Mobile Carrier Change Intention Analysis Based on IT Service Management Platform

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Abstract

The purpose of this study is to understand the user intention to continue or change mobile carriers, considering the current mobile phone market in Japan. The market was mainly shared by three Major Mobile-Carriers (3MMC): docomo, au, and SoftBank. However, the number of Mobile Virtual Network Operators (MVNOs) customers has been increasing recently, and Rakuten Mobile has entered the mobile phone market as a Mobile Network Operator (MNO). Currently, the mobile phone market is highly competitive and there is little difference in mobile phone services offered by various carriers. Under such competitive conditions, mobile carriers need an appropriate method to develop service strategies to maintain or increase their market share. To understand users' mobile carrier change intention, we classified each carrier's users into two user segments based on continuous or change intention and analyzed the differences between the segments. We showed that the user segmentation model can extract information about the differences in characteristics of two user segments from their decision-making factors and user attributes with respect to mobile services. Understanding these differences is important as carriers consider when and what strategies to implement in order to maintain or increase market share.

Keywords: demand analysis, carrier change intention, user segmentation, service management

1   Introduction

The number of mobile phone subscribers in Japan exceeds 200 million, which is approximately 1.6 times the population of Japan, and the growth of the mobile phone market has been quite slow, indicating that the market is saturated. In the past, the market was divided among the three Major Mobile-Carriers (3MMC), NTT docomo, au (by KDDI), and SoftBank, but in recent years, MVNOs (Mobile Virtual Network Operators) have been increasing the number of subscribers with low price plans. Additionally, in 2020, Rakuten Mobile (Rakuten) started providing mobile services as a new mobile network operator (MNO), which makes the mobile market an even more competitive environment. In order to maintain and increase their market share amidst

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competition, carriers are continuously launching new service menus one after another, including new charge plans and collaboration services with other service providers, but other carriers will soon provide similar services, making it difficult to differentiate their services. As a result, it has become difficult for mobile carriers to develop effective service strategies to maintain or increase their market share. When the number of mobile phone subscribers was growing significantly, there were differences in service attributes among the mobile services offered by each carrier. At that time, the main decision-making factors in mobile carrier choice behavior were service attributes such as price, available terminal types, and optional services, and sensitivity analysis of service attributes was important. Therefore, modeling service choice behavior [1] and estimating service demand based on the Framework of Scenario Simulation (FSS) [2][3][4] was an effective method for developing service strategies. Several types of discrete choice modeling have been studied to analyze telecommunication service choice behavior [5][6][7][8]. We proposed mobile carrier choice modeling that considers incentive and restrictive factors as decision makers [9]. In addition, we proposed modeling for choosing a mobile carrier that considered differences in service attributes among 3MMC, such as differences in charge menus (e.g., family plans) and the availability of iPhone terminals [10] [11].

However, as competition in the mobile phone market is fierce, there is currently little difference among mobile phone services offered by 3MMC, in terms of charges, available terminals, and optional services. On the other hand, a variety of collaboration services have been emerging one after another in the mobile phone market. For example, docomo offers one year of free access to Amazon Prime service when signing up for a new service plan. This is not a special case; mobile carriers not only provide mobile services, but also offer fixed-line services for Internet access via optical fiber. Furthermore, they also sell services in industries other than telecommunications, such as health-related services and financial services. In this market situation, from the user's perspective, some users choose a mobile carrier based on the service characteristics of the mobile services, while others choose a mobile carrier based on collaboration services such as video-on-demand services and Internet access services. On the other hand, some users who would like to continue using their current mobile carrier regardless of changes in the service menus offered by other mobile carriers. Thus, the choice set of services and their decision-making factors are becoming more diversified, and different for each user. In other words, there are different types of user segments in the mobile phone market.

Therefore, to understand mobile carrier choice behavior, it is necessary to extract information that can capture differences in user segment characteristics from mobile service attributes, user attributes, and all other relevant factors. We proposed IT Service Management Platform (ITSMP) [12] to analyze and understand the service market by considering all factors related to service choice behavior. This platform allows us to identify and organize all decision-making factors related to mobile carrier choice behavior, including factors about collaboration services and factors related to the process leading to the choice of service menu. We also developed several supervised learning models to understand the differences in decision-making factors between two user segments, 3MMC and MVNO [13].

In September 2022, the total number of Rakuten Mobile subscribers which consists of MNO and MVNO users, exceeded 5 million subscribers [14], and this is a new era of competition mainly led by four NMOs. In this paper, we apply the ITSMP to the analysis of mobile carrier change intentions in order to understand the current competitive market. Users of each carrier are classified into two user segments, stable and unstable users, respectively. Stable users are users

who intend to continue using their current mobile carrier. Unstable users are users who intend to change their current mobile carrier. Four user segmentation models for each of the four MNOs and one segmentation model for all MVNO users, i.e., a total of five user segmentation models are constructed, and the differences between the two user segments, stable users and unstable users, are analyzed in terms of decision-making factors. Furthermore, by dividing unstable users into segments that want to change carriers immediately and segments that want to change carriers eventually, it is possible to analyze whether differences in decision-making factors can be explained for segments divided by the strength or weakness of their intention to change carriers. Understanding these differences is important for carriers to consider when and what strategies to implement. In this paper, we then analyzed the differences in the models constructed for each carrier, and found that the significant decision-making factors differed from carrier to carrier.

