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Integrating PPC and Flat Fee Pricing Schemes to Optimize the Internal Search Engine Revenue in the Electronic Market

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INTEGRATING PPC AND FLAT FEE PRICING SCHEMES TO OPTIMIZE THE INTERNAL SEARCH ENGINE REVENUE IN THE ELECTRONIC MARKET

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Abstract

Currently, the predominant pricing plan for the search engine (SE) advertising services in a proprietary electronic market is a flat fee (FF) pricing. These services have faced the challenge of customer attrition recently since FF pricing results in the inequality of service surplus among subscribers. A more sustainable and profitable pricing model would be to distinguish advertising resources by providing an additional usage-based pricing for certain user groups to transfer the service surplus among subscribers. We conceive a hybrid model integrating Pay-Per-Click (PPC) pricing into FF pricing. This proposed scheme can offer an incentive-compatible mechanism to attract more subscribers by relieving the inequity of service surplus, and eventually result in the increasing revenue of service providers.

Keywords: search engine marketing; proprietary search engine; flat fee; incentive-compatible mechanism; pricing model; market efficiency

1. Introduction

Over the last 30 years, e-commerce has been booming with the widespread Internet usage. Forrester predicts that the U.S. e-commerce market will increase from $176.9 billion in 2010 to $229.1 billion in 2013 [1]. The fast growing e-commerce has reinforced the online advertising. Among various online advertising channels, search engine marketing (SEM), aimed at promoting websites by increasing their visibility in search listings, is mounting rather quicker than others [2]. According to the Sixth Annual State of Search Engine Marketing Report by Search Engine Marketing Professional Organization (SEMPO), the SEM industry in North American is likely to grow 14%, from $14.6 billion in 2009 to $16.6 billion by the end of 2010 [3], while this figure is projected to only about $4.1 billion in 2003 [4]. Today, the top three SEM suppliers in the world are Google AdWords, Microsoft adCenter, and Yahoo! Search Marketing.

There are two types of SEM, public SEM and internal SEM for proprietary electronic markets. The public SEM is publicly accessible without requesting a membership (see Table 1), for example, Google AdWords. The public SEM is well accepted and has matured. For example, Google's total advertising revenues were $21,129 million in 2008 and grew at 8% in 2009 to hit $22,889 million [5]. The internal SEM is the kind of information services available in a proprietary electronic market and operated by the market provider mainly for product information dissemination. The examples can be found in various forms of electronic markets, such as, eBay

(Consumer-to-Consumer), Amazon (Business-to-Consumer), and Alibaba (Business-to-Business).

Table 1. A Comparison between public SEM and internal SEM
(Source: Novak and Hoffman 2000 [6])

Aspects	Public SEM	Internal SEM
Relationship to the market	Any electronic market	A proprietary electronic market
Service independency	Independence	Incorporating into Member Services
Content & structure	Broad, varied information types and content	Structured around products and services
Pricing policy	Pay-Per-Click underpinned by keyword auction	Flat Fee (FF)
Client	Any potential advertisers	Suppliers in the electronic market
Audience	All Internet users	Specific target segments of potential customers
Utility of click (conversion rate)	Low	High
The ability to measure the utility of search engine advertising	Disability of measuring and tracking visits and uses of customers	Ability of measuring and tracking visits and uses of customers for activities on this platform
Research status	Mature stage	Preliminary stage

Internal SEM has formed a particular advertising market. We denote this advertising market as *search engine advertising market* (SEAM). The public SEAM denotes the advertising market belonging to public search engine, such as Google. The products in a SEAM are various search engine (SE) advertising services. The clients are the suppliers in the primary electronic market who are selling their products. They are potential buyers of the advertising resources. They have two levels of status in the SEAM: *product supplier* (everyone has this status), and *subscriber* of SE advertising services (service fee payer). The advertising resources are the clicks of the primary market visitors.

