**ICT Leapfrogging and Stock Market Performance in Selected Sub-Saharan African Countries**

**Abstract**

ICT leapfrogging hypothesis suggests that developing countries like SSA countries should skip traditional stages of development and rapidly embrace information communication technology. According to this hypothesis, developing countries would experience rapid development if they absorb ICT leapfrogging. This study, tested ICT leapfrogging hypothesis on stock exchange performance in selected SSA countries. The study covered 2008-2022. Principal Component Analysis was employed in computing single measure of ICT and stock performance based on ICT and stock performance variables. Hypothesis was tested using fixed effect estimate and the result found that ICT leapfrogging hypothesis did not hold on stock performance in the selected SSA countries. The study concludes that lack of telecommunication infrastructure in the SSA region is a major factor that contributed to the failure of ICT leapfrogging hypothesis on stock performance in the selected SSA countries. The study therefore recommended that telecommunication infrastructure be provided in the SSA region.

**Key Words:** ICT leapfrogging, Stock Market Performance, Principal Component Analysis (PCA), SSA.

**1.1 Introduction**

“Importance attached to stock exchange market indicates that finance is a panacea for economic growth and development especially in developing economies” (Jamilu & Asad-Ul 2021). To ensuring economic growth and development, there is a need to promote stock exchange markets because stock exchange market helps in capital mobilization from deployment to productive sector. It also helps in achieving capital formation which is a crucial factor in development. Laeven, (2014) added by asserting that financial development and integration of financial assets would transcends to economic growth because it allows for risk sharing. Kolapo, Oke and Olaniyan (2018) in their study found that some countries are poor due to poor performing financial markets. This assertion could be believed in sub-Saharan African countries as the region is dominated with small economies and poor financial markets. Solarin, Shahbaz, Khan and Razali (2019) assert that stock markets are seen as one of the important aspects of a market economy, in the sense that stock markets enable firms to have access to capital as capital mobilization is one of the primary objectives of stock exchange markets.

Economies in SSA

“Africa is perceived to be a continent with significant prospects in terms of resources and tagged as a new developmental frontier. In the light of this perception, some African countries have commenced economic and structural reforms in the financial sectors to revive the so far subdued systems and, more essentially, to strengthen and develop their stock markets” (Ngoa & Songs, 2021). The major reason that necessitated these reforms has been the need to strengthen financial markets through stock markets development, in order to induce improved economic growth. Therefore, the development of stock markets in an emerging economy is seen as one of the major panaceas for achieving economic growth and lifting the standard of living. Arguably, a sound regulatory environment that supports the development of the stock markets is key to driving market confidence for both listed companies and investors.

“Information and Communication Technology (ICT) is the automation of processes, controls, and information production using computers, telecommunications, software's and other gadget that ensure smooth and efficient running of activities. It is a term that largely covers the coupling of electronic technology for the information needs of a business at all levels. ICT has surpassed the role of support services or only electronic data processing; its fields of applications are slightly global and unlimited. Its devices especially the Internet and modern computer email facilities have further strengthened early modernizations like the telephone and fax. Other ICT devices include data recognition equipment, factory automation hardware and services, tele-computing and teleconferences using real time and online system”, Adeoti, (2020).

The information and communication technology (ICT) “leapfrogging” hypothesis has been represented and explained in diverse ways. According to Adeleye, Achugamonu, George, Ogbari and Ola-David (2023), ICT leapfrog is interpreted to mean when developing economies use ICT to bypass key developmental stages to narrow the productivity gaps between developed and developing economies. In other words, these economies use ICT to jump-start their development goals. A slight deviated interpretation is provided by Fong (2009) who defined ICT “leapfrog” as a situation where ICT being an advanced and state-of-the-art technology is applied to an area previously not deployed to achieve some spontaneous development.

“The nexus between Information Communication Technology and stock market development, particularly in recent years, has been mostly determined based on studies of industrialized economies, as well as the rising markets and high-income economies of the world. The study of the relationship of Information Communication Technology with the development of stock markets, especially in the past years, has focused mostly on the economies of developed countries and developing markets, including the economies of countries with a high interest rate” (Okwu 2015).

