

2005

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Kim, Jin Ki, "Mobile Subscribers' Willingness to Churn Under the Mobile Number Portability (MNP)" (2005). *AMCIS 2005 Proceedings*. 325.

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Mobile Subscribers' Willingness to Churn under the Mobile Number Portability (MNP)

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ABSTRACT

Mobile number portability (MNP) means that customers using mobile service can retain their telephone numbers when they change operators. Mobile carriers are concerned about which factors influence willingness to churn of customers. This study examined these concerns through three steps. The first is checking whether willingness to churn between the different situations, without MNP and with MNP differs. The second is to figure out how different factors influence willingness to churn in those situations. Finally, a classification model is proposed to categorize the subscribers who have willingness to churn or not. This study shows that the difference of willingness to churn before and after MNP. The results show that quality and price are the most influential factors in both cases. Inconvenience of changing numbers is additional factor in case of the unavailability of MNP. The results have implications particularly that mobile carriers should consider their quality of service and price more under the new situation.

Keywords

Mobile number portability (MNP), churn, mobile telecom services, customer satisfaction, service price, service quality, telecom policy and management

1. INTRODUCTION

The mobile telecommunications market is one of the most competitive markets in the telecommunications industry sector. More than three carriers on an average are competing in each market world wide. The competition has been on the new subscription basis, as the mobile market has been growing unexpectedly fast. However, since the end of 1990s, as the growth rate decreases, the competition pattern has shifted to the churn competition.

Mobile carriers recognize the importance of churn management. Moreover, since the mid-1990s, most telecom regulators have been trying to introduce the mobile number portability (MNP) in their market in order to promote the mobile customers' welfare and foster the competition in the mobile market. As a result of that, mobile carriers are facing more fierce competition, and the importance of churn management is reinforced.

Research on the willingness to churn has crucial implications for mobile business as well as telecom policy makers. There is research on the churn management and MNP, in particular some studies on churn management under the MNP. However, there is little research about the factors that influence the subscribers' churn before and after the MNP has been changed. The purpose of this research is to investigate how the willingness to churn has changed by the MNP, to find out factors to influence the willingness to churn before and after the MNP, and to focus on the target customer under the MNP.

2 MOBILE NUMBER PORTABILITY

Number portability (NP) - the ability of telephone customers to keep their numbers when moving between operator, service or location - is firmly on the agenda of the National Regulatory Authorities of the countries introducing fair competition into the telecommunications market. NP is increasingly accepted as an integral part of a competitive environment and is being considered for introduction in a number of liberalizing countries (OfTel, 1997a). Its purpose is to foster consumer choice and effective competition by enabling subscribers to switch between providers without the costs and inconvenience of changing telephone numbers. From the middle of the 1990s, many telecom regulators proposed to implement MNP as a tool for reinforcing competition in the mobile market.

NP was first available for free-phone services in the U.S. in 1993. For the local service, Hong Kong introduced it first in 1995 (OfTel, 1997a). For the mobile service, Singapore introduced MNP first. Telecommunication Authority of Singapore made

the MNP mandatory in order to promote competition in April 1997. The European Commission (EC) has tried to introduce MNP in European countries. Through the 1999 Communications Review, the Commission proposes to extend the MNP (Bernardi and Nuijten, 2000). EC recommended member countries launch MNP until 2000 (Directive97/33/EC, 1997).

In the U.S., the Federal Communications Commissions (FCC) had requested all wireless carriers had the capability to query the appropriate NP database to deliver calls to ported numbers by the end of December 1998. The mobile carriers had to introduce MNP in the top 100 Metropolitan Statistical Areas (MSA) by the end of June 1999 (Bernardi and Nuijten, 2000; FCC, 1996, 1997). After permitting to delay the launching three times, the FCC ordered mobile carriers to provide MNP from November 2003 (FCC, 2003a, 2003b). Since November 2003, wireless local number portability (WLNP) has been available in the top 100 MSAs. In Hong Kong, MNP was implemented in March 1999. MNP is implemented by a distributed database solution (Bernardi and Nuijten, 2000). In the case of Korea, mobile carriers have provided the MNP from 2004 (MIC, 2002, 2003).

