THE EVOLUTION GAME ANALYSIS OF CUSTOMER WORD-OF-MOUTH REFERRALS UNDER ON-NET AND OFF-NET DIFFERENT PRICING-BASED ON THE PERSPECTIVE OF RECIPROCITY PREFERENCE

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Abstract
Enterprises implement reward referral program. The customer’s recommendation motivation is often easy to be questioned, which makes the reward of enterprises fail to effectively simulate customer’s recommended behavior. This paper describes a model by planting the reciprocity motivation hypothesis to study customer word-of-mouth referral behavior under on-Net and off-Net different pricing. The research reveals that customer word-of-mouth referral subjects are often inclined to become the reciprocal subjects under on-Net and off-Net different pricing. Reciprocal word-of-mouth referral subjects account for the proportion of the overall number is S. By adjusting the various benefit payments in the process of customer referrals, there is a threshold which makes the efficiency of referrals monotone increasing before it is decreasing when S ∈ (0, 1). And reciprocal customers in the overall referral subjects will be into dominant stable equilibrium state. When S ∈ (0, θ), customers return to rational state and evolve into stable equilibrium state which is entirely contrary to reciprocal subjects. Then reciprocal word-of-mouth referrals completely fail.

Keywords: Word-of-Mouth Referrals; On-Net and Off-Net Different Pricing; Reciprocity Preference; Evolution of Game Theory, Consumer Behavior
INTRODUCTION
In the recent years, marketing managers have increasingly focused on word-of-mouth (WOM) as effective source of new customer acquisition (Godes et al., 2005; Smith et al. 2007; Hartmann et al., 2008). In order to promote referrals from existing customers, some Enterprises begin to actively design and develop all kinds of Customer referrals Program. Enterprises encourage customers to recommend products or services to their family or friends, and reward every successful presenter. For example, when customers recommend a new shampoo to others, Procter & Gamble Company rewards them a safari suit small shampoo. Finally, the plan wins 2 million presentees (Kelly, 2000).

Biyalogorsky (2001), Chen & Shi (2003), Kornish and Li (2010), Lobler & Welk (2004) study the incentive mechanism of customers’ successful recommendation; Xiao etc. (2011) use the game theory method to determine enterprise’s best reward policy. Although the scholars at home and abroad for referrals for exploration, most studies focus on the combination of the low price and rewards, illustrating the impact of direct economic returns for referrals. However, in a certain sense, direct economic returns will make the customer the sales staff of the enterprise, and make the customer with the customer-marketing personnel’s double identity. Presenter’s double identity determines the customers’ ambivalent attitude when they recommend. The reason is that some people think the motivation of recommendation is just in order to obtain self-interest behavior of reward. Therefore, direct reward incentive mechanism can’t effectively simulate customer’s recommended behavior.

Under the inside and outside of network differential pricing, customers recommend others to join the network which is the altruistic behavior on the basis of going after return. In the mutual benefit environment, the ambivalence will be weakened; customers will have more power to recommend products or services to their friends. Based on the above discussion, the article will study customer referrals, be based on the reciprocal preference perspective and use evolutionary game method to explore customer referrals under on-Net and off-Net different.

LITERATURE REVIEW
How to develop the optimal customers recommend incentive mechanism, scholars have been a lot of work. Biyalogorsky (2001) mainly studies the incentive mechanism of customer’s successful recommendation that the combination of price and reward is the optimal strategy. Chen & Shi (2003) introduce the future discount as reward strategies, the recommended successful customers can buy the product at a low price in the future; Lobler & Welk (2004) suggest the optimal combination of the mechanism about the price and reward. They point out that customers recommend to others in reward (Biyalogorsky, 2001), and part of customers will
spontaneously recommend in the case of no reward. For these spontaneous recommended customers, the bonus that the enterprise gives is actually a free-rider behavior; Xiao (2011) uses the game theory method to determine the optimal incentive policy of the enterprise, finding that the optimal combination mainly depends on the price and the recommended efficiency of presenters.

