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****Original Research****

PROBABILITY MODELING OF CUSTOMER SWITCHING BEHAVIOR AND VOICE TARIFF DISPARITIES IN TANZANIAN TELECOM MARKETS

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Abstract

The telecommunications sector has experienced significant growth, driven by technological advances, improved internet access, investment from both the private and public sectors, and competitive pricing. Therefore, it is crucial to understand the factors that influence customer switching. This study examines voice tariff disparities between telecommunications operators in Tanzania and determines the probability of customer switching behavior. This was achieved by analyzing the relationship between tariff differences and the likelihood of customers switching service providers. A quantitative research approach was used using secondary data from the Tanzania Communications Regulatory Authority (TCRA), covering the period from the quarter ending March 2023 to the quarter ending June 2024. Descriptive statistics and logistic regression were used to model the effects of tariffs on switching behavior. Findings indicated that higher local SMS and on-net voice tariffs significantly increase the probability of customers switching providers, while higher international voice tariffs surprisingly reduce the likelihood of customer switching behavior. The study concluded that competitive pricing, particularly in SMS and local voice services, is essential for customer retention. It recommends that telecom operators focus on cost-effective service offerings and improve network quality to minimize churn. Future research should explore the dynamics behind the lower switching tendency for international services to enhance retention strategies for premium service users.

Keywords: voice tariff disparities, customer switching behavior, telecom operators, customer retention.

1.0 INTRODUCTION

The telecommunications industry has experienced significant growth globally and in Tanzania over the past two decades, driven by rapid technological advances and improved internet accessibility as well as the expansion of telecommunications services across the country. This growth has been driven by both government initiatives and significant investments by private telecom operators (Ezeigweneme et al., 2024; Okeleke, 2019; Suleiman et al., 2018; Tanzania Communications Regulatory Authority [TCRA], 2024). Understanding customer behavior in telecommunications market is crucial for service providers to effectively offer their products and services. Numerous studies have explored how customers make choices regarding products and services. According to Hidayati et al. (2018), individuals in Bangladesh select service providers based on factors such as tariff, brand reputation, and customer service. Mwela (2024) notes that the selection is influenced by customer profiles, available products, and service quality. To stay competitive, service providers need to gain insight into their customer demographics, decision-making processes, and the factors that influence those decisions. The heightened competition has led to a broader array of product offerings, intensifying the competitive landscape.

The Tanzanian telecommunications market is highly competitive and features several major players including Vodacom, Airtel, Tigo, Halotel and Tanzania Telecommunications Corporation Limited (TTCL). These operators offer a wide range of services such as voice calls, short message services (SMS) and data packages at different prices (Suleiman et al., 2018; Tanzania Communications Regulatory Authority [TCRA], 2024). The differences in voice tariffs significantly shape consumer behavior, particularly in terms of switching intentions, as customers are increasingly price sensitive and likely to switch providers for lower tariffs or better service (Salhieh, 2019). Factors influencing this behavior include price sensitivity, service quality, promotional offers, and brand loyalty (Hidayati et al., 2018).

Despite the significant growth of the telecommunications sector in Tanzania, customer switching behavior has become common and poses a critical challenge for mobile service firms. Factors such as voice tariff disparities, geographical location, income levels, and access to technology greatly influence this behavior among major operators in Tanzania main land such as Vodacom, Airtel, Tigo, Halotel and TTCL (Mwigira & Ntimbwa, 2023; Suleiman et al., 2018). The combination of inequalities in voice tariffs, geographical restrictions, income fluctuations and unequal access to technology pose a complex challenge for mobile operators in Tanzania. These factors not only influence consumer choices and preferences, but also force operators to change their strategies, pricing models and continuously adapt service offerings in order to remain competitive.

Understanding these dynamics through probabilistic modeling is critical to developing effective customer retention strategies because it allows companies to determine the likelihood of switching and address the underlying issues that contribute to customer retention (Khoh et al., 2023; Salhieh, 2019). Therefore this study aims to analyze the voice disparities of mobile network operators and their impact on customer loyalty and switching probabilities to assist telecommunications companies in developing more efficient retention strategies and pricing models for long-term competitiveness.

