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Original Article

The Economic Efficiency of Android Phone Enabled Modems and Standard Modems in Nigeria: The Case of Abuja

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Android Phone, Modem, Economic Efficiency, Ordinal Logit Regression.

ABSTRACT

This study examined the economic efficiency of Android phone-enabled modems and standard modems in Nigeria. A sample of 388 commercial (cybercafe) and private internet service users were selected using random sampling. The data were analyzed using frequency and percentage calculations to identify patterns and trends as well as ordinal logit regression analysis. The research study revealed that the odds for higher economic efficiency rise when subscribers or commercial (cybercafe) and private internet service users' monthly internet subscriptions is lower. Similarly, the study revealed that the odds for higher economic efficiency rise when subscribers or commercial (cybercafe) and private internet service user's daily internet access time increases. Regarding connectivity issues while using an Android-enabled modem, the study showed that the odds for higher economic efficiency fall when connectivity challenges increase. The odds for higher economic efficiency increase when connectivity challenges arise while using a standard modem. The research study also showed that the odds for higher economic efficiency increases when more expensive Android phones are used. The study further revealed that the odds for higher economic efficiency will fall when subscribers or commercial (cybercafe) and private internet service users use less expensive standard modems. The study also revealed that the effect of the explanatory variables or predictors is different across the levels of the dependent or explained variable. Thus, the study recommends that regulatory agencies and operators should come up with a price per megabyte of internet access that will reduce the initial cost of services rendered by private and commercial internet users in a bid to drive economic growth. Regulators and service providers must ensure minimal or no interference with the service provided to end users in a bid to promote the economic efficiency of Internet services. Efforts must be made by the government to the efficient devices affordable, and an embargo must be placed on the importation of internet devices (phone and standard modem) with poor efficiency.

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INTRODUCTION

The introduction of laptops into Nigeria over the years has demonstrated its crucial role in integrating digital apps in main frame macroeconomies. The perception of this magnitude depends on three important factors. Firstly, Oyelaran-Oyeyinka & Lal (2005) observed that the extent of the mass adoption of laptops in the processing of various economic activities, the quality of data networks domiciled in the country and the country's economic development. In Nigeria, laptops are dotted in almost every office and home in urban centres. In Nigeria's formalised private sector, according to Aker & Mbiti (2010) such as the financial institutions, Universities, hospitals and entertainment circles, The use of laptops is on the rise as a means of providing services to consumers in a convenient and accessible way, allowing for greater flexibility and reach in service delivery In the public sector, as observed by Avgerou (2008), Laptops are being leveraged to provide access to government services and administrative functions at both state and federal levels, enabling citizens to interact with central agencies more efficiently and effectively. These laptops are connected devices that access the World Wide Web at affordable connectivity rates coupled with different processing applications or apps. The development of a robust, dependable, and affordable telecommunications infrastructure that provides high-quality data services to all segments of the population is a crucial driver of swift economic growth, political stability, social progress, and cultural advancement in any nation.

Laptops, according to Paunov & Rullo (2016), is defined as computers that are portable and suitable for use on the go, are about a century old in Nigeria but is yet to record commensurate growth in spite of their overwhelming importance in the economy. According to the National Bureau of Statistics, NBS (2019), 4.5% of Nigerians have access to the World Wide Web via the modems on laptops. According to Odusanya & Adetutu (2020), Initially, the primary use of telecommunications in the country was for entertainment purposes among young people, rather than contributing to socio-economic development. This likely contributed to the limited attention given to its expansion. At independence in 1960, the country had a mere 18,724 telephone lines for a population of 45 million, resulting in a low tele density of 0.4 telephones per 1000 people. The telephone network consisted of 121 exchanges, with 116 manual and 5 automatic exchanges. However, since independence, various development plans have been implemented to expand and modernize the telecommunications network and services. The introduction of GSM (Wireless) technology in August 2001 revolutionized the Information and Communications Technology sector in Nigeria. According to Ejiogu, Obiora, and Ejiogu (2020), mobile telephony has rapidly become the most popular method of voice communication in Nigeria, with growth so rapid that Nigeria has been hailed as a success story in various forums. "one of the fastest growing GSM markets in the world".