2   Mobile Carrier Choice Modeling

2.1   IT Service Management Platform (ITSMP)

Conventional service choice models used service attributes as decision-making factors. Its purpose was primarily to analyze sensitivity to service attributes. In recent years, the IT service market has become more complex and diverse.   The number of services available to choose from and the patterns of service combinations, including collaboration services, are increasing, and the needs and preferences of users for services are also diversifying.

The purpose of ITSMP [12] is to analyze these complex service market structures and understand service choice behavior by considering all factors related to choosing a service, including factors about collaboration services and factors related to the process leading to the choice of service menu. A characteristic of ITSMP is that it analyzes and profiles the market structure from three perspectives: services, users and other factors related to service choice behavior. Today, some users have service choice behavior that is independent of service attributes. In order to analyze and profile such users, it is necessary to investigate other factors except service attributes, and the process by which users begin to use the service. Even if the purpose is to understand service choice behavior, it is important to analyze choice behavior from the appropriate perspective for the problem to be solved, rather than focusing only on the analysis of the service itself. Each mobile carrier needs useful information to develop sales and service strategies to maintain or increase market share. Here, we focus on the two user segments defined in Section 1, stable and unstable users, to obtain useful information. To maintain and increase market share, it is effective to increase the number of stable users and decrease the number of unstable users. Therefore, the purpose of this study is to understand the differences in characteristics of the two user segments.

2.2   User segmentation using supervised learning model

We proposed user segmentation modeling to create differential descriptions of user segments [15]. This model is created using a binominal logistic regression analysis. Given two segments, segment 0 and segment 1, Equation 1 calculates the probability P_1 that a user belongs to segment 1. The probability P_0 that a user belongs to segment 0 can be calculated as $1 - P_1$. In Equation 2, the variable x_k represents the explanatory variables such as decision-making factors. The variable β_k represents the coefficient of the explanatory variable x_k, and α represents the constant

term.

$$P_1 = 1/(1 + \exp(-V_1)) \qquad (1)$$

$$V_1 = \alpha + \sum_k \beta_k \, x_k \qquad (2)$$

3 Summary of Survey

3.1 Sampling condition of survey data

For the analysis of user's intention to change carriers, we used survey data conducted by MO-BILE MARKETING DATA LABO [16]. Sample data was collected using a Web interview system. The number of sample users was 40,000. Of the sample users, 50.4% were male users. By age groups, 6.9% were in their teens, 15.1% in their 20s, 17.1% in their 30s, 22.1% in their 40s, 19.4% in their 50s, and 19.4% in their 60s. The sample was collected to be close to even by gender and age. The following is an analysis of 35,035 mobile phone users.

3.2 Segment definition and aggregated results by segment

In order to analyze factors related to user's intention to change carriers in the mobile phone market, segmentation was conducted using information on whether users intend to continue using their current mobile carriers or not. The definition of segmentation is shown in Table 1. Stable users mean users who intend to continue with their current mobile carrier. On the other hand, unstable users mean users who intend to change from their current mobile carrier to another one.

Table 1: Definition of segmentation based on mobile carrier change intention

Name of segments		Mobile carrier change intention	Number of samples	
Segment 0 (Unstable users)	**Sub-segment 0-A**	**I want to change current mobile carrier immediately**	**1,261**	**10,799**
	Sub-segment 0-B	**Not immediately, but I'm considering changing current mobile carrier eventually**	**9,538**	
Segment 1 (Stable users)		**I'm not considering changing current mobile carrier**		**24,236**

Table 2: Number of stable and unstable users in the sample by mobile phone carrier

		Segment 0 (Unstable users)		Segment 1 (Stable users)
		Sub-segment 0-A	**Sub-segment 0-B**	
docomo	**3,130**	**341**	**2,789**	**9,093**
au	**2,569**	**312**	**2,257**	**6,057**
Softbank	**2,184**	**310**	**1,874**	**3,244**
Rakuten	**243**	**22**	**221**	**618**
MVNO	**2,673**	**276**	**2,397**	**5,224**

