TELKOMNIKA Indonesian Journal of Electrical Engineering
Vol.12, No.2, February 2014, pp. 1416 ~ 1423
DOI: http://dx.doi.org/10.11591/telkomnika.v12i2.3822

The Switching Choices of Subscribers in China Mobile Market

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Abstract

The exploratory research on subscribers' switching choice has vital theoretical and practical value. We present eighteen factors which influence subscribers' switching choice, and then establish a Discrete Choice Model (DCM) for subscribers' switching choice of the 3G/4G operators in China. With a consumer oriented perception, variables are divided into four parts, including subscriber's characteristics, mobile usage traits, terminal needs and satisfaction. Based on the survey data supported by China Academy of Telecommunication Research of MIT, the study illustrates that there are six factors significantly affects the subscribers switching choice respectively in two scenarios(with MNP or not), but in either scenario they are not all the same.And meanwhile the model predicts the subscribers' choice with high accuracy, so it canprovide a strong evidence for operators' decision-making of subscription design and 3G/4G marketing strategies, and enhance their subscriber holdings. At last, it will support the authority to make proper asymmetric Mobile Number Portability (MNP) policy.

Keywords*: custom behavior, switching choice, discrete choice model, mobile number portability, mobile internet*

1. Introduction

In recent years, the subscribers of mobile internet are increasing rapidly because of the era of 3G/4G. The huge resource of customers is the basement for the operators' development, and they need to hold on old customers and absorb new ones gradually. Fierce competitions in telecommunications are demanding more for the operators and how to maintain more customers becomes the keypoint to win in this field.

The market of China's mobile communications is seized by three carriers, but they are in a serious imbalance competition. With the era of 3G and full-service operation, all operators launch comprehensive contests in the aspects of product, brand and service. And MNP is adopted by more countries as a landmark policy to promote effective competition. So the tests of MNP are launched formally in Tianjin and Hainan in November 22, 2010, which will break the operator's lock of subscribers.

Therefore, how to analyze the factors affecting subscribers' switching choice is vital mean to win in mobile market.And so we launch the research.The communication technology is advancing so quickly, but the theoretical study of switching behavior is relatively scarce all over the world, especially referring MNP. Then we choose China Unicom to investigate because of its global mainstream 3G technology (WCDMA). Based on empirical data of the Sichuan subscribers of China Unicom, we make research on switching behavior of consumers with the MNP or not, providing a support for the operator's development and the formulation of the MNP for the Ministry of Industry and Information.

So the research benefits the operators a lot from the practical value and it also introduces a new effective and succinct research framework for the switching choice in China mobile market rather than the traditional methord, such as structural equation modeling. And the conclusions are consice, effective and explicit for both theoretical and practical usages.

Received July 4, 2013; Revised August 29, 2013; Accepted September 21, 2013

2. The Proposed Method

Majority of Scholars studies the attractiveness of the operators, customer satisfaction, loyalty, and switching intention in mobile market. Yet, the related researches are not thorough and comprehensive, only staying at the level of structural equation analysis(SEA) or industry strategies, lacking of enough samples, deep data mining and proper modeling.

2.1. Switching Intention

The research of switching choice mainly focuses on switching intention. Keaveney (1995) defines switching intention as that the customer's psychological tendencies to stop the consumption of the current brand or transfer to others [1]. Bitner (1990) speculates that the switching behavior may occur owing to the constraints of time or money, the lack of alternatives, switching costs and habits [2]. Ganesh (2000) points out that the switching behavior stems from consumer switching intention and that the attitude after usage impacts the customer's repurchase and switching intention directly [3]. Burnham (2003) investigates the U.S. long-distance telephone market, finding that the switching costs significantly influences consumers' intentions to keep on their usage [4]. Kim and Kwon (2003) test that network size matters the choices when new subscribers choose their service providers in Korean [5]. Corrocher and Zirulia (2009) show that the consumers are more likely to choose the same operator because of their friends and family [6]. Pratompong Srinuan (2011) sets a study about the Thai cellular market and finds four dimensions affecting switching choice [7]. Tülin Durukan (2011) examines the effects of the MNP and then scrutinized the relationships among MNP application satisfaction, perceived public illumination activities and knowledge about the application with the intention to switch the operator [8]. Yi Fei Chuang (2011) investigates the factors that influence subscribers' switching intentions in Taiwan mobile market and finds that there are pull effects encouraging subscribers to switch and suck effects motivating them to stay [9].

