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Effect of Automated Teller Machines on the Return on Assets of the Listed Commercial Banks in Kenya

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Abstract: *This paper examines the effect of automated teller machines on the return on assets of the listed commercial banks in Kenya. The sample included all the 11 commercial banks listed on the Nairobi Stock Exchange. The study discovered that automated teller machines positively and significantly influenced the return on assets of commercial banks in Kenya in the period 2007 – 2016. All the variables met the classical linear regression model diagnostic tests meaning that they were normally distributed, homoscedastic and had no autocorrelation. Further, there was a positive correlation between automated teller machines and return on assets implying a strong relationship between the two variables. The study recommends that commercial banks in Kenya should increase their efforts towards adoption of automated teller machines to automate their service delivery to customers.*

Keywords: *Return on assets, automated teller machines, commercial banks*

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I. Introduction

Increasing global interest to stimulate the innovative action of institutions, especially technological innovation, aims at retaining or strengthening the competitiveness of national economies. It is also is due to realization of the consequences on utilization of resources and environment effect resulted from economic activity, which demands modelling of fresh systems of production and consumption (Diaconu, 2011). Technological innovations have a strong impact on firm performance (Suzuki, 2015). An institution's performance for much of the business and economics literature concentrates on profits, return on investment, economic rents or shareholder returns (Harrison & Wicks, 2013).

1.1 Statement of the Problem

The Kenyan financial sector has experienced massive changes in the recent past. Many reforms undertaken in the sector have led to rapid expansion of financial products, activities and organizational forms that have improved and accelerated the efficiency of the financial system. This has been made possible by advances in technology and changing economic conditions (Ngari & Muiruri, 2014). The number of automated teller machines increased by 14.2 percent from 2381 in December 2012 to 2718 in December 2015. However, the banking sector profitability increased by 24 percent from 107.9 billion in 2012 to 134 billion in 2015 (CBK, 2015).

There is a discrepancy in the rate of increase of banking sector profitability and the rate of increase in automated teller machines, which is a measure of technological innovation. In other words, the technological innovations to support the gradual growth have not matched the pace. This was a key trigger for this study. Nevertheless, despite the extensive empirical literature focused on the relationship between technological innovations and firm performance, the outcomes do not give definitive answers. The answers are predominantly discrepant depending on the measure of performance employed (Kannebley, Sekkel, & Araújo, 2010). These varied conclusions also triggered this study. The direction and magnitude of innovation impacts could differ with the period taken into consideration (Kannebley et al., 2010). Therefore, this research investigates the effect of automated teller machines on the return on assets of the listed commercial banks in Kenya in the period 2007-2016.

II. Literature Review

This study analyzed the effect of automated teller machines on the return on assets of the listed commercial banks in Kenya.

1.2 Research Objectives

1. To examine how automated teller machines affect return on assets of the listed commercial banks in Kenya.

1.3 Research Hypothesis

H_{01}: Automated teller machines have no significant effect on the return on assets of the listed commercial banks in Kenya.

2.1 Literature Review

2.1.1 Marxian Economics and Modern Economic Theory

Marx is primarily an economist who focuses on the developing economies. Since organizations introduce technological innovations in order to boost financial performance, they in effect innovate to boost property share of the national product. In other words, they innovate to favor capital (Singer, 1969). Lange (1935) believes that the necessity of technical development for the perpetuation of the capitalist structure is inferred in Marxian economics by revealing that it is only in a progressive economy that there can be existence of capitalist profit and interest.

Marx explains the profit of the capitalist entrepreneur, from which also interest on capital is obtained. This is because of the contrast between the value of the worker's labour power and the usefulness of the product created by the worker. Therefore, the labour theory of value has no characteristics that would make it, from the Marxist perspective, higher than the modern more elaborate theory of economic equilibrium. Its most applicable statement (i.e. the equality of price to average cost plus " normal " profit) is incorporated in the modern theory of economic equilibrium. The necessity of the reality that labour-saving technical innovations are every time available at the appropriate moment cannot be inferred by economic theory and in this sense, the necessity of economic evolution cannot be proved. However, Marxian economics does not attempt to prove this. It demonstrates that the capitalist system cannot sustain itself without such innovations. This evidence is given by an economic theory which proves that profit and interest on capital can occur only on account of the unpredictability of a certain datum (Lange, 1935).