Indeed, these developments have been truly explosive: according to statistics from the Nigerian Communications Commission (NCC), compared with just about 450,000 working lines from NITEL in 2001, by August 2004, the GSM operators had recorded over seven million

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subscribers. However, the mass establishment of Internet cafes in Nigeria actually predated the widely recognized GSM revolution, but the advent of GSM technology gave an additional impetus to their growth and expansion, further accelerating their development and reach. The advent of Android phones in Nigeria was observed by Atkinson and McKay (2017) to further deepen the impact of digital technologies on the economy at large, and this growth trend were The varying design specifications, such as duration, and the unique personal characteristics of customers, play a significant role in explaining the differences in internet usage access time, battery life or duration, motivation for using surfing, memory size, phone storage capacity, search engines employed, internet skills acquisition, frequency of internet use and type of modem used.

Problem Statement/Justification

By leveraging efficient, reliable, and cost-effective techniques to optimize Android phone usage, compared to standard modems, Nigeria can experience a significant surge in the adoption of internet-enabled Android phones and modems, leading to improved economic development, enhanced evaluation of internet information content, and mitigation of challenges encountered while using the internet via these devices. UNDP & NBS (2021) opined that the integration of these technologies has revolutionized the way businesses operate, allowing for increased productivity and cost savings. With the ability to access information and communicate with colleagues and clients from anywhere at any time, employees are able to work more efficiently and effectively. This has resulted in faster decision-making processes, streamlined workflows, and ultimately, increased profits for companies. Furthermore, Uzoho (2021) observed that the accessibility of Android phones and modems has opened up new opportunities for small businesses and entrepreneurs to compete on a global scale. With the ability to reach customers worldwide through e-commerce platforms and digital marketing strategies, businesses can expand their reach without the need for a physical storefront. Finally, Eke & Osi (2023) argued that advancements in Android phone and modem technology have undoubtedly played a significant role in improving economic efficiency by enhancing communication, increasing productivity, and opening up new avenues for growth in the business world.

As regards gaps in literature, studies have found that as these technologies continue to improve, businesses are able to operate more efficiently, leading to increased productivity and profitability. One key gap is how Android phone and modem technology has improved economic efficiency is through enhanced communication and connectivity. Another area begging for attention is to investigate whether faster internet speeds and more reliable connections, businesses can communicate with clients and employees more effectively, leading to quicker decision-making processes and streamlined operations. Additionally, there are questions about the ability to access information quickly and easily on mobile devices over a sustained period of time and how it allows businesses to stay competitive in a rapidly changing market. Furthermore, by leveraging the power of Android technology, can companies adapt to market trends more quickly and make informed decisions that drive growth on the go? As these technologies continue to evolve, it will be crucial for scholars to explore how they are shaping the business landscape and driving improvements in productivity and profitability.

The question now is how technically efficient, in terms of economics, is accessing the net via a standard standalone modem compared to an android phone modem? Is there a significant difference in efficiency between the two platforms in Nigeria? Hence, the motivation for this study is to provide a benchmark for policymakers to assess their technical efficiencies.

Objectives of the Study

The general objective of the study is to examine the economic efficiency of Android phone enabled modems and standard modems in Nigeria. This will be achieved through the following specific objectives:

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- To assess the nature, pattern and adoption of Android phones as modems.
- To examine the nature, pattern and adoption of Stand-alone/standard modems.
- To assess the economic impacts of android phones as modems and standard modems.
- To examine and compare the technical/economic efficiencies of Android phone enabled modems and standard modems.
- To proffer empirical-based policies.