Based on the above review of literature, most studies focus on the combination of low price and rewards, showing the impact of direct economic returns for referrals. In a sense, direct economic returns make customers become sales personnel of the enterprise, and let customers have the customer - marketing personnel's double identity. Kozinets & De Valck (2010) think reward referral program (RRP) has broken the established social norms. The tension of market norms and social norms results in the customer diversification reaction on RRP. The source of conflict is the double identity of the presenter. Li Hui-fan & Fan Xiu-cheng (2015) present the mind of customers who have the dual identity often arise two arguments in the fight: the idea is that they share the experience about product or service under the social norms; Another view is that they recommend to others for rewarding under the market norms themselves, which make incentives of the enterprise fail to effectively stimulate customer’s recommended behavior. The contradiction of two arguments makes the customer difficult to decide. The reason is that some people think the motivation of recommendation is just in order to obtain self-interest behavior of reward. Wirtz (2013) shows "if the customer thinks the motivation of their recommended behavior might be questioned by others, customers may be more cautious when recommend, especially for those who pay more attention to others views ". Presenter’s double identity (customer - marketers) determines customers’ ambivalent attitude for referrals. Direct reward incentive mechanism can't effectively induce customers to recommend the products or services of enterprises. So, some scholars argue that incentive mechanism is not confined to direct reward. Ryu & Feick (2007) suggest that it not only considers the direct influence of reward, but also the study should be extended to other marketing. Williams & Buttle (2011) think that price could significantly influence the evaluation and communication of the customer about service (Sundaram, etc., 1998; Mangold and Miller, 1999). Biyalogorsky (2001) make the price as a kind of reward strategy. Through exploring the diffusion of innovation, they conclude that charges mode is interaction with customers’ recommended behavior. In the management practice, enterprises try to take advantage of cost model to stimulate the recommended rate. For example, Mobile operators offer a low rate for customers in the same network (e.g., cornet cluster network package). Laffont (1998) presents mobile network operators can produce “tariff-mediated network effects” with the help of price difference by forming the different on-Net and off-Net standards. Van Den
Butle & Lilien (2001) raise that the network effect will induce existing customers to increase recommend strength. Christian Barrot (2013) makes empirical study for the German mobile network operators. The results show that service pricing (network inside 5 cents/min VS network outside 15 cents/min; do not distinguish between inside and outside, 10 cents/min) can affect customers’ recommended behavior. It is on-Net and off-Net different pricing that triggers word-of-mouth referrals, improving the overall recommended behavior. Unfortunately, the existing research does not delve into on-Net and off-Net different pricing which is how to influence customers with increasing chances of referrals and successful probability.

On-net and off-net different pricing is different price for the same service or product inside and outside the network. Gabrielsen & Vagstad (2008) explore on-net and off-net different pricing in the point of customer switching cost. They think that on-net and off-net different pricing will increase customer switching cost, make the customer more loyal to the enterprise, and make the enterprise gain more profits. Under on-net and off-net different pricing, customers are more willing to recommend the product or service of enterprises. Customers join into the same networks operators, and the costs will be lower. In the mutual benefit environment, the ambivalence will be weakened, customers will have more power to recommend products or services to their friends and share experience with them. In addition, from the perspective of utility theory, it depends on individual utility and social interests if customers would be willing to recommend word-of-mouth, such as whether the recommended information is recognized by the presentees. Customer is not only driven by personal interest motivation, but strongly influenced by much social preference, including mutual motivation.

However, most existing studies have mainly focused on incentive mechanism of direct economic returns. Few scholar puts reciprocal preference into customer referrals. Pu Yong-jian (2009) argues that reciprocal preference as a kind of cooperative behavior under certain conditions will induce reciprocity behaviors by producing mutual motivation. Reciprocity behavior tends to maximize each other’s interests in the form of reward. The way usually reduces or damages the interests of them, but will eventually increase the overall welfare. The only sole purpose of rational behavior is in the pursuit of self-interest maximization.

In essence, the mutual benefit is a kind of altruism behavior based on returns, rather than purely unilateral dedication. Reciprocity theory indicates that rational individuals must be restricted by others’ interests in pursuit of their own interests. Only in this way can we realize the harmony of personal interests, others’ interests and group interests. Under on-Net and off-Net different pricing, customers recommend others to join the network which is a kind of altruism behavior based on returns, so do presentees. The interests are mutual restriction, which ultimately is beneficial to the improvement of the overall interests. Therefore, the article study
customer referrals introduce reciprocal preference theory and use evolutionary game method to explore customer referrals under on-Net and off-Net different.

**Based on Reciprocal Preference Customer Referrals Evolution Model Analysis**

In biological game we often use replication dynamic model (Replicator Dynamics), namely RD model, to study the evolution of the different groups when they separately select a strategy game at some point. According to RD model, assuming that the adaptability of a group exceeds the average population, the number of individuals in a population will increase. If the pay of a certain group is less than the average level, the proportion of the number of individuals in the whole population would be reduced. In RD model, when customers recommend word-of-mouth, game partners (presenter and the presentee) are limited to two types: reciprocity and self-interest.