Evidence from literature shows that most study have been on ICT adoption and stock market performance. For example the study of Okwu (2016) was limited to Nigeria and South Africa, Igwilo and Athenia (2021)examined ICT adoption and stock development in Africa in general, Vaumi, Leudjou and Faha (2021) examined the determinants of adoption and use of Information and Communication Technologies (ICT) in SSA firms, Sibindi, (2022) investigated whether information communication technology (ICT) adoption influences the development of SSA life insurance markets and Usman, Ozturk, Hassan, Maria, Zafar and Ullah (2021) examined how ICT affects the performance of emerging and frontier stock markets. ICT leapfrogging hypothesis has been tested in SSA as most studies concentrated on the effect of ICT and stock market performance. To this end, this study tested ICT leapfrogging on stock market performance in eight (8) Sub-African countries.

**2.0 Literature Review**

**2.1 Information and Communications Technology (ICT)**

According to Hatra et al (2021), “information and communication technology refers to all technologies for processing and storing information electronically. For this purpose, equipment such as computers, communication equipment, networks, fax machines and any controllable electronic package are used, Ong, Habidin, Salleh and Fuzi, (2021) states that ICT is a set of technologies for manufacturing, storing, exchanging, and using information in various business forms. This includes business information, voice conversations, still and motion pictures, multimedia and other forms that have not yet been created. As this technology develops and expands in society, it affects micro and macroeconomic variables. The use of ICT and its applications has accelerated company processes and has led to increased growth through fundamental business changes, including the emergence of E-commerce and ICT-related activities”.

**2.2 Stock Exchange Market**

Abadi, Faghani and Tabatabaee, (2013) defined “stock exchange market as the secondary capital market where large and small investors can buy and sell securities (share, bond)”. Fama and French, (1988) defined “a stock exchange as a market in which securities are traded by members of the exchange who may act as both agent (brokers) and as principal (dealers)”. Farid, (2018) defined “stock exchange market as the citadel of capital; the temple of value. A stock market or equity market is a public exchange market for the company stock (shares) trading and derivatives at an agreed price” (Abadi, Faghani & Tabatabaee, 2013). A stock exchange is an organised marketplace, licensed by a relevant regulatory body, where ownership stakes (shares) in companies are listed and traded. The company often uses the listing to raise funds through issuing new equity shares (an initial public offering or IPO). Investors can then buy and sell these listed shares in the so-called ‘secondary market. However, investors can make or lose money while actively engaging in the trade of shares

**2.3 Empirical Review**

Binuyo and Aregbeshola (2015) examined “the impact of information and communication technology (ICT) on output growth in Nigeria, South Africa, Egypt, Algeria, Morocco, Libya, Sudan, Kenya, and Ghana. The study found a positive relationship between ICT and economic growth in accord with earlier studies. The Granger causality test results indicate that only fixed wireless communication system Granger cause GDPPPP out of the five predictors suggesting that the other ICT predictors merely associate with GDP not necessarily Granger cause it as most of the earlier studies erroneously suggest”. Okwu (2016) examined “ICT in relation to stock market development, economic growth and development and other macroeconomic variables in Sub-Saharan Africa. The study found that the effect of mobile telephone on all market indicators was positive and significant. Further, aggregate effect of the ICT proxies and moderating variables on all market indices was statistically significant. The ICT proxies accounted for positive dynamics in market outcomes, market operations and, thus, sine quo non to growth and development of the markets and financial sectors in the Continent”. His finding is in agreement with the finding of Binuyo and Aregbeshola (2015).

Asongu and Nwachukwu (2017) investigated “the role of internet and mobile phone penetration (ICT adoption measures) in complementing financial formalization and ‘in-formalisation’ (financial sector development) in improving financial access in Africa using evidence based on generalised method of moments with 53 African. The study found that Africa is experiencing an uneven asymmetric development in mobile phone (41 percent) and internet penetration (9.6 percent) as against the fact that developed economies had reached saturation levels as at 2010 in terms of their mobile phone and internet penetration which is consistent with the view that ICT market in Africa presents considerable opportunities for doing business compared to North America, Europe and Asia”.