2.2. MNP

The MNP is mainly about the scope of mobile number portability, referring that consumers are free to convert to other operators without changing mobile number. There are two modes in the MNP policy: symmetric MNP and asymmetric MNP. The symmetric MNP allows switch without changing mobile number. The asymmetric MNP only permits to transfer from dominant carriers into others.

As a controlling policy, MNP helps to build an effective competitive environment, curb the market imbalance and protect the users' welfare.

Klemperer (1987) segments the switching costs, analyzes the impact of switching costs on the telecommunication market and puts forward three types of switching costs: transaction costs, learning costs, and contract costs [10, 11]. Burnham (2003) holds the idea that the switching costs includes all the resources you would giveup, such as economic, time, effort, psychological, interpersonal resources [4]. Jongsu (2006) carries on a research in Korean mobile market with correlation analysis showing that the switching costs have been lowered considerably since MNP has been in force. However, a significant level of switching costs remains despite MNP [12]. Rafique (2011) analyzes the satisfaction level of customers by variables such as the price, call clarity, user friendliness, value-added services, support services and customer complaints after MNP was introduced by Pakistan Telecommunication Authority [13]. Chen Wenpei analyzes the effects of different types of switching costs on customer loyalty and finds that the program switching costs have little effect while the relationship switching costs have a significant negative impact [14, 15].

In summary, there are a few researches on switching intention in the past ten years. Most scholars try to propose some variables affecting the switching intention, and then use SEA to identify. Yet, it is hard to measure and quantify the intention and preferences, and some SEA need strict hypothesis, or even too complicated. And so we present the DCM to describe the switching choice. It's simple, but effective. It's easy to use, but you must try hard to get enough empirical datas and screen the proper samples. Now it is a new time for data mining of E-commerce [16, 17]. The major difference between DCM and the traditional analysis is that the DCM measures the customers' choices rather than their preferences. The choice is nearer to consumers' actual behaviors and the customer only need to answer "yes" or "no". So, we can get the data more succinctly and accurately, and the results will be more practical and effective for research and industry.

3. Research Method

3.1. The Basic Data analysis

By means of interviewing and telephone follow-up in this research, we survey subscribers of China Unicom in dozens of areas in Sichuan Province, covering 21 cities, such as Chengdu, Mianyang, Dazhou, Yibin, Meizhou and so on. There are 800 questionnaires among which 501 of them are valid, and 146 valid samples come from Chengdu and rest are from the other 20 cities. We design the questionnaire considering 4 aspects including subscriber's characteristics, needs of mobile usage, terminal demand and satisfaction, and measure dependent variables of 18 dimensions and response variables of two dimensions. Subscriber's characteristics include gender, age, whether is native, whether is urban, work and income status. Needs of mobile usage include the number of numbers, telephone charge, calling time, whether surfing on mobile Internet, surfing cost and surfing time. Terminal demand includes 3G terminal usage and terminal change plan. Satisfaction includes subscription satisfaction and support service satisfaction. The response variables of two dimensions represent switching choice with MNP or not respectively, 1 represents switching and 0 means not. Basic statistics on the variables above are showed in Table 1.