Most telecom regulators analyzed the cost-benefit of NP before launching the services. Singapore, Hong Kong, the U.K., and Korea analyzed the effect of MNP in their markets respectively (NERA, 1998; Oftel, 1997a; Yum, Kim, Lee, Seo, and Rhee, 2002). The framework of the cost benefit analysis employed in those studies is basically the same as the NERA performed upon the request of UK's OFTEL (Kim and Chang, 2001; Oftel, 1997a, 1997b). In order to estimate each benefit, economic benefit or welfare is derived for each of three mobile market stakeholders, such as customer, incumbent carrier, and competitive carrier. In terms of technological method, there are two different methods to implement NP basically. The first one is signaling relay function (SRF)-based solution and the other is intelligent network (IN)-based solution (Bernardi and Nuijten, 2000; EuropeEconomics&Arcome, 1999; Lin and Rao, 1999).

3. CHURN MANAGEMENT

MNP is intended to intensify the competition in the mobile telecom market. Mobile service providers are trying to retain their subscribers or to induce competitors' subscribers by porting their numbers. As the mobile market approaches the saturation stage, this competition will be fierce. As the result, mobile service providers have more concern with the churn management, which has become an important management tool to keep their customers or to attract competitors' customers. Various tools for churn management are described in the literature.

3.1 Statistical Method

Traditionally, customer retention, customer loyalty, and customer satisfaction are important goals for telecom service providers. Using the LISREL analyses, Gerpott, Rams, and Schindler (2001) show that overall customer satisfaction impacts positively on customer loyalty, which in turn influences a customer's decision to terminate or extend their service. Using the structural equation model, Kim, Park, and Jeong (2004b) show that call quality and value-added services are influential factors to the customer satisfaction.

Kim and Yoon (2004) used a binomial logit model to identify the determinants of subscriber churn and customer loyalty in the Korean mobile market. The probability that a subscriber will switch carriers is dependent on the level of satisfaction with service attributes including call quality, tariff level, handsets, brand image, as well as income, and subscription duration. The subscription duration is not significant in affecting the loyalty-induced action.

3.2 Data Mining and Machine Learning

A mobile service provider wishing to retain its subscribers needs to be able to predict which of customers may be at-risk of changing services, and will make those subscribers the focus of customer retention efforts (Mozer, Wolniewicz, Grimes, Johnson, and Kaushansky, 2000; Wei and Chiu, 2002). Data mining techniques have been used in churn management to increase the hit ratio.

Wei and Chiu (2002) propose a technique that predicts churning from subscriber contractual information and call pattern changes extracted from call details. Mozer et al. (2000) explore techniques from statistical machine learning to predict churn and, based on these predictions, to determine what incentives should be offered to subscribers to improve retention and maximize profitability to the carrier. Lejeune (2001) presents a customer relationship management framework based on the integration of the electronic channel. This framework consists of four tools that should provide an appropriate collection, treatment and analysis of data. Hwang, Jung, and Suh (2004) suggest a customer lifetime value model considering past profit contribution, potential benefit, and defection probability of a customer. Gans (2000) provides that churn charges do not perform a useful role in encouraging consumers to switch only when it is efficient to do so.

4. RESEARCH METHOD

Under the MNP environment, the mobile carriers are trying to retain their customers or to attract competitor's customers. The crucial factors to influence churning have much importance. This paper consists of three steps. The first is to show there is the difference of willingness to churn between without MNP and with MNP. Secondly, it is to discover influencing factors of mobile subscribers' willingness to churn in two different situations: without MNP and with MNP. Finally, it is attempted to propose an estimating model to predict the subscribers who has intention to churn under the MNP.