LITERATURE REVIEW

Laptops are portable electronic devices that enable mobile productivity, remote access to documents and information, and connectivity via private or public networks. The first portable computer, the IBM 5100, debuted in 1975, followed by the first commercially successful portable computer, the Osborne 1, in 1981, and the first laptop, the Gavilan SC, in 1983. Since then, the industry has experienced rapid growth, with the global laptop market projected to reach $108.91 billion by 2025, driven by demand for lightweight and technologically advanced laptops, online gaming, and government initiatives in Asia Pacific. In Nigeria, laptops are widely used for internet access, entertainment, social networking, and e-mail, despite challenges such as poor electricity supply, inadequate charging facilities, and substandard network services. Mobile banking and online banking applications have also become popular among Nigerian students, offering convenient and secure transaction services. The technology infrastructure in Nigeria is hindered by systemic crises, affecting economic growth. Despite this, internet access is available through various channels, including mobile networks, modems, and Wi-Fi. However, end-users face challenges like power outages, differing levels of education, and varying access to ICT technologies. Common internet connections include dial-up, landline, and mobile networks, with dial-up being the slowest and most widely available. While ICT-oriented development policies are advocated, the digital divide persists, and empirical research on modem technical efficiencies is scarce, particularly in the Nigerian context. ICTs are a crucial catalyst for economic transformation, and their strategic integration is vital for sustainable development in sub-Saharan Africa. To harness the full potential of ICTs, policymakers and stakeholders must adopt a comprehensive approach that addresses the region's unique challenges and opportunities. This includes investing in infrastructure, promoting digital literacy, and fostering innovation and entrepreneurship. By embracing ICTs, sub-Saharan Africa can unlock its economic potential, drive growth, and create a brighter future for its citizens.

Research has extensively examined the impact of ICT on economic growth and development in advanced economies, revealing significant contributions to productivity and efficiency. As noted by Liebana-Cabanillas, Marinkovic, and Kalinic (2017), the widespread adoption of ICT-driven processes has substantially enhanced service production, leading to improved productivity and efficiency gains.

As noted by Ejiogu, Obiora, and Ejiogu (2020), mobile banking services encompass a range of features, including account management (e.g., mini-statements, account history), payment platforms (e.g., micro-payments, mobile recharging), investment services (e.g., portfolio management, real-time stock quotes), and support services (e.g., credit requests, insurance coverage). These features mirror those of automated teller machines, with the exception of cash transactions, and enable users to access account information, perform transactions, and manage their finances remotely. As observed by Uzoho (2021), the proliferation of mobile and internet banking has revolutionized access to financial services, leveraging widespread adoption of end-user modems to democratize connectivity. This has enabled users to access a range of services, including virtual assistance from call center representatives or branch staff, although the availability of this feature in Nigeria is not universally assured.

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As noted by Moser (2015), phone banking representatives are capable of processing a wide range of transactions, including loan applications, investment transactions, and address changes, which were previously only available at physical bank branches. Mobile banking has emerged as a central platform for a vast volume of transactions, leveraging ICT skills and enabling the micro-management of financial activities for numerous small businesses on a daily basis. According to experts, the growing population and urbanization are driving a shift towards mobile banking, leading customers to adopt online transaction channels as a preferred alternative to traditional face-to-face banking. As noted by Ejiogu, Obiora, and Ejiogu (2020), despite the progress made in mobile banking, several obstacles remain, including inadequate access to information, technical issues with handsets and devices, and security risks related to financial transactions and data transmission over wireless networks. Overcoming these intricate challenges demands a concerted effort from a range of stakeholders, including mobile app developers, wireless network providers, banks' IT departments, power experts, and policymakers, working together to address these complex issues.

Analytical Framework

This research utilizes a stochastic production function model to evaluate the technical efficiency of conventional modems compared to Android-enabled modems in Nigeria, with a focus on laptop-based internet access via these two platforms. The distinguishing feature of these modems is their ability to facilitate internet access through either standard or Android-enabled modalities. As defined by Maroofi, Kahrarian, and Dehghani (2013), technical efficiency is achieved when maximum output is generated from a given set of inputs, leveraging the available technology to its fullest potential. As noted by Maroofi, Kahrarian, and Dehghani (2013), the use of stochastic frontier production functions in econometrics and applied economic analysis has gained significant traction over the past two decades. Pioneering applications of this technique in developed countries were made by Püschel, Mazzon, and Hernandez (2010) and Shaikh and Karjaluoto (2015). In Nigeria, researchers such as Ajibefun and Abdulkadri (1999), Ojo and Ajibefun (2000), and Ojo (2003) have also employed this method to model efficiency, contributing to the growth of empirical applications in this field. The stochastic frontier production function

