return on asset (ROA) as a measure of banks financial performance, this study proposes the following hypothesis.

H01; There is a positive and significant relationship between automated teller machine and listed commercial banks financial performance in Ethiopia.

H02; There is a positive and significant relationship between POS machine and listed commercial banks financial performance in Ethiopia.

H03; There is a positive and significant relationship between mobile banking and listed commercial banks financial performance in Ethiopia.

H03; There is a positive and significant relationship between bank leverage and listed commercial banks financial performance in Ethiopia.

Theoretical Literature review

This study was advanced by the transaction cost and technology acceptance theories, because they are based on the assumption that the main reason for innovation is to increase the firm's profitability through achieving higher competitive advantages and sustainable developments. In transaction cost theory; one of the object of adoption/implementation of technology in banking as well as in the financial sectors as a whole is to lower the cost involved in transacting for the benefit of the customers and the banks itself. Whereas in the technology acceptance theory; the theory establishes the users adoption of a new information system is determined by an individual intension to use the system that is dependent on the users perception about the

system (Davis, 1989). Therefore, the technology acceptance theory refers to an individual perception that electronic banking are away better than any other traditional mode of banking services as a whole.

Empirical literature review

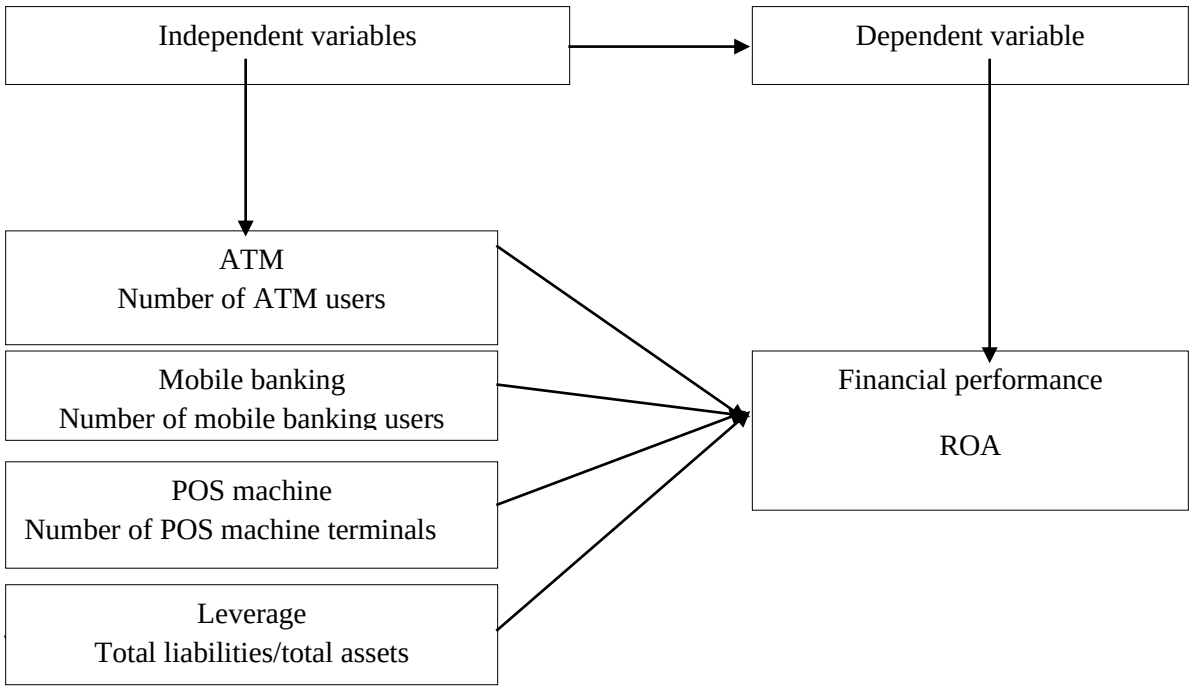
Now in both developed and developing countries in the world, the importance of technology based/ electronic banking service/ product implementation increased day to day. Because e-banking services are able to provides lower transaction cost, lower risk and high return

The studies conducted in US and European countries result showed that e-banking application required advanced technology increasing the overall profitability of the banks, they obtained that e-banking has a significant positive contribution to the development of competition in the banking sector and banks financial performance(Arnaboldi and Claeys, 2008, Ciciretti et al. 2009, Hasan 2002). In addition the studies conducted in developing countries assured that e-banking service application has both positive and negative effects on the financial performance of banking industry(Al-Samadi & Al-Wabal 201, Sumra et al. 2011, Gutu 2014).