2.0 OBJECTIVE OF THE STUDY

The objectives of the study is to analyze the disparities in voice tariffs among different telecom operators in Tanzania and to estimate the probability of consumers switching telecom operators based on these tariff disparities.

3.0 LITERATURE REVIEW

The scholar reviewed and discussed the literature in this section, drawing on the theoretical and empirical reviews highlighted below.

3.1 Theoretical literature review on customer switching behavior in telecom markets

In the competitive landscape of telecommunications, understanding customer switching behavior is vital for providers aiming to retain their clientele and attract new users. This section explores the theoretical foundations of customer switching behavior within telecom markets, drawing upon established two theories such as consumer choice and utility maximization and Theory of Interdependent Demand.

The consumer choice and utility maximization theories of Jevons, Menger and Walras, which analyze how individuals optimize utility based on income and prices (Aleskerov et al., 2007). In the context of this study, telecom customers are viewed as rational agents who aim to maximize their utility when selecting a service provider. Voice tariff disparities between providers act as one of the key variables influencing these decisions. Customers are likely to switch from one provider to another if they perceive that doing so will increase their utility, whether through lower costs, better service quality, or a combination of both.

The theory of interdependent demand for a communications service, developed in 1974, shows how the value of a communications service increases with the number of users due to network effects, with each additional user increasing the value of the service to others (Rohlfs, 1974). This theory is relevant to this study because it shows that customer switching behavior is influenced not only by differences in voice tariffs, but also by the network size and quality of telecommunications providers becomes. Customers are less likely to switch if their current provider has a larger network and better service, even if the tariffs are slightly more expensive. However, significant tariff differences can provide incentives to switch, regardless of the size of the network. Thus, this theory helps model switching behavior by integrating both pricing and network dynamics.

3.2 Empirical literature review on customer switching behavior in telecom markets

Empirical research on consumer switching behavior in the telecom industry has been extensive, particularly in developed markets. However, studies focusing on developing countries,

including Tanzania, are relatively scarce.

The study by Hidayati et al. (2018) used a quantitative statistical approach to examine customer behavior when selecting telecommunications service providers using data from 331 respondents. Their results showed that brand, network quality and distribution had a significantly positive influence on customer behavior, whereas tariff and advertising had no significant influence. Similarly, (Malik et al., 2014) studied customer switching behavior in the mobile phone industry and found that perceived usefulness, ease of use and switching costs were key, with non-tariff factors such as customer loyalty being more important than pricing in influencing switching decisions.

The study by Al-Otaiby and Ismail (2022) explores the factors influencing telecom customer switching behavior in Saudi Arabia, analyzing 301 valid responses from an online survey of 1,098 participants. The study revealed that offers and prices of tariffs as the primary drivers for switching, while e-services emerged as more significant. The findings emphasize the need for competitive pricing strategies and enhanced e-services to retain customers in the Saudi telecom market. Moreover Salhieh (2019) study on customer behavior in switching mobile services in Jordan found that price, network coverage, and customer service significantly influence decisions, achieving 83% predictive accuracy. The findings identified the importance of enhancing customer satisfaction and loyalty through competitive offerings, which is relevant to Tanzania's telecom market affected by high voice tariffs (Tanzania Communications Regulatory Authority [TCRA], 2009). Moreover, Mwigira and Ntimbwa (2023) emphasized that effective marketing strategies, including customer satisfaction and branding, are vital for influencing consumer choices in this sector.

The study by Lunn and Lyons (2018) analyzed consumer switching behavior in Ireland telecommunications markets using ordered logistic regression and identified billing shocks and potential savings as the main drivers of switching, with long-standing subscribers being less likely to switch. Grigoriou et al. (2018) found that pricing plans are the main factor in brand switching behavior in four countries. Similarly, Khoh et al. (2023) used predictive analytics to highlight service quality and price sensitivity as key factors influencing customer churn in telecommunications market. Krishnan et al. (2022) they used machine learning techniques to predict telecommunications customer churn, achieving the highest accuracy of 93% and

helping companies identify at-risk customers for retention. In the same way, Saha et al. (2022) developed a machine learning-based personalized plan model in which Random Forest achieved 83% accuracy, suggesting that personalized plans based on customer behavior can improve satisfaction and loyalty.