$$Y_i = X^{\beta}_i \, e(Vi \, U_i) \qquad (1)$$

Where Y_i is the number of successful online transactions in a specified unit, X_i is the vector of input quantities, and βi is the vector of production function parameters. The frontier production function f (X_i, βi) is a measure of maximum potential output for any particular input vector X. The Vi and U_i cause actual production to deviate from this frontier. The Vi is the systematic component, which captures the random variation in output, which is due to the factors that are not within the control of the end users of Laptops (e.g. energy availability, GSM/Standard modem network efficiency, internet network availability and efficiency). The Vi is assumed to be independently, identically distributed with zero mean and constant variance {i.e. Vi ~ N (0, σ^2)} and independent of U_i. The U_i is a non-negative term representing the deviations from the frontier production function, which is attributed to controllable factors (technical inefficiency). It is half normal, identically and independently distributed with zero mean and constant variance {i.e. U_i ~ N (0, σ^2)}. The stochastic frontier production function model is established using the maximum likelihood estimation procedure (MLE). The technical efficiency of either wired or wireless internet access is defined in terms of the observed output (Y_i) to the corresponding frontier output (Y_ii) given the available technology, that is, according to Seyoum et al. (1998):

$$TE = Y_i$$

$$\text{In}Y_i = \beta i \, \text{In} \, X_i + Vi - U_i \qquad (2)$$

So that,

$$0 \leq TE \geq 1.$$

METHODOLOGY

The study area was FCT Abuja in the Gwagwalada area council. Abuja, Nigeria, is a

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planned city and capital of Nigeria. It is one of the most developed cities in Nigeria and is considered one of the wealthiest urban areas in Africa [1]. The city is home to many government buildings, businesses and foreign embassies, which has led to significant growth and investment in the city [1]. The population of Abuja is over 2.5 million, making it the fourth biggest metropolitan population in Nigeria. The city is known for its modern architecture, well-planned layout, green spaces and cultural attractions.

The socio-economics characteristics of Abuja, Nigeria, is as follows: The city's economy is stagnant due to inflation and a weaker currency, real estate is booming, with many developers constructing new residential developments due to the fact that the housing market is expensive, and many people cannot afford to buy or rent. One great contributory factor is seemingly – Corruption, which is a significant issue, with many politicians and civil servants profiting from government contracts and real estate deals. The city's infrastructure is above average, with many amenities and services available as the population is growing, with many people moving to the city for economic opportunities and a higher standard of living. Small businesses, such as outdoor gardens and street food vendors, are thriving while education is expensive, with many private schools charging high fees.

Abuja is a case study for economic efficiency of Android phones as modems and standalone modems in Nigeria for the following reasons: High adoption rate: Abuja has a high adoption rate of Android phones and mobile internet, making it an ideal location to study the economic efficiency of using Android phones as modems. Secondly, the widespread use of mobile data: Mobile data is widely used in Abuja, and many residents rely on their Android phones for internet access, making it a suitable location to study the economic efficiency of mobile data. As a result, there is high availability of standalone modems: Abuja has a range of standalone modem options available, including 3G and 4G networks, making it an ideal location to compare the economic efficiency of Android phones and standalone modems. Thirdly, due to the diverse user demographics: Abuja has a diverse population, including students, professionals, and entrepreneurs, who use Android phones and standalone modems for various purposes, making it an ideal location to study the economic efficiency of these devices across different user groups. This has engendered a competitive market: Abuja has a competitive telecom market, with several network providers offering a range of plans and promotions, making it an ideal location to study the economic efficiency of Android phones and standalone modems in a competitive environment. Also, the huge market adds pressure to demand - High demand for internet access: Abuja has a high demand for internet access, driven by the presence of government agencies, businesses, and educational institutions, making it an ideal location to study the economic efficiency of Android phones and standalone modems in meeting this demand. By studying Abuja, we can gain insights into the economic efficiency of using Android phones as modems and standalone modems in Nigeria, including the cost-effectiveness, productivity, and convenience of these devices, and identify best practices, challenges, and opportunities for improvement.

A sample of 388 commercial (cybercafe) and private internet service users were selected using purposive random sampling. Meanwhile, according to the NPC (2016), the population of the Federal Capital Territory 3,564,126 (FCT Abuja). In view of the foregoing, the sample size for the study was determined using the Yamane (1967) formula for determining sample size. This is expressed below as:

$$n = \frac{3564126}{1+3564126*0.05^2} = \frac{3564126}{8911.32} = 400$$

Based on Yamane's (1967) formula as presented above, the sampled respondent was four hundred (400).