4.1 Variables

Call quality is the top issue that directly creates customer satisfaction for mobile subscribers (Kim and Yoon, 2004; Kim, Park, Paik, Seol, and Park, 2004a). Price is also an influential factor to customer satisfaction for mobile subscribers (Gerpott et al., 2001; Kim and Yoon, 2004). However, differentiated price plans do not increase the level of customer satisfaction (Kim et al., 2004a). Mobile handsets might influence the customer satisfaction. The empirical studies, however, have not shown positive results between intention to churn and satisfaction to mobile handsets (Gerpott et al., 2001; Kim and Yoon, 2004; Kim et al., 2004a).

The desire to leave one's phone number unchanged is a significant determinant of the customer retention (Gerpott et al., 2001). In regard to switching costs or churn costs, there are disputable arguments. One part is that switching intention is affected by switching cost and switching promotion (Kim et al., 2004b). Factors creating switching costs positively affect customer satisfaction. Loss cost and move-in cost were significant in this regard (Kim et al., 2004a). However, there is other argument. Critics argue that churn costs are only relevant when churn is actually expected, but only on an expected basis. Churn charges do not perform a useful role in encouraging consumers to switch only when it is efficient to do so (Gans, 2000).

Value-added services are growing continuously as mobile telecom technology evolves rapidly. Value-added services affect customer satisfaction significantly (Kim et al., 2004a). A customer support service is also important for creating customer satisfaction. Interpersonal relationships between carriers and customers have a positive effect on the switching barrier. Trust and the personal relationships between the company and the customer are also significant in the mobile telecommunication industry (Kim et al., 2004a). Kim and Yoon (2004) show that brand image, subscription duration, or income influence the customer churn in addition to the above variables.

Figure 1 shows the results of previous studies on the influential factors on customer satisfaction and intention to churn or retention of mobile telecom services.

Previous literature exhibited that a lot of variables influencing the intention to churn or retention. It can be classified into four groups in which have related variables. First, quality and price are the most influential factors to intention to churn as well as to customer satisfaction. Second group is related with the switching cost which includes efforts to promote switching and the inconvenience by changing numbers. Third group is demographic variables related with using services, such as duration of subscription and income. The last one is satisfaction on handsets.

Based on those finding of previous literature, this study proposes three groups for independent variables which explain the willingness to churn. The first one is quality and price of services, which was already proven in the previous literature. Quality and service price are the important tools for competition in market. Quality and price are critical factors when MNP is provided as well as in case of without MNP (Gerpott et al., 2001; Kim and Yoon, 2004; Kim et al., 2004a; Kim et al., 2004b). The second group has factors which are related with number portability. Switching cost, inconvenience by changing number without MNP, and churn history are the factors in that group (Gerpott et al., 2001; Kim and Yoon, 2004; Kim et al., 2004b). The third group is demographic factors which includes the usage history as well (Kim and Yoon, 2004). The last group is related with payment burden and income (Kim and Yoon, 2004). Each group consists of specific variables to influence the willingness to churn. Therefore, for the independent variable, demographic variables, usage history, churn history, satisfaction with tariff and quality of current service, and inconvenience and cost of number changing are proposed, following previous literatures. In this study, the willingness to churn is regarded as the dependent variable. Table 1 shows the descriptive statistics of independent variables and dependent variables.

