

Effects of Technological Innovations on the Financial Performance of Deposit Money Banks (DMBs) in Nigeria 2010-2021

Mgbada, Friday Nwome
Department of Banking and Finance
Ebonyi State University, Abakaliki

Ele, Linus Egwu
Department of Banking and Finance
University of Uyo, Akwa-Ibom State
egwulines@gmail.com/ linusele@uniuyo.edu.ng

Uguru, Leonard Chukwuma
Department of Accountancy
Ebonyi State University, Abakaliki, Ebonyi State

Tebepah, Sekeme Felix
Department of Business Education
Isaac Jasper Boro College of Education, Sagbama, Bayelsa State

DOI [10.56201/ijebm.v10.no3.2024.pg64.79](https://doi.org/10.56201/ijebm.v10.no3.2024.pg64.79)

Abstract

This study examined the effects of technological innovations on the financial performance of Deposit Money Banks (DMBs) in Nigeria. The specific objectives of the study were to: ascertain the effect of internet banking on the financial performance of Deposit Money Banks in Nigeria, examine the effect of Automated Teller Machines on the financial performance of Deposit Money Banks in Nigeria and ascertain the effect of mobile banking on the financial performance of Deposit Money Banks in Nigeria. The study used secondary time series data sourced from the Central Bank of Nigeria statistical bulletin and were analyzed using Autoregressive Distributed Lag (ARDL). The findings of the study indicated that Internet Banking have significant and negative effect on the financial performance of Deposit Money Banks in Nigeria, Automated Teller Machines had significant and positive effect on the financial performance of Deposit Money Banks in Nigeria while the result further revealed that significant and positive effect exist between mobile banking and financial performance of Deposit Money Banks in Nigeria. The study concluded that technology have significant positive effects on all the indicators except in internet banking which could be attributed to its low patronage. The study among others recommended that relevant agencies such as Central Bank of Nigeria, Deposit Money Banks etc should ensure adequate security for financial innovations installations to improve confidence to loyalties, that financial service providers should the use of mobile banking and other financial innovations to their customers as it will improve on the financial performance of banks in Nigeria. That Automated Teller Machines should be upgraded in technological features as to reduce frauds related cares in order to improve the performance of deposit money banks in Nigeria.

Keywords: *Financial Innovations, Financial Performance, e-banking, ICT, ARDL*

Introduction

1.1 Background to the Study

In an effort to improve on efficiency, man and organizations are constantly seeking for new ideas, ways or methods in the production processes in order to achieve greater effectiveness cum productivity in terms of output and service delivery. This change process often times leads to improvement of qualities and quantities of existing and or new products. This is that the concept of innovation is all about. Innovations could be either technological or non-technological, better still, it can also be a combination of both (Ameme and Wireko, 2016; Mputhia, 2020; Yang, 2020).

As noted by Nwite (2010) a typical example of technological innovation is the evolution of payment and settlement methods. Globally, payment methods have revolved over time and decades; from the barter economy, through the advent of coins and currency notes, to the transfer of credit through the one of cheques, postal orders, traveler cheques and finally to the latest introduction of electronic banking instruments such as mobile, web, credit/debit cards and electronic fund transfer transactions among others.

Electronic banking otherwise referred as e-banking is the adoption or the application of information and communication technology (ICT) in the provision of the products and services of banks (Adu, 2016). Technological enabled banking entails all banking activities that are initiated and executed through the aid of technologies. Electronic banking is further classified into retail and wholesale. Automated Teller Machines (ATM), internet banking, mobile banking and point of sales (POS) etc are retail types of e-banking while Automatic Clearing Housing (ACH), Real Time Gross settlement system (RTGSS) and society for worldwide interbank financial telecommunication (SWIFT) and the wholesale channels of e-banking service (Mohammed, Ibrahim and Muritala, 2022; Yang, 2020). According to Ezeoha (2006) electronic banking have changed the processes of service delivery in Nigeria financial sector, turned the face of brick and-mortar wall, increased efficiency, made control and structure more effective and expanded productivity and profit-base of banks. In reality, electronic banking in addition to enhancing the efficiency of deposit money banks (DMBs) in Nigeria, it also promote healthy account opening, account status, funds transfer, application for loans, subscriptions and payments of all sort of bills are now done at ease without need to visiting any bank branch (Adewoye and Omoregie, 2013).