Under on-net and off-net different pricing, according to different individual attribute, the presenter and presentee can be divided into four kinds of transfer state:(1) the presenter and presentee are self-interested individual. If in game, the presentee gets the difference of n unit, presenter obtains n units compensation; (2) the presenter and presentee are mutually beneficial economic individuals. Both sides get the difference of m unit. Pu Yong-jian etc.(2007) show that economic effect under reciprocal preference will be bigger than economic effect under the self-interest motive, so m > n;(3) presenter for self-interest, the presentee for mutual benefit. Presenter gets the difference of n + k unit. The presentee will pay for k unit to the presenter as reciprocity transfer and obtain the compensation value of n - k unit. It is less than fully rational interest payments; (4) the presenter for reciprocal, the presentee is self-interest. The presenter gets the difference of n-k unit and the presentee obtain n + k unit payments.

Based on the above analysis, the paper establishes a game model of customer word-of-mouth referral behavior under the perspective of reciprocal preference, as figure 1 (m> n > k > 0):

**Figure 1: Reciprocity Game Matrix**

<table>
<thead>
<tr>
<th>Presentee</th>
<th>Reciprocity</th>
<th>Self-Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reciprocity</td>
<td>M ,M</td>
<td>N-K, N+K</td>
</tr>
<tr>
<td>Self-Interest</td>
<td>N+K, N-K</td>
<td>N, N</td>
</tr>
</tbody>
</table>
Under on-net and off-net different pricing, if customers recommend successfully, presentees buy the product or service. Based on the principle of reciprocity, presentees will recommend the product or service to others. Presenter and presentee are of symmetry. A certain economic individual is not only presenter but also presenter. Whether it is a presenter or presentee, the payment value is the same. That is to say, in the perspective of reciprocal preference, the payment value of word-of-mouth referral individual is just related to the type. It only depends on individual self-interest or reciprocity. Therefore, under on-net and off-net different pricing, based on mutual benefit perspective, customer word-of-mouth referral game model is in line with the premise of symmetry evolutionary game analysis.

If \( u_1, u_2 \) respectively presents the reciprocity and self-interest individual payment, \( u \) is average payment of economic individual, \( s \) and \( 1-s \) respectively presents the proportion of the reciprocity and self-interested individuals in the overall group. We make use of differential equation \( F(s) \) to describe RD model.

\[
\begin{align*}
    u_1 &= ms + (1-s)(n-k) = ms + n-k-ns + ks \\
    u_2 &= (n+k)s + n(1-s) = ns + ks + n - ns = ks + n
\end{align*}
\]

\[
\tilde{u} = u_1 + u_2 = ms^2 - ns^2 + ks^2 + ns - ks + (ks + n)(1-s) = ms^2 - ns^2 + n
\]

\[
F(s) = s(u_1 - \tilde{u}) = s(ms + n - k - ns + ms^2 + ns^2 - n) = s[(m-n)s - k](1-s)
\]

If \( F(s) = 0 \), get \( s_1 = 0, s_2 = \frac{k}{m-n}, s_3 = 1 \)

If \( F'(s) = 0 \), get \( 3(m-n)s^2 - 2(m-n+k)s + k = 0 \), \( \Delta = 4\left\{(k - \frac{1}{2}(m - n))^2 + \frac{3}{4}(m - n)^2\right\} > 0 \)

Two different solution are \( s_1 = \frac{2(m-n) - \sqrt{4(m-n+k)^2 - 12(m-n)k}}{6(m-n)} \), \( s_2 = \frac{2(m-n) + \sqrt{4(m-n+k)^2 - 12(m-n)k}}{6(m-n)} \)

If \( F'(s) = -3ms^2 + 3ns^2 + 2ms - 2ns + 2ks - k \), get \( F'(0) < 0 \), \( F'\left(\frac{k}{m-n}\right) > 0 \), \( F'(1) = n + k - m \)

If \( n + k - m < 0 \). By the zero-point theorem, we can know \( F'(s) \) at least has a point in \( (0, \frac{k}{m-n}) \) make \( F'(s) = 0 \), so is \( (\frac{k}{m-n}, 1) \). But \( F'(s) = 0 \) has two different solution. So we can indicate \( F'(s) \) image as figure 2, and \( F(s) \) image as figure 3.

\[
\begin{align*}
    0 < s_1' < \frac{k}{m-n} \\
    \frac{k}{m-n} < s_2' < 1
\end{align*}
\]