Table 1. Socio-demographic and Mobile Usage

Socio-demographic information				Mobile usage and the intention to switch			
		Frequency	Ratio			Frequency	Ratio
Gender	Male	340	67.86%	month cost	<=20	17	3.39%
	Female	161	32.14%		20-49	124	24.75 %
Age	<=15	9	1.80%		50-79	107	21.36%
	16-25	219	43.71%		80-119	119	23.75%
	26-35	136	27.15%		120-200	81	16.17%
	36-45	73	14.57%		201-299	26	5.19%
	46-55	35	6.99%		=>300	27	5.39%
	=>56	29	5.79%	month calling time	<=150	85	6.96%
Native	No(0)	162	12.38%	(minute)	151-300	106	21.16%
	Yes(1)	439	87.62%		301-600	153	30.54%
City	country	163	32.53%		>600	157	31.34%
	city	338	67.47%	Internet	No(0)	125	24.95%
Job	Government officer	6	1.2%	usage	Yes(1)	376	75.05%
	Private officer	287	57.29%	3G usage cost/month	<=20	247	49.30%
	Migrant workers	51	10.18%		>20	254	50.70%
	unemployed	156	31.14%	satisfaction of subscription	No(0)	148	29.54%
Sim-cards	1	304	60.68%		Yes (1)	353	70.46%
	2	158	31.54%	satisfaction of support	No (0)	152	30.34%
	3	27	5.39%	service	Yes (1)	349	69.66%
	4	12	2.40%	3G mobile phone	No (0)	164	32.73%
				usage	Yes (1)	337	67.27%

3.2. Utilitarian Model of Switching Choice

DCM is mainly used to measure how consumers choose among different products/services in real or virtual market. The most vital assumption of DCM is that consumers understand and choose the products/services according to its multiple attributes and tend to choose the one with more utility. Another fundamental assumption means that compared with preference, the choice is much closer to the reality. It can be widely used in product development, market share, brand competition analysis, market segmentation and pricing strategy. Meanwhile, it is also a kind of processing discrete, nonlinear complex advanced techniques of multivariate statistical analysis of qualitative data, generally using the binomial and Multinomial LOGIT model. This paper adopts binomial LOGIT model.

In DCM, the subscript i indicates different subscribers of China Unicom. Dependent variable y_i (equals 0 or 1) represent the subscriber's specific choice, the variables influencing the subscriber's choice are X_i.We use U_i^1as the utility of person i who switch the operator, and U_i^0represents he do not. Their utility are random variables, and then

$$\begin{cases} U_i^1 = \alpha_1 + X_i'\beta^1 + u_i^1 \ldots\ldots (1) \\ U_i^0 = \alpha_0 + X_i'\beta^0 + u_i^0 \ldots\ldots (2) \end{cases}$$

Subtracting the two type

$U_i^1 - U_i^0 = (\alpha_1 - \alpha_2) + X_i'(\beta^1 - \beta^0) + (u_i^1 - u_i^0)$

denoted:

$y_i^* = U_i^1 - U_i^0 \;\; \alpha^* = \alpha_1 - \alpha_2 \;\; \beta^* = \beta^1 - \beta^0 \;\; u_i^* = u_i^1 - u_i^0$

This is the breakthrough point of the binary choice model. It called Y_i^* as transition variable, and can't be observed. When Y_i^* is greater than zero, then you should choose "1", namelyswitching; otherwise, staying.

$$p(Y_i = 1) = p(Y_i^* > 0) = p(u_i^* > -\alpha^* - x_i'\beta^*) = 1 - F(-\alpha^* - X_i'\beta^*)$$

So,

$$p(Y_i = 0) = p(Y_i^* \le 0) = p(u_i^* \le -\alpha^* - x_i'\beta^*) = F(-\alpha^* - X_i'\beta^*)$$

Therefore,

$$p(Y_i = 1) = p(Y_i^* > 0) = p(u_i^* > -\alpha^* - x_i'\beta^*) = 1 - F(-\alpha^* - X_i'\beta^*) \cdots\cdots (3)$$

$$p(Y_i = 0) = p(Y_i^* \le 0) = p(u_i^* \le -\alpha^* - x_i'\beta^*) = F(-\alpha^* - X_i'\beta^*) \cdots\cdots (4)$$

Through the Y_i^*, the variables are associated with the probability of event to occur. It provides the probability of a potential structure model. We choose the logistic function as $F(\cdot)$ distribution function. The model which we use the logistic function in is called a LOGIT model. The logic function (LOGIT)$\Lambda(x) = F(x) = \frac{1}{1+\exp^{-x}} = \frac{\exp^x}{1+\exp^x}$, into (3) type $\ln\frac{p(y_i=1)}{1-p(y_i=1)} = Xi'\beta + ui$(5). We call (5) as logistic regression model.