The survey study employed a questionnaire as an instrument of data collection. The questionnaires were administered among commercial (cybercafe) and private internet service users using both

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purposive and convenient sampling techniques. The purposive sampling technique is a non-random sampling technique that was employed to reach cafe operators, while a convenient sampling technique was also used to select respondents who will be ready and willing to respond to the questionnaire. The questionnaire for the study was administered to respondents residing and operating within Gwagwalada, Gwako, the University of Abuja main campus and the Iddo community.

Model Specification and Technique of Analysis

The specified model is expressed as:

$$NST = \beta_0 + \beta_1 COST + \beta_2 ACESS + \beta_3 CONNECTAM + \beta_4 CONNECTSM + \beta_5 COSTADP + \beta_6 COSTSM + \mu \quad [1]$$

Where: NST is an ordinal variable for the number of successful transactions per week, with the least value being 1 and the highest being 4 (it is a proxy for the efficiency of the digital economy). COST: is an ordinal variable for the cost of a monthly internet subscription. The last category is 1, and the highest is 4). ACCESS: is an ordinal variable for daily internet access time. The lowest category is 1, while the highest is 4. CONNECTAM: is an ordinal variable for connectivity challenges with using an android phone modem. The least category is 1, while the highest is 2. CONNECTSM: is an ordinal variable for connectivity challenges with using a standard modem. The least category is 1, while the highest is 2. COSTAP: is an ordinal variable for an average cost of an Android phone. The least category is 1, while the highest is 4. COSTSM: is an ordinal variable for the average cost of a standard modem. The least category is 1, while the highest is 4; μ: Error term.

The specified model is estimated by ordinal logistic regression using SPSS version 21.

RESULTS AND DISCUSSION

Table 2 presents the results of the ordinal regression of the economic efficiency of Android phone enabled modems and standard modems in Nigeria. The result presented revealed that the odds for higher economic efficiency (number of successful internet transactions per week) will be 0.141 times low when a monthly internet subscription is between 1000 to 5000 Naira and 0.310 times low when a monthly internet subscription is between 6000 to 10000 Naira. Also, the odds for higher economic efficiency will decrease by 0.379 times when a monthly internet subscription is between 11000 to 15000 Naira. Meanwhile, it contradicts these studies. The Nigerian Bureau of Statistics, NBS (2023), reports that A monthly internet subscription between 1000 to 5000 Naira is associated with a significant increase in economic efficiency, with a odds ratio of 1.75 (95% CI: 1.23-2.48) compared to lower subscription plans. Again, A monthly internet subscription between 6000 to 10000 Naira is associated with an even higher increase in economic efficiency, with a odds ratio of 2.51 compared to lower subscription plans, (Eke, C., & Osi, M. 2023). Yaqub, Bello, Adenuga, & Ogundeji (2013) in a study conducted in Lagos, Nigeria found that individuals with higher monthly internet subscriptions (above 5000 Naira) had a significantly higher number of successful internet transactions per week, with a mean difference of 12.6 transactions (95% CI: 9.2-16.0) compared to those with lower subscriptions.

The implication is that as less time is spent on the internet owing to the lower amount of subscription, fewer transactions is completed.

Regarding daily internet access time, the study showed that the odds for higher economic efficiency (number of successful internet transactions per week) will be 1.242 and 1.946 times higher when daily internet access time is between 0 to 6 hours and 7 to 12 hours, respectively. Also, the odds for higher economic efficiency will decrease by 0.699 times when daily internet access time is between 8 and 16 hours. These indicate that the odds for higher economic efficiency rise when subscribers or commercial (cybercafe) and private internet

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service users' daily internet access time increases. By implication, the greater the number of hours spent on the internet, the more successful transactions will be recorded.

With reference to a connectivity issues or hitches, while using an android phone modem, the study revealed that the odds for higher economic efficiency would be 0.323 times lower when connectivity issue or hitches arises while using an android phone modem. This implies that the more disruption encountered when connected to the internet, the fewer transactions will be completed successfully. The plausible reason is when calls are coming, the internet connection is disrupted, and this tends to reduce the efficiency of using the Android phone as a modem.

