

무선데이터서비스 활성화를 위한 MVNO 전환의사비용 추정

Estimating Willingness to Switch to MVNO for Activation of Mobile Data Services

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요 약

본 논문은 조건부 가치측정법을 이용하여 MVNO 전환의사비용을 추정하고 MVNO를 통한 무선데이터서비스 활성화를 위한 바람직한 전략을 제시하고자 한다. 연구결과 이용자의 사용패턴이나 MVNO에 대한 인식여부는 MVNO 전환비용에 영향을 미치지 않지만 서비스 만족도는 전환비용에 유의한 영향을 미치지 않았다. 이는 현 이동통신사의 만족도와 상관없이 일정수준 이상의 요금절약이 예상될 경우 소비자는 MVNO사업자로 가입을 전환할 수 있음을 의미한다. 또한 이동통신사업자별로 가입자 전환비용에 유의한 차이가 존재하며 시장지배적사업자의 전환비용이 가장 크게 나타났다. 이는 추가적인 규제가 존재하지 않을 경우 시장지배적 사업자로 시장 쏠림현상이 일어날 가능성이 있음을 의미한다. 따라서 무선데이터서비스 활성화를 위한 MVNO사업자들의 시장점유율 확보를 위해서는 제품이나 품질의 차이보다는 요금차별화를 통한 전략적 접근이 바람직하고, 규제기관은 이동통신사업자간 상이한 가입자충성도를 고려하여 규제정책을 수립해야 할 것이다. 본 연구는 MVNO 시장확장을 위한 전략방안 마련에 활용될 수 있을 것으로 기대되며, 규제기관의 통신정책방향에 대한 시사점을 제시할 수 있을 것으로 기대된다.

☞ 주제어 : 조건부가치측정법, 전환의사비용, 전환비용, 가상이동망사업자.

ABSTRACT

This study uses the contingent valuation method to estimate the switching cost for adopting the MVNO service. The findings are as follows.: First, Willingness To Switch(WTS) increases as users' using pattern and perceived degree of MVNO service, but satisfaction with current service provider does not play a significant role in predicting Switching Cost. This means that as amount of money users can save exceeds a certain level, users decide to willingly change their service provider to MVNO regardless of their level of satisfaction with current service provider. Second, there are differences in WTS among service subscribers in SKT, KT and LGU+. It means that there will be a difference in the tendency to switch to MVNO among subscribers of service providers. This study suggest the following managerial perspective to effectively promote the MVNO and boost the MVNO market for activation of mobile data services.: First, MVNOs are better off applying differentiated pricing scheme at attractive rates than using a differentiation of service product and quality. Second, regulators should consider how to implement an MVNO regulatory policy when there is an asymmetric customer loyalty among MNOs. This research will be used to set the MVNO's pricing strategy and to build up a successful regulatory policies.

☞ keyword : Contingent Valuation Method, Willingness To Switch, Switching Cost, MVNO

1. Introduction

ITU(2001) defines a MVNO as an operator that offers mobile services to end users but that does not have a

governmental license to use its own radio frequency[1]. It is well known that Mobile Virtual Network Operator (MVNO) is an effective way to promote competition and offer consumers a wider choice of services at lower prices. Nevertheless, telecommunications regulators often face difficult choices regarding the need for and extent of regulatory intervention. One issue is the regulation of the wholesale price (paid by MVNOs to MNOs) and the other is the terms and conditions of access.

Until the late 1990s, the mobile telecommunications market was considered to be a closed oligopoly market, as

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there were limited spectrum resources and there was a tremendous initial investment for the network infrastructure. However, the advent of the MVNO concept and business model suggests that the mobile telecommunications market could be an open competition market.