In (3) $p(Y_i = 1)$ is the probability that the subscriber i will switch from China Union, and X_i is a vector of subscriber socio-demographic characteristics (x1 to x8), subscription traits (x9 to x14), the terminal choice (x15 x16) and satisfaction of China Union Services (x17 x18). β is the parameter vector to be estimated by method of maximum likelihood and $F(\cdot)$ is the cumulative logistic distribution function. In (3), the parameters relate changes in the explanatory variables to the direction of changes in the switching probability.

Table 2. Description of Variables

Variable	Description
(x1)Gender	=1 if the respondent is male; Otherwise=0
(x2)Age	Subscriber's age
(x3)Native	=1 if the respondent is native; Otherwise=0
(x4)City or Village	=1 if the respondent lives in city; Otherwise=0
(x5)Government officer	=1 if the respondent is employed by a government agency; Otherwise=0
(x6)Private officer	=1 if the respondent is employed by a private company; Otherwise=0
(x7) Migrant workers	=1 if the respondent is Migrant workers; Otherwise=0
(x8) income	=1 if income is less than 1500 RMB; Otherwise=0
(x9)the number of mobile numbers	1: one 0: more than one
(x10) cost in each month	1: below 120 0: 120 and above
(x11) calling time in each month	1: below 300 minutes 0: 300 minutes and above
(x12) mobile Internet usage	1: Yes 0: No
(x13) cost for mobile internet	1: below 20 0: 20 and above
(x14) time for 3G usage	1: within an hour 0: other answers
(x15) Whether hold 3G terminal	1: Yes 0: No
(x16)3G terminal switching plan	1: Yes, plan to 0: No, don't
(x17) subscription satisfaction	1: satisfied 0: not satisfied
(x18) support service satisfaction	1: satisfied 0: not satisfied
(y1) without MNP	1:switching 0: not switching
(y2) MNP	1:switching 0: not switching

This study relates the ‘‘switching choice’’ to 18 factors. The value of the dependent variable was set to 1 when the subscribers were going to switch operator in the next three months and to 0 for not switching, and meanwhile we considered the decision in two scenarios, with MNP or not. The explanatory variables involved in this model are displayed and described clearly in Table 2.

4. Results and Discussion

4.1. Scenario 1 the Market without MNP

Table 3. Estimation Results in Scenario I (without MNP)

The LOGISTIC Procedure

Model information			
Response	choice		
Response level	2		
Model	binary logit		
Optimization	Fisher's sconng		
Observations Reed	501		
Observations Used	501		

Response Profile

Ordered Value	choice	Total Frequency
1	1	54
2	0	447

Probability modeled is choice=1

Predicted Probabilities and Observed Responses

Concordant %	72.0	Somers'D	0.477
Discordant %	24.3	Gamma	0.495
Percent Tied	0.7	Tav-a	0.092
Pairs	24138	c	0.738
Concordant %	72.0	Somers'D	0.477

Analysis of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pt>ChiSq
Intercept	1	1.6296	0.6672	5.9667	0.0146
x1	1	1.1619	0.4113	7.9822	0.0047
x8	1	0.5798	0.3219	3.2441	0.0717
x12	1	1.2500	0.4879	6.5633	0.0104
x14	1	0.8600	0.4504	3.6456	0.0562
x16	1	0.7901	0.3142	6.3223	0.0119

Odds Ratio Estimates

Effect	Point Estimates	95% Wald Limits	Confidence
x1	3.196	1.427	7.156
x8	1.786	0.950	3.356
x12	0.296	0.110	0.745
x14	0.423	0.175	1.023
x16	2.204	1.190	4.079
x17	0.333	0.179	0.617

In Table 3, when no MNP, the results discover that the probability of subscribers switching is dependent on gender (x1), low incomes (x8), internet usage (x12), time for 3G usage (x14), 3G terminal switching plan (x16) and satisfaction of support service (x17). And x1, x8, x16 are positively correlated with the switching choice, while x12, x14, x17 are negatively correlated with the switching choice.