Ezirim, Adebajo, Elike and Muoghalu (2019) examined “the effects of information technology on the growth and development of the capital market in Nigeria for the period 1998–2017. They found that the level of ICT-facilitated interaction between stockbrokers and investors significantly affected the growth of market capitalisation and the volume and value of shares traded. It was found that information technology does not significantly affect a number of listings and government bonds”. Owusu-Agyei, Okafor, Chijoke-Mgbam, Ohalehi and Hasan (2020) employed “a panel of 42 sub-Saharan African (SSA) countries for the period 2000–2016 to investigate the relationship between ICT adoption, human capital development, economic freedom and financial development. They found that Internet use had a positive impact on different measures of financial development. Further, their results revealed that subsamples of SSA countries differ on their levels of human capital development and economic freedom”.

Chien and Kurniawati (2020) investigated “the effects of information and communication ICT diffusion on financial development for 81 countries over the period 1990–2018. They found that, comparing the different effects of ICT on financial development between the high-income group and the middle- and low-income groups, telephone and Internet positively influenced both groups’ financial development, whereas mobile cellular caused a negative effect in high-income countries, but a positive effect in middle- and low-income countries”. This study has partial agreement with the findings of Owusu-Agyei, etal (2020) be that at some point, the study supported that ICT adoption had a positive effect on financial development and in another point, the study found that some ICT parameters like mobile cellular had a negative effect. Furthermore, Asongu and Odhiambo (2020) examined the impact of ICT on both life- and non-life insurance industries by employing a panel study of 48 countries for the period 2004–2014. They documented a positive relationship between ICT adoption and life insurance consumption.

Ejemeyovwi, Osabuohien and Bowale (2021) empirically “investigated the interaction of ICT adoption and innovation, and the role of this digitalisation interaction on financial development in Africa and across the subregions. The results of their study documented that ICT–innovation interaction shock positively drives financial development”. Igwilo and Athenia (2021) examined “the causal relationship between ICT adoption and stock market development in Africa. The study examined a panel of 11 African stock exchanges for the period 2008–2017 and employed the panel ARDL bounds testing procedure to test for cointegration and examine the causal relationship between ICT adoption and stock market development. The results of the study documented a bi-directional causal relationship (complementarity) between ICT adoption and stock market development. In essence, ICT adoption and stock market development reinforce each other”.

**2.4 Literature Gap**

Evidence from empirical studies above shows that no attention has been paid on ICT leapfrogging hypothesis in SSA. This is because most studies focused in the effect of ICT on stock market performance. This makes this study unique as it tested ICT leapfrogging hypothesis in eight (8) SSA countries.

**3.0 Methodology**

This study is on ICT leapfrogging and stock market performance in selected SSA, for the period from 2008 to 2022 being a 15 (fifteen)-year period. There are 49 sub-Saharan African countries and of these countries, only 24 countries have stock exchange markets. Of the 24 countries, Angola, Cape Verde, Gabon, Lesotho and Mozambique have no listed firms in their stock exchange markets. Furthermore, there are no available data at World Development Indicators (WDI) for Cameroon, Malawi, Rwanda, Seychelles, Somalia, Sudan, Eswatini, Tanzania, Uganda, Zambia and Zimbabwe. Therefore, this study was conducted in 8 Sub-Saharan African countries and they are Botswana, Ghana, Ivory Coast, Kenya, Mauritius, Namibia, Nigeria and South Africa. Principal Component Analysis (PCA) was employed in computing single measure of stock performance and ICT based on the indices of these variables. The study employed Fixed Effect estimate in testing the hypothesis as the study is a static panel and Huasman test indicated fixed effect as the best estimation technique.

**3.1Theoretical Framework**

The theoretical framework of the study lies on technology diffusion model modified by Rogers (2003). Several studies have anchored their research on Roger’s (2003) model of innovation diffusion. Specifically, Okwu (2015) and Jensen, Johnson and Mercer (1998) empirically examined the effect of ICT adoption on stock market performance in developing countries using the Rogers (2003) theory of diffusion. Rogers (2003) explained that diffusion is the process by which communication is passed through several channels over time among the members of a social system. Innovation is defined as an idea, construct or practice that is perceived and developed by an individual, group of individuals or unit of adoption. To this, adoption is the use of the idea which is the innovative outcome in its full action. So, innovation diffusion is now the process by which the ideas are communicated and adopted by members of a giving setting.