Furthermore, a study on Tanzanian telecommunications using Sternberg's love triangle theory found that improving service quality that reflects customers' passion could reduce switching behavior (Amani, 2022). Taken together, these studies highlight the value of predictive modeling and tailored services for minimizing churn and increasing customer retention in telecommunications markets. Despite extensive research on customer switching behavior in telecommunications markets, particularly in developed economies, there are still limited studies focusing on the dynamics of tariff differences in voice tariffs in telecommunication service and switching behavior in developing countries such as Tanzania. Existing research has examined factors such as customer loyalty, service quality and pricing, but there is a gap in modeling the likelihood of customer switching behavior specifically related to tariff differentials in the Tanzanian telecommunications market.

4.0 METHODOLOGY

This section outlines the method, techniques, and procedures used to collect, analyze, and interpret data in a way that aligns with the research objective. It comprises the research approach, design, sampling methods, data collection method, and data analysis strategies.

4.1 Research approach and design

A quantitative research approach was adopted, using a descriptive research design to measure the relationship between voice tariff disparities and customer switching behavior. The choice of this design was appropriate for analyzing secondary data without manipulating the study environment, allowing for a comprehensive exploration of the variables under investigation.

4.2 Population and sample

The population of this study consisted of telecommunications customers in Tanzania from five major service providers such as Airtel, Halotel, Tigo, TTCL and Vodacom. The sampling frame was drawn from the Tanzania Communications Regulatory Authority (TCRA) quarterly reports, which provided data on telecommunications tariffs (voice, SMS and data). A census sampling technique was used, meaning that all relevant data from quarterly reports

between March 2023 and June 2024 were included in the analysis. This approach was chosen due to the availability and completeness of secondary data to ensure the study captures the full spectrum of customer behavior.

4.3 Data Source and collections

This study used secondary data collected from the Tanzania Communications Regulatory Authority (TCRA) Communications Statistics, specifically covering the period from the quarterly report ending March 2023 to the quarterly report ending June 2024. These data include detailed information on telecom tariffs (voice, SMS, and data) across five big service providers in Tanzania, such as Airtel, Halotel, Tigo, TTCL and Vodacom.

Table 3.0: Study variables description table

Variable Name	Variable Type	Variable Category	Description
Switching Behavior (Dependent Variable)	Binary	Dependent	1 = Switched, 0 = Did not switch
On-Net Voice Tariff (TZS per minute)	Continuous	Independent	The cost of making a voice call within the same network.
Off-Net Voice Tariff (TZS per minute)	Continuous	Independent	The cost of making a voice call to a different network.
East Africa International Voice Tariff (TZS per minute)	Continuous	Independent	The cost of making an international voice call to East Africa.
Other International Voice Tariff (TZS per minute)	Continuous	Independent	The cost of making an international voice call to countries outside East Africa.
Local SMS Tariff	Continuous	Independent	The cost of sending a local SMS

(TZS per SMS)			within Tanzania.
International SMS Tariff (TZS per SMS)	Continuous	Independent	The cost of sending an international SMS.
Data Tariff (TZS per MB)	Continuous	Independent	The cost of data usage.
Operators	Categorical	Independent	1. Airtel 2. Halotel 3. Tigo 4. TTCL 5. Vodacom

Source: TCRA communications statistics

4.4 Data Analysis

Data was analysed with the assistant of Statistical Package for Social Sciences (SPSS) software version 26. Descriptive statistics such as standard deviation were conducted to determine the variability of tariff rates and influence customers' switching decisions. These statistics support probabilistic modeling by clarifying the data distribution and providing a basis for the logistic model. Using a logistic regression model, the probability of customer switching behavior was analyzed depending on different telecommunications tariffs.

The logistic regression model is suitable because the dependent variable (switching behavior) is binary (1 = Switched, 0 = did not switch). The model estimates the relationship between the independent variables (different tariffs) and the probability of customers switching to another telecommunications provider.