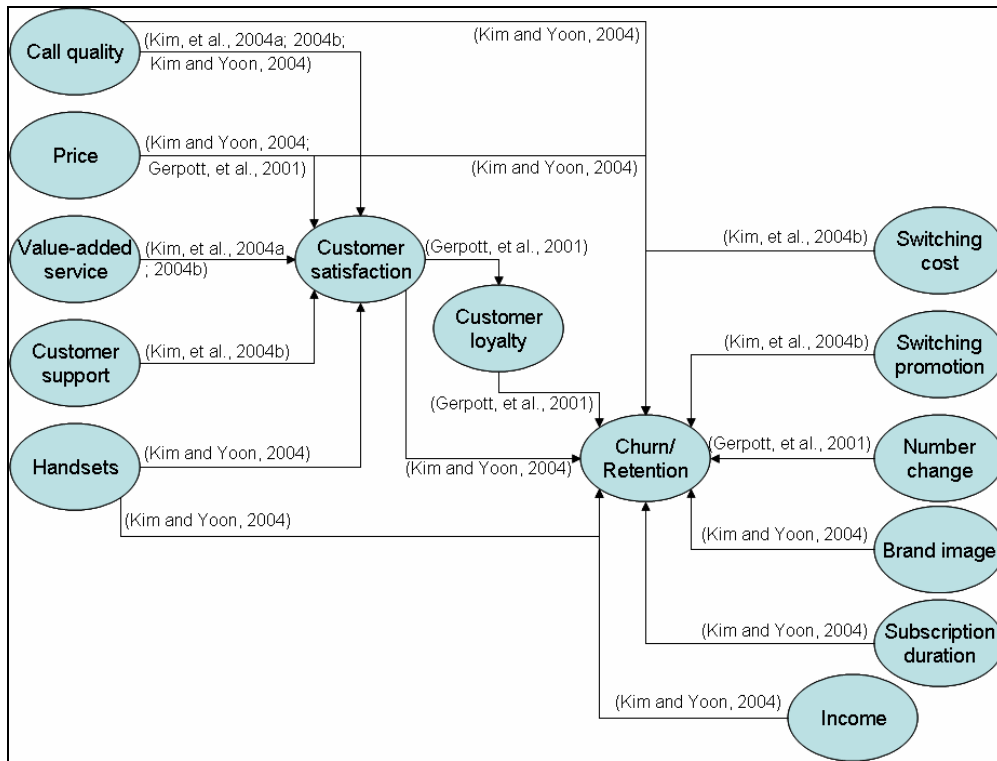


Figure 1. Previous Literatures on Customer Satisfaction and Intention to Churn or Retention of Mobile Telecom Services

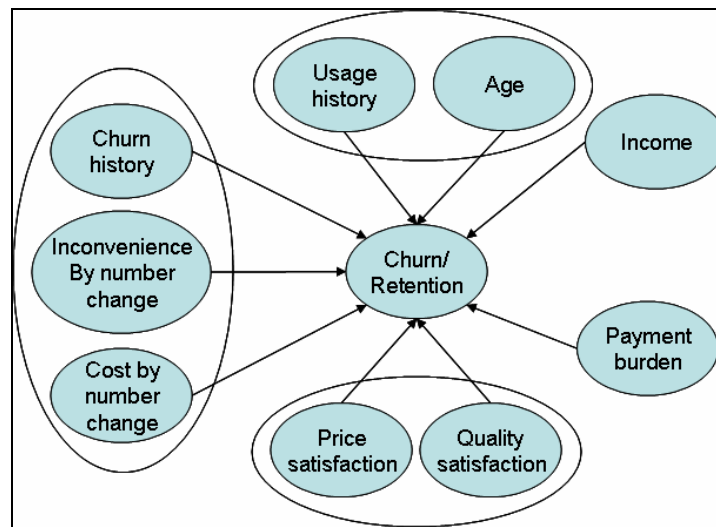


Figure 2. Research Framework

| Variables | Description | Mean | Standard Deviation |
|--|--|--------|--------------------|
| Dummy for willingness to churn without MNP | 1=Yes, 0=No | 0.16 | 0.366 |
| Dummy for willingness to churn with MNP | 1=Yes, 0=No | 0.27 | 0.444 |
| Age | Subscriber's age | 35.12 | 11.62 |
| Duration of subscription | Duration of using mobile phone (years) | 4.09 | 2.645 |
| Dummy for churn experience | 1=Yes, 0=No | 0.30 | 0.459 |
| Tariff Satisfaction | 1= unsatisfied, 5=most satisfied | 2.88 | 0.894 |
| Quality Satisfaction | 1= unsatisfied, 5=most satisfied | 3.51 | 0.877 |
| Inconvenience by number changing | 1= not inconvenient, 5= much inconvenient | 4.11 | 0.978 |
| Cost for changing number | Estimated monthly costs by changing number divided by house-hold monthly income (Korean won) | 0.0575 | 0.198 |
| Income | Household monthly income (categorized; Korean won) | 316.24 | 124.422 |
| Monthly payment | Monthly payment of house-hold for mobile service (Korean won) | 13.18 | 9.162 |