Among the positive factors, gender (x1) shows that men are more likely toswitch. As shown in Odds Ratio Estimates, Point Estimate of x1 equals 3.196, and it means that the male’s switching probability is 3.196 times as much as the female’s withother variables fixed. So the operators need to spend more to retain the male and for the female with relatively high loyalty, the cost is much lowerand some preferential policies may be effective. The low-income’s switching probability is 1.786 times as muchas the others’. Since the low-income are usually price-sensitive, the operators can provide more preferential subscription on their acceptable price level, such as increasing the amount of subscription or SMS plans, to enhance the utility of them. The switching probability of 3G terminal holder is 2.024 as muchas the others’, which shows that the bundled terminal plans take effects.

For the negative factors, the switching probability of mobile internet users (x12) is only 0.286 times as muchas the others’. Similarly, the switching probability of long-time 3G users (x14) is only 0.243 times as high as the others’. The both variables illustrate that the 3G users are satisfied with the 3G service of local Unicom, and then it should promote the 3G service for more customers to cultivate their 3G usage wont. What’s more, the switching probability of satisfied subscribers is only 0.333 times as muchas the others’, which shows the high-quality subscription provided by Sichuan Unicom can effectively hold the subscribers.

Base on Response Profile table, we can get the regression equation:

$$\log\left[\frac{\mathrm{p(y1=1)}}{1-\mathrm{p(y1=1)}}\right] = -1.6296 + 1.1619 * \mathrm{x1} + 0.5798 * \mathrm{x8} \\ -1.25 * \mathrm{x12} - 0.86 * \mathrm{x14} + 0.7901 * \mathrm{x16} - 1.1011 * \mathrm{x17}$$

Then we can effectively predict one's switching probability, by putting the six parameters into calculation. And Percent Concordant=0.72 shows the model has strong predictive ability. The larger Percent Concordant is, the stronger the predictive ability of the model has.

4.2. Scenario 2 the Market with MNP

Table 4. Estimation Results in Scenario II (with MNP)

The LOGISTIC Procedure				**Analysis of Maximum Likelihood Estimates**			
Model information		Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pt>ChiSq
Response	choice	Intercept	1	-0.5227	0.3946	1.7543	0.1853
Response level	2	x6	1	0.9275	0.3371	7.5714	0.0059
Model	binary logit	x8	1	0.6507	0.3555	3.3501	0.0672
Optimization	Fisher's sconng	x10	1	0.00225	0.00119	3.5888	0.0582
Observations Reed	501	x15	1	-0.3657	0.2064	3.1374	0.0765
Observations Used	501	x17	1	-0.6209	0.2054	9.1415	0.0025
Response Profile				**Odds Ratio Estimates**			
Ordered Value	choice	Total Frequency		Effect	Point Estimates	95%Wald Limits	Confidence
1	1	201		x6	2.528	1.306	4.895
2	0	300		x8	1.917	0.955	3.848
Probability modeled is choice=1				x10	1.002	1	1.005
Predicted Probabilities and Observed Responses				x15	0.694	0.463	1.04
Concordant %	64.1	Somers'D	0.289	x17	0.537	0.359	0.804
Discordant %	35.2	Gamma	0.291	x18	0.739	0.494	1.104
Percent Tied	0.6	Tav-a	0.139				
Pairs	60300	c	0.644				
Concordant %	64.1	Somers'D	0.289				

In Table 4, when implementing MNP, the result shows that private officer (x6), low incomes people (x8), month cost (x10), 3G terminal holds (x15), satisfaction of subscription satisfaction (x17) and support-service satisfaction (x18) can explain significant effects of the switching choice. And x6, x8, x10 are positively correlated with the switching choice, while x15, x17, x18 are negatively correlated with the switching choice.

Among the positive factors, Private Employee (x6) shows that private employees are more likely to make the switching choice. As shown in Odds Ratio Estimates, Point Estimate of x6 equals 2.528, and means that the switching probability of private employees is 2.528 times as much as the non-private employees' when other variables are fixed. With more job mobility and less bonus, the private employees tend to choose the subscription which is cheap and more convenient to their jobs. So operators should design more preferential subscription besides the high-quality products and services to prevent the loss of customers. The switching probability of the low-income is 1.917 times as much as the others'. Since the low-income are usually price-sensitive, the operators meet their demand on a acceptable price level, such as increasing the amount of voice pakage or SMS plans The switching probability of users with high average cost in each month (x10) is 1.002 times as high as the others'. Operators should provide better service to enhance the loyalty of them to keep profits and advantage.