For many years, the Korean regulatory authority, Ministry of Science, ICT and Future Planning (MSIP), has regarded MVNOs as necessary for promoting competition and reducing mobile rates. After a long delay, the MSIP set the date of March 2010 for introducing MVNOs to the Korean mobile telecommunications market. By January 2015, there were three mobile network operators and 27 MVNOs in the Korean mobile telephony market. The total number of MVNO subscribers now stands at 4.7 million (4,748,628), representing a growth of 91% in the last 13 months (2.49 million net adds). In spite of rapid subscriber growth in the last year, the Korean mobile telecommunications market still has the characteristics of an oligopolistic market. The three MNOs hold 92% of the mobile telephony market share, and the MVNO share of the market is no more than 8.1%.

According to the current Korean regulatory framework for MVNOs, only SKT, which is the dominant player in the mobile market, has the obligation to provide wholesale access to MVNOs. Also, the MSIP released an order extending number portability obligations to MVNO in April 2012. There are many empirical analyses of MNP in telecommunications sector. Shin and Kim (2008) analyzed US market and showed mobile number portability was a significant factor that allowed customers to switch to the new MVNO services[2]. Sánchez and Asimakopoulos (2012) study effect of MNP on customer churn rates, and Lee et al. (2006) analyze the relationship between MNP and switching cost[3][4]. Another recent-introduced regulatory intervention in support of MVNO is mobile phone blacklist system, which was introduced on May 1, 2012. The blacklist system enables cell phones to be sold through diverse channels, such as retail outlets that are not owned by mobile carriers. Before introduction of blacklist, mobile phones had only been sold in mobile carrier retail outlets, and subscribers could only use cell phones that were supplied by mobile carriers. The MSIP expects that the blacklist system will expand MVNO subscribers' choice in mobile phone and eventually contribute to facilitating MVNOs. In spite of

these diverse regulatory remedies for an effective MVNO market to grow, the MVNOs still appear to be struggling amid big-box competition and have trouble in increasing their market share.

From a regulatory and competition policy perspective, MVNOs have been a popular debate topic in the last decade. There have been a variety of studies on MVNOs. The studies have generally concentrated on the benefits of MVNO model, the success factors of the MVNO business, regulatory policy, and the relationship between MNOs and MVNOs (Banerjee and Dippon 2009, Song 2010, Cricelli et al. 2011)[5][6][7].

Meanwhile, the switching cost is also one of the most discussed contemporary issues in the telecommunications sector. Empirically, the possibility that the intention to switch is influenced by consumer's behavior and attitudes has been demonstrated by Ajzen (1991), Bansal (1999) and others (Jones et al. 2003, Gupta et al. 2004)[8][9][10][11].

Also, there are several recent contribution that investigate the switching cost in the telecommunication sector. Grzybowski (2008) used panel data from households in the UK to consider the switching cost in the UK mobile telecommunications industry[12]. Grzybowski (2008) finds that switching costs differ across the network operators from which consumers switch. The highest switching costs have the consumers of Orange and lowest of Vodafone. Cullen and Shcherbakov (2010) used cross-sectional consumer survey data to estimate consumer switching costs in the US wireless industry[13]. Cullen and Shcherbakov (2010) suggests the presence of consumer switching costs associated with a change of provider amounting to approximately \$230 USD. Although there have been numerous studies about switching cost in telecommunication sector, there is no empirical study of estimate switching cost using contingent valuation method (CVM).

This study aims to estimate willingness to switch compensation from MNO to MVNO as proxy values for the magnitude of the switching cost using contingent valuation method in the Korean mobile telecommunications market. The study has three goals: i) to obtain willingness of subscriber to switch compensation as proxy values for the magnitude of the switching cost, ii) to examine how the willingness to switch varies by socio-economic

characteristics, such as age, gender, income and education; iii) to determine whether there is a difference of WTS among service providers and how it affect competition and market conditions in the Korean mobile telecommunications market.

The remainder of this paper is organized as follows. The next section provides a brief sketch of the Korean mobile telecommunications market and the current status of regulation for MVNOs. Section 3 discusses the methodology, survey design and data, and the study results are presented in section 4. Section 5 concludes with a summary of the primary findings and considers several limitations of the study.