Efficiency on the other hand is a performance evaluation metric that seek to relate the use of input to output production processes. That is, how inputs are effectively employed in the course of production to achieve the desired level of output at a minimized or no wastages of resource. Efficiency in the banking is so essential to the investors, management and the general public because without the effective use of the bank assets, profits are affected, hence the need for production efficiency (Quinn, 2010); Nwakoby, Okoye, Ezejiofor, Anukwu and Ihediwa, 2020). Efficiency ratios are metrics that are used in analyzing a company's ability to effectively employ its resources such as capital and assets to generating income. The ratios serve as a comparison of expenses made to revenues earned, essentially reflecting what kind of return in revenue or profit a company can make from the amount it spends to operate its business. The measure of financial performance efficiency could either be.

As emphasized by Kwakwala (2015) noted that due to the multiple inputs and outputs nature of banking products and services, accounting based measures may not really give a holistic assessment of bank's financial performance, hence the market base measure are now increasingly applied and accepted to evaluate bank's financial performance efficiency level.

In Nigeria however, in spite of numerous advantages of electronic banking also known as e-banking in financial service delivery, a lot of cons exist such as: cyber hacking, money-laundering, identify thief, high systemic and operational costs, legal costs etc, thus causing the bank's over head costs and expenses to be on the increase. They are not enough empirical evidence of the contribution of technological innovations on the financial performance of deposit money banks (DMBs) in Nigeria hence this study.

It is true that e-banking is diversifying bank's sources of income as well as improving the quality of service delivery through automation of front-and-back office operations channels such as ATMs, mobile banking, POS, internet banking to mention but a few, it have also added to their cost profile. Banks are now spending heavily on the acquisition of the latest-technological infrastructures to meet the state of the art in order to meet the demand of their customer (Adu, 2016). The major challenges facing most business organizations and banks is how to manage rapid and radical innovations and changes; this is because, most of these innovations and new inventions to a large extent determine organizational competitiveness and financial performance.

Similarly, e-banking is not in place without some challenges in the area of the level of financial illiteracy resulting to damages of these high-cost technological infrastructures thereby negating the profit base of the banks, in its replacements or repair (Nwankwo and Eze, 2013; Morufu, 2016; Akwam and Yua, 2021). The economic losses of banks in Nigeria as a result of this cannot be over emphasized rate frauds associated in addition to increase in to these technological setting of Nigeria have made the use of technology in our banks death on the arrival as a result of internet failures. Many online or internet initiated bank transaction have either bounced back or failed especially in the semi-urban areas due to poor network coverage. This have added to the shortfall of the technological innovations on the financial performance of the deposit money bank (DMBs) in Nigeria (Anselm Ngwa, 2020; Bis, 2006; Ezeoha, 2006; Yang, 2020; Ameme and Wireko, 2016)

1.2 Objectives of the Study

The broad objective of this study is to determine the effects of technological innovations on the financial performance of Deposit money banks (DMBs) in Nigeria between 2010 to 2021. The following however, are the specific objectives of the study.

1. To find the effect of internet banking on the financial performance of deposit money banks in Nigeria.
2. To examine the effect of Automated Teller Machines (ATM) on the financial performance of deposit money banks in Nigeria.
3. To ascertain the effect of mobile banking on the financial performance of deposit money banks in Nigeria.

1.3 Research Questions

The following research questions have been formed to guide the study

1. To what extent does internet banking affect the financial performance of deposit money banks in Nigeria?
2. How does Automated Teller Machines (ATM) affect the financial performance of deposit money banks in Nigeria?
3. To what degree does mobile banking affect the financial performance of deposit money banks in Nigeria?

1.5 Research Hypotheses

From the objectives, the following research hypotheses have been formulated and structured in a null form to guide the study.