For the negative factors, the switching probability of the satisfied with voice service (x17) is only 0.537 times versus the unsatisfied. Operators should try to improve the quality of voice sevice. The switching probability of 3G terminal users (x15) is 0.694 times vesus non-3G terminal users, showing that 3G satisfaction affects the switching a lot, operators should design more 3G subscription and terminal bundled policies to spread the 3G usage. The switching probability of the satisfied with the support service (x18) is 0.694 times vesus the unsatisfied,

therefore the operators should improve overall quality of service to increase customer satisfaction.

Base on Response Profile, we get the regression equation:

$$\log\left[\frac{\mathrm{p}(\mathrm{y2}=1)}{1-\mathrm{p}(\mathrm{y2}=1)}\right] = -0.5227 + 0.9275 * \mathrm{x6} + 0.6507 * \mathrm{x8} + 0.00225 * \mathrm{x10} - 0.3657 * \mathrm{x15} - 0.6209 * \mathrm{x17} - 0.3025 * \mathrm{x18}$$

Then we can effectively predict the probability switching via this equation, by putting the 6 parameters into calculation. And Percent Concordant=0.64 shows the model has strong predictive ability, however, comparing with the MNP scenario (0.72), it has a slight decrease, showing that MNP intensifies the competition and increases the possibility and randomness of switching, thus reduces the prediction accuracy.

In totally comparing to others' researches, we have several contributions. The very first one is that most scholars study on this problem use the SEA, which is too complicated and ineffective for the subscribers real choices, and meanwhile, cause it refers to so many conception and indirect relationships between variables, so it is hard for the opertators to utilize the conclusions to make strategies. In short words, they are concise and effective enough. The second is that many models about this is static. It means that it can only decribe the facts, but can't adjust the parameters dynamicly, and in our research every time you get new samples you can add it into the model more easily, and the results will be more accurate. The third one is that our model can predict the subscribers' choice more accurately and effective, and if you continuously get samples from the customers, the prediction will be better. The fourth one is that we really do so many interviews that we know China mobile market better, and the China mobile market is so large and has many different traits from others, yet we haven't found someone investigate, survey and analyse like us.

5. Conclusion

In this study, without MNP, the gender (x1), low incomes (x8), 3G/4G terminal switching plan (x16) are positive for switching, while internet usage (x12), time for 3G/4G usage (x14), support service satisfaction are negative for switching, and this model has well prediction on switching owing to its high Percent Concordant up to 0.72.

With MNP, Private officer (x6), low incomes people (x8), month cost (x10) are positive for switching, while 3G/4G terminal usage (x15), subscription satisfaction (x17), support service satisfaction (x18) are negative for switching. And the prediction effect of the model has a slight decrease owing to the Percent Concordant down to 0.64. This model can effectively evaluate the factors that affect the switching choice and predict users switching probability, which is very useful for the operators in making market strategies to hold more subscribers.

For theoretical value, this research firstly applied DCM to the quantitative analysis of the switching choice in China 3G market. So it provides an effective method for the switching behavior research, broadening the application field of DCM. And the accurate quantitative results are convincing, effective and valuable. At the end, it is also an amazing way to excavate the subscribers' behavior pattern via the abundant datas of the operators.

For practical value, it helps the operators know more about their subscribers' loyalty, satisfaction, price sensitivity and so many quantifiable factors. It also helps them to discern the trends of market. Specificly, the MNP increased the switching ratio from 0.1078 to 0.4012, and intensify competitionThis model can effectively evaluate the factors that affect the switching choice and predict users switching probability, which is very useful for the operators in making market strategies to hold more subscribers.

From the view of market regulation, it shows that the impact of implementing symmetric MNP would be harmful for smaller operators. Since local Unicom is in a disadvantage, the asymmetric regulation should be practiced, only allowing subscribers to transfer from dominant operator to others, so as to balance the telecom market equilibrium and curb the monopoly.