2.1.2 Schumpeter's Theory of Innovation

The conventional understanding of Schumpeter's theory of profits through innovation concentrates on the quasi-monopoly positions spread in markets by entrepreneurial firms that experience great benefits. The leading innovators obtain supernormal profits customarily connected to less input prices and greater output prices or costs (Cantwell, 2000). At the core of the Schumpeterian theorem is the notion that small firms are more efficient in converting research and development inputs into innovative activity compared to big firms. This is partially owing to the fact that research and development is a risky venture. Large organizations are able to minimize risk accompanying technological innovation via diversification into simultaneous projects unlike small organizations. Further, economies of scale in promotion and in distribution ease penetration of new product markets, therefore enabling bigger organizations to make more profits from innovations (Suzuki, 2015).

Innovation constitutes the acceptance of a new concept, process, product or service, developed internally or externally. Innovation adoption follows from and is dependent on a firm's range of administrative, strategic and technical skills. Organizations are able to access technological spillover from their rivals and extra-industry origins via inter-organization channels. A firm grows networks and builds relations through its life. These relations deepen environmental exposure and minimizes the distance an organization ought to bridge as it reaches out to external knowledge to embrace technological innovations (Pennings & Harianto, 1992).

2.2 Conceptual Framework

The conceptual framework shows the relationship between the independent and the dependent variable. Further, it shows any other factor that may have any effect of the two variables. The conceptual framework in this particular research shows the relationship between automated teller machines and return on assets of the listed commercial banks in Kenya. The conceptual framework in Figure 1 shows automated teller machines as the independent variable and return on assets as the dependent variable.

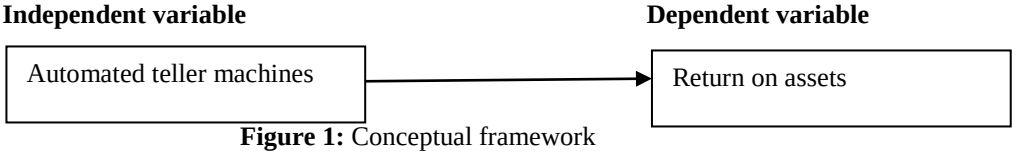

Figure 1: Conceptual framework

2.2.1 Return on Assets

The study aims to evaluate the effect of automated teller machines on the return on assets of the listed commercial banks in Kenya. Return on assets demonstrates how profitable a company is relative to its total assets. Data on return on assets was collected from secondary sources including published financial statements of the commercial banks, bank annual reports and Central Bank of Kenya periodic reports for the period of 2007-2016.

2.2.2 Automated Teller Machines

The researchers used the number of automated teller machines to measure automated teller machine transactions in Kenya. Data on automated teller machines was collected mainly from Central Bank of Kenya periodic reports for the period of 2007-2016 and the Communications Authority of Kenya website.

2.3 Empirical Review

Discussions on the effect of technological innovations on financial performance of the listed commercial banks in Kenya have been done by various authors. Gichungu and Oloko (2015) used a descriptive research design to examine the relationship between bank innovations and commercial banks financial performance in Kenya in the period 2009 -2013. The research specifically sought to establish the impact of automated teller machines, mobile banking, online banking and agency banking on the financial performance of commercial banks in Kenya. They targeted all the 43 commercial banks in Kenya. The study established a positive relationship between technological innovation and the financial performance of commercial banks in Kenya.

Kamau and Oluoch (2016) conducted a study to assess the contribution of internet, mobile, automated teller machines, credit cards and agency banking on commercial bank performance in Kenya. The study used correlation research design to find out the causal effect of innovation on the performance of commercial banks in the period 2012-2015. The target population of the study included all the 43 commercial banks in Kenya. The study concluded that automated teller machines had the highest influence on financial performance of commercial banks in Kenya. In addition, mobile banking, automated teller machines, credit and debit cards usage, internet banking and agency banking have a positive notable effect on the performance of commercial banks in Kenya.

Ngumi (2014) carried out a study to evaluate the effect of bank innovations on financial performance of commercial banks in Kenya. The specific objectives of the study were: to establish the effect of bank innovations on income, return on total assets, profitability and customer deposits of commercial bank in Kenya. The study employed a descriptive survey design and a questionnaire was used to gather primary data. Secondary data was also used to validate the communicative and pragmatic validity of primary data. The target study units for this research were 20 conveniently selected commercial banks. The findings showed that bank innovations had statistically significant influence on income, return on assets, profitability and customer deposits of Kenyan commercial banks. Nevertheless, tests for significance also showed that the influence was statistically significant. The findings further revealed that mobile phones had a higher moderating effect than internet services on the bank innovations when influencing financial performance of commercial banks in Kenya.