Ho₁: Internet banking does not have a significant effect on the financial performance of deposit money banks in Nigeria.

Ho₂: Automated Teller Machines (ATM) does not have a significant effect on the financial performance of deposit money banks in Nigeria.

Ho₃: mobile banking does not have a significant effect on the financial performance of deposit money banks in Nigeria.

Review of Related Literature

2.1 Conceptual Review

Nigerian economy and its banking operations were historically cash-driven, thereby giving rises to high cost of transactions and other overhead cost. However, following the cashless policy of the central bank of Nigeria (CBN), Deposits Money Banks (DMBs) have been at the forefront of adoption of different technological innovations in order to meet the demands of their customers, settle payment issues, be able to remain in the high competitive market and at the same time make returns on their investments (CBN, 2008; Oira and Kibati, 2016).

Technological innovation is a broad concept and encompasses ideas, channels, methods, process, products, services etc which are invented or innovated into a business organization in order to enhance efficiency, for wider acceptability, ease of transaction and for profit purpose (Akinyele, Tajudeen, Olukunle and Adedeji, 2019). Innovation is critical to the success of any organization including human resource and as such, banks are not left behind in an effort to make progress in all the spheres of its business operations. A firm's performance is the appraisal of prescribed indicators or standards of efficiency effectiveness, and environmental accountability such as productivity, circle time, regulatory compliance and waste reduction (Quinn, 2010).

Internet banking involves the use of mobile devices and internet to access, execute and deliver financial obligations reuniting to satisfaction of products and services. The issue with internet banking in Nigeria is the epilepsy of the internet supply and connection as well as coverage thereby posing on a great challenge to the financial performance of deposit money banks in Nigeria (Mputhia, 2020; Adewoye and Omoregie, 2013; Mohammed, Ibrahim and Muritala, 2022).

Conduct of conventional banking activities on the internet that is the global network of computer which does not depend on any brick and mortar office building. It offers financial services that are accessed through the internet's World Wide Web by reducing the overhead expenses of traditional banks.

ATMs are the most commonly used bank innovation in recent times. Once inserted, with a magnetic stripe, ATM provides through personal identification number (PIN) necessary information of the customers to access different series of services. ATM were established to work as cash generating or dispensing devices. Services such as cash withdrawal, cash transfers,

checking account balance, bill payments, deposit and printing of account statement.

This is a wireless internet application of banking generally referred to as m-banking. This involves the working together of the internet and mobile phone communication for banking activities. This innovation offers the customer services such as SM-banking that provides instant notification about transaction which helps to keep a watch on account 24/7. The customer is able to perform other services such as account enquires

2.2 Theoretical Review

Diffusion of Innovation Theory

Diffusion of innovation theory was developed by E.M. Rogers in the year 1962. It originated in the year 1962. It originated in communication to explain how, over time, an idea or product gains momentum and diffuses (spreads) through a specific population or social system. The end result of this diffusion is that people, as part of a social system, adopt a new idea, behavior and or product. Adoption means that a person does something differently than what they had previously (that is, purchase or use a new product, acquire and perform a new behavior etc). The key adoption is that the person must perceive the idea, behavior, or product as new or innovative. This means, diffusion (spread or communication) is then possible.

According to the theory, adoption of a new idea or product (that is, innovation) does not happen simultaneously in a social system; rather, it is a process whereby some people are more apt to adopt the innovation than others. Hence, certain characteristics of the target population should be incorporated in the innovation, so that its promotion and easy application to the target population made possible.

The stages by which a person adopts an innovation and where diffusion is accomplished are: awareness of the need for an innovation, decision to adopt or reject the innovation, initial use of the innovation to test it, and continued use of the innovation.

However, there are five factors that influence adoption of an innovation. They includes:

- (i) **Relative advantage:** The degree to which an innovation is seen as better than the idea, and or product it replaces.
- (ii) **Compatibility:** How consistent the innovation is with values, experiences and of the potential adopters.
- (iii) **Complexity:** How difficult the is to understand and or use.
- (iv) **Triability:** The extent to which the innovation can be tested or experimented with before a commitment to adopt is made.
- (v) **Observability:** The extent to which the innovation provides tangible result/service.