Rogers (2003) further noted that after innovation, several adopters would emerge with certain attribute of adoption. This study therefore sees stock market operators as among the several adopters that would emerge in adopting ICT innovation. It should also be noted that every innovation aims at improving a giving system. Adoption of ICT by stock market operators is to enhance the performance of stock exchange. It has become a vital tool not only for industrial and marketing advantages, but also for effective policy measures to overcome existing and even increasing digital inequalities.

Based on the assumption that technology usage tends to an equilibrium level over time along an S-shaped path, the model is specified as:

loghi,t – loghi,t-1 = qi [logh\*i – loghi,t-1] …………………………. (3.1)

where hi,t is ICT use in country (stock market exchange) in period t,

hi,t-1 is ICT use in country (stock market exchange) i in the preceding period

t-1, h\*i is post-diffusion (adoption) equilibrium level in country (stock market exchange)

I, and qi is the speed of adjustment in country (stock market exchange) i.

In the model, ICT is the explained variable and factors that cause changes in ICT level are the explanatory variables. Thus, the model considers ICT usage in relation to the determinants of extent of usage.

But the model is modified in this study by using ICT adoption as the explanatory variable while the determinants of stock exchange performance constitute the explained variable. This necessitated the need to adapt or modify the model in line with the data sets and study thrust. For convenience, h and q are substituted with X and Y respectively. Thus, the model becomes:

logXi,t – logXi,t-1 = Yi [logX\*i – logXi,t-1]………………………………(3.2)

where Xi is ICT adoption in stock market exchange i in time period t,

Xi,t-1 is ICT adoption in stock market exchange i in the preceding time period, t-1,

X\*i is post-ICT adoption optimal stock performance for stock exchange i

Yi is the speed of adjustment to optimal stock performance in stock exchange i.

The metrics of ICT adoption and stock exchange transaction capacity stand as the explanatory and explained variables respectively. Whereas an autonomous component, Φ0, and a stochastic term, μ, are introduced into the model as

log STDEXi,t – log STDEXi,t-1 = Φ0 + Φ1ICTt + μ……………………………….(3.3)

where log STDEXi,t – logSTDEXi,t-1 depicts of transaction capacities dynamics responding to ICT leapfrogging.

Given a dynamic environment such that changes in ICT and the control variable brings changes in stock market performance, equation (2) becomes:

∆ STDEX k,jt = ∆ [Φ0 + Φ1k,jt k, jt + 1k,jt k, jt + ᶙ ]…………………..(3.4)

**3.2 Model Specification**

This study adopted the model of Okwu (2015), on ICT adoption and stock markets, that is the independent variables, which is the subset (division) of ICT network as acknowledged by Perin and Poullot (2013). The following general empirical research model was developed in the form of Panel data regression equation:

From equation 3.4

STDEX = f(ICT, ICT2, Zk)…………………………………………………………………3.5

ICT = NBU, NMU, IU, FTU

NBU = Number of Broadband user

NMU = Number of Mobile phones Users

IU = Number of Internet Users

NFTU = Number of Fixed Telephone Users

STDEX = NLC, MC, TVT, TR

NLC = Number of Listed Companies per 10,000 people

MC = Stock Market Capitalisation as a % of GDP, that is 𝑀𝑎𝑟𝑘𝑒𝑡 𝐶𝑎𝑝𝑖𝑡𝑎𝑙𝑖𝑠𝑎𝑡𝑖𝑜𝑛𝐺𝐷𝑃%

TVT = Stock market total value traded as a % of GDP, that is 𝑇𝑜𝑡𝑎𝑙 𝑉𝑎𝑙𝑢𝑒 𝑇𝑟𝑎𝑑𝑒𝑑𝐺𝐷𝑃%

TR = Stock Market Turnover Ratio in (%),

Zk = GDP

ST𝐷E𝑋𝑖𝑡 = 𝜑0+ 𝜑1ICT𝑖𝑡+ 𝜑2ICT2𝑖𝑡 + 𝜑3ln𝐺𝐷𝑃𝑖𝑡 + μ𝑖𝑡................3.6

Where :

STDEX = Stock Market performance Index

ICT = ICT adoption index

ICT2 = Square of ICT adoption index (ICT leapfrogging index)

GDP = Gross Domestic Product

𝜑0 = Model intercept

𝜑1 and 𝜑2 represent the coefficients of the model explanatory variables.