Here, unstable users are defined as segment 0 and stable users as segment 1. Furthermore, unstable users,   denoted as segment 0, were classified into two sub-segments, sub-segment 0-A and sub-segment 0-B, depending on whether they intend to change carriers immediately or not immediately. The sample users were also divided into five groups according to their current carrier: docomo, au, SoftBank, Rakuten and MVNO, with each group divided into stable and unstable users. The number of samples belonging to each segment by carrier is shown in Table 2.
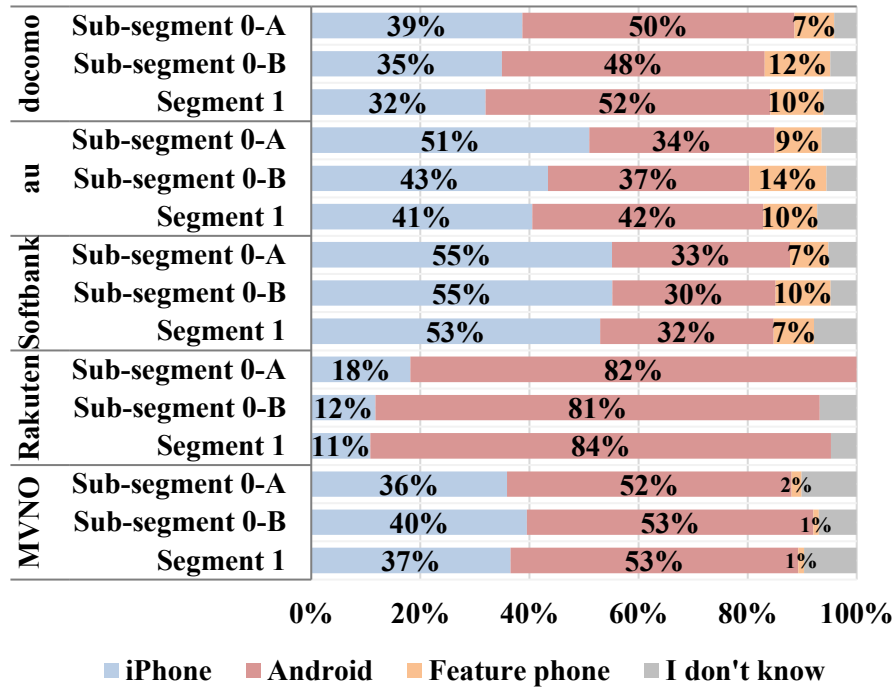
		iPhone	Android	Feature phone	I don't know
docomo	Sub-segment 0-A	39%	50%	7%	
	Sub-segment 0-B	35%	48%	12%	
	Segment 1	32%	52%	10%	
au	Sub-segment 0-A	51%	34%	9%	
	Sub-segment 0-B	43%	37%	14%	
	Segment 1	41%	42%	10%	
Softbank	Sub-segment 0-A	55%	33%	7%	
	Sub-segment 0-B	55%	30%	10%	
	Segment 1	53%	32%	7%	
Rakuten	Sub-segment 0-A	18%	82%		
	Sub-segment 0-B	12%	81%		
	Segment 1	11%	84%		
MVNO	Sub-segment 0-A	36%	52%	2%	
	Sub-segment 0-B	40%	53%	1%	
	Segment 1	37%	53%	1%	

Figure 1: Ratio of mobile terminal types by segment based on carrier change intention

		Family plan user	Non family plan user
docomo	Sub-segment 0-A	50%	50%
	Sub-segment 0-B	54%	46%
	Segment 1	58%	42%
au	Sub-segment 0-A	43%	57%
	Sub-segment 0-B	46%	54%
	Segment 1	49%	51%
Softbank	Sub-segment 0-A	37%	63%
	Sub-segment 0-B	39%	61%
	Segment 1	41%	59%
MVNO	Sub-segment 0-A	18%	82%
	Sub-segment 0-B	20%	80%
	Segment 1	22%	78%
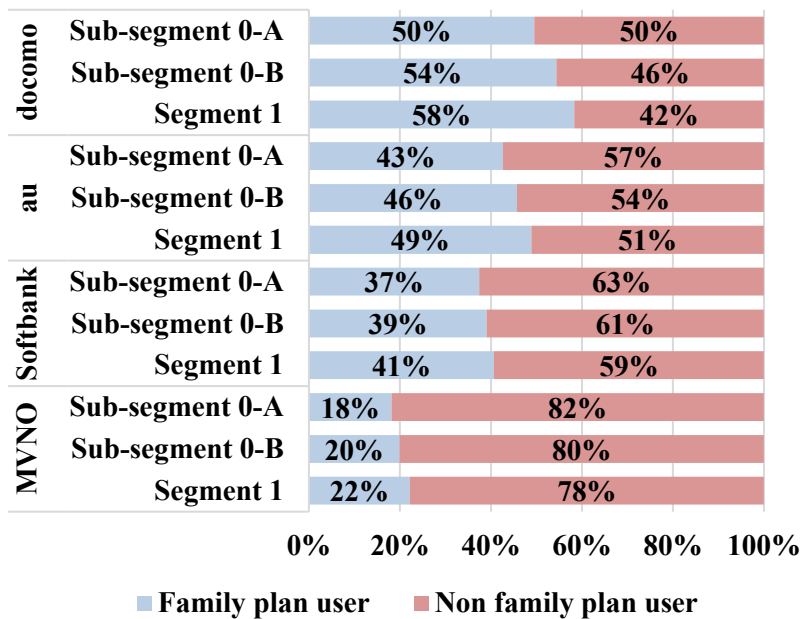
Figure 2: Ratio of family plan usage by segment based on carrier change intention