Generally, numerous empirical studies have been conducted in the world to examine the effect of e banking on the financial performance banking industry such as Yasin. (2008), Punjab et al. (2009), (K., 1998) (Furst, 2000a, 2000b, 2002a and 2002b) and (Sathye, 2005). However, still the findings of such empirical studies revealed that mixed and contradicting results of e-banking effect on the financial performance of banking industry.

Conceptual framework

A conceptual framework for the present study shows the relationship of e-banking services on financial performance of Commercial Banks in Ethiopia, and has been depicted in Figure 2.1 below.



Source: compiled by the researcher

3. Methodology

To achieve the objectives stated above, the study adopted quantitative research approach to analyze the effect of internet banking on the financial performance of commercial banks. Basically the rationality behind is that it is an appropriate approach to analyzed the cause and effect relationship of the dependent and independent variables in the study (Creswell, 2009).

Data type and collection methods

Secondary data was used from eight sampled commercial banks covering for the period of 2010-2020. For the study secondary data was derived from national bank of Ethiopia (NBE), and from each sampled commercial banks audited annual reports. In addition document review method of data collection was also used to collect all the necessary information's from such secondary sources of financial statements

Sampling techniques and sample size determination

Based on the specific natures of the study, in this research non probability- purposive sampling technique was appropriately used to determine the sample size of the study. As a result based on the specified sampling method eight banks were selected as a simple size in the study based on the criteria listed below.

- Only commercial banks expected to have electronic banking services for the period of 2010-2020 and only banks has completed required data (audited annual financial statements for the period of 2010-2020)

Method of data analysis

To analyzed the collected data, the researcher was used both descriptive and inferential statistics. For the analysis of the data in this study statistical software package of ''STATA'' version 13 and ''EViews'' version 9 were used accordingly.

4. Econometric model specification

In this study the researcher was used panel data, since; it combines the elements of both time series dimensions and cross-sectional data dimensions. According to Gujarati (2004), investigating the problem using panel data provide greater advantages over simply using pure cross sectional and pure time series data separately. "panel data provides more degree of freedom and efficiency, reduce linear relationships among variables, provides more informative data and dynamic changes, lastly, it helps to detect and measure effects that simply cannot be investigated in pure cross-sectional data or pure time series data"(Gujarati, 2004). Therefore, the general functional form of the model is stated as

$ROA_{it} = \beta_0 + \beta_1 ATM_{it} + \beta_2 POS_{it} + \beta_3 MOBB_{it} + \beta_4 Leve_{it} + u_{it}$

where, ROA= Return on asset for bank I at period t, ATM= Automated teller machine, POS= pos machine terminals, MOBB= Mobile banking, Leve = Leverage of bank, Uit =Disturbance or error term, i stands for the ith cross-sectional unit & t for the t^{th} time period, β0 represent a constant or intercept term and β1… β4 represent slope coefficients.

Panel unit root test

Before going to any estimation process, testing for stationary is vital issue in the time series nature data. Because running any sort of regression with non-stationary variables will lead to a problem of spurious result i.e. inference based on statistical test of t and F test will be invalid.

5. Empirical Results and Discussion

Panel unit root test results

The basic rationality of conducting panel unit root test is to check whether the data employed in the study is stationary or not. Therefore, to examine the stationary of study variables the researcher was used five panel data unit root tests. The results of each stationary test confirmed that all variables are stationary at level. On the other hand all variables stationary at level indicates that, panel co- integration test is not required, because, a precondition for running panel co-integration test states that at least two variables in the study must be non-stationary variables at level.

Table 5.Panel unit root test results at level

Variables	Assume individual intercept and trend in the model									
	Levin, Lin & Chu t*		Breitung t-stat		Im, Pesaran and Shin W-stat		ADF - Fisher Chi-square		PP - Fisher Chi-square	
	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.
ROA	-7.228	0.000**	-0.83866	0.2008	-3.233	0.1087	34.07	0.0053**	36.608	0.0000**
Leve	-16.29	0.0000**	-1.73341	0.0415*	-9.400	0.0082**	64.480	0.0001**	24.366	0.0000**
ATM	-5.668	0.0000**	-1.85223	0.0320*	-5.831	0.2029	58.766	0.0256*	27.646	0.8307
POS	-3.13	0.0000**	-0.12290	0.4511	-1.573	0.0578	31.082	0.0015**	62.609	0.0000**
MOBB	-18.23	0.0000**	-1.34670	0.0890	-11.876	0.0001**	43.615	0.0000**	37.469	0.0087**

Source: EViews 9 output

Note:- ** and * shows significant at 1% and 5% significance level respectively.