In the same vein, the study revealed that the odds for higher economic efficiency will be 0.323 times higher when connectivity issue or hitches arises while using a standard modem. The implication is that the odds for higher economic efficiency increase when connectivity challenges arise while using a standard modem. The plausible explanation for this development is that the standard modem is immune to the connectivity disruption that the android phone-enabled modem is subjected to due to incoming calls and other activities the device is built for. Thus, a standard modem suffers less connection disruption.

Regarding the average cost of an android phone, the study showed that the odds for higher economic efficiency would increase by 1.422 and 4.627 times when the average cost of an android phone ranges from 50000 to 100000 and 110000 to 170000 Naira, respectively. Also, the odds for higher economic efficiency will rise by 1.043 times when the average cost of an android phone is between 180000 to 230000 Naira. These imply that the odds for higher economic efficiency increase when more expensive Android phone are used. The plausible explanation is that the more expensive an Android phone, the more its efficiency in terms of usage owing to the additional capabilities due to the higher cost of purchase.

On the average cost of a standard modem, the study showed that the odds for higher economic efficiency will decrease by 0.250 and 0.297 times when the average cost of a standard modem ranges from 5000 to 10000 and 11000 to 17000 Naira, respectively. Also, the odds for higher economic efficiency will fall by 0.188 times when the average cost of a standard modem is between 18000 and 23000 Naira. The implication is that the odds for higher economic efficiency will fall when subscribers or commercial (cybercafe) and private internet service users use less expensive standard modems. This shows that the more expensive a device is, the better its performance and efficiency in terms of usage and service delivery.

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Table 1: Case processing summary

		N	Marginal Percentage
Number of successful transactions per week	Below 20	158	40.70%
	20 -39	124	32.00%
	40-59	60	15.50%
	60 and more	46	11.90%
What is your monthly internet subscription cost	1000-5000	94	24.20%
	6000-10000	91	23.50%
	11000-15000	129	33.20%
	16000 and more	74	19.10%
What is your daily internet access time	0-6 hours	90	23.20%
	7-12 hours	87	22.40%
	8-16 hours	133	34.30%
	17 hours and more	78	20.10%
Have you had connectivity issues with your android phone	Yes	314	80.90%
	No	74	19.10%
Have you had connectivity issues with the standard modem	Yes	71	18.30%
	No	317	81.70%
What is the average cost of an Android phone	50000-100000	112	28.90%
	110000-170000	126	32.50%
	180000-230000	74	19.10%
	240000 and more	76	19.60%
What is the average cost of a standard modem	5000-10000	103	26.50%
	11000-17000	131	33.80%
	18000-23000	92	23.70%
	24000 and more	62	16.00%
Valid		388	100.00%
Missing		0	
Total		388	

Source: Authors computation, SSPS version 27, 2023

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Table 2: Parameter estimates

		Estimate	Exp(B)	Std. Error	Wald	df	Sig.	95% Confidence Interval	
								Lower Bound	Upper Bound
Threshold	[NST = 1.00]	-2.856		0.523	29.818	1	0	-3.881	-1.831
	[NST = 2.00]	-1.183		0.505	5.497	1	0.019	-2.172	-0.194
	[NST = 3.00]	-0.007		0.507	0	1	0.989	-1.001	0.987
Location	[COST=1.00]	-1.956	0.141	0.421	21.594	1	0	-2.781	-1.131
	[COST=2.00]	-1.172	0.310	0.35	11.214	1	0.001	-1.859	-0.486
	[COST=3.00]	-0.971	0.379	0.291	11.097	1	0.001	-1.542	-0.4
	[COST=4.00]	0[a]	#VALUE!	.	.	0	.	.	.
	[ACCESS=1.00]	0.217	1.242	0.371	0.344	1	0.558	-0.509	0.944
	[ACCESS=2.00]	0.666	1.946	0.322	4.279	1	0.039	0.035	1.297
	[ACCESS=3.00]	-0.357	0.700	0.285	1.566	1	0.211	-0.916	0.202
	[ACCESS=4.00]	0[a]	#VALUE!	.	.	0	.	.	.
	[CONNECTA=1.00]	-1.131	0.323	0.262	18.58	1	0	-1.645	-0.617
	[CONNECTA=2.00]	0[a]	#VALUE!	.	.	0	.	.	.
	[CONNETM=1.00]	0.455	1.576	0.258	3.098	1	0.078	-0.052	0.961
	[CONNETM=2.00]	0[a]	#VALUE!	.	.	0	.	.	.
	[COSTADP=1.00]	0.352	1.422	0.296	1.412	1	0.235	-0.228	0.932
	[COSTADP=2.00]	1.532	4.627	0.301	25.856	1	0	0.942	2.123
	[COSTADP=3.00]	0.042	1.043	0.333	0.016	1	0.899	-0.61	0.695
	[COSTADP=4.00]	0[a]	#VALUE!	.	.	0	.	.	.
	[COSTMD=1.00]	-1.387	0.250	0.328	17.872	1	0	-2.031	-0.744
	[COSTMD=2.00]	-1.215	0.297	0.31	15.309	1	0	-1.823	-0.606
	[COSTMD=3.00]	-1.674	0.187	0.343	23.76	1	0	-2.347	-1.001
	[COSTMD=4.00]	0[a]	#VALUE!	.	.	0	.	.	.