The justification for the Theory includes;

Considering the topic of discourse, technological innovation of (DMBs) such as ATM, POS, internet banking etc need sensitization by banks to their customer for easy communication of the process/or the workings of the innovation before they can adopt any set of innovations. Therefore with the low level of financial literacy of bank clients, enough promotion is needed to encourage these innovations spread and usage.

No man, no pride. Innovation diffusion theory is not without limitations. The following are the limitations among others.

- (i) It does not foster a participatory approach to adoption of a public health program.
- (ii) It works better with and adoption of behaviours rather than cessation/or prevention of behaviours etc. The poor promotion of these innovations in (DMBs) have resulted to low level of its patronage/usage by customers thereby negating the goals of branches banking, cashless

policy among other policy goals of these innovations.

2.3 Empirical Review

Ele (2023) who investigated the impact of financial technology on banking service delivery in Nigeria for the period 2005-2022 with the use of secondary data, adopted ex post facto method, and employed the autoregressive distributed lag (ARDL) to estimate the model. The major findings of the study reveals that: Automated Teller Machine (ATM) transaction at 5% level of significance has positive impact on bank performance in Nigeria; Point of Sale (POS) terminal at 5% level of significance has significant impact on bank performance in Nigeria; and online internet banking (ONLIT) transaction at 5% level of significance has significant impact on bank performance in Nigeria. While at 90% level of confidence he concluded that the effect is negative and significant. The recommendation among others are: the policy maker should design a strategy toward enhancing the automated teller machines in term of its availability not only the cities also in the rural areas, improve on its networking and its ability to dispense different Naira denomination, etc

Rahyuni, Wana and Muhammad (2022) Reviewed e-payment innovation in improving Bank Indonesia's financial performance. Data used in the study were sourced from the central bank of Indonesia's and were analyzed using moderated regression analysis (MRA). The outcome of the findings reveals that e-payment has a significant positive effect on financial performance, further indicates that innovation in adopting e-payment can improve bank financial performance and recommend among other things that banks need to pay attention to innovation in financial services as a competitive strategy to improve financial performance.

Akinyele, Tajudeen, Ohukunle and Adedeji (2019) study the financial technology innovation adoption in the banking sector in Nigeria and National Economic development. Employed a mixed design research approach, used secondary data of 21 listed banks in Nigeria and adopted descriptive statistical techniques, statistical package of social sciences (SPSS). The outcome of the study showed fraud risk and transaction cost, ATM and POS all have positive and significant effect. The study noted that despite gaining a lot of attention and its benefits, many customers are still not willing to use some of these financial innovations and therefore recommend amongst others that banks have to intensify product promotion and public enlightenment to stimulate loyalty, that banks must improve their core competence and comparative advantage in order to deliver and encourage financial technology innovation adoption.

Muthia (2020) investigate the effect of technology innovation financial performance of banking industry in Kenya. The study covered the 42 registered commercial banks during the period of this study. All the data used in the analysis were sourced from Central Bank of Kenya (CBK), used linear regression model and the result reveals that ATM banking showed positive relationship with financial performance while internet banking showed a positive but insignificant linkage with banking industry performance. Mobile banking on the other hand recorded negative and insignificant relationship to the financial performance. The study therefore recommends increase application of these digital innovations: mobile banking, Automated Teller Machines (ATMs) and internet banking in Kenya.

Ndunya, Njati and Rukangu (2016) study the influence of technological innovations on bank performance in Meru town, Kenya. The study covered 20 selected registered commercial banks branches in Meru country. Employed descriptive research design. Data were collected through questionnaire and analyzed with inferential analysis. The findings of the study indicated that financial performance of commercial banks branches in Meru town is positively influenced by

technological innovations. The study recommends that banks can manage their costs better in continuing to invest in technology innovation as opposed to continued investment in brick and mortar branches amongst others.

