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 can provide 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

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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 method, such as structural equation modeling. And the conclusions are concise, effective and explicit for both theoretical and practical usages.
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.

Klempere (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 give up, 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>
<thead>
<tr>
<th>Table 1. Socio-demographic and Mobile Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td><strong>Age</strong></td>
</tr>
<tr>
<td>&lt;=15</td>
</tr>
<tr>
<td>16-25</td>
</tr>
<tr>
<td>26-35</td>
</tr>
<tr>
<td>36-45</td>
</tr>
<tr>
<td>46-55</td>
</tr>
<tr>
<td>&gt;=56</td>
</tr>
<tr>
<td><strong>Native</strong></td>
</tr>
<tr>
<td>No(0)</td>
</tr>
<tr>
<td>Yes(1)</td>
</tr>
<tr>
<td><strong>City</strong></td>
</tr>
<tr>
<td>country</td>
</tr>
<tr>
<td>city</td>
</tr>
<tr>
<td><strong>Job</strong></td>
</tr>
<tr>
<td>Government officer</td>
</tr>
<tr>
<td>Private officer</td>
</tr>
<tr>
<td>Migrant workers</td>
</tr>
<tr>
<td>unemployed</td>
</tr>
<tr>
<td>Sim-cards</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

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 $U_i$ as the utility of person i who switch the operator, and $U_i^0$ represents he do not. Their utility are random variables, and then
\begin{align}
U_1^i &= a_1 + X_i^i \beta^1 + u_i^1 \quad \cdots (1) \\
U_0^i &= a_0 + X_i^0 \beta^0 + u_i^0 \quad \cdots (2)
\end{align}

Subtracting the two type
\begin{align*}
U_1^i - U_0^i &= (a_1 - a_2) + X_i^i (\beta^1 - \beta^0) + (u_i^1 - u_i^0) \\
\text{denoted:}
\end{align*}
\begin{align*}
y_i^* &= U_1^i - U_0^i \\
\alpha^* &= a_1 - a_2 \\
\beta^* &= \beta^1 - \beta^0 \\
u_i^* &= u_i^1 - u_i^0
\end{align*}

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", namely switching; otherwise, staying.

\begin{align*}
p(Y_i = 1) &= p(Y_i^* > 0) = p(u_i^1 > -\alpha^* - x_i^i \beta^*) = 1 - F(-\alpha^* - x_i^i \beta^*) \\
\text{So,}
\end{align*}

\begin{align*}
p(Y_i = 0) &= p(Y_i^* \leq 0) = p(u_i^1 \leq -\alpha^* - x_i^i \beta^*) = F(-\alpha^* - x_i^i \beta^*) \\
\text{Therefore,}
\end{align*}

\begin{align*}
p(Y_i = 1) &= p(Y_i^* > 0) = p(u_i^1 > -\alpha^* - x_i^i \beta^*) = 1 - F(-\alpha^* - x_i^i \beta^*) \cdots (3) \\
p(Y_i = 0) &= p(Y_i^* \leq 0) = p(u_i^1 \leq -\alpha^* - x_i^i \beta^*) = F(-\alpha^* - x_i^i \beta^*) \cdots (4)
\end{align*}

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 \((\text{LOGIT}) \Lambda(x) = F(x) = \frac{1}{1+\exp^{-x}} = \frac{\exp^x}{1+\exp^x}\) into (3) type \(\ln \frac{p(y_i=1)}{1-p(y_i=1)} = x_i^i \beta + u_i^i\) (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). \(\beta\) 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.

\begin{table}[h]
\centering
\begin{tabular}{|l|l|}
\hline
Variable & Description \\
\hline
(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 \\
\text{(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 \\
\hline
\end{tabular}
\caption{Description of Variables}
\end{table}
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

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 to switch. 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 with other 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 lower and some preferential policies may be effective. The low-income’s switching probability is 1.786 times as much as 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 much as 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 much as 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 much as 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:
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)

<table>
<thead>
<tr>
<th>Model information</th>
<th>Parameter</th>
<th>DF</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>Wald Chi-Square</th>
<th>P&gt;ChiSq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response choice</td>
<td>Intercept</td>
<td>1</td>
<td>-0.5227</td>
<td>0.3946</td>
<td>1.7543</td>
<td>0.1853</td>
</tr>
<tr>
<td>Response level</td>
<td>x6</td>
<td>1</td>
<td>0.9275</td>
<td>0.3371</td>
<td>7.5714</td>
<td>0.0059</td>
</tr>
<tr>
<td>Model</td>
<td>binary logit</td>
<td>x8</td>
<td>0.6507</td>
<td>0.3555</td>
<td>3.5051</td>
<td>0.0672</td>
</tr>
<tr>
<td>Optimization</td>
<td>Fisher’s scoring</td>
<td>x10</td>
<td>0.00225</td>
<td>0.00119</td>
<td>3.5888</td>
<td>0.0582</td>
</tr>
<tr>
<td>Observations</td>
<td>501</td>
<td>x15</td>
<td>-0.3657</td>
<td>0.2064</td>
<td>3.1374</td>
<td>0.0765</td>
</tr>
<tr>
<td>Observations Used</td>
<td>501</td>
<td>x17</td>
<td>-0.6209</td>
<td>0.2054</td>
<td>9.1415</td>
<td>0.0025</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ordered Value</th>
<th>Response Profile</th>
<th>Total Frequency</th>
<th>Effect</th>
<th>Odds Ratio Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>choice</td>
<td>201</td>
<td>x6</td>
<td>2.528</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>300</td>
<td>x8</td>
<td>1.917</td>
</tr>
<tr>
<td>Predicted modeled is choice=1</td>
<td>x10</td>
<td>1.002</td>
<td>1</td>
<td>1.005</td>
</tr>
<tr>
<td>Predicted Probabilities and Observed Responses</td>
<td>x15</td>
<td>0.694</td>
<td>0.463</td>
<td>1.04</td>
</tr>
<tr>
<td>Concordant %</td>
<td>64.1</td>
<td>0.289</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discordant %</td>
<td>35.2</td>
<td>0.291</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent Tied</td>
<td>0.6</td>
<td>0.139</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pairs</td>
<td>60300</td>
<td>0.644</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concordant %</td>
<td>64.1</td>
<td>0.289</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 service. The switching probability of 3G terminal users (x15) is 0.694 times versus 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 versus the unsatisfied,
therefore the operators should improve overall quality of service to increase customer satisfaction.

Base on Response Profile, we get the regression equation:

\[
\log \left( \frac{p(y_2 = 1)}{1 - p(y_2 = 1)} \right) = -0.5227 + 0.9275 \times x_6 + 0.6507 \times x_8 \\
+ 0.00225 \times x_{10} - 0.3657 \times x_{15} - 0.6209 \times x_{17} - 0.3025 \times x_{18}
\]

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 operators 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 dynamically, 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. Specifically, the MNP increased the switching ratio from 0.1078 to 0.4012, and intensify competition. 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.

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 the 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.

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