Although we have done a full and accurate work, there are still that we can do better. The first is that we are supposed to compare all the three operators, not only the China Union. The second means we should have to compare different regions in China mobile market, not

only Sichuan. So the next plan is to investigate zhe neighbours of Sichuan province, such as Tibet and Guizhou.

In summary, this model aims to reveal the important variables that influence the decisions of mobile subscribers, and can also predict the level of switching probability of mobile subscriber to find out the most disloyal subscribers, and then take some effective strategies to reduce the level of switching probability and absorbing more subscribers.

Acknowledgements

This work was supported by Humanities and Social Sciences Fund Project, Ministry of Education of the PRC, Grant No. 11YJA630081 (planning project) and Grant No. 11YJA630109(general project); Project 11YJA630109 supported by; Project 71271032 supported by National Natural Science Foundation of China;

References

[1] Susan M Keaveney. Customer Switching Behavior in Service Industries: An Exploratory Study. *Journal of Marketing.* 1995; 59(2): 71-82.
[2] Mary Jo Bitner, Bemard H Booms, Mary Stanfield Tetreault. The Service Encounter: Diagnosing Favorable and Unfavorable Incidents. *Journal of Marketing*. 1990; 54(1):71-84.
[3] Ganesh, J Arnold, MJ Reynolds, KE. Understanding the customer base of service providers: an examination of the differences between switchers and stayers. Journal of Marketing. 2000; 64(3): 65-87.
[4] Burnham TA, Frels J, Mahajan V. Consumer switching costs, a typology, antecedents, and consequences. *Journal of the Academy of Marketing Science*. 2003; 31(2): 109-126
[5] Kim H, Kwon N. The advantage of network size in acquiring new subscribers: a conditional logit analysis of the Korean mobile telephony market. *Information Economics and Policy*. 2003; 15(1): 17-33.
[6] Corrocher N, Zirulia L. *Me and you and everyone we know: an empirical analysis of local network effects in mobile communications.* Telecommunications Policy. 2009; 33(1-2): 68-79.
[7] Pratompong Srinuan, Mohammad Tsani Annafari, Erik Bohlin. *An analysis of switching behavior in the Thai cellular.* Market Information. 2011; 13(4): 61-74.
[8] Tülin Durukan, İbrahim Bozacı, Taylan Taner Doğan. Mobile Number Portability in Turkey: An Empirical Analysis of Consumer Switching Behavior. *European Journal of Social Sciences*. 2011; 20(4): 572-585.
[9] Yi-Fei Chuang. *Pull and suck effects in Taiwan mobile phone subscribers switching intentions.* Telecommunications Policy. 2011; 35(2): 128-140.
[10] Klemperer PD. The competitiveness of markets with switching costs. *The Rand Journal of Economies*. 1987; 18(1): 138-150.
[11] Klemperer P.D. Markets with Consumer Switching Costs. Quarterly Journal of Economics. 1987; 102(2):375-394.
[12] Jongsu. Estimating the extent of potential competition in the Korean mobile telecommunications market: switching costs and number portability. *International Journal of Industrial Organization*. 2006; 24(1): 107-124.
[13] Rafique Ahmed Khuhro. Customer satisfaction in telecom industry after mobile number portability. *Interdisciplinary Journal of Contemporary Research in Business.* 2011; 3(8): 840-847.
[14] Chen Wenpei, Chen Qiang. *The empirical research on the effect of switching costs on consumer loyalty.* Guide to Business. 2012; 24(1): 34-36.
[15] Lee J. The impact of switching costs on the customer satisfaction-loyalty link: mobile phone service in France. *Journal of Service Marketing*. 2001; 15(1): 35-48.
[16] Qishen Zhou, Zuowei Yin, Qiu Ying, Shanhui Wang. Intelligent Data Mining and Decision System for Commercial Decision Making. *TELKOMNIKA Indonesian Journal of Electrical Engineering*. 2014; 12(1).
[17] LU LIAN. A Brief Analysis into E-commence Website Mode of the Domestic Luxury. *TELKOMNIKA Indonesian Journal of Electrical Engineering.* 2014; 12(1).