Source: Authors computation, SSPS version 27, 2023

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The diagnostic statistics from *Table 3* revealed that with regard to the model fitting information, there is a significant improvement in the fit of the model compared to the null model. Thus, the estimated model has a good fit. From *Table 4*, the Pseudo R-squared using the MacFadden statistic showed that the estimated model has a 10.6 per cent improvement in the prediction of the outcome based on the predictors in comparison to the null model. From *Table 5*, the test of parallel lines shows the estimated model is not significant (prob. value (0.845) > 0.05), implying that the probability of falling to a higher category does vary for economic efficiency using Android phone enabled modem and standard modem measured by the number of successful transactions per week. This means that the effect of the explanatory variables or predictors is different across the levels of the dependent or explained variable.

Table 3: Model fitting information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	851.165			
Final	746.855	104.31	14	0

Source: Authors computation, SSPS version 27, 2023

Table 4: Pseudo R-Square

Cox and Snell	0.236
Nagelkerke	0.256
McFadden	0.106

Source: Authors computation, SSPS version 27, 2023

Table 5: Test of Parallel Lines

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	746.855			
General	726.338[b]	20.517[c]	28	0.845

Source: Authors computation, SSPS version 27, 2023

CONCLUSION

This study examined the economic efficiency of Android phone enabled modems and standard modems in Nigeria. A sample of 388 commercial (cybercafe) and private internet service users were selected using purposive random sampling. Data were analysed using frequency and percentages, as well as ordinal logit regression analysis.

The research study revealed that the odds for higher economic efficiency (number of successful internet transactions per week) fall when subscribers or commercial (cybercafe) and private internet service users' monthly internet subscriptions is lower. Similarly, the study revealed that the odds for higher economic efficiency (number of successful internet transactions per week) rise when subscribers or commercial (cybercafe) and private internet service users when daily internet access time increases. Regarding connectivity issues while using an Android-enabled modem, the study showed that the odds for higher economic efficiency fall when connectivity challenges increase. While the odds for higher economic efficiency increase when connectivity challenges arise while using a standard modem. The research study also showed that the odds for higher economic efficiency increases when more expensive Android phone are used. The study further revealed that the odds for higher economic efficiency will fall when subscribers or commercial (cybercafe) and private internet service users use less expensive standard modems. The study also revealed that the effect of the explanatory variables or predictors is different across the levels of the dependent or explained variable.

In light of the above, the study has been able to establish, based on the research questions and objectives, that Android-enabled modems and

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standard modems drive the economic efficiency of internet services in Nigeria and also the impact of each device on the number of successful internet transaction per week differs.

Recommendations

Based on the research findings, the following recommendations are advanced: Since the economic efficiency of Android phone and standard modems is a function of the cost of monthly internet subscription, regulatory agencies and operators should come up with a price per megabyte of internet access that will reduce initial cost of services rendered by private and commercial internet users in a bid to drive economic growth.

Regulators and service providers must ensure minimal or no interference with the service provided to end users in a bid to promote the economic efficiency of Internet services. The study revealed that the more expensive devices have greater efficiency compared to the less expensive ones, an effort must be made by the government to the efficient devices affordable, and an embargo must be placed on the importation of internet devices (phone and standard modem) with poor efficiency.

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