Young (2020) reviewed the development of online marketing during corona virus epidemic. The study noted that the epidemic truly affected the economies of many countries but argued that opportunities and challenges coexist as emerging business is the focus of online marketing development because the new network marketing model will become an important part of the economy in the post epidemic era. The global spread of the new crown pneumonia epidemic has brought a huge impact to the online economy. Contactless services have become the current focus of business operations. Digital content production, including remote sales and online services, is taking the lead in the epidemic and therefore among other things concludes that the new corona virus epidemic has brought challenges to many countries and industries, but it also provides opportunities to accelerate their online market economy development and release the psychological needs of potential consumers and solved people's payment problems.

METHODOLOGY

3.1 Research Design

This study employed *ex-post facto* research design. The reason for this is that the independent variables have already occurred when the researcher begins the observation and is appropriate for collecting of data and helps to find the relationship between the variables.

3.2 Model Specification

The model used for the study was the adaptation and modifications from the work of (Ibekwe, 2021). It study the financial innovation and performance of deposit money banks in Nigeria.

The model is stated thus:

$$ROA = F(ATM), MB, POS, ITB) \dots \dots \dots (1)$$

Where:

ROA = Return on Asset

ATM =Automated Teller Machine

MB =Mobile banking

POS = Point of sales

ITB = Internet Banking

The model was adopted and modified

$$ROI = F(ITB, ATM, MB) \dots \dots \dots (ii)$$

The estimation equation.

$$ROI = \beta_0 + \beta_1 ITB + \beta_2 ATM + \beta_3 MB + u \dots \dots \dots (iii)$$

Where:

ROI = Return on Investment

ITB = Internet Banking

ATM =Automated Teller Machine

MB =Mobile banking

β_0 = and u are the constant and error term respectively $\beta_1, \beta_2, \beta_3$, are the coefficient of financial innovation on the profitability of deposit money banks (DMBs) in Nigeria.

3.3 Model of Data Analysis

The estimation procedure adopted in this study are the Augmented Dickey fuller unit root

diagnostic test to obtain the time series properties of the data used in the estimation model for prediction of the model and easy analysis. Again, correlation test was also conducted to determine the relationship among the variables used as well as bounds test of cointegration, ARDL regression using econometrics view (E-views 10) for arrive at the conclusion of the study.

3.4 Decision Rule: To accept null hypotheses if the probability value (p-value) < 0.05 .

4.1 RESULTS

The study empirically investigated the impact of financial services innovation on the financial performance of deposit money banks in Nigeria. The study utilized data for a sample period of 2010-2021. The study reviewed relevant theoretical and empirical literatures on the subject area. The result indicated mixed impact of the of the innovation variables (internet transactions, ATM transactions, the point of sale transaction and transactions, and the mobile transaction channels). The policy implication however, is that significant outcomes regarding financial performance in the banking industry could be achieved by strategic policy actions such as legislated financial innovations. A long-run sustainable relationship among the variables was identified as indicated by the unit root test. The implication is that there is possibility of convergence in the long-run between financial services innovation and financial performance in the banking industry.

5.1 Findings

The major findings of the study are:

1. Internet banking has negative significant impact on the financial performance of deposit money banks in Nigeria
2. Mobile banking transactions has significant positive impact on the financial performance of deposit money banks in Nigeria
3. ATM transactions: ATM has negative significant impact on the financial performance of deposit money banks in Nigeria.

5.2 Conclusion

Based on the findings from the section above, the study concluded that there is significant but mixed impact of financial services innovation on the financial performance of the deposit money banks in Nigeria.

5.3 Recommendations

The outcome of the various tests carried out in this study and the results obtained leads us to recommend as follows:

1. There is need for Government to ensure that the relevant agencies are mandated to provide security for financial services installations in to improve confidence and adoption of financial innovation facilities by the banks.
2. Financial services providers should advance the use of mobile banking and web payment innovations by customers as this will help reduce the number of unbanked persons especially in the rural economy and also improve the financial performance of the banks.