The mode presented as follow;

$$\text{logit}\,(P) = \text{Ln}\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 + \beta_5 X_5 + \beta_6 X_6 + \xi$$

$$P = \frac{1}{1 + e^{\beta_0+\beta_1 X_1+\beta_2 X_2+\beta_3 X_3+\beta_4+\beta_5 X_5+\beta_6 X_6}}$$

Where

P is the probability of a customer switching telecom providers.

β0, β1, ..., βn are the coefficients obtained from the logistic regression analysis.

The independent variables include the various tariffs such as

X_1 = On-Net Voice Tariff

X_2 = Off-Net Voice Tariff

X_3 = International Voice Tariff

X_4 = Local SMS Tariff

X_5 = International SMS Tariff

X_6 = Data Tariff.

ξ = Is the error term

4.5 Quality Procedures

Validity was enhanced by using verified secondary data from TCRA, a reputable and authoritative source in Tanzania's telecommunications industry. Reliability was ensured by using a robust data analysis procedure via SPSS, which included checking statistical assumptions before performing logistic regression. In addition, model fit was assessed using the Hosmer-Lemeshow test to confirm the goodness of fit, while measures such as Cox & Snell R^2 and Nagelkerke R^2 were calculated to assess the explanatory power of the model. The results showed high reliability, with a significant portion of the variance in customer switching behavior explained by the independent variables.

5.0 RESULTS

This section presents the results of the descriptive analysis, logistic regression, and model interpretations.

5.1 Finding presentations

This section presents the findings from an analysis of telecom tariffs and consumer behavior in Tanzania. It includes descriptive statistics and logistic regression to understand how pricing strategies affect customer switching behavior

5.1.1 Descriptive statistics

Summary statistics for the study variables are presented in Table 4.1

Table 5.1: Descriptive statistics

Variable	N	Minimum	Maximum	Mean	Std. Deviation
On-Net Voice Tariff (TZS per minute)	30	10.00	30.00	26.00	8.137
Off-Net Voice Tariff (TZS per minute)	30	20.00	30.00	28.00	4.068
International Voice Tariff (TZS per minute)	30	900.00	2871.33	1941.45	549.404
Local SMS Tariff (TZS per SMS)	30	5.00	11.00	7.87	1.852
International SMS Tariff (TZS per SMS)	30	95.00	285.00	184.88	71.811
Data Tariff (TZS per MB)	30	8.00	9.35	9.3050	0.24648
Consumer Switching Behavior	30	0.00	1.00	0.67	0.479

Source: Author's computations using SPSS output of TCRA data

The results in Table 5.1 show that on-net voice tariffs range between TZS 10.00 and TZS 30.00, with a mean of TZS 26.00, while off-net tariffs have a mean of TZS 28.00. International voice tariffs have a mean of TZS 1941.45 and a standard deviation of 549.404, which affects customer choice. Local SMS rates vary little, but international SMS rates have a mean of TZS 184.88 and a standard deviation of 71.811. It is noteworthy that around two thirds of customers have changed providers at least once, which is due to high market mobility.

Table 5.2: Consumer switching behavior by operator

Operator	Did not switch probability	Switched probability
Airtel	0.5	0.5
Halotel	0.167	0.833
Tigo	0.333	0.667
TTCL	0.167	0.833
Vodacom	0.5	0.5

Source: Author's computations using SPSS output of TCRA data

The Table 5.2 shows the probability of customers who switched or did not switch by telecom operator. Halotel and TTCL show the highest percentages of switching behavior, with 0.833 of customers switching. In contrast, Airtel and Vodacom show a more balanced behavior, with estimate probability of 0.5 for the customers switching. This suggests that operators like Halotel and TTCL may be facing more difficulties in retaining customers compared to Vodacom, Tigo and Airtel.