Table 1. Descriptive Statistics of Variables

4.2 Data

This study uses a survey data from Korean market. Sample data is assigned to classification by region and ages. The quota of sub-sections is followed by the National Census data by the Korea National Statistical Office (KNSO).

| | |
|--------------------|---|
| Survey interviewee | Mobile phone user (15-59 years-old) |
| Survey method | Face-to-face interview |
| Survey region | Seoul, Busan, Daegu, Daejeon, Gwangju (The largest metropolitan areas in Korea) |
| Sample size | 1,000 persons |
| Sampling error | In 95% significant level, $\pm 3\%$ |
| Sampling method | Quota sampling by region, age, and service provider |

Table 2. Survey Scheme

Based on the sample assignment by region and age, the study segments the sample by the market share of mobile service providers. In Korean mobile market, there three mobile carriers: SK Telecom, KTF, and LG Telecom. This study segments the sample by the market shares of those carriers as of August 2002.

| Mobile Carrier | SK Telecom | KTF | LG Telecom | Total |
|----------------------------|------------|-------|------------|-------|
| Market share (August 2002) | 53.6% | 32.3% | 14.1% | 100% |
| Sample size | 536 | 323 | 141 | 1,000 |

Table 3. Sample Assignment by Mobile Carrier

The survey was conducted in October 2002 for one month by the Hankook Research, a marketing research company in Korea (HanKook Research, 2002). This survey research was sponsored by the Korea Information Strategy Development Institute (KISDI), a research institute sponsored by the Korean government. Interviewers in each region took a survey and reported their results to the central office. For the accuracy of the survey, the central office verified results by calling interviewees back asking the same questions as the survey. They included the sample data only if the answers were correctly the same. The verification was carried out with 10% of the total survey sample of interviewees.

4.3 Research Methods

The objective of this study is to show how different factors are influencing the willingness to churn without MNP from that with MNP. For the first step, we checked whether the willingness to churn differ between services without MNP and those with MNP, using the analysis of variance (ANOVA).

For the second step, we used the logistic regression method in order to search the different factors to influence the willingness to churn. Logistic regression is recommended to be used in case the dependent variable is a discrete variable (Tabachnick and Fidell, 2000). Logistic regression is preferred when assessing the contribution of variables because it is less affected by variance covariance inequalities across groups, is able to handle categorical variables easily, and offers case-wise diagnostic measures for examining residuals (Hair, Anderson, Tatham, and Black, 1998). Logistic regression method is used in previous literatures (Kim and Yoon, 2004; Kim et al., 2004a).

The third step is to try to show the factors influencing the customers' changing their willingness to churn after the MNP is provided, using the discriminant analysis. Discriminant analysis is suitable for the case of a single categorical-dependent variable and several independent variables. Discriminant function analysis is used to classify cases into the values of a categorical dependent, usually as a dichotomy. Keaveney and Parthasarathy (2001) used the discriminant function analysis to show the customer switching behavior in online services market.