If \( s_1' \) get

\[
\begin{align*}
    \sqrt{(m-n)^2 - (m-n)k + k^2} < m - n - 2k \\
    2n - 2m + k < \sqrt{(m-n)^2 - (m-n)k + k^2}, \text{ get } n + k - m < 0,
\end{align*}
\]

Hypothesis is verified
From function image of $F'(s)$, we can know $F'(0) < 0$, $F'(\frac{k}{m-n}) > 0$, $F'(1) = n+k-m<0$, so $s_1=0$ is a stable equilibrium; $s_2 = \frac{k}{m-n}$ is unstable equilibrium; when $n+k-m>0$, $s_3=1$ is unstable equilibrium; when $n+k-m<0$, $s_3=1$ is a stable equilibrium. We have verified $n+k-m<0$, so $s_3=1$ is also a stable equilibrium. The phase diagram of dynamic equations as shown in the figure 4.
Reciprocal word-of-mouth referral subjects account for the proportion of the overall number is $S$. When $s > \frac{k}{m-n}$, by $F(s)$ - figure 4, we can know that the expected revenue of reciprocal referrals subjects will exceed the average. By the phase diagram figure 5 of dynamic equations, we can know that the results of the evolution will be into $s_3=1$ stable state. At this time, all word-of-mouth referral subjects are entirely reciprocal subjects, the efficiency of customer referrals is improved fundamentally; When $s < \frac{k}{m-n}$, by $F(s)$ - figure 3, we can know that the expected revenue of reciprocal referrals subjects will be less than the average. By the phase diagram figure 4 of dynamic equations, we can know that the results of the evolution will be into $s_1=0$ stable state. At this time, all word-of-mouth referral subjects return to rational state and the traditional economic theory has absolute advantage. Then reciprocal word-of-mouth referrals completely fail.

Based on the above analysis, under on-net and off-net different pricing, the evolution mechanism of customer referrals game model shows that customer referrals will not only be into steady state with the maximum efficiency, but also with the minimum efficiency under the mutual environment. Therefore, the enterprise should adjust the various benefit payments in the process of customer referrals (e.g.: $m, n, k$) to make $S \in \left(\frac{k}{m-n}, 1\right)$. Then the enterprise can realize the maximum efficiency of customer word-of-mouth referrals. When $s=s_2'=\frac{2(m-n)+\sqrt{4(m-n+k)^2-12(m-n)k}}{6(m-n)}$, the efficiency of customer referrals will reach the maximum.

**CONCLUSION AND OUTLOOK**

Direct reward incentive mechanism can't effectively simulate customer referrals under the complete contract. It has failed to effectively solve the contradiction about their attitude when customer recommends the product or service. The reason is that some people think the motivation of recommendation is just in order to obtain self-interest behavior of reward, not...
sharing the product or service from the heart. Under on-net and off-net different pricing, customers with reciprocal preference motivation can weaken “economic person hypothesis” to a large extent. It is customer’s ambivalence of self-interest behavior that is also weaken. It can improve the efficiency of customer referrals.

According to the basic ideas of evolutionary game, on-net and off-net different pricing can realize the positive evolution of customer referrals under the mutual environment. Reciprocal customers in the overall referral subjects will be gradually into dominant advantage eventually evolve into stable equilibrium state and realize the maximum efficiency of customer referrals. In mutual evolution process, if reciprocal word-of-mouth referral subject account for the proportion of the overall number is less than a certain threshold, customers return to rational state and evolve into stable equilibrium state which is entirely contrary to reciprocal subjects. At the moment, the traditional economic theory has absolute advantage and reciprocal word-of-mouth referrals completely fail. Therefore, in order to guarantee reciprocal word-of-mouth referral subjects finally occupy the dominance equilibrium state of positive evolution, the enterprise needs to adjust the various benefit payments (e.g.: m, n, k) in the evolution of the initial state to make \( S = \left( \frac{k}{m-n}, 1 \right) \). Only in this way can the enterprise realize the maximum efficiency of customer word-of-mouth referrals.

However, the paper also has some limitation. Firstly, researches about customer referrals behavior under on-net and off-net different pricing are mainly experiential products (e.g.: telecommunication service or fitness club membership) and if applicable in other industries needs to study further. Secondly, if the second price difference (the nonlinear pricing) can more effectively induce customer referrals, the paper is not involved. In the future we can do empirical comparative study about customer referrals from the nonlinear pricing and on-net and off-net different pricing and further explore the impact of pricing model on the other industries.

REFERENCES
Kelly, E. This is One Virus You Want to Spread. Fortune, 2000, 11:297-300.