2. Mobile market

Korea has one of the most penetrated and sophisticated mobile markets in the world. By January 2015, the Korean mobile market had grown to 58.7 million users, which is a 115.0% penetration rate. Korea's penetration rate is higher than in any other developing countries, including the mature markets in Europe and the US. The competition that was introduced in the 1990s has brought some changes to the Korean mobile telecommunications market, but the market structure is still considered to be an oligopoly. Table 1 shows the market share of service providers as of January 2015.

While Korea has the highest mobile penetration in the world, MVNOs were introduced relatively late compared to other countries. This delayed introduction was primarily related to concerns among the MNOs about a dangerous encroachment on their subscriber base. For many years, there have been heated discussions between the regulator and the mobile network operator about the introduction of MVNOs

in the Korean mobile market. The MNO has insisted that the Korean mobile market is so intensively competitive and oversaturated that the positive impact of MVNO entry may be limited. The MNO has also insisted that the MVNO entry will likely damage the MNO's incentive to invest in the network infrastructure. On the contrary, proponents of MVNOs stress that MVNOs can lead to more service competition and greater innovation in the mobile market. While there have been pros and cons to the introduction of MVNOs, the MSIP introduced MVNOs and expects that competition will increase and prices will receive downward pressure.

As mentioned previously, since the introduction of MVNO in 2010, many regulatory interventions which are considered to be necessary to ensure a successful MVNO market have been implemented. However, MVNOs have failed to challenge the existing MNOs. After more than 4 years of operation, the combined market share of the 27 active MVNOs is barely above 8%. This failure is believed to be related to the inability of the MVNOs to compete with the MNOs in terms of service differentiation, pricing and consumer intimacy.

3. Data and Methodology

3.1 Data collection

The data used in this study were obtained from the web-based online survey. The survey period covered from May to June 2014. Prior to distributing the full survey, pilot test was conducted to determine the reasonable initial bid price and ensure the validity of the questionnaire.

The survey invitation e-mail, which encourages subscribers to participate in the web-based online survey, together with

(Table 1) Mobile market share of service providers in Korea (as of January 2015)

Service Provider	Subscriber					M/S
	2G	3G	LTE	Wibro	Total	
SKT	3,177,017	6,303,324	17,028,347	113,273	36,621,961	45.7%
KT	0	4,560,674	10,679,652	743,391	15,983,717	27.4%
LGU+	2,455,238	-	8,480,498	-	10,935,736	18.8%
MVNOs	551,600	3,696,332	500,696	-	4,748,628	8.1%

source: MSIP homepage(<http://www.msip.go.kr>)

a description of the survey background, was sent to a randomly selected sample of 5,000 subscribers taken from a database of the survey firm. A total of 553 responses were obtained. Observations with missing values for the variables in the analysis were excluded. The response rate was 11.06%, which is slightly lower than the typical response rate for general population surveys. It is generally known that Response rates range from 7 to 44 percent for Web surveys, and from 6 to 68 percent for e-mail surveys (Elliot et al. 2002)[14]. Also Fan and Yan (2010) insisted that the response rate in the web survey on average is approximately 11% lower than that of other survey modes[15].

3.2 Questionnaire Design

The survey questionnaire contains a total of 18 questions including two questions for examining whether a strategic bias existed. The questionnaire was organized into four parts. The first part obtained information on the socio-economic and demographic characteristics of the respondent, including age, gender, occupation, monthly income, education level and location of residence. The second part comprised questions regarding the respondent's perceptions of MVNOs. The third part determined the mobile service experience of the respondent, such as the level of satisfaction with the current service provider, years of subscription and amount of