**3.3 Principal Components Analysis**

Principal component analysis (PCA) is a commonly applied method to reduce the attributes of a data set, where variables have different meanings when applied in a certain way. This method was applied to help generate a single composite index of stock market performance, as well as ICT for the selected eight SSA stock exchanges. The PCA indices for stock market performance (STDEX) and ICT (ICT) was applied in testing ICT leapfrogging hypothesis for STDEX and ICT from determining variables. The equation is stated as:

𝛽𝜚=𝜛𝜚1×1+𝜛𝜚2×2+𝜛𝜚3×3+⋯+𝜛𝜚𝛾×𝛾……………………………….3.7

Where,

𝛽𝜚 = estimate of the jth factor 𝜛𝜚 = weight on factor score coefficient

𝜚 = variable of interest

𝛾 = number of variables.

**Table.1: Variables, Description, Measurement and Sources**

|  |  |  |
| --- | --- | --- |
| **Variables** | **Abbreviation** | **Sources** |
| **ICT Adoption Variables** |  |  |
| Number of Broadband Users | NBU | International Telecommunication Union database |
| Number of Fix Telephone Users | NFTU | International Telecommunication Union database |
| Internet Users | IU | International Telecommunication Union database |
| Number of Mobile phone Users | NMU | International Telecommunication Union database |
| **Stock Market Development Variables** |  |  |
| Stock Market Total Value Traded to GDP (%) | TVT | World Bank Global Financial Development database |
| Stock Market Capitalisation to GDP (%) | MC | World Bank Global Financial Development database |
| Stock Market Turnover Ratio (%) | TR | World Bank Global Financial Development database |
| Number of Listed Companie | NLC | World Bank Global Financial Development database |
| **Control Variable** |  |  |
| Gross Domestic Product | GDP | World Bank Global Financial Development database |

World Development Indicator andInternational Telecommunication Union database (2025)

**4.0 Results and Discussion:**

**4.1. Correlation Test**

This test is carried out to ensure that the explanatory variables are not highly correlated. High correlation among explanatory variables leads to the problem of multicollinearity.

**Table 2: Correlation Coefficients of this study**



**Source: Author’s computation using STATS 15 (2025)**

Result from table 2 shows thatnumber of broadband users (NBU), number of fixed telephone users (NFTU) and number of mobile phone users (NMU), internet users (IU) and gross domestic product (GDP) had positive correlation with total value traded (TVT), market capitalization (MC) and number of listed companies (NLC). This implies total value traded, market capitalization and number of listed companies change in the same direction with ICT adoption. However, it was found that all the explanatory variables had negative correlation with turnover ratio. This denotes that ICT adoption changes in an opposite direction with turnover ratio. From the result also, all the correlation coefficients among the explanatory variables are all below 0.8 tolerate limits. This implies that there is no potential multicollinearity problem among the explanatory variables in all the models used for the study.

**4.2 Principal Component Analysis (PCA)**

This study used PCA to determine appropriate composite indices for stock market performance and ICT in the selected SSA countries using the equation below:

𝛽𝜚=𝜛𝜚1×1+𝜛𝜚2×2+𝜛𝜚3×3+⋯+𝜛𝜚𝛾×𝛾……………………………….4.1

Where,

𝛽𝜚 = estimate of the jth factor 𝜛𝜚 = weight on factor score coefficient

𝜚 = variable of interest

𝛾 = number of variables.