5. RESULTS

928 in 1,000 samples are included in the analysis because 72 samples have systematic errors. Excluding 30 samples that have missing data, 898 samples are analyzed for the ANOVA and logistic regression analysis. Table 4 shows the result of ANOVA. Without MNP, the willingness to churn is 16 percent, while the willingness to churn with MNP is 27 percent. It shows that MNP increase the willingness to churn. The difference is statistically significant.

| Variable | Without MNP | | With MNP | | F-value | p-value |
|----------------------|-------------|--------------------|----------|--------------------|---------|---------|
| | Mean | Standard deviation | Mean | Standard deviation | | |
| Willingness to churn | 0.16 | 0.366 | 0.27 | 0.444 | 34.463 | 0.000 |

Table 4. Analysis of Variance on Willingness to Churn Without MNP and With MNP

Table 5 shows the results of logistic regression. When the MNP is not introduced, the willingness to churn is affected by satisfaction to tariff and service quality, monthly payment of house-hold for mobile services, the degree of inconvenience by changing number, and age. In case of MNP, satisfaction to service quality and price as well as age and period of using mobile services are influential factors to the willingness to churn.

| Variables | Without MNP | | | | With MNP | | | |
|----------------------------------|---------------------------|------------|-----------------|---------|---------------------------|------------|-----------------|---------|
| | B | Std. Error | Wald Chi-square | p-value | B | Std. Error | Wald Chi-square | p-value |
| Age | -0.035 | 0.010 | 11.675 | 0.001 | -0.034 | 0.008 | 17.592 | 0.000 |
| Duration of subscription | 0.031 | 0.045 | 0.492 | 0.483 | 0.071 | 0.034 | 4.250 | 0.039 |
| Dummy for churn experience | 0.048 | 0.224 | 0.046 | 0.831 | 0.110 | 0.177 | 0.383 | 0.536 |
| Tariff satisfaction | -0.271 | 0.118 | 5.279 | 0.022 | -0.170 | 0.093 | 3.357 | 0.067 |
| Quality satisfaction | -1.020 | 0.112 | 82.234 | 0.000 | -0.725 | 0.091 | 63.404 | 0.000 |
| Inconvenience by number changing | -0.258 | 0.104 | 6.112 | 0.013 | -0.093 | 0.085 | 1.198 | 0.274 |
| Cost for changing number | -0.730 | 0.732 | 0.994 | 0.319 | -0.514 | 0.488 | 1.108 | 0.292 |
| Income | 0.001 | 0.001 | 1.590 | 0.207 | 0.000 | 0.001 | 0.408 | 0.523 |
| Monthly payment burden | -0.036 | 0.014 | 6.777 | 0.009 | -0.016 | 0.010 | 2.535 | 0.111 |
| Constant | 4.658 | 0.777 | 35.978 | 0.000 | 3.271 | 0.625 | 27.407 | 0.000 |
| -2 Log Likelihood | 659.338 | | | | 949.789 | | | |
| Cox and Snell R ² | 0.136 | | | | 0.106 | | | |
| Nagelkerke R ² | 0.232 | | | | 0.154 | | | |
| Chi-square | 131.370 (df=9) Sig. 0.000 | | | | 100.794 (df=9) Sig. 0.000 | | | |

Table 5. Results of the Logistic Regression

The third step is to clarify customers who change their willingness to churn as the MNP is provided. That is, when the MNP is not available, they do not intend to churn, but they have the willingness to churn after the MNP is launched. Those customers might be the target customers for mobile carriers. For this analysis, we excluded 148 samples that have the answer "Yes" for the question of the willingness to churn without the MNP. The 9 samples that have missing data are also excluded. The 771 samples are analyzed. We begin our discriminant analysis with a test of the assumption of equal covariance matrix. Box's M statistics (significance 0.465) verified that our data do not violate that assumption. The overall canonical correlation 0.138 indicates that the model of independent variables in our analysis explains $(0.138)^2$ or 1.90% of the variance in the dependent variable.