There is a wide range of pricing models to finance SE advertising services, including pay-per-click (PPC), pay-per-action (PPA), pay-per-lead (PPL), pay-per-purchase (PPP), and so on. Among these pricing models, the PPC model, underpinned by the keyword biding mechanism, is widely adopted in the public SEAM. The advertiser pays when a user clicks on its advertisement and visits its site. However, the PPC pricing model is open to abuse by click fraud, although rising sophisticated means of detection are used. In July 2006, Google settled a class-action lawsuit for $90 million fund since plaintiffs alleging it did not do enough to prevent click fraud [7]. For another, the advertiser takes the risk of the conversion rate from a casual click, a visit to an actual sale in PPC campaign. However, the internal SEM releases those issues for its special characteristics (see Table 1).

The SE advertising services in a SEAM is an important portion in a premium customizable package for the subscribers in a proprietary electronic market. Normally the provider of the market adopts the flat fee (FF) pricing model to finance their services. FF pricing model, the earliest Web advertising pricing model, is a fixed price for a given period of time as paid inclusion in a SEAM, for example, the annual membership fee. Because FF ignores volumes of the usage/traffic (the amount of individuals who visit a site), it fails to differentiate SE advertising services for users. This reduces the efficiency of the SEAM.

The motivation that we look into the pricing problem in the SEAM is triggered by the issue raised in Alibaba's B2B market, regarding the efficiency of the FF pricing model adopted by the company.

Alibaba Group, started in Hangzhou, China, in 1999, is a leading electronic marketplace assembling business to business (B2B) international trade, online retail and payment platforms and data-centric cloud computing services. Alibaba Group consists of Alibaba.com (B2B), Taobao.com (C2C), Alipay (a third-party electronic payment service provider), Alibaba Cloud Computing, and Yahoo! China. By mid 2010, it has nearly 18,000 employees in more than 60 cities in China, plus a few other oversea subsidiaries at the US, Japan, UK, and Singapore [8]. Recently, Alibaba B2B has received complaints from its e-market subscribers because the number of inquiries or feedbacks some subscribers received did not bring enough benefit to compensate the cost of annual membership fee. As a result, they may unsubscribe from the SEAM after current billing cycle. This raises the issue how to optimize the allocation of the limited advertising resources among subscribers. Could an incentive-compatible pricing model be incorporated into current pricing scheme, such as PPC? What is the impact of this new scheme on current subscribers in the SEAM? These are the problems that this paper is intended to tackle.

This paper proceeds as follows. In section 2, we present relevant research background and research efforts in this field. We analyze the inefficiency of current FF pricing scheme in the SEAM in section 3. In section 4, we conceive a hybrid pricing model by incorporating PPC pricing into FF pricing, and explain the efficiency of the proposed new pricing plan. We present the limitation of our proposed model and future research works in section 5.

2. Relevant Background and Research Work

2.1 Alibaba's TrustPass program – the Internal SE Advertising Services

It is more illustrative that we look into the case of Alibaba as an example. Alibaba's TrustPass program, launched in 2002, includes a paid SE advertising services for suppliers in its B2B electronic market. After paying the annual fee, TrustPass subscribers have opportunities to be ranked in a good place in a search engine result list. Figure 1 displays a screen shot with search results in Alibaba' internal SE. The main difference between an internal SE and a public SE is that the former only provides one set of search results, while the latter delivers a set of organic search results and another set of sponsored search results. Products of more competent subscribers usually rank top places and hence receive more inquiries from potential customers than less competent subscribers. This situation leads to the Matthew Effect (the rich get richer and the poor get poorer) - the competent subscribers have better chances to be exposed in the market with more opportunities, and hence more budget for advertising. As a result, those less competent subscribers will unsubscribe TrustPass. This implies the decline of revenue for Alibaba. Therefore, improving the market mechanism is critic.