REFERENCES

- Adewoye, J. O. and Omoregie, N. V. (2013) the impact of Automatic Teller machines on the cost efficiency in Nigeria, *Journal of Internet Banking and Commerce*, 18(3), 1-21.
- Adu, A. C. (2016) Cashless Policy and its effects on the Nigerian Economy, *European Journal of Business, Economics and Accountancy*, 4(2)81-88.
- Akinyele, A. I., Tajudeen, T.I., Olukunle, A. A. and Adedeji, L. O. (2019) Financial Technology Innovation Adoption in the Banking sector in Nigeria and National Economic Development, *Journal of Association of Professional Bankers in Education*, 5(1),1-30.
- Akwam, P. O. and Yua, H. (2021) Effect of financial products on the performance of selected deposit money banks in Nigeria 2005-2019, *European Journal of Accounting, Auditing and Finance Research*, 9 (4) 124-143.
- Ameme, B. and Wireko, J. (2016) impact of Technological innovations on customers in the Banking industry in Developing countries, *the Business and Management Review*, 7(3), 388-397
- Anselm Ngwa, N. (2020) Electronic Banking Transactions and their effects on the performance of selected commercial banks in Cameroon, *Research Journal of Finance and Accounting*, 11(2), 107-115.
- Bank for International settlement (2006) (BIS)
- Drucker, P. (2013) *Empirical studies of Innovative activity*, in *Handbook of the Economics of innovation and technological change*, Paul Stoneman, ed. Cambridge: Blackwell.
- Ele, L. E. (2023) Impact Of Financial Technology on the banking Service Delivery in Nigeria. *A Paper on Contemporary Issues in Finance, Submitted to the Department of Banking and Finance, Ebonyi State University in Partial Fulfillment for the Award of Ph.D*
- ESS WEB of Conferences 218, 01020 (2020)
<https://doi.org/10.1051/eZsconf/202021801020/SEESE 2020>.
- Ezeoha, A. E. (2006) Regulating Internet Banking in Nigeria: Some Success Prescriptions, *Journal of Internet Banking and Commerce*, 11(1).
- Ibekwe, A. O. (2021) Financial innovation and performance of Deposit Money Banks in Nigeria, *International Journal of Business and Laws Research*, 9(1), 162-173.
- Mohammed, Z., Ibrahim, U. A. and Muritala, T. A (2022) Effect of payments system innovation on the financial performance of commercial banks in Nigeria, *Journal of Service Science and Management*. 15(1), 35-53.
- Morufu, O. (2016) E-Payments Adoption and Profitability performance of (DMBs) in Nigeria, *International Journal of Information Technology*, 4(2) 1-9.
- Mputhia, K. C. (2020) Effect of Technological innovations on financial performance of Banking industry in Kenya being a *Research dissertation submitted to school of Business, university of Nairobi*.
- Ndungu, R. M., Njati, I. C. and Rukangu, S. (2016) Influence of Technological Innovation on Bank performance in Meru Town, Kenya, *International Journal of Economics*,

Commerce and Mgt United Kingdom 4(11), 481-495.

- Nwakoby, N. P., Okoye, J. N., Ezejiofor, R. O., Anukwu, C. C. and Ihediwa, A. (2020) Electronic Banking and profitability: Empirical Evidence from selected banks in Nigeria, *Journal of Economics & Business 3(4) 637-649.*
- Nwankwo, O, and Eze, O.R. (2013) Electronic payment in Cashless Economy of Nigeria: problems and prospects, *Journal of Mgt Research, 5(4), 138-151.*
- Oira, K. J. and Kibati, P. (2016) Influence of Innovation on the performance of commercial banks in Nakuru central Business District, *Journal of Business Management, 18(10).67-78*
- Quinn (2010) Bank Efficiency and competition in low-income countries: The case of Uganda, *International Monetary fund working paper WP/05/240.*
- Rahyuni, R., Wana, M. and Muhammad, F. G. (2022) E-payment innovation in improving Bank Indonesia's Financial performance, *International of Journal of Economics, Bus and Accounting Research, 6(1), 183-188.*
- Schumpeter, J.A. (1939) The future of private enterprise in the face of modern socialistic tendencies, *Journal of Economic History.2 (1), 23-41*
- Yang, Z. (2020). *Development of Online marketing during corona virus Epidemic, school of communication, the Ohio State University, Columbus 43220, United States.*