(Table 2) Variables in the survey

Variables	Category
Gender	Male, Female
Age	below 20, 20's, 30's, 40's, over 50's
Occupation	General Manager, Experts and related business employee, Office Worker, Service industry employee (including salesman and related business employee), Agriculturalist (agriculture, forestry, fishery), Certified technician and related business employee, Student, Engineer and related business employee, Laborer, Others
Living Location	Seoul, Daejeon, Daegu, Pusan, Gwangju, KyoungGi, KyoungSang, JeonLa, ChungCheong, KangWon, Jeju, Others
Service provider	SKT, KT, LGU+
Education level	Less than a high school diploma, High School diploma, Bachelor's degree, Master Degree, Doctoral Degree
Monthly Income level	Lees than 2000k won per month, 2000k to 3000k, 3000k to 4000k, 5000k or more
Job Relatedness to telecommunications	Yes, No
Experience in participating in mobile service price reduction campaign	Yes, No
Experience of service provider change	Yes, No
Year of subscription	Lees than 1 year, 1-2 years, 2-3 years, 3-4 years, 4-5 years, 5-6 years, 6-7 years, 7 year or more
Monthly payment	Lees than 20,000won, 20,000 to 30,000won, 30,000 to 40,000won, 40,000 to 50,000 won, 50,000 to 60,000won, 60,000 or more
Amount of monthly Use	Lees than 30min. 30-1 hour, 1-2hours, 2-3hours, 3-4hours, 4hours or more
Awareness of MVNO	extremely well, very well, somewhat well, slightly well, Not at all well
Benefit recognition of MVNO	extremely well, very well, somewhat well, slightly well, Not at all well
Satisfaction with current service provider	Extremely satisfied, Very satisfied, satisfied, very dissatisfied, Extremely dissatisfied
Intention of switching service provider	Extremely, very, somewhat, slightly, Not at all

monthly use. In the fourth part, we asked for the respondent's Willingness To Switch from MNO to MVNO. There were a total of 17 variables in the survey including the two strategic bias variables.

The questionnaire began with a detailed description of the benefits of MVNOs. This description provided a crucial component of the questionnaire, as respondents were informed about their compensation. Respondents also received information about number portability, which allows users to keep their current phone number even if respondent change from current service provider to MVNO. To elicit the WTS to MVNO, the closed-ended question format, which is known as the Dichotomous Choice Contingent Valuation Method, was used. The WTS question presents each respondent with a sequence of two bids and asks for a 'yes' or 'no' vote on whether the respondents WTS equals or exceed each bid. The second bid is based on the respondent's response to the first bid, the second bid is twice higher than the first bid if the first response is no and halved if the first response is yes.

The following is an example of the wording of the questions:

*“Let us assume that the price you pay for service will be lowered if you were to switch to an MVNO from your current service provider; taking into consideration how much you can receive in the price reduction, are you willing to switch to MVNO if you can save B_f won per month? If yes(no), are you willing to switch to MVNO if you save $1/2 * B_f$ ($2 * B_f$) won per month?”*

According to the results of pilot test conducted in advance, the initial bid price begins with 2,000 won, 4,000 won, 5,000 won, and 10,000 won. One of four monetary bidding values was randomly suggested for the first bid.

To check how representative of the population the sample is, Chi-square tests was conducted in terms of gender, age, service provider and living location.

Taking for granted that the sample was a probability sample, the data appeared to be representative of the population in terms of gender, service provider and living location. In comparisons between the sample and population, the chi-square statistics were not statistically significance for

gender ($p=.194$), service provider ($p = 0.310$) and living location ($p = 0.137$). However, it should be mentioned that the distribution is skewed in the direction of the younger respondents, so the majority of the sample, approximately 47.2% are representatives of the two younger groups, whereas only 16.5% represent the oldest group. Table 4 presents the summary descriptive statistics about 553 respondents.