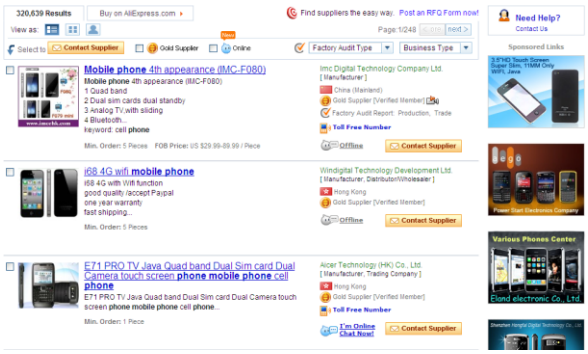

Figure 1： Search Results for Search Term "mobile phone" in Alibaba.com internal SE

2.2 Relevant Research Efforts

Sen et al summarize five major sources of revenues for SE as of paid inclusion, paid submission, content promotion, keyword-linked banner advertisements, and paid placement [9]. Paid inclusion is a campaign that guarantees products to list pages in the main search results. Paid Placement is guaranteed a high ranking, usually in relation to desired search keywords with a particular position.

The FF pricing reduces risks and administrative costs for service providers, and provides predictable fee for advertisers. Referring to the definition by Sen et al, the FF pricing used by the SEAM is for paid inclusion, but different from the FF scheme for paid placement in Sen et al. However, the FF scheme is not incentive-compatible, causing the same public good problem as those services free of charge. Thus far, the inefficiency of FF pricing in network services has been well-studied in last fifteen years (see McKnight and Boroumand 2000, Lin et al 2002) [10] [11]. Novak et al discuss the challenge of FF pricing that fails to demonstrate to the advertisers the value of their advertising expenditures [6]. Hoffman and Novak (2002) introduce a CDnow case to present the trend that per-click pricing and pay for performance displace the traditional impression model in Internet advertising marketing [12]. McKnighta and Boroumand discuss the inefficiency of FF pricing for internet services and propose new service pricing models [10]. Lin et al explore a virtual private network (VPN) traffic pricing model. The proposed pricing mechanism can effectively promote a VPN's transmission efficiency in the service welfare rate based on their experiment [11]. Odlyzko discusses Paris metro system with differentiated services in the prices as traffic management to accommodate user preferences at the cost of utilization efficiency of the network [13]. Altmann and Chu discuss the efficiency of purely FF pricing and the challenge of per-minute pricing plans in network services, and propose more flexible pricing plans providing access to the Internet via FF pricing based services and charging for extra demand based on usage [14]. Sundararaja suggests that firms should transform from low fixed-fee penetration pricing in nascent information market to an optimal pricing mix including usage-based pricing options as these markets mature [15].

In another aspect, some related works discuss the influential factors for revenue maximizing of SEM, such as clicks, performance of products and ranks. Hoffman and Novak (2000) analyze and compare advertising models on the Internet [6]. Chatterjee and Hoffman model the commercial "clickstream" at an advertiser supported Web site to predict consumers interacting with advertising stimuli [2]. Weber and Zheng design a two-stage model of search intermediaries and find that profit-maximizing search engine design is its rankings considering both product performance and bid amount [16]. Feng et al discuss that the performance of several mechanisms for allocating sponsored slots depending on the degree of correlation between suppliers' willingness to pay and their relevance to the search term [17]. Ghose and Yang use a hierarchical Bayesian modeling framework to quantify the relationship between different sponsored search metrics [18].

3. The Inefficiency of the Flat Fee Scheme in Internal SE Advertising

The inefficiency problem in the internal SE advertising pricing is similar to the problem in a public good market but with its own specialties. For example, the annual fee for Alibaba's TrustPass covers other member services except SE advertising services. As usual, the FF pricing model results in inequality of service surplus among Alibaba's subscribers. Those better benefited take away others' and eventually reduce the number of subscribers. Because of limited advertising resources, a SEAM is a seller market with limited counts of clicks available in a given time period [19]. In a public SEAM, the use of the advertising resources is based on the competing price and the market is generally efficient. We are to use a mathematic model to study the problem of current FF pricing scheme in a SEAM.

Let all advertising resources in a SEAM be *A*, which is the total number of clicks in a given time

period. Denote N as the number of suppliers needing the internal SE advertising services to promote their businesses. However, only up to M of them, $M < N$, will possibly be allocated enough advertising resources to receive none negative net benefit. They pay a FF rate r for the service in a given period. Therefore, the FF revenue R of the SEAM provider is determined by the number of subscribers and annual fee, i.e.

$$R = M * r \quad (1)$$

We call this market clearing status as the primitive status. Obviously, the primitive status is impossible because the subscribers of the internal SE advertising service are diversified regarding their competences in taking advantage of the service after entering the SEAM by paying a fixed fee. Those having a better strategy and being more competence may consume more advertising resources with more clicks. This leaves the less competent subscribers less likely to be listed in search results since the search result slots are the scarce resource on search engines.