**Table 3: Eigenvalue of this study**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **STDEX** |  |  |  |
| Components | Eigenvalue | Difference | Proportion | Cumulative |
| Comp 1 | 2.66758 | 1.66782 | 0.6669 | 0.6669 |
| Comp 2 | 0.999759 | 0.720366 | 0.2499 | 0.9168 |
| Comp 3 | 0.279393 | 0.226119 | 0.0698 | 0.9867 |
| Comp 4 | 0.0532733 |  | 0.0133 | 1.0000 |
|  | **ICT** |  |  |  |
| Components | Eigenvalue | Difference | Proportion | Cumulative |
| Comp 1 | 2.02552 | 1.10429 | 0.5064 | 0.5064 |
| Comp 2 | 0.921232 | 0.06756 | 0.2303 | 0.7367 |
| Comp 3 | 0.833675 | 0.65411 | 0.2134 | 0.9501 |
| Comp 4 | 0.199569 |  | 0.0499 | 1.0000 |

**Source: Author’s computation using STATA 15 (2025)**

The first principal component explains the maximum variance (66%) in all the individual indicators (eigenvalue of 2.02). The second principal component explains the maximum amount of the remaining variance (25%), with an (eigenvalue of 0.99). The third principal component explains 0.7% of the variance with an (eigenvalue of 0.28), while the fourth principal component explains the remaining (0.01%) of the indicators at (eigenvalue of 0.05) of the variance. Therefore, the first two principal components are more relevant measures of STDEX as they explain over 91% of the total variance.

For ICT, the first principal component explains the maximum variance (51%) in all the individual indicators (eigenvalue of 2.66). The second principal component explains the maximum amount of the remaining variance (23%), with an (eigenvalue of 0.92). The third principal component explains 21% of the variance with an (eigenvalue of 0.83), while the fourth principal component explains the remaining (0.04%) of the indicators at (eigenvalue of 0.2) of the variance. Therefore, the first two principal components are more relevant measures of ICT as they explain over 73% of the total variance.

**Table 4: Eigenvectors of this study**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **STDEX** | | | | | |
| Variables | Comp 1 | Comp 2 | Comp 3 | Comp 4 | Unexplained |
| TVT | 0.5936 | 0.0646 | -0.3089 | -0.7403 | 0 |
| TR | -0.0412 | 0.9976 | 0.0437 | 0.0358 | 0 |
| MC | 0.5861 | 0.0206 | 0.4627 | 0.6648 | 0 |
| NLC | 0.5500 | -0.0170 | 0.8298 | 0.0932 | 0 |
|  | **ICT** |  |  |  |  |
| Variables | Comp 1 | Comp 2 | Comp 3 | Comp 4 | Unexplained |
| IU | 0.3952 | -0.6050 | 0.6196 | 0.3064 | 0 |
| NMU | 0.3891 | 0.7834 | 0.3522 | 0.3330 | 0 |
| NFTU | 0.5048 | -0.1419 | -0.7002 | 0.4846 | 0 |
| NBU | 0.6616 | -0.0090 | -0.0430 | -0.7486 | 0 |

**Source: Author’s computation using STATA 15 (2025)**

As noted in Table 4, the positive coefficients for the first principal component (PC2) imply that they represent the overall measure for stock market performance. The maximum weight in PC1 is for total value traded (TVT) suggesting that there is a strong influence of the variable in the component. Stock market turnover ratio has the strongest influence in PC2, number of listed firms has dominates PCA 3 while stock market capitalization shows the largest positive weight in PC4.

For ICT**,** the positive coefficients for the first principal component (PC2) imply that they represent the overall measure for ICT adoption. The maximum weight in PC1 is for number of broadband users (NBU) suggesting that there is a strong influence of the variable in the component. Number of mobile phone users (NMU) has the strongest influence in PC2, internet users dominates PCA 3 while number of fixed telephone users shows the largest positive weight in PC4.

This study used PCA to determine an appropriate composite index for stock market performance and ICT adoption in selected SSA stock exchanges using the following specific PCA equations:

**STDEX** **=** 0.5936∗TVT - 0.0412∗TR + 0.5861∗MC + 0.5500∗ NLC.………….4.2

**ICT** **=** 0.3952∗IU + 0.3891∗NMU + 0.5048∗NFTU + 06616∗ NBU.………….4.3

**4.2.2: Scree Plot**

This graph is used to denote the components with the highest variance. It basically used to justify the table result. From the graph, it is clearly seen that the first two components explain the highest variance in the four components.