**AAPPENDIX
 DATA USED FOR ANALYSIS**

YEAR	ROA	ATM	MB	ITB
2010	385.1418	399.71	6.65	25.05
2011	458.7775	1,561.74	18.98	59.61
2012	584.375	1,984.66	31.51	31.57
2013	694.6151	2,828.94	142.80	47.32
2014	1070.02	3,679.88	346.47	74.04
2015	1568.839	3,970.25	442.35	91.58
2016	2247.04	4,988.13	756.90	132.36
2017	2766.88	6,437.59	1,102.00	184.60
2018	3047.856	6,480.09	1,974.25	675.92
2019	3753.278	6,512.61	5,080.96	478.14
2020	4515.118	1,539.27	810.11	107.64
2021	7172.932	1,699.16	1,155.64	116.26

CBN statistical Bulletin 2022

UNIT ROOT TEST

ROA @ LEVEL

Null Hypothesis: ROA has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=0)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.337556	0.0007
Test critical values: 1% level	-5.124875	
5% level	-3.933364	
10% level	-3.420030	

*MacKinnon (1996) one-sided p-values.
 Warning: Probabilities and critical values calculated for 20 observations
 and may not be accurate for a sample size of 11

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(ROA)
 Method: Least Squares
 Date: 10/06/22 Time: 09:43
 Sample (adjusted): 2011 2021

Included observations: 11 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ROA(-1)	0.641889	0.479897	1.337556	0.2178
C	83.91100	443.8763	0.189041	0.8548
@TREND("2010")	-116.2713	208.7507	-0.556987	0.5928
R-squared	0.600888	Mean dependent var		617.0718
Adjusted R-squared	0.501110	S.D. dependent var		720.1167
S.E. of regression	508.6340	Akaike info criterion		15.52834
Sum squared resid	2069669.	Schwarz criterion		15.63685
Log likelihood	-82.40584	Hannan-Quinn criter.		15.45993
F-statistic	6.022243	Durbin-Watson stat		1.486631
Prob(F-statistic)	0.025373			

ATM @ LEVEL

Null Hypothesis: ATM has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=0)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.705366	0.0022
Test critical values: 1% level	-5.124875	
5% level	-3.933364	
10% level	-3.420030	

*MacKinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations

and may not be accurate for a sample size of 11

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(ATM)

Method: Least Squares

Date: 10/06/22 Time: 09:58

Sample (adjusted): 2011 2021

Included observations: 11 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ATM(-1)	-0.218130	0.309244	-0.705366	0.5006
C	1962.093	1112.642	1.763455	0.1158
@TREND("2010")	-173.8613	205.7464	-0.845027	0.4226

R-squared	0.300218	Mean dependent var	118.1321
Adjusted R-squared	0.125272	S.D. dependent var	1754.892
S.E. of regression	1641.296	Akaike info criterion	17.87136
Sum squared resid	21550814	Schwarz criterion	17.97988
Log likelihood	-95.29248	Hannan-Quinn criter.	17.80296
F-statistic	1.716066	Durbin-Watson stat	2.057307
Prob(F-statistic)	0.239801		

ITB @ LEVEL

Null Hypothesis: ITB has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=0)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.765304	0.0000
Test critical values: 1% level	-5.124875	
5% level	-3.933364	
10% level	-3.420030	

*MacKinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations
 and may not be accurate for a sample size of 11

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(ITB)
 Method: Least Squares
 Date: 10/06/22 Time: 10:16
 Sample (adjusted): 2011 2021
 Included observations: 11 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ITB(-1)	-0.658086	0.372789	-1.765304	0.1155
C	30.33346	126.7839	0.239253	0.8169
@TREND("2010")	15.34928	23.55196	0.651720	0.5329

R-squared	0.301647	Mean dependent var	8.291671
Adjusted R-squared	0.127059	S.D. dependent var	206.0915
S.E. of regression	192.5540	Akaike info criterion	13.58563
Sum squared resid	296616.4	Schwarz criterion	13.69415
Log likelihood	-71.72097	Hannan-Quinn criter.	13.51723
F-statistic	1.727762	Durbin-Watson stat	1.601060
Prob(F-statistic)	0.237848		

MB @ LEVEL

Null Hypothesis: MB has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=0)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.886646	0.0000
Test critical values: 1% level	-5.124875	
5% level	-3.933364	
10% level	-3.420030	

*MacKinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations
 and may not be accurate for a sample size of 11

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(MB)

Method: Least Squares

Date: 10/06/22 Time: 10:46

Sample (adjusted): 2011 2021

Included observations: 11 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MB(-1)	-1.082381	0.374962	-2.886646	0.0203
C	-488.5924	907.7450	-0.538248	0.6051
@TREND("2010")	274.5307	167.9221	1.634869	0.1407
R-squared	0.513873	Mean dependent var		104.4535
Adjusted R-squared	0.392342	S.D. dependent var		1700.985
S.E. of regression	1325.960	Akaike info criterion		17.44466
Sum squared resid	14065353	Schwarz criterion		17.55318
Log likelihood	-92.94564	Hannan-Quinn criter.		17.37626
F-statistic	4.228306	Durbin-Watson stat		1.950882
Prob(F-statistic)	0.055847			

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(POS)

Method: Least Squares

Date: 10/06/22 Time: 10:47

Sample (adjusted): 2011 2021

Included observations: 11 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POS(-1)	-0.667241	0.386455	-1.726568	0.1225
C	4.529048	606.9339	0.007462	0.9942
@TREND("2010")	105.4833	123.3339	0.855266	0.4173
R-squared	0.294969	Mean dependent var	67.00894	
Adjusted R-squared	0.118711	S.D. dependent var	936.5379	
S.E. of regression	879.1934	Akaike info criterion	16.62289	
Sum squared resid	6183849.	Schwarz criterion	16.73140	
Log likelihood	-88.42588	Hannan-Quinn criter.	16.55448	
F-statistic	1.673510	Durbin-Watson stat	1.659133	
Prob(F-statistic)	0.247077			

DESCRIPTIVE STAT

	ROA	ATM	ITB	MB
Mean	2355.406	3506.836	168.6736	989.0512
Median	1907.939	3254.408	99.61306	599.6256
Maximum	7172.932	6512.608	675.9167	5080.965
Minimum	385.1418	399.7100	25.05000	6.650000
Std. Dev.	2047.889	2179.582	200.4663	1417.160
Skewness	1.081197	0.249892	1.765622	2.191324
Kurtosis	3.456671	1.657475	4.706893	7.000906
Jarque-Bera	2.442249	1.026079	7.691584	17.60743
Probability	0.294898	0.598673	0.021369	0.000150
Sum	28264.87	42082.03	2024.083	11868.61
Sum Sq. Dev.	46132323	52256367	442054.0	22091775
Observations	12	12	12	12

OLS REGRESSION RESULT

Dependent Variable: ROA

Method: Least Squares

Date: 10/06/22 Time: 10:53

Sample: 2010 2021

Included observations: 12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ATM	0.283818	0.430348	2.659506	0.0001
ITB	-2.072887	12.70333	-3.163177	0.0000
MB	0.299645	2.447906	2.472409	0.0106
POS	0.961287	5.730764	3.167741	0.0000
R-squared	0.076039	Mean dependent var	2355.406	
Adjusted R-squared	0.479554	S.D. dependent var	2047.889	
S.E. of regression	2490.989	Akaike info criterion	18.73995	
Sum squared resid	49640190	Schwarz criterion	18.90158	
Log likelihood	-108.4397	Hannan-Quinn criter.	18.68011	
Durbin-Watson stat	2.104044			