Keep M as the maximum number of subscribers who share the internal SE advertising resources, and M' as the actual number of the subscribers who are willing to stay in the SEAM. Let α be the competent level of subscribers in the SEAM. We assume that α is uniformly distributed in $[0, 1]$. A subscriber $i \in \{1, M\}$ has a competent level α_i. Subscriber i's decision to maintain his membership is justified by the profit function:

$$\pi_i = Q(\alpha_i) = h_i + S_i(c_i(\alpha_i), v_i(\alpha_i)) - r \quad (2)$$

s.t. $\sum_{i=1}^{M} v_i \leq A$

Where

h_i – the benefit from other services rather than internal SE advertising service.

S_i – the benefit from internal SE advertising service.

c_i – the conversion rate of the subscriber, which is determined by the competent level of subscribers.

v_i – the number of clicks that the subscriber receives in a service billing cycle. The competent level of subscribers determines their amount of clicks.

If $\pi_i < 0$, subscribers will be likely to unsubscribe from the SEAM after current billing cycle. The total number of subscribers who make non-negative profit is M', which is less than M. From the analysis, the capacity related factor α determines M'. If the number of subscribers reduces from M to M', the internal SE advertising provider's actual revenue becomes

$$R' = M' * r < R \quad (3)$$

Figure 2 presents two charts for better illustrating the above models. Without loosing their intuition, these simplified charts assume that subscribers are identical except their competent levels. We can see that, the ABC is the negative benefit for a certain subscribers group, the inequality of click resources allocation due to competent levels results in only $M' < M$ subscribers have positive surplus of the service.

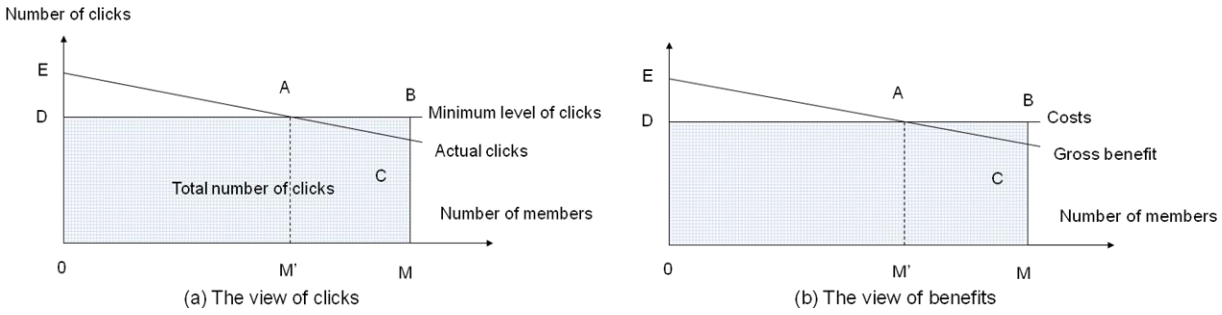

Figure 2: The inequality of the SEAM service reduces the number of subscribers

4. Hybrid SE Advertising Service Pricing

Figure 2 has hinted us that if we can exploit the positive surplus from those more competent subscribers to compensate those having a negative profit, it could make more subscribers receiving a positive profit from the SEAM. A general approach for this is the incentive-compatible mechanism by usage-based pricing [11]. This idea is not new. For example, the PPC with keyword auction in current public SEAM is a good case. The challenge of the SEAM in a proprietary electronic market is how to adopt the incentive-compatible mechanism while maintaining the original FF scheme for other kinds of services besides SEM. In order to deal with this problem, we conceive a hybrid revenue model by incorporating a PPC model into the FF model, instead of completely giving up FF scheme. According to our model, since the click is directly relevant to the revenue of subscribers from the SEAM, the SE advertising providers will charge a fixed price per click from subscribers who consume extra clicks than a certain threshold. This way increases the revenue of SE advertising providers by differentiating advertising resources and investments of subscribers in the SEAM, meanwhile relieves excess surplus due to original FF scheme for these more competent subscribers. At the same time, the SE advertising provider will compensate a fixed price per click for subscribers who received lower clicks than a certain threshold. We expect that the revenue of the subscribers with low gross benefit exceeds their cost via compensation. As a result, those may renew the SE advertising service in the next period, and remain in the SEAM. The increasing number of subscribers amplifies the revenue of SE advertising providers.