**Figure 1: Scree plot of eigenvalues.**

**Source: Author’s computation using STATA 15 (2025)**

**4.2.3 KMO Statistics**

This statistic is designed to test the rationale for using principal components analysis for set of variables. If KMO statistics is below 0.05, it implies that the computation of an index using PCA is not needed for that set of variables. However, when the overall KMO statistics is greater than 0.05, it then justifies the use of PCA for the set of variables used.

**Table 5: KMO Statistics of this study**

|  |  |
| --- | --- |
| **STDEX** |  |
| Variables | KMO |
| TVT | 0.6239 |
| TR | 0.1263 |
| MC | 0.6572 |
| NLC | 0.8839 |
| Overall | 0.6900 |
| **ICT** |  |
| Variables | KMO |
| IU | 0.3774 |
| NMU | 0.3513 |
| NFTU | 0.4109 |
| NBU | 0.4467 |
| Overall | 0.4120 |

**Authors computation using STATA 15 (2025)**

From the result in table 5, KMO statistics = 0.6900 and 0.4120 > 0.05. This shows that PCA is justified for the computation of stock exchange market performance using market capitalization (MC), turnover ratio (TR), total value traded (TVT) and number of listed firms (NLC) and ICT adoption using internet users (IU), number of mobile phone users (NMU), number of fixed telephone users (NFTU) and number of broadband users (NBU).

**4.3 Test of Hypothesis**

**Table 6: ICT Leapfrogging Hypothesis on Stock Performance in the Selected SSA Countries**

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | Pooled OLS | FE | RE |
| ICT | 0.407\*\*\*  (0.125) | 0.104  (0.045) | 0.025  (0.045) |
| ICT2 | 0.215\*  (0.120) | 0.001  (0.032) | 0.041  (0.035) |
| LNGDP | 0.749\*\*\*  (0.079)\*\*\* | -0.296\*  (0.152) | 0.115  (0.134) |
| CONSTANT | -18.707\*\*\*  (1.98)\*\*\* | 7.326\*  (3.778) | -2.888  (3.344) |
| Hausman Test | 21.03  (0.0003) |  |  |
| f-statistics = 298.4  p-value = 0.000 |  |  |  |
| Serial Correlation Test  Pesaran’s CD = 0.370  p-value = 0.7115 |  |  |  |
| Heteroskedasticity Test | 2.31  (0.0892) |  |  |

**Authors computation using STATA 15 (2025)**

**\*\*\*, \*\* and \* represent significant at 1%, 5% and 10% respectively.**

The dependent variable is stock market performance which was measured using computed index (STDEX) while the independent variable is ICT adoption which was computed using PCA. Leapfrogging variable is the square of ICT index and the control variable is gross domestic product (lnGDP)

**Estimated equation:** ST𝐷E𝑋𝑖𝑡 = 𝜑0+ 𝜑1ICT𝑖𝑡+ 𝜑2ICT2𝑖𝑡 + 𝜑3ln𝐺𝐷𝑃𝑖𝑡+μ𝑖𝑡

**Regression output:** ST𝐷E𝑋𝑖𝑡 = 7.32 + 0.104ICT𝑖𝑡 + 0.001ICT𝑖𝑡2 - 0.0057IU + 0.296lnGDP𝑖𝑡

**5.0 Conclusion and Recommendations**

The result in table 6 shows that ICT leapfrogging hypothesis (ICT2) does not hold on stock performance (𝜑 = 0.001, p-value = 0.982 > 0.05). This implies that skipping of traditional stages of development and rapidly embracing information communication technologies by the selected SSA countries does not favor stock exchange markets in the region under study. ICT leapfrogging hypothesis implies that developing countries like countries in SSA can jump-pas or skip traditional stages of development and rapidly embrace information communication technology (ICT). The study tested ICT hypothesis in SSA and found that ICT leapfrogging does not hold. There is doubt in this result as SSA region is characterized with infrastructure constrain, limited human capital, cultural and social factors and institutional and regulatory barriers. Based on the finding, the study recommends that governments and organization in SSA region should focus on investing on telecommunication infrastructure, education and training.

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Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

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