(Table 3) The results of Chi-square test for accounting for the non-response and avoiding sample bias

Gender		Observed N	Expected N	Residual
Male		289	273.7	15.3
Female		264	279.3	-15.3
Total		553		
Chi-Square		1.686	D_f	1
Asymp. Sig.			.194	
Age	Below 20	129	84.1	44.9
	20's	132	84.1	47.9
	30's	100	99.5	0.5
	40's	101	104.5	-3.5
	Over 50's	91	180.8	-89.8
Total		553		
Chi-Square		96.123	D_f	4
Asymp. Sig.			.000	
Service Provider	SKT	270	273.7	-3.7
	KT	187	172.5	14.5
	LGU+	96	106.7	-10.7
	Total	553		
Chi-Square		2.342	D_f	2
Asymp. Sig.			.310	
Living Location	Seoul	124	112.7	11.3
	Daejeon	19	17.1	1.9
	Daegu	33	28.2	4.8
	Pusan	46	39.8	6.2
	Gwangju	16	16.6	-0.6
	Kyung-Gi	123	127.1	-4.1
	Kyung-Sang	63	65.7	-2.7
	JeonLa	42	39.8	2.2
	Chung-Cheong	32	40.3	-8.3
	KangWon	10	17.1	-7.1
	Jeju	12	6.1	5.9
Others	33	42.5	-9.5	
Total		553		
Chi-Square		16.124	D_f	11
Asymp. Sig.			.137	

(Table 4) Descriptive Statistics

Items	N	Mean	Std. Deviation
Year of subscription	553	2.1935	1.4917
Monthly payment		3.0289	.96265
Amount of monthly Use		3.0163	1.4249
Awareness of MVNO		3.5371	1.1240
Benefit recognition of MVNO		3.5443	1.0453
Satisfaction with current service provider		2.5859	.8599
Intention of switching service provider		3.5696	1.1321

3.3 Basic model of this study

As we mentioned earlier, we used a double-bounded dichotomous choice (DBDC) approach to estimate the WTS as a proxy value for the cost of switching to an MVNO. The dichotomous choice format is the one advocated by an expert panel convened by the National Oceanographic and Atmospheric Agency as being the most appropriate for environmental valuation (Arrow et al., 1993)[16].

We adopted the econometric model that was proposed by Cameron and James (1987)[17]. Let the willingness to accept of *i* respondent be given by y_i^* , where *i* is the *i*_{th} respondent of the sample and is dependent on the respondent's characteristics x_i' ; y_i^* can be written as equation (1):

$$y_i^* = x_i' B + \epsilon_i \quad (1)$$

where x_i' is the vector that represents *i*'s characteristics, *B* is the coefficient to be estimated and ϵ_i is the mean zero error term. We can define the indicator function in equation (2):

$$I_{ji} = 1 \quad \text{if } y_i^* \geq t_{ji}$$

$$I_{ji} = 0 \quad \text{if } y_i^* < t_{ji} \quad j=1,2 \quad (2)$$

where *i*=1, 2, ..., *N* is the index of each respondent in the sample, t_{1i} is the initial bid, and t_{2i} is the higher or lower bid. Respondent $i(I_{1i}, I_{2i})$ belongs to one of the following 4 cases: (0,0), (0,1), (1,0), (1,1) means to (Yes, Yes), (Yes, No), (No, Yes), (No, No) in respectively. For example, (No, No) means "No" for the bid price in first and second question. The sample log-likelihood function is expressed in equation (3):

$$\begin{aligned} \text{Log}L = & \Sigma(I_{1i}I_{2i})[1 - F(\frac{t_{2i} - x_i'B}{\sigma})] \\ & + I_{1i}(1 - I_{2i})[F(\frac{t_{2i} - x_i'B}{\sigma}) - F(\frac{t_{1i} - x_i'B}{\sigma})] \\ & + (1 - I_{1i})I_{2i}[F(\frac{t_{1i} - x_i'B}{\sigma}) - F(\frac{t_{2i} - x_i'B}{\sigma})] \\ & + (1 - I_{1i})(1 - I_{2i})[F(\frac{t_{2i} - x_i'B}{\sigma})] \end{aligned} \quad (3)$$