Massoud, Saunders and Scholnick (2006) conducted a study to test the effect of ATM surcharges on larger compared to smaller banks. The study considers the possibility that ATM surcharges affect the profitability of commercial banks. The study discovered that after other bank factors are controlled, higher ATM surcharges lead to a higher market share of deposits of larger banks and a lower market share for smaller banks, findings that are in tandem with customer switching. Smaller banks can however positively affect their market share by creating bigger ATM networks.

Alber (2011) carried out a study using a sample of 6 commercial banks (out of 11) for the period 1998-2007. The researcher did an analysis of the profit efficiency of the commercial banks in Saudi Arabia, and testing how it could be affected by banking expansion. The study concluded that the availability of phone banking, number of automated teller machines and number of branches had a positive effect on profit efficiency of the commercial banks in Saudi Arabia. On the other hand, the researcher discovered that the number of point of sale terminals, availability of PC banking and availability of mobile banking did not improve bank profit efficiency.

III. Research Methodology

The study employed a pragmatism research philosophy. The study employed a mixed research design. The population comprised of all the listed commercial banks in Kenya licensed by the Central Bank of Kenya over 2007- 2016 period. The study investigates all the 11 commercial banks listed on the Nairobi Stock Exchange and hence it is a census survey. Listed commercial banks are considered since they are regulated and hence very transparent in their activities. Data for this study was collected mainly from secondary sources. The

secondary sources included published financial statements of the commercial banks, bank annual reports, Central Bank of Kenya periodic reports for the period of 2007-2016 and the Communications Authority of Kenya website. The Stata data analysis and statistical software was used for data analysis. A linear regression model was employed to estimate the relationships between the variables. Descriptive statistics will also be employed to analyse the data. A linear regression model to find out the effect of technological innovation on the financial performance of the listed commercial banks in Kenya.

IV. Data Analysis and Results

The researchers used the Augmented Dickey Fuller test to conduct the unit root test for stationarity for the study variables. The null hypothesis is that the series contains a unit root and the alternative hypothesis is that the series is stationary. The dependent variable, return on assets, was found to be stationary.

4.1 Unit root test on return on assets

Table 1 shows the Dickey-Fuller unit root test for return on assets, showing the test critical values at 1 percent, 5 percent and 10 percent levels. The MacKinnon approximate p-value was used to determine whether return on assets was stationary or not.

Table 1: Unit root test for return on assets

Dickey-Fuller test for unit root **Number of observations = 8**

		Interpolated Dickey-Fuller		
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z (t)	-2.828	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z (t) = 0.043

D2.Return on assets	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_cons	.0014286	.0014286	1.00	0.356	-.002067	.0049242

From the output in Table 1, the MacKinnon approximate p-value, P=0.043 at the 95 percent confidence interval after getting the first difference. This value is less than 0.05, 0.01 and 0.1 and we therefore reject the null hypothesis of a unit root at all significance levels i.e. 1 percent, 5 percent and 10 percent. The series for return on assets is hence stationary. Having a stationary series data on return on assets is key owing to the fact that non-stationary time series data in financial models produces unreliable and spurious regressions to unreliable inferences drawn from the data, leading to poor decision making.

4.2 Classical Linear Regression Model diagnostic tests

4.2.1 Normality

The study used the skewness and kurtosis test to check for normality. The null hypothesis is that the variables are normally distributed while the alternative hypothesis is that the variables are not normally distributed. The results are shown in Table 2.

Table 2: Skewness/Kurtosis tests for normality

Variable	**Obs**	**Pr(Skewness)**	**Pr(Kurtosis)**	**adj chi2(2)**	**Prob>chi2**
Return on assets	10	0.1285	0.3079	3.79	0.1504
Automated teller machines	10	0.1928	0.9320	2.00	0.3676

From the output in Table 2, the researchers used the p-values to decide whether the variables were normally distributed or not. Based on both the skewness and kurtosis p-values, we cannot reject the hypothesis that automated teller machines and return on assets are normally distributed, at 1 percent, 5 percent and 10 percent significant levels.