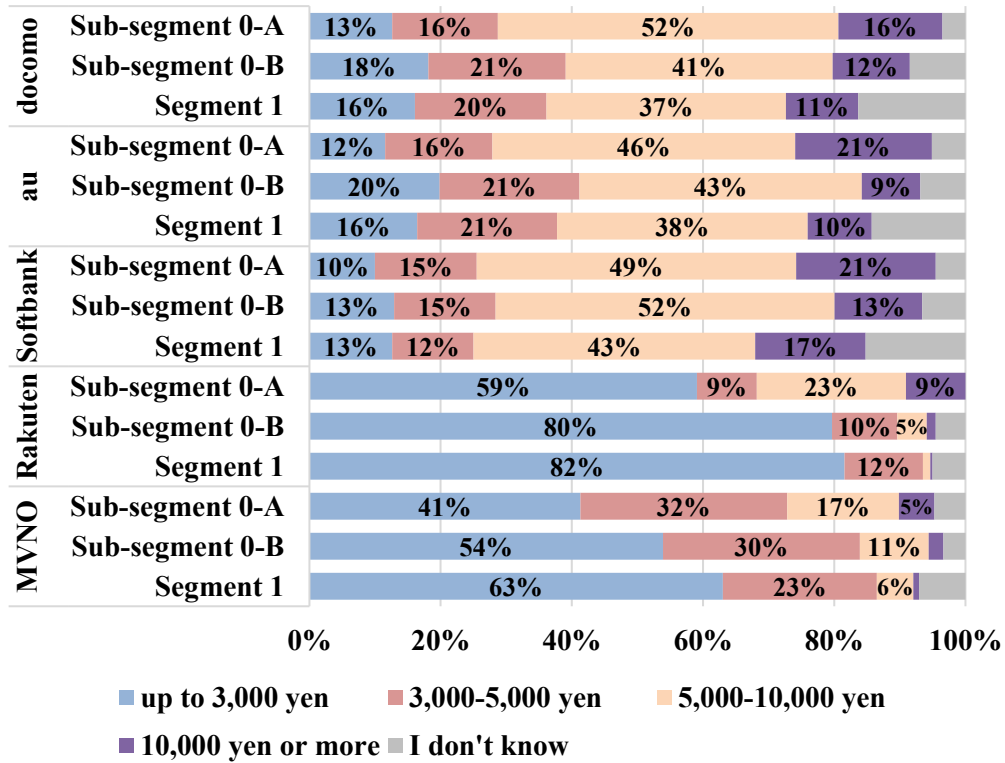|		up to 3,000 yen	3,000-5,000 yen	5,000-10,000 yen	10,000 yen or more	I don't know
docomo	Sub-segment 0-A	13%	16%	52%	16%	
	Sub-segment 0-B	18%	21%	41%	12%	
	Segment 1	16%	20%	37%	11%	
au	Sub-segment 0-A	12%	16%	46%	21%	
	Sub-segment 0-B	20%	21%	43%	9%	
	Segment 1	16%	21%	38%	10%	
Softbank	Sub-segment 0-A	10%	15%	49%	21%	
	Sub-segment 0-B	13%	15%	52%	13%	
	Segment 1	13%	12%	43%	17%	
Rakuten	Sub-segment 0-A	59%	9%	23%	9%	
	Sub-segment 0-B	80%	10%	5%		
	Segment 1	82%	12%			
MVNO	Sub-segment 0-A	41%	32%	17%	5%	
	Sub-segment 0-B	54%	30%	11%		
	Segment 1	63%	23%	6%		

Figure 3: Distribution of monthly charge by segment based on carrier change intention

Figure 1 shows the mobile terminal usage of stable users (segment 1) and unstable users (sub-segment 0-A and sub-segment 0-B) for each carrier. Figure 2 also shows the usage of family plans for stable and unstable users for each carrier. All sample users using Rakuten are non-family plan users and are omitted in Figure 2. The differences in mobile terminal and family plan usage between carriers are larger than the differences between segments within the same carrier. Similarly, Figure 3 shows the distribution of monthly charges for stable and unstable users for each carrier. This figure also indicates that the differences between carriers are larger than the differences between segments within the same carrier. Therefore, in order to understand the differences between stable and unstable users within the same carrier and to develop service strategies that lead to customer retention, the analysis based on user attributes shown in Figure 1-3 is insufficient, and a method to extract the differences between stable and unstable users within the same carrier is needed.

4   User Segmentation Modeling for Each Carrier

In order to understand the difference between stable and unstable users within the same carrier, user segmentation models were developed for each carrier: docomo, au, SoftBank, Rakuten, and MVNO. By constructing three models (Model 1, Model 2, and Model 3, shown below) for each carrier, we analyzed whether there were differences in decision-making factors depending on the strength or weakness of the intention to change carriers.