The maximum likelihood estimation of the model parameters involves maximizing the above equation with respect to the parameters *B* and σ . Once the parameters *B* and σ are maximized, the estimation of the mean WTS is calculated as the following: $E(Y) = \bar{x}' B$

4. Results

4.1 Factor Analysis

A factor analysis was performed to reduce the number of variables and to avoid multi-collinearity. The factor scores for each derived factor were used as the input data to explain the WTS to the respondents. Among the 17 variables, 8 were included in the factor analysis, 7 were used as moderating variables to measure the moderating effect on the WTS and the other 2 were used to locate a strategic bias.

(Table 5) Description of derived factors and their corresponding variables

Variables/Factors	Component		
	Factor1	Factor2	Factor3
Experience of service provider change	-.861	-.173	-.040
Year of subscription	.798	.070	.015
Monthly payment	.671	-.263	-.125
Monthly usage time	.472	.210	.055
Awareness of MVNO	.046	.876	.042
Benefit recognition of MVNO	.133	.875	.028
Satisfaction with current service provider	-.035	.108	-.873
Intention of switching service provider	-.080	.192	.829

The demographic variables were all qualitative. However, the results are difficult to analyze when demographic variables are included in the factor analysis, so we performed the factor analysis after removing the demographic variables, as they were used as moderating variables. Moderating variables provide information about the expected conditions if there were a relationship between the dependent and predictor variables. The principal components method with varimax rotation was used for the 8 variables, and there were 3 underlying factors with eigenvalues of greater than one. The 3 factors explained 65.988% of the variation in the eleven variables. A description of each factor and the corresponding variables is provided in Table 5: (1) Individual Using Pattern (fac_UP), (2) perceived degree of MVNO service (fac_MA), and (3) intentions to switch and satisfaction with the current service provider (fac_satis). Table 6 presents eigenvalue and share of total variance explained by the principal components.

4.2 Estimation results of the willingness to switch to MVNO

(Table 6) Eigenvalue and share of total variance explained by the components

Component	Rotation Sums of Squared Loadings		
	eigenvalue	Percentage of variance explained	Total cumulated percentage of variance explained
1	2.078	25.978	25.978
2	1.729	21.617	47.595
3	1.471	18.393	65.988

With data from 553 respondents, the model parameters were estimated for equation (1). The maximum likelihood estimates of the parameters were obtained using TSP 5.0 with the Newton-Raphson optimization method. Table 7 displays the coefficients and standard errors for the WTS equation. The results show that fac_UP (individual using pattern) and fac_MA (MVNO-Awareness) affect WTS to MVNO. This implies that WTS increases as fac_UP and fac_MA increase, but fac_satis does not play a significant role in predicting WTS. The first relationship of interest is between fac_MA and WTS. It means that the more

respondents know about MVNO and its benefit, the more respondents seek more compensation for switching to MVNO. It is also noteworthy that fac_satis does not have effect on WTS. It is generally considered that customer satisfaction is an indicator of switching intentions (Jones et al. 2000, Ping Jr. 1994); and customer satisfaction increases the customer retention rate (Ranaweera and Prabhu 2003)[18][19][20]. This result is inconsistent with the finding of prior studies that satisfaction levels have positive effect on customer loyalty and explain a substantial portion of variance in customer retention. Thus it seems that, as amount of money users can save exceeds a certain level, users decide to willingly change their service provider to MVNO regardless of their level of satisfaction with current service provider.

(Table 7) The results of maximum likelihood estimate

Type	Parameter	Estimate	S.E.	t-statistics (p-value)
Constant		19924.17	7949.02	2.5064 (.012) *
Predictor	fac_UP	3639.32	718.79	5.0630 (.000)**
	fac_MA	4821.45	756.59	6.3725 (.000)**
	fac_satis	377.79	672.92	.5614 (.575)
Control variable	Gender	-1882.17	1377.49	-1.3663 (.172)
	Age	-1837.58	543.42	-3.3814 (.001) **
	Job	-22.84	300.18	-.0761 (.939)
	Living Location	-481.03	208.22	-2.3101 (.021) *
	Service Provider	-1816.87	923.34	-1.9677 (.049)**
	Education	82.52	492.08	.1677 (.867)
	Income	172.55	526.08	.3279 (.743)
	Job Relation	1372.24	3045.49	.4505 (.652)
	Campaign experience	-31.06	1368.34	-.0227 (.982)
Sigma		14063.78	649.44	21.6550 (.000)**
No. of observation		553	Log likelihood	-966.1759

Respondents' experience with a signature-collecting campaign and employment, which were used to examine a strategic bias, do not affect WTS (see Table 8). This indicates that a strategic bias does not occur with respect to parameters B and σ , which will be discussed in detail in the next section.

(Table 8) Estimation results of mean WTA

Parameter	Estimate (won)	S.E.	t-statistics (p-value)
Mean WTP	9,452.66	667.30	14.16 (.000)***
Confidence Interval(95%) - using $\pm 1.96 \times S.E.$		Lower	Upper
		8144.76	10,760.58
Chi-squared(p-value)		200.66	(.000)***

*** : p<0.01

As previously mentioned, the mean WTA from the dichotomous WTA questions is calculated as $E(Y) = \bar{x} B$. The mean WTS was 9,452.66 won per month. Table 6 summarizes the estimation results of the mean WTA.

Given that the average monthly payment of the mobile telecommunication service subscriber(ARPU : average revenue per user) is 35,622 won per month(as of 2015.1Q), the calculated mean WTA (9,452.66won per month) is more than 25% of the average monthly payments for using the mobile telecommunication service. Thus, to attract subscribers and sustain the business in the long term, the retail price of the MVNO should be more than 25% lower than that price of the MNO.

A managerial implication is that MVNOs are better off applying differentiated pricing scheme at attractive rates than using a differentiation of service product and quality.

4.3 Test bias results

There are several possible biases in CVM. To avoid bias, the construction of scenarios and measurement instruments is important. Nevertheless, the possibility of bias remains. To calculate the WTP for number portability, three major biases concerning the double-bounded dichotomous choice approach were examined, including the nay/yea-saying bias, anchoring bias, and strategic bias.

The results for the nay/yea-saying bias show that the δ estimate is negative ($\delta = -.546$, t-statistic: 15.057) in the full equation $y_2^* = \delta y_i + x_i' \beta_s + \epsilon_2$. In order to examine whether the nay/yea saying bias and anchoring bias exists, the bivariate model is transformed to include the first dichotomous choice response in the WTA model in the second response as well. If the parameter δ is estimated to be negative(positive) statistically, it can be inferred that an anchoring(nay/yea saying) bias exists. This suggests that a nay/yea-saying bias does not exist, but an anchoring bias may exist. This also suggests that the estimation of the mean WTP may be under or overestimated. However, after excluding four response cases ($(I_{1i}, I_{2i})=(1,0)$) from the sample, a nay/yea-saying bias appears to still exist (t-statistic: -29.904). Thus, an anchoring bias may be caused by the structure of the four monetary bids rather than a survey error. However, the presence of an anchoring bias does not distort the mean WTA estimation. To avoid a strategic bias, the respondents were asked if they are involved in work related to mobile telecommunications and if they have experience collecting signatures for a mobile service price reduction campaign. Five percent of the respondents said yes to the former question, and thirty two percent of the respondents said yes to the latter question. This provides an opportunity to test for a strategic bias. The estimate of the variable 12(Awareness of MVNO) and 13(Benefit recognition of MVNO) parameters is statistically insignificant (p=0.652, p=0.982), which means that β_{11} and β_{12} are not zero, so a strategic bias does not exist.

4.4 Difference in WTS between MNOs - existence of a customer loyalty difference

In this section, we assess the difference in the willingness to switch between MNOs and examine whether the phenomenon known as customer loyalty exists or not in the Korean mobile telecommunication market. Furthermore, if so, how it would affect the competition of the mobile market.

The customer loyalty can be defined as the customer's favorable attitude toward an service or product, resulting in repeat purchasing behavior. Of course, WTS difference does not necessarily mean that existence of customer loyalty

difference when there are price difference, and presumably, quality difference as well. However, if it is assumed that there are no price differences and quality differences, WTS difference between service providers can provide indirect evidence of existence customer loyalty difference.

Prior to calculating the WTS, price difference and quality difference were examined. According to a recent survey results for mobile telecommunications service quality performed by MSIP from December 2012 to January 2013, all three service providers(SKT, KT, LGU+) have an excellence grade (S) in 97.5% of the country in terms of the access success ratio and the interruption ratio. Also, in terms of price level, the call rate per minute is very similar to each other.(i.e., 10.8 won per minute) It is concluded that there was no quality difference and price difference among the service providers. As a result, we can say that there exists customer loyalty difference in the Korean mobile telecommunications market if there is a difference in WTS to MVNO among service providers.

For the analysis, 553 questionnaires were completed. A total of 270 of the questionnaires were completed by SKT subscribers, and KT and LGU+ subscribers completed 187 and 96 questionnaires, respectively. The maximum likelihood estimates of the parameters were also obtained using TSP 5.0 with the Newton-Raphson optimization method. According to the results of the analysis(see Table 9), the mean willingness to switch to MVNO was 10,907.62 won per month for SKT subscribers, 8,498.23 won/month for KT subscribers and 7,080.18 won per month for LGU+ subscribers.

(Table 9) The results for determining the difference of WTS estimate of each service provider

provi-der	WTS Estimate (won)	Standard Error	t-statistics	Confidence Interval (95%)	
				Lower	Upper
SKT	10,907.62	1090.96	9.99**	8769.33	13045.91
KT	8498.23	973.47	8.72**	6589.98	10406.02
LGU+	7080.18	1507.43	4.69**	4125.62	10034.76

** : p<0.05

Based on the results of this test, we can draw the following presumptions. As shown in Table 9, there are

differences in WTS among service subscribers in SKT, KT and LGU+ at the 0.05 significance level. It means that there will be a difference in the tendency to switch to MVNO among subscribers of service providers. It is confirmed empirically that difference of customer loyalty may exist. It is highly probably that high customer loyalty of dominant player, SKT, would have an adverse effect on competition and even aggravate an asymmetric market situation. In other words, if the willingness to switch to MVNO is asymmetric with a dominant player and there is no any additional regulatory mechanism, mobile telecommunication market may be highly concentrated by one strong dominant player.

5. Conclusions

The primary purpose of this paper was to use the contingent valuation method to estimate the willingness to switch (WTS) to MVNOs as a proxy for the switching cost in the Korean mobile telecommunications market. This approach provides an indirect estimate of Korean mobile subscribers' switching cost for adopting the MVNO service. This study also shows that there is a difference in customer loyalty among subscribers of current mobile network operators. Although this is a country specific research, the findings of this study have several policy and managerial implications where are applicable to other country's mobile telecommunications market in general.

The most important findings from managerial perspective is that MVNOs are better off applying differentiated pricing scheme at attractive rates than using a differentiation of service product and quality. The second implication in the perspective of policy is asymmetric customer loyalty with a dominant player may leads to highly concentrated market by one strong dominant player. In other words, if a WTS difference among service providers exists and WTS is asymmetric with a dominant player, the asymmetric market situation may become more aggravated. Thus, regulators should consider how to implement an MVNO regulatory policy when there is an asymmetric customer loyalty among MNOs. Limitation of this study is as follow: since respondents do not account for persistent heterogeneity in consumer preferences, one should be careful when

interpreting the results. Time series analyses will be carefully studied in the later researches of this paper.

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