Table 6 shows the results of the discriminant analysis. Any variable with a pooled, within-group correlation loading higher than 0.30 or less than (-) 0.30 is considered substantive (Kohli and Devaraj, 2003). Our analysis reveals that age, duration of subscription, and satisfactions to quality meet this criterion. The model correctly classified 56.9% of the cases.

| | | Pooled Within Group Correlation Between Variables and Discriminant Function | Standardized Canonical Discriminant Function Coefficients |
|----------------------------------|---|---|---|
| Age | | 0.586 | 0.786 |
| Duration of subscription | | -0.337 | -0.578 |
| Tariff satisfaction | | 0.169 | 0.096 |
| Quality satisfaction | | 0.493 | 0.555 |
| Inconvenience by number changing | | -0.297 | -0.187 |
| Monthly payment burden | | -0.130 | 0.009 |
| Group Centroids | | 0.054 (unwilling to churn), -0.359 (willing to churn) | |
| Eigenvalue | | 0.020 | |
| Wilks' Lambda | | 0.981 Sig. 0.022 | |
| Classification Results | | | |
| | | Predicted | |
| | | 0 | 1 |
| Observed | 0 | 376 | 294 |
| | 1 | 38 | 63 |
| Ratio | 0 | 56.1% | 43.9% |
| | 1 | 37.6% | 62.4% |

Table 6. Results of the Discriminant Analysis

6. CONCLUSIONS

In this study, we discover that the factors influencing the willingness to churn before and after MNP is provided differ from that when the MNP is provided.

The factors influencing the willingness to churn without the MNP are the satisfaction with tariff and service quality, payment burden, degree of inconvenience changing number, and age. When the MNP is provided, satisfaction to service quality and price, age and duration are influential factors to the willingness to churn. From the results, we can discover that in both situations, age and satisfaction to call quality and price are important factors influencing the willingness to churn. It is well-known that call quality and price are essential in keeping customers for mobile carriers. This study reinforces the previous research (Gerpott et al., 2001; Kim and Yoon, 2004; Kim et al., 2004a).

This study also shows that the difference of factors influencing the willingness to churn between two market situations: without the MNP and with the MNP. Without the MNP, the inconvenience changing number and payment burden influence the willingness to churn, besides age and satisfaction with call quality and price. In regards to the changing number, the inconvenience of changing number influences the willingness to churn without the MNP, but with the MNP, it does not. The

cost of changing number does not influence that in both situations. It also reinforces the previous findings (Gans, 2000; Gerpott et al., 2001; Kim et al., 2004a; Kim et al., 2004b). In the case of the MNP, the duration is a new influential factor to the willingness to churn.

These findings provide implications for the mobile telecom market. Regardless of whether the MNP is provided, call quality and service price are the crucial factors to influence the willingness to churn. From the different influential factors, we can find that the main competitive tools in the mobile market, call quality and service price are more important factors in the case of the MNP, while in the case of no MNP availability, other peripheral factors, such as the inconvenience of changing number and payment burden are also influential factors to the willingness to churn.

The results show implications that mobile carriers should have more concern with service quality and price under the MNP market situation than before. Their core competence should rest on increasing service quality and reducing the price. For the policy maker, it is shown that the MNP will fulfill the policy objectives, which is increasing market competition and reinforcing the customers' welfare. Moreover, the competition will be shown by the core competition tools, such as quality and price.

7. FUTURE STUDIES

This research study has some limitations. First, the data is derived from the Korean market. In future study, the comprehensive data needs to generalize the model. In terms of methodology, some variables need to be checked for validity. Although most variables are measurable objectively, some variables are necessary to check the internal validity.

The second issue is how to choose between the linear discriminant analysis and non-linear data mining method. Linear discriminant analysis determines linear separators and neural networks compute non-linear decision surfaces (Bradley, Fayyad, and Mangasarian, 1999). Data mining methods are still disputable on whether those methods explain the causal relationship, although those methods show higher hit ratio. In future study, the combination of two different approaches will be analyzed.

Whether the satisfaction handsets bring is the influential factor is disputable. In this study, the variable is excluded due to lack of consensus on the issue. The satisfaction to handsets might be an influential factor to subscribers' churn in the market. In future study, the factor should be examined.

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