Table 5.3: Probability of customer choice for different telecom services

Service Type	Tariff (TZS)	Airtel	Halotel	Tigo	TTCL	Vodacom
On-Net Voice Tariff	10	0.25	0.25	0.25	0.25	0.25
	30	0.20	0.20	0.20	0.20	0.20
Off-Net Voice Tariff	20	0.25	0.25	0.25	0.25	0.25
	30	0.20	0.20	0.20	0.20	0.20
International Voice Tariff	900	0.167	0.857	-	-	-
	1565	0.167	-	0.857	-	-
	1673.33	0.167	-	-	-	0.857
	1811	0.167	-	-	-	0.857
Local SMS Tariff	5	0.143	0.857	-	-	-
	8	0.20	-	0.40	-	0.40
	10	0.143	-	-	0.857	-
	11	1.00	-	-	-	-
International SMS Tariff	95	0.143	0.857	-	-	-
	138.06	0.143	-	-	-	0.75
	200	1.00	-	-	-	-
	215	0.25	-	-	-	0.75
Data Tariff	8.00	0.90	-	-	-	-
	9.35	0.172	0.207	0.207	0.207	0.207

Source: Author's computations using SPSS output of TCRA data

The results in Table 5.3 show that for both on-net and off-net voice plans at TZS 10 and TZS 20, all five telecom operators - Airtel, Halotel, Tigo, TTCL and Vodacom have the same probability of being selected by customers are each with a probability of 0.25. At the slightly

higher tariff of TZS 30, the probability of choosing any operator drops evenly to 0.20. This suggests that there are no significant differences between operators for voice services in these price ranges, indicating uniform pricing and no clear advantage in customer preferences across networks for these tariffs. Halotel also dominates international voice and local SMS services, particularly in the lower price ranges. For the international voice plan, Halotel charges TZS 900 and the probability of being selected is 0.857 compared to 0.167 for Airtel. This suggests that Halotel's pricing strategy is attracting customers looking for cost-effective options, particularly for international calls. Dominance in the local SMS market (probability 0.857 at TZS 5) shows Halotel's strength in cost-sensitive subdivisions.

Vodacom and Tigo hold competitive market positions, particularly in mid to high price ranges. Vodacom dominates international voice tariffs above TZS 1673.33 with a probability of 0.857, indicating that customers prefer Vodacom in premium service categories. Tigo also performs well on local SMS services with a probability of 0.40 at TZS 8, suggesting competitive pricing in the mid-range SMS market. Although Airtel is present in most service categories, the probability of being selected is lower for many plans, except for certain services like local SMS at TZS 11 and data services at TZS 8, where the probability of being selected is 0.90. This highlights Airtel's targeted approach to maintaining customer loyalty in certain tariff subdivisions where the company has a monopoly or competitive advantage in pricing.

5.1.2 Logistic regression analysis output

Table 5.4: Logistic regression model summary

Model Statistic	-2 Log Likelihood	Cox & Snell R^2	Nagelkerke R^2	Hosmer and Lemeshow Test (Chi-square)	Significance of Hosmer and Lemeshow
Value	30.270	0.832	0.822	0.087	.007

Source: Constructed by author using SPSS output of TCRA data

The results in Table 5.4 showed a -2 log likelihood value of 30.270, reflecting the fit of the model to the data. The Cox & Snell R^2 value of 0.832 suggests that approximately 83.2% of the variance in the dependent variable is explained by the model, while the Nagelkerke R^2 value of 0.822 indicates similarly strong explanatory power. The Hosmer-Lemeshow test gave a chi-square value of 0.087 with a significance level of 0.007, meaning the model has a good fit as

the low chi-square value suggests that the observed data is closely related match the expected results.

Table 5.5 Logistic regression coefficients

Variable	B	S.E.	Wald	Sig.	Exp(B)
On-Net Voice Tariff (TZS per minute)	8.880	3796.5	0.000	0.008	1.67
International Voice Tariff (TZS per minute)	-0.081	35.3	0.000	0.096	0.56
Local SMS Tariff (TZS per SMS)	55.320	23808.1	0.000	0.008	1.49
International SMS Tariff (TZS per SMS)	0.159	69.4	0.000	0.008	1.43
Data Tariff (TZS per MB)	152.005	78240.8	0.000	0.008	1.42
Constant	-1495.965	761653.4	0.000	0.008	1.67

Source: Constructed by author using SPSS output of TCRA data

The odds ratios (Exp(B)) from the logistic regression in Table 5.5 showed that tariff changes influence the likelihood of customers switching behavior. For the on-net voice tariff, a positive coefficient (B = 8.880), which is statistically significant with the p-value = 0.008 < 0.05 and an odds ratio of 1.67, indicates that an increase in on-net voice tariff by one unit result in customers being 67% more likely to switch. Likewise, the local SMS tariff (B = 55.320, Exp(B) = 1.49) with a p-value of 0.008 < 0.05 and the international SMS tariff (B = 0.159, Exp(B) = 1.43) a positive relationship, where customers are 49% and 43% more likely to switch when these tariffs increase.