- Model 1. Segmentation model with segment 1 and segment 0
- Model 2. Segmentation model with segment 1 and sub-segment 0-A

● Model 3. Segmentation model with segment 1 and sub-segment 0-B

As shown in Table 3, a total of 22 variables were used as candidate explanatory variables for each model. Eighteen of these variables were dummy variables, and were attributes related to the services currently used, and took a value of 1 if the respondent perceived a benefit and 0 otherwise. The remaining four variables are dummy variables for user attributes. Specifically, for each of the questions "have ever changed carriers," "use a sub-mobile carrier," "use iPhone," and "use a family plan," the variable took a value of 1 if it is applicable for the respondent and took a value of 0 otherwise. Here, family plan refers to a service that offers discounts on the monthly charges and free calls between family members when the same family members use the same mobile carrier. Using sub-mobile carrier means using its service in conjunction with the main carrier service.

Segmentation models were developed using the supervised learning model introduced in Section 2. The coefficients of the explanatory variables were estimated using the backward elimination method, provided that the p-value of each variable was less than 0.05. BellCurve for Excel [17] was used to estimate the coefficients of the model. In the following table of model estimation results, the symbols "*" and "**" indicate the significant level of the variable in the estimation model. The symbol "*" indicates that the p-value is less than 0.05 and the symbol "**" indicates that the p-value is less than 0.01.

Table 3: Candidate of explanatory variables for user segmentation models

	Variable name		Variable name
1	Quality of order and maintenance	12	Availablity of latest mobile terminals
2	Place to ask any questions	13	Coverage of communication area
3	Campaign benefits and giveaways	14	Mobile terminal warranty service
4	Easy-to-understand price plan	15	No unnecessary options
5	Low communication charges	16	Communication stability
6	Low terminal charges	17	Loyalty program
7	Communication data speed	18	Lineup of mobile terminals
8	Discounts based on contract length	19	User who has changed mobile carriers
9	Maximum amount of data available	20	iPhone user
10	No contract term restrictions	21	Family plan user
11	Abundant discount services	22	Sub-mobile carrier user

4.1 Modeling for docomo users

The estimation results of three user segmentation models for docomo users are shown in Table 4. Each model outputs the probability that a user belongs to segment 1. Factors with negative coefficients represent the characteristics of unstable docomo users. Factors with positive coefficients represent the characteristics of stable docomo users. The variables with positive coefficients in the three models shown in Table 4 indicate that loyalty program and family plan are effective in maintaining stable docomo users. The results of Model 2 show that docomo users in segment 1 place more importance on the coverage of communication area and communication

stability than users in segment 0-A. These are probably the strength of docomo over other mobile carriers. The results of Model 3 show that compared to users in segment 0-B, users in segment 1 place more importance on discounts based on contract length and abundant discount services. It is assumed that these also contribute to the retention of docomo users. However, sub-mobile carrier users, users who have changed mobile carriers, and iPhone users have lower barriers to changing carriers. Furthermore, users in sub-segment 0-A place importance on no contract term restrictions, lineup of mobile terminals, and places to ask any questions, while users in sub-segment 0-B place importance on low terminal charges and no unnecessary options. Users in sub-segment 0-A could move the market in the short term, and mobile carriers need to take early action. On the other hand, users in sub-segment 0-B may gradually move the market, and mobile carriers will need to take medium- and long-term measures. The following shows the estimation results for au, Softbank, Rakuten, and MVNO users, but only the main characteristics are briefly described.

Table 4: Estimation result of docomo users

Explanatory variables	Model 1		Model 2		Model 3	
	Estimated coefficients	p-value	Estimated coefficients	p-value	Estimated coefficients	p-value
Sub-mobile carrier user	-0.5511	P < 0.001 **	-1.0909	P < 0.001 **	-0.4570	P < 0.001 **
User who has changed mobile carriers	-0.6002	P < 0.001 **	-1.0778	P < 0.001 **	-0.5356	P < 0.001 **
No contract term restrictions	-0.3413	0.0121 *	-0.8225	0.0034 **		
Lineup of mobile terminals			-0.6830	0.0013 **		
Place to ask any questions			-0.5333	0.0283 *		
Low terminal charges	-0.3282	0.0013 **			-0.3472	0.0011 **
iPhone user	-0.1085	0.0150 *	-0.2391	0.0410 *	-0.1013	0.0296 *
No unnecessary options					-0.2150	0.0400 *
Abundant discount services					0.2074	0.0355 *
Family plan user	0.1353	0.0016 **	0.2355	0.0386 *	0.1239	0.0054 **
Coverage of communication area			0.2784	0.0480 *		
Discounts based on contract length	0.3405	P < 0.001 **			0.3666	P < 0.001 **
Loyalty program	0.1568	0.0020 **	0.5882	P < 0.001 **	0.1165	0.0254 *
Communication stability	0.1322	0.0048 **	0.6838	P < 0.001 **		
Constant	1.0553	P < 0.001 **	3.2688	P < 0.001 **	1.1912	P < 0.001 **

4.2 Modeling for au users

The estimation results of three segmentation models for au users are shown in Table 5. Factors with positive and negative coefficients are similar to those estimated for docomo users. Focusing on the difference from docomo users, the quality of order and maintenance is effective in maintaining stable au users. On the other hand, users in the 0-A sub-segment place importance on availability of latest mobile terminals.

Table 5: Estimation result of au users

Explanatory variables	Model 1		Model 2		Model 3	
	Estimated coefficients	p-value	Estimated coefficients	p-value	Estimated coefficients	p-value
Sub-mobile carrier user	-0.5383	P < 0.001 **	-1.4326	P < 0.001 **	-0.3278	0.0043 **
No contract term restrictions	-0.3514	0.0262 *	-1.1202	P < 0.001 **		
Place to ask any questions	-0.6236	P < 0.001 **	-1.0692	P < 0.001 **	-0.5528	P < 0.001 **
Lineup of mobile terminals			-0.7328	0.0019 **		
User who has changed mobile carriers	-0.6112	P < 0.001 **	-0.5185	P < 0.001 **	-0.6364	P < 0.001 **
Availablity of latest mobile terminals	-0.2288	0.0287 *	-0.6201	0.0077 **		
iPhone user	-0.1013	0.0386 *	-0.3891	0.0013 **		
Coverage of communication area	-0.1227	0.0384 *			-0.1549	0.0107 *
Family plan user	0.1228	0.0118 *			0.1170	0.0211 *
Abundant discount services	0.3456	P < 0.001 **			0.3617	P < 0.001 **
Communication stability			0.4555	0.0052 **		
Quality of order and maintenance	0.1936	0.0171 *	0.4774	0.0376 *	0.1643	0.0478 *
Discounts based on contract length	0.1577	0.0324 *	0.6621	0.0033 **		
Loyalty program	0.2168	P < 0.001 **	0.7671	P < 0.001 **	0.1650	0.0079 **
Constant	1.0112	P < 0.001 **	3.2439	P < 0.001 **	1.1136	P < 0.001 **

4.3 Modeling for Softbank users

The estimation results of three segmentation models for SoftBank users are shown in Table 6. The quality of order and maintenance is effective to maintain stable Softbank users. The results of Model 2 in Table 6 show that stable Softbank users place more importance on low communication charges compared to sub-segment 0-A users. The results of Model 3 show that stable Softbank users have value for maximum amount of data available than users in sub-segment 0-B. Thus, when compared to stable docomo users and stable au users, stable Softbank users are found to have different characteristics.

Table 6: Estimation result of Softbank users

Explanatory variables	Model 1		Model 2		Model 3	
	Estimated coefficients	p-value	Estimated coefficients	p-value	Estimated coefficients	p-value
Sub-mobile carrier user	-0.5143	P < 0.001 **	-1.2185	P < 0.001 **	-0.3436	0.0120 *
No contract term restrictions	-0.4280	0.0133 *	-0.8993	0.0049 **		
User who has changed mobile carriers	-0.6746	P < 0.001 **	-0.8680	P < 0.001 **	-0.6497	P < 0.001 **
Lineup of mobile terminals	-0.3553	0.0084 **			-0.4036	0.0034 **
Coverage of communication area	-0.2795	P < 0.001 **			-0.3142	P < 0.001 **
Easy-to-understand price plan	0.2403	0.0280 *				
Maximum amount of data available	0.2512	0.0160 *			0.2543	0.0181 *
Loyalty program			0.3878	0.0261 *		
Discounts based on contract length	0.3453	P < 0.001 **	0.5839	0.0112 *	0.2995	0.0012 **
Low communication charges			0.6415	0.0101 *		
Quality of order and maintenance	0.2951	0.0089 **	0.9095	0.0044 **	0.2361	0.0385 *
Constant	0.6401	P < 0.001 **	2.5833	P < 0.001 **	0.7953	P < 0.001 **

4.4　Modeling for Rakuten users

Since the sample size for sub-segment 0-A was not sufficient to develop a segmentation model, two segmentation models were developed for Rakuten users. The estimation results of two models are shown in Table 7. Estimated results show that stable Rakuten users tend to be attracted to communication data speeds, low terminal charges, and loyalty program. The linkage with Rakuten's online market point program is considered effective in retaining customers. Regarding speed, it is assumed that this is because Rakuten offers unlimited packet usage and high speed within its service area, while other carriers have contract that reduce speed when packet usage exceeds a certain amount. Unstable Rakuten users tend to be attracted to discount services.

Table 7: Estimation result of Rakuten users

Explanatory variables	Model 1		Model 3	
	Estimated coefficients	p-value	Estimated coefficients	p-value
Sub-mobile carrier user	-0.7357	P < 0.001 **	-0.7374	P < 0.001 **
Abundant discount services	-0.6784	0.0060 **	-0.7003	0.0055 **
User who has changed mobile carriers	-0.3972	0.0490 *	-0.4264	0.0432 *
Loyalty program	0.4171	0.0153 *	0.4040	0.0227 *
Low terminal charges	0.4820	0.0165 *	0.4708	0.0232 *
Communication data speed	1.2503	0.0026 **	1.1611	0.0052 **
Constant	1.1601	P < 0.001 **	1.2903	P < 0.001 **

4.6　Modeling for MVNO users

The results of three user segmentation models for MVNO users are shown in Table 8. The result of Table 8 shows that stable MVNO users value low prices, which matches the service strategy of MVNOs.

Table 8: Estimation result of MVNO users

Explanatory variables	Model 1		Model 2		Model 3	
	Estimated coefficients	p-value	Estimated coefficients	p-value	Estimated coefficients	p-value
Mobile terminal warranty service	-0.5944	P < 0.001 **	-1.1592	P < 0.001 **	-0.4928	0.0025 **
Place to ask any questions			-0.9124	0.0022 **		
Sub-mobile carrier user	-0.4810	P < 0.001 **	-0.8154	P < 0.001 **	-0.4412	P < 0.001 **
Lineup of mobile terminals			-0.7978	0.0055 **		
Coverage of communication area			-0.5736	0.0086 **		
User who has changed mobile carriers	-0.4454	P < 0.001 **	-0.4861	P < 0.001 **	-0.4432	P < 0.001 **
Campaign benefits and giveaways	-0.4626	P < 0.001 **			-0.4791	P < 0.001 **
iPhone user	-0.1362	0.0069 **			-0.1451	0.0053 **
No unnecessary options					0.1440	0.0392 *
Family plan user	0.1575	0.0088 **			0.1582	0.0109 *
Easy-to-understand price plan	0.1540	0.0050 **	0.7156	P < 0.001 **		
Communication stability			0.8403	0.0015 **		
Low communication charges	0.4013	P < 0.001 **	1.1011	P < 0.001 **	0.3248	P < 0.001 **
Constant	0.8316	P < 0.001 **	2.8170		0.9940	P < 0.001 **

Unstable MVNO users are considered to have low barriers to changing carriers because they use sub-mobile carrier or have experience changing carriers, but they also place importance on terminal warranty services, which can also be interpreted as terminals being the main choice factor. The result of Model 2 shows that stable MVNO users place more importance on communication stability and easy to understand price plan than sub-segment 0-A users, and users in sub-segment 0-A are assumed to be requiring services like those provided by 3MMC.

4.7 Comparing with each carrier model

Comparison results for Model2 and Model3 estimation results for each carrier are shown in Table 9. The symbol of "- (2)" and "- (3)" in Table 9 represent the negative sign of coefficients in Model 2 and Model 3, respectively. Similarly, the symbol of "+ (2)" and "+ (3)" in Table 9 represent the positive sign of coefficient in Model 2 and Model 3, respectively. The explanatory variables with negative coefficients in Model 2 are indicated by a dark red background color, meaning factors that require early action. The explanatory variables with negative coefficients only in Model 3 have a light red background color, indicating that they are factors that need to be considered for medium- to long-term measures. On the other hand, the explanatory variables with positive coefficients in Model 2 have a blue background color, indicating the carrier's greatest strength. In addition, the explanatory variables with positive coefficients only in Model 3 are shown with a light blue background color, indicating factors that are effective in retaining customers.

Table 9: Comparison results of segmentation models for each carrier

Explanatory variables	docomo	au	Softbank	Rakuten	MVNO
User who has changed mobile carriers	- (2), -(3)	- (2), -(3)	- (2), -(3)	- (3)	- (2), -(3)
Sub-mobile carrier user	- (2), -(3)	- (2), -(3)	- (2), -(3)	- (3)	- (2), -(3)
iPhone user	- (2), -(3)	- (2)			- (3)
No contract term restrictions	- (2)	- (2)	- (2)		
Low terminal charges	- (3)			+ (3)	
Place to ask any questions	- (2)	- (2), -(3)			- (2)
Availablility of latest mobile terminals		- (2)			
Coverage of communication area	+ (2)	- (3)	- (3)		- (2)
Lineup of mobile terminals	- (2)	- (2)	- (3)		- (2)
Mobile terminal warranty service					- (2), -(3)
Campaign benefits and giveaways					- (3)
No unnecessary options	- (3)				+ (3)
Communication stability	+ (2)	+ (2)			+ (2)
Loyalty program	+ (2), +(3)	+ (2), +(3)	+ (2)	+ (3)	
Quality of order and maintenance		+ (2), +(3)	+ (2), +(3)		
Discounts based on contract length	+ (3)	+ (2)	+ (2), +(3)		
Abundant discount services	+ (3)	+ (3)		- (3)	
Easy-to-understand price plan					+ (2)
Maximum amount of data available			+ (3)		
Communication data speed				+ (3)	
Low communication charges			+ (2)		+ (2), +(3)
Family plan user	+ (2), +(3)	+ (3)			+ (3)

For stable 3MMC users, point programs are effective. On the other hand, common weaknesses of 3MMC are restriction on the contract period and lineup of mobile terminals. In the case of Rakuten, communication data speed, low terminal charges, and point program seems to be effective in retaining users. In the case of MVNO, low communication charges and easy-to-understand charge plan are effective in retaining users. Therefore, these characteristics can be extracted to develop service strategies. The current main decision-making factors are different for each carrier, and we consider that understanding these conditions will lead to an appropriate service strategy.

5　User Segmentation Modeling for Stable Users

Stable users tend to continue with their current carriers and are users that the carrier needs to maintain. Focusing on stable Rakuten users, we compared them to stable 3MMC users and stable MVNO users and analyze their characteristics. Here, we used docomo stable users as representatives of 3MMC stable users. Two segmentation models are then constructed. The first model is a supervised learning model for two segments, stable Rakuten users and stable docomo users, to analyze the differences between the segments. The second model is a supervised learning model for two segments, stable Rakuten users and stable MVNO users.

The estimation result of user segmentation model for stable Rakuten users and stable docomo users is shown in Table 10. Here, stable Rakuten users are analyzed as segment 1 shown in Section 2. Factors with negative coefficients represent characteristics of stable docomo users. Factors with positive coefficients represent characteristics of stable Rakuten users. The result of Table 10 shows that low communication charges, easy-to-understand price plan, and no contract term restrictions are attractive to stable Rakuten users. These are the points that differentiate Rakuten from docomo. Another feature is that many of stable Rakuten users have experience changing from other carriers because Rakuten newly entered the market as MNOs in 2020.

Table 10: Estimation results of segmentation model for stable Rakuten and stable docomo users

Explanatory variables	Estimated coefficients	P value
Coverage of communication area	-2.5900	P < 0.001 **
Discounts based on contract length	-2.4844	P < 0.001 **
Communication stability	-1.5972	P < 0.001 **
iPhone user	-1.4955	P < 0.001 **
Quality of order and maintenance	-1.2087	P < 0.001 **
Place to ask any questions	-1.0789	0.0429 *
Sub-mobile carrier user	0.8042	P < 0.001 **
Low terminal charges	1.2277	P < 0.001 **
Campaign benefits and giveaways	1.2622	P < 0.001 **
Easy-to-understand price plan	1.7684	P < 0.001 **
No contract term restrictions	1.9242	P < 0.001 **
Cheap communication charges	2.1929	P < 0.001 **
User who has changed mobile carriers	3.0398	P < 0.001 **
Constant	-4.2653	P < 0.001 **

Table 11 shows the estimation result of user segmentation model for stable Rakuten users and stable MVNO users. Stable Rakuten users are analyzed as segment 1. Factors with negative coefficients represent the characteristics of stable MVNO users, while factors with positive coefficients represent the characteristics of stable Rakuten users.　While low rates overlap with the

characteristics of services offered by MVNO, Rakuten was found to differentiate itself from MVNO through its campaigns, loyalty program, and no contract term restrictions. On the other hand, comparing the two stable users, iPhone users were more likely to be stable MVNO users.

Table 11: Estimation results of segmentation model for stable Rakuten and stable MVNO users

Explanatory variables	Estimated coefficients	P value
iPhone user	-1.4970	P < 0.001 **
Coverage of communication area	-1.2922	P < 0.001 **
Discounts based on contract length	-1.1822	0.0128 *
Communication stability	-0.8173	P < 0.001 **
Quality of order and maintenance	-0.7680	0.0037 **
No unnecessary options	-0.5460	P < 0.001 **
Low communication charges	-0.2268	0.0219 *
Abundant discount services	0.3942	0.0359 *
Sub-mobile carrier user	0.5233	P < 0.001 **
User who has changed mobile carriers	0.6970	P < 0.001 **
Communication data speed	0.7459	P < 0.001 **
No contract term restrictions	1.1164	P < 0.001 **
Loyalty program	1.3487	P < 0.001 **
Campaign benefits and giveaways	1.5335	P < 0.001 **
Constant	-2.6792	P < 0.001 **

5   Conclusion

Currently, the mobile phone market in Japan is highly competitive and there is little difference in the mobile phone services offered by the various carriers. As a result, a variety of collaboration services have introduced, and the patterns of service combinations are becoming more diverse. In addition, user decision-making factors are also diversifying, making it difficult to understand user segments. The purpose of this study is to understand the user intention to continue or change mobile carriers, considering the current mobile service market. We classified each carrier's users into two user segments, stable users and unstable users, based on their intention to continue using their current carrier. Because it is important for each carrier to increase stable users and to decrease unstable users to maintain or increase the market share. We constructed user segmentation models to analyze the differences between stable users and unstable users. Furthermore, we showed that user segmentation models can also extract information that can capture differences in user segment characteristics from mobile service attributes, and user attributes. Understanding these differences is important as carriers consider when and what strategies to implement in order to maintain or increase market share. We then analyzed the differences in the models constructed for each carrier and found that the significant decision-making factors differed from carrier to carrier. The results of the analysis in this paper are based on the intention to change carriers, and the relationship with choice behavior is a subject for future study. 5G technology-based services was launched, and mobile carriers have started new charge plans. We will continue to analyze choice behavior to understand the future market considering these changes.

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