4.2.2 Heteroscedasticity

The study employed the White's General Heteroscedasticity test to check for heteroscedasticity in our variables. The null hypothesis is that there is constant variance (presence of homoscedasticity) while the alternative hypothesis is that, the variance is varying (presence of heteroscedasticity). Table 3 shows the results.

Table 3: White's test for heteroscedasticity

chi2(2) = 5.23
Prob > chi2 = 0.0733

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	5.23	2	0.0733

From the output in Table 3 the p-value, P=0.0733, which is greater than 0.01 and 0.05. This means that we do not reject that null hypothesis that the series has a constant variance and 1 percent and 5 percent significance levels. It is important for the variables to be homoscedastic because if the usual testing procedures are conducted despite heteroscedasticity, inferences drawn can be very misleading and hence lead to invalid conclusions. The classical linear regression model assumes a constant variance.

4.2.3 Autocorrelation

The researchers used the Durbin-Watson test to check for autocorrelation in the variables. The null hypothesis is that there is no autocorrelation while the alternative hypothesis is there is autocorrelation. Table 4 shows the results of Durbin's test for autocorrelation.

Table 4: Durbin's test for autocorrelation

Durbin-Watson d-statistic (2, 10) = 2.03813

The Durbin–Watson d statistic in table 3 is 2.03813. Assuming that our variables are strictly exogenous, we do not reject the null of no first-order serial correlation.

4.3 Correlation analysis

Correlation measures the strength of the association between the study variables. The researchers conducted a correlation analysis on all the dependent and independent variables in stata and the outcome is shown in table 5. The stronger the correlation, the closer the variables will fall to the regression line and therefore the more accurate the prediction will be.

Table 5: Correlation analysis between automated teller machines and return on assets

	Year	Automated teller machines	Return on assets
Year	1.0000		
Automated teller machines	0.9576	1.0000	
Return on assets	0.7977	0.8874	1.0000

A positive value shows that the variables are positively related while a negative value shows that the variables are negatively related. There was a strong positive correlation of 0.8874 between return on assets and automated teller machines, implying a strong relationship between the two variables. This is in line the results of Ngumi (2014), Alber (2011) as well as Kamau and Oluoch (2016).

4.4 Regression Analysis

The researchers conducted a regression analysis to find out relationship between return on assets and automated teller machines. The researchers made use of the stata to input and compute the study's measurements of the regressions. The coefficients for the constant and independent variable are useful in predicting the dependent variable.

4.4.1 Regression analysis between return on assets and automated teller machines

Table 6 shows the regression analysis between return on assets and automated teller machines

Table 6: Regression analysis between return on assets and automated teller machines

Source	**Sum of squares**	**Mean Squares**	**Observations**	=	**10**
			F(1, 8)	=	29.65
Model	.000165382	.000165382	Prob > F	=	0.0006
Residual	.000044618	5.5773e-06	R-squared	=	0.7875
			Adj R-squared	=	0.7610
Total	.00021	.000023333			

Return on assets	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Automated teller machines	6.81e-06	1.25e-06	5.45	0.001	3.93e-06	9.69e-06
_cons	.0129721	.0026821	4.84	0.001	.006787	.0191571

From the output, Adjusted R-squared=0.7610. This implies that automated teller machines explain 76.10 percent of the variability of the return on assets in the population. The regression model is statistically significant at the 95 percent confidence interval, F (4, 5) = 29.65, P =0.0006 because the p-value is less than 0.05. This means that, in general, the model applied can statistically and significantly predict return on assets at the 95 percent confidence interval. This is in line the results of Ngumi (2014) and Alber (2011).

V. Conclusion

The study indicates that the automated teller machines explain the return on assets of commercial banks in Kenya. This is inferred from the strong relationship between the two variables in the study. Automated teller machines explain 76.10 percent of the variability of the return on assets in the population. The study concludes that automated teller machines positively and significantly influenced the return on assets of commercial banks in Kenya in the period 2007 – 2016. All the variables met the classical linear regression model diagnostic tests meaning that they were normally distributed, homoscedastic and had no autocorrelation. Further, the variables had a positive correlation implying a strong relationship between automated teller machines and return on assets. The study recommends that commercial banks in Kenya should increase their efforts towards adoption of automated teller machines to automate their service delivery to customers.

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