However, the situation is different with the international language tariff. A negative coefficient (B = -0.081) and an odds ratio of 0.56 with a p-value of 0.096, which is not statistically significant, indicate that increases in this tariff reduce the likelihood of customer switching by 44%. This suggests that customers are less likely to change their service provider due to higher international voice rates compared to other services such as SMS or data. For the data tariff (B = 152.005, Exp(B) = 1.42) and p-value 0.008 < 0.05 also show a significant impact on customer behavior, with the probability of switching increasing by 42% with each increase in data MB rises.

5.3 Findings discussion

The results of this study provide valuable insights into the factors influencing customer switching behavior in the Tanzanian telecommunications market, with a particular focus on pricing and service offerings. The results show that pricing, particularly for local SMS tariffs, plays a crucial role in customers' decision to switch providers, supporting previous research by Al-Otaiby and Ismail (2022) and (Mwigira and Ntimbwa, 2023). Both studies show that telecommunications providers are more likely to experience customer churn when their tariffs are higher, particularly for services such as international voice and SMS services. The current study further supports this by showing that increases in local SMS rates significantly increase the likelihood of switching, consistent with findings on service affordability and customer loyalty.

In contrast, the results of this study show a clear difference in international telephone rates. While logistic regression analysis found a negative association between international voice tariff increases and customer switching, suggesting that higher international voice tariffs reduce the likelihood of switching, this is in contrast to the studies by Salhieh (2019) and Lunn & Lyons (2018). These studies showed that price increases generally cause customers to switch because they are dissatisfied with rising costs. The lower switching behavior at higher international tariffs in the Tanzanian context could be due to the limited options for international services in certain regions and the customers not requiring them to use this service, making switching more difficult for customers.

Similar to Malik et al. (2014) the current study finds that perceived ease of use and competitive service offerings, such as those provided by Halotel and Vodacom, significantly influence customer preferences. Halotel's dominance in the lower tariff ranges, particularly in local SMS and international voice services, reflects findings from previous studies suggesting that price-sensitive customers prefer affordable and reliable services. Halotel's market share is consistent with research by Grigoriou et al. (2018), which highlighted that voice quality and service affordability are key factors in customer loyalty.

This study adds to the existing literature by highlighting the role of competitive pricing and

customer-focused services in reducing churn. However, it offers a unique insight into the Tanzanian telecommunications market, where certain high-priced services such as international voice tariffs do not necessarily lead to switching behavior, contrary to trends observed in other international markets. This suggests that the dynamics of customer behavior in Tanzania may be different due to market structure, limited competition or region-specific factors.

6.0 CONCLUSION AND RECOMMENDATION

This study reveals that pricing disparities across various telecom services significantly influence customer switching behavior in Tanzania. Halotel and TTCL experience higher switching rates due to their higher tariffs, particularly for international services, while Vodacom and Airtel maintain more balanced switching patterns. The study highlights the importance of competitive pricing strategies, especially for on-net and off-net voice tariffs and local SMS services, as they contribute to customer loyalty. Furthermore, unlike many international markets, higher international voice tariffs in Tanzania do not necessarily increase.

To reduce the likelihood of customer switching, telecom operators should adopt more competitive pricing strategies, particularly for international services. Also, improving service quality especially in terms of network coverage and call quality should be prioritized, as customers tend to prefer operators with higher service standards. Furthermore, operators should focus on customer centric pricing models that address the needs of various income groups in Tanzania, particularly in cost sensitive categories like SMS and data services. To end, further research is necessary to understand the reasons behind reduced switching for higher international tariffs, as exploring these dynamics could offer valuable insights for better customer retention strategies in premium service subdivisions.

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