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Automatic lag length selection based on SIC: 0 to 1 Decision is made based on the majority test result, Decision is made based on the majority test result, Levin, Lin and Chu and Breitung: Assumes common unit root process, and Im, Pesaran and Shin W-stat, ADF - Fisher Chi-square and PP - Fisher Chi-square: Assumes individual unit root process

Table 5.1 Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	81	2.766914	.9372948	-.17	4.7
ATM	81	67.68444	16.72618	0	87.5
POS	81	27.78852	18.19318	-6.8	115
MOBB	81	32.6137	28.11579	-13.2	150

leve	81	86.16691	3.735045	70.2	95.3

Source: STATA 13 output

Table 5.1 above indicates that, 2.7% mean value for the financial performance measured by ROA, this means sampled banks over the study period's averagely record 2.7% financial performance increments as a result of e-banking service implementations.

Table 5.1.1 correlation analysis of dependent and independent variables

	ROA	ATM	POS	MOBB	level
ROA	1.0000				
ATM	0.2914	1.0000			
POS	-0.3285	-0.5051	1.0000		
MOBB	-0.1726	-0.5948	0.7966	1.0000	
leve	0.0287	0.4387	-0.2861	-0.3037	1.0000

Source: STATA 13 output

As indicated above in the correlation analysis of table 5.1.1 financial performance as a measurement of ROA has negative linear association with POS machine and mobile banking. Whereas, the correlation analysis above confirmed that, performance as a measurement of ROA has positive linear association with automated teller machine and leverage.

Model identification tests

To determine appropriate panel data estimation model, researcher was applied different specification tests, such as F-test, Breusch and Pagan Lagrange Multiplier test and Hausman specification test.

a. Pooled OLS model Vs fixed effect model

F-test is applied to make a choice between pooled OLS regression model and fixed effect model. By default Xtreg and areg panel data regression command with the fe option conducts the F-test for fixed effect model. Therefore, the last line of the regression output presents the F-test as presented below.

F	test	that	all	u_i =0:	F(8,	68)	=	4.45	Prob	>	F = 0.0002

As we have seen above, the result emphasizes the validity of fixed effect model over the pooled OLS regression model, since the test statistics in the F-test is statistically significant at 1 level of significance.

b. pooled OLS model Vs random effect model

Breusch and Pagan's (1980) Lagrange Multiplier (LM) test was appropriately tested to make a choice between pooled OLS regression and random effect model.

Breusch and Pagan Lagrangian multiplier test for random effects		
ROA[cdbnks,t] = Xb + u[cdbnks] + e[cdbnks,t]		
Estimated results:		
	Var	sd = sqrt(Var)
ROA	.8785216	.9372948
e	.54786	.7401757
u	.0675468	.2598977
Test: Var(u) = 0		
chibar2(01) = 14.87		
Prob > chibar2 = 0.0001		

Source: STATA 13 output

Based on Breusch and Pagan's (1980) Lagrange Multiplier (LM) test result presented above, the researcher reject the null hypothesis and conclude that the random effect model is appropriate than pooled OLS model.

c. Random effect Vs fixed effect model

Hausman specification test is applied to make a choice between random and fixed effect model.

---------- Coefficients ----------			
	(b) fixed	(B) random	(b-B) sqrt(diag(V_b-V_B)) Difference S.E.
ATM	.0263648	.0224832	.0038816 .
POS	-.0225241	-.0246683	.0021442 .
MOBB	.0171626	.0149214	.0022412 .
leve	-.0002621	-.0226843	.0224222 .0173405
b = consistent under Ho and Ha; obtained from xtreg			
B = inconsistent under Ha, efficient under Ho; obtained from xtreg			
Test: Ho: difference in coefficients not systematic			
chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)			
= 3.67			
Prob>chi2 = 0.0353			

Source: STATA 13 output

As we have seen above, based on Hausman specification test researcher rejects the null hypothesis, suggesting that fixed effect model is appropriate than random effect model to get efficient and consistent parameter estimations in the regression analysis.

Diagnostic tests for classical linear regression model assumptions (CLRM)

Items tested	Tests applied	Probability
Normality	Skewness/Kurtosis	0.45123
Autocorrelation	Wooldridge	0.21341
Autocorrelation	Modified Wald	0.31252
Multicollinearity	Vif	Mean vif 2.103

Source: STATA 13 output

The diagnostics tests presented above, confirmed that Normality, Autocorrelation, Autocorrelation and Multicollinearity problems in the data has not been observed. Therefore, the data in the model fits and does not affect standard errors and any parameter estimates.