In fact, although our compensation mechanism is based on the counts of clicks, the benefit from the clicks in the SEAM distinguishes among subscribers. There are two factors determining the utility of each click. One is the conversion rate from clicks to transactions. Another is the profit of each transaction for different subscribers. The conversion rate relies on the competent level of subscribers to optimize their websites and promote their services for consumers. The efficiency of each transaction for subscribers depends on the product performance and goods traded in one transaction. For example, there are two subscribers, A and B. For one tranaction, A sells 1000 LV bags and each package worth $1000. B just sells one bag and the bag worth $100. Thus, A can gain higher profit from a deal than B. Based on our model, A can gain a higher profit from each click.

Therefore, although the hybrid pricing scheme can increase the number of subscribers via compensation mechanism, it is hard to achieve all M potential subscribers considering the efficiency of compensation. In the compensation mechanism relying on the counts of clicks, some subscribers receive the surplus from the compensation, and other subscribers might not achieve enough compensation to make up for their cost so they still unsubscribe from the SEAM. Similarly, after the SE advertising provider charges fee from these more competent subscribers having the same clicks, their service surplus is different regarding the utilities of clicks.

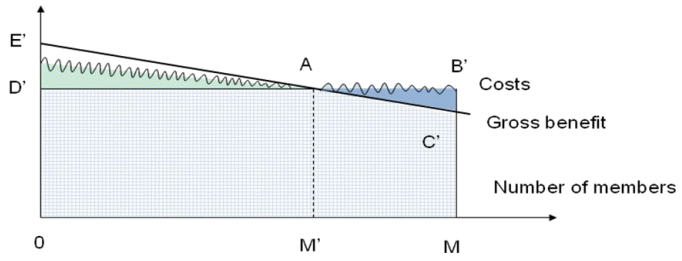

Figure 3: the benefit of subscribers in the hybrid pricing model

Figure 3 presents a chart to illustrate this intuition. The area *AB'C'* is the total compensation from SE advertising providers. From the illustrative chart, we notice, with the compensation, the benefits of a part of subscribers with lower clicks are higher than the cost, and others are lower than the cost. The wave-like edge of the charge and compensation is due to utilities of clicks for subscribers because the

same number of clicks may be related to different levels of conversion rates or different utilities of transactions.

A basic setting for the hybrid scheme:

Now, the revenue structure of the SE advertising provider contains three additional portions from Eq.(3): the revenue from PPC incomes, R_c, the costs for the compensation for the subscribers with low clicks, L, and the extra subscribers' fees from those having low clicks but benefited by the new promotion policy, ΔR. The total revenue of internal SE advertising is

$$R'' = R' + R_c - L + \Delta R \quad (4)$$

Let the threshold of charging a high-click fee be v_H, the threshold of paying back a low-click compensation be v_L, the per-click-based extra charge for high-click subscribers be q_H, and the per-click-based low-click compensation be q_L We have

$$R_c = \Sigma_{j=1}^{N} q_H [(v_j - v_H) + |v_j - v_H|] / 2 \quad (5)$$

$$L = \Sigma_{j=1}^{N} q_L [(v_L - v_j) + |v_L - v_j|] / 2 \quad (6)$$

$$\Delta R = (M'' - M') * r \quad (7)$$

where $M'' > M'$ is the number of subscribers who have non-negative profit from the new mechanism. It is obvious we must set $v_H \geq v_L$.

The above indicates that the SE advertising provider needs to deal with the tradeoff between the revenue of PPC campaign, R_c, extra subscribers fees, ΔR, and the compensation, L. