Research on Prediction Model of the Impact of New Telecom Services Tariff Based on the Customer Choice Behavior

JIANG Xin-kuang[1,a], CHEN Xu[2]

[1,2]School of Management and Economics, University of Electronic Science and Technology of China, Chengdu, 610054, China.

[a]shallots918@gmail.com

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Abstract. This paper studies the impact of new telecom services tariff on the customers inside (customers who have ever chosen the original telecom service packages) and the revenue variation from the perspective of utility and customer choice behavior. On the basis of the quantification of telecom services tariff, a measurement model is built through multi-nominal logit(MNL) choice rule to predict the impact. Important indicators such as utility of service packages, transfer probability of the customers inside and expected change of revenue are obtained, which are useful for market orientation, revenue prediction and optimization management of the new telecom services tariff.

Introduction

As communication technologies develop constantly and the telecom operators promote all-business operation, the competition advantages based on technology start to fade away. Every leading operator is trying to launch products and service packages to meet customers' needs, so telecom services tariff is not a new conception for most people. Now the telecom market is complex and ever-changing, according to the different development requirement in various periods, telecom operators launch various sorts of new service packages. Since promotion of new telecom service packages concerns not only product orientation and operating income for telecom operators but also service perception and acceptance for customers, scientific and reasonable analysis of prediction is imminently needed. However, the management level of telecom services tariff, as it is now, is unable to keep pace with the development level seriously, and analysis methods on the impact of new service packages are scarce.

In recent years, several studies have focused on the telecom services tariff preview and the amount of customers influenced by it. Shin-Yuan Hung, etc.(2006)[1] compare various data mining techniques by using customer demographics, billing information, contract/service status, etc. and build accurate churn prediction models; Liu and Chen(2008)[2] propose a model of packages with analysis of current package preview, which is proved effective on actual package data of telecom enterprise; Hyunchul Ahn, etc.(2011)[3] propose a customer classification model, predict the purchase of cross-selling products and produce the results of prediction as a form of probabilities by applying various data mining techniques. Jia, etc. (2011)[4] research the prediction of the amount of the new customers and the transfer customers, use decision tree algorithm to find the transfer rules of customers. Hou, etc.(2011)[5] analyze several kinds of prediction models of mobile communication customers and obtain the best one through the prediction error analysis. Zhang, etc.(2012)[6] establish a design method of telecom services tariff based on customer lifetime value which applies to the assessment of new service packages through empirical research. The researches above on the impact of new service packages on the amount of customers and revenue are mostly on basis of data mining techniques and refer to customer choice behavior only in the aspect of assessment of customer value, all of which do not consider the customer choice behavior in prediction of the impact of new telecom service packages.

Above all, in the aspect of the theoretical research, prediction of the impact on customers and revenue in telecom services tariff mostly is done by using the single method: data mining techniques,

which lacks the analysis of customer behavior. Therefore, this paper analyzes the prediction of impact of new telecom services tariff, which does not only make up the deficiency of current researches but also provide guidance for telecom operators in management practice.

Issues

Telecom operators launch new telecom services tariff in the target market, which is designed more reasonable. However, it may be not popular with customers. To the customers in telecom market, there are two choices: transfer to the new services tariff, or continue to use the existing one. Obviously, if the new services tariff is more attractive, the customers inside network would transfer to the new one, that leads to changes in expenditure and then influence the revenue.

In this paper, we consider that a telecom operator is going to launch a new services package N, the promotion of which will influence the existing services package $S_j (j = 1,2,\ldots,t)$. All the tariff content of services package N and services package S_j is known as well as the customers' bill of services package S_j. The impact of new services package N on customers inside and revenue variation needs to be confirmed.

Models and Analysis

Before the construction of specific models, the tariff content of telecom services package needs to be quantified. Through our investigation and research, four indexes are extracted to describe a whole services package tariff: service composition, monthly subscription fees, free quantity of every specific service and extra unit price of every specific service (unit price of the usage over free quantity). The concrete description is shown in the following table.

Table 1 The quantization of services package tariff

Index	service composition	free quantity of every specific service	monthly subscription fees	extra unit price of every specific service
Representative	the name of every service	l_k^N	P^N	p_k^N
Form	text set	real number set	real number set	real number set
example	{local calls, SMS, internet…}	{100 mins, 50 SMS, 80 MB…}	40 yuan	{0.2yuan/min, 0.1yuan/SMS, 0.3yuan/MB…}

Utility of Service Packages. After the launch of a new services package, the customers inside are faced with the choice that whether transfer to the new one or not. So we propose the utility of service packages as measurement conception and assume that customers do not transfer to the new services package unless it is larger than the existing one. The customers' preference for product of telecom services package largely depends on price, which is different from generic products[6]. So without regard to the difference in brands, hardware of operators and service quality, we define the utility of services package to customers as follow:

$$U_i = B_i - R_i \qquad i = 1,2,\ldots,n$$

$U_i^{S_j N}$ and $U_i^{S_j}$ respectively represent the utility of services package N and S_j to the customer i using services package S_j, $B_i^{S_j N}$ and $B_i^{S_j}$ respectively represent the psychological expectation payment for services package N and S_j by the customer i using services package S_j, $R_i^{S_j N}$ and $R_i^{S_j}$ respectively represent the actual payment for services package N and S_j by the customer i using services package S_j.

The actual payment $R_i^{S_j}$ can be obtained from the customers' bills, and $R_i^{S_j N}$ can be calculated as follows.

$$R_i^{S_j N} = P^N + \sum_{k=1}^{m_j} p_k^N q_{ijk} \qquad (i = 1,2,\ldots,n_j \ ; \ j = 1,2,\ldots,t)$$

$$q_{ijk} = \begin{cases} h_{ijk} - l_k^N & , \ h_{ijk} > l_k^N \\ 0 & , \ h_{ijk} \le l_k^N \end{cases} \qquad (i = 1,2,\ldots,n_j ; \ j = 1,2,\ldots,t \ ; k = 1,2,\ldots m_j)$$

The meaning of P^N, p_k^N, and l_k^N is shown in table 1, and h_{ijk} represents the usage of service k of the customer i using services package S_j. q_{ijk} represents the usage over free quantity of service k of the customer i using services package S_j.

Customer Choice Probability. The odds of customers purchasing a product mainly depend on their perception of product utility. However, not all customers will transfer when the utility of the new service package N is better than that of the original package S_j because they are not absolutely rational. The tendency of transferring is also influenced by the subjective factors, therefore we introduce the concept of choice probability $P_i^{S_j N}$ to describe the possibility of customers transferring from package S_j to package N. In terms of the choice probability rule, many choice models were widely approved in the past based on customer utility function. Among those models, the quality-based choice model and MNL(Multi-Nominal Logit) model are relatively typical[8]. According to the research of Susan H. Xu and Y. Akcay[9], we may conclude that it is best to use quality-based choice model for the products whose quality can be arranged in order, otherwise, it is more appropriate to use MNL model. For the telecom package products, the various packages provided by different operators have their distinctive features, leading to implicit prices and difficulties in comparison to each other, therefore we adopted the most commonly used probability choice rule ---Multi-Nominal Logit Choice Rule for its calculation. According to this rule, we may obtain the customer transfer probability expression as follows.

$$P_i^{S_j N} = \frac{e^{\mu U_i^{S_j N}}}{e^{\mu U_i^{S_j N}} + e^{\mu U_i^{S_j}}} \qquad i = 1,2,\ldots,n_j ; \ j = 1,2,\ldots,t$$

$P_i^{S_j N}$ refers to the probability of customer i in package S_j transferring to package N. μ is a proportion parameter, which can be determined by inverse method and scaled based on the data of actual market share investigation. We establish each customer's probability of transferring in the influenced package S_j, which can intuitively reflect the transferring possibility of each customer when facing the new packages.

Revenue Variation. Based on the above consumer expenditure and customer choice probability, we can obtain the expected revenue variation resulting from the impact of new packages on users inside.

$$E(\Delta R) = \sum_{j=1}^{t} \sum_{i=1}^{n_j} \beta_{ij} \cdot P_i^{S_j N} \cdot \left(R_i^{S_j N} - R_i^{S_j} \right)$$

$E(\Delta R)$ refers to the expected value of revenue variation. We use expected value to describe income variability based on choice probability. We also use a stated variable β_{ij}, which is calculated as follows.

$$\beta_{ij} = \begin{cases} 1 & U_i^{S_j N} > U_i^{S_j} \\ 0 & U_i^{S_j N} \le U_i^{S_j} \end{cases} \qquad i = 1,2,\ldots,n_j \ ; \ j = 1,2,\ldots,t$$

Its value is determined by the utility of customer i using package N and package S_j, it means that the customer will be likely to transfer to the new package only when utility of new package is bigger than the old one.

In conclusion, we obtained the most important two measurement index regarding the impact prediction of new package: customer transfer probability and expected revenue variation.

Conclusions

This paper studies the impact preview of new telecom services tariff from the utility and customer choice behavior perspective, obtain the transfer probability of customers inside and the expected revenue variation. According to the transfer probability, operators is able to learn the degree of preference for new service tariff and implement differential management by different approaches of marketing and service; according to the expected revenue variation, conditions of risk and revenue can be estimated intuitively. Both of them would greatly benefit the revenue management for telecom enterprises.

This paper researches the impact on the customers inside with no regard to the customers outside the network who is willing to choose the new telecom services tariff, however, all the customers of new telecom services include two parts: customers inside and outside. So the further study can be conducted on the impact of new telecom services tariff on the customers outside the network.

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