Table: 5.2. Fixed effect model regression results

Fixed-effects (within) regression	Number of obs = 81
Group variable: cdbnks	Number of groups = 9
R-sq: within = 0.2825	Obs per group: min = 9
between = 0.0367	avg = 9.0

overall = 0.1545				max =	9	
				F(4,68)	= 6.69	
corr(u_i, Xb) = -0.1669				Prob > F	= 0.0001	
ROA	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
ATM	.0263648	.0073414	3.59	0.001***	.0117153	.0410144
POS	-.0225241	.0078051	-2.89	0.005***	-.0380989	-.0069494
MOBB	.0171626	.0054864	3.13	0.003***	.0062146	.0281105
leve	-.0002621	.0352445	-0.01	0.994	-.0705914	.0700672
_cons	1.071186	2.881763	0.37	0.711	-4.679283	6.821655
sigma_u	.56280438					
sigma_e	.74017568					
rho	.36634922 (fraction of variance due to u_i)					
F test that all u_i=0: F(8, 68) = 4.45 Prob > F = 0.0002						

Source: STATA 13 output

******* indicates that significance at 1% level of significance.

Table 5.2 above presents that, fixed effect model regression results on the effect of electronic banking services on the financial performance of commercial banks in Ethiopia. In the regression results, the coefficient of determination (R^2) measures the proportion of the variation in dependent variable explained by the independent variables jointly, in the sample (Gujarati 2004). On the other hand, the (R^2) value of 28.5% represents about 28.5% of the variation in the financial performance of Ethiopian commercial banks is explained by the listed independent variables such as automated teller machine, POS terminals, mobile banking and leverage of the banks jointly.

Automated teller machine and financial performance

As we have seen above, the fixed effect model regression coefficient of automated teller machine is positive at 1% level of significance. The partial regression coefficient of automated teller machine is .0263648 and it tells us with the influence of all other explanatory variables held constant, as the number of automated teller machine increases say bay one, on average, the financial performance of commercial banks in Ethiopia goes up by 2.6%. This implies that, the number of automated teller machine of a bank is an important determinant of financial performance and this empirical result is consistent with many findings such as (Gardachew, 2010; Noah *etal*., 2016 and Sumra *etal*.,2011).Therefore, the researcher fail to reject the null hypothesis of there is a positive and significant relationship between automated teller machine and the financial performance of Ethiopian commercial banks.

POS machine and financial performance

From the regression output indicated in table 5.2 above, the coefficient of POS machine is negative at 1% level of significance, which indicates that the number of POS terminals is also an important determinant of Ethiopian commercial banks financial performance. -.0225241 is the partial regression coefficient of POS terminals and the coefficient tells us that with the influence of all other explanatory variables held constant, as number of POS machine terminal increases say by one, on average, the financial performance of Ethiopian commercial banks goes down by -2.2 %. This implies that, commercial banks in Ethiopia may spent more POS machine terminal related costs than the benefits obtained from which services. This empirical result is contradict with many of empirical literatures in the area (Sumra *etal*., 2011).

Mobile banking and financial performance

The regression coefficient of mobile banking is positive as indicated from the regression results in above at 1% level of significant; this means mobile banking service is an important determinant of Ethiopian commercial banks financial performance. .0171626 is the partial regression coefficient of mobile banking and the coefficient tell us that with the influence of all other explanatory variables held constant, as numbers of mobile banking user increases say by one, on average, the financial performance of Ethiopian commercial banks goes up by 1.7 %. The empirical result of the study is consistent with the findings of (Gutu, 2014).

Leverage and financial performance

The regression coefficient of leverage is negative as indicated from the regression result in above but not significant. This implies that the leverage ratio measured by total liability divided by total asset is not significantly determining Ethiopian commercial banks financial performance.

6. Conclusion and recommendations

The main objective of the study was to examine the effect of electronic banking on the financial performance of commercial banks in Ethiopia. To achieve the objective of the study the researcher was identified automated teller machine, POS machine terminals, mobile banking and bank's leverage as an explanatory variables. The research was used strongly balanced panel data from nine commercial banks over the study period of 2011-2019. The data were obtained from national bank of Ethiopia and from their audited annual reports.

After various model specification tests have been employed, in the research fixed effect regression model is used to examine the effect of identified explanatory variables on the financial performance of Ethiopian commercial banks. The result of the regression analysis showed that automated teller machine, POS terminals and mobile banking services are the key determinants of Ethiopian commercial banks financial performance. Therefore, Ethiopian commercial banks should assess and work more carefully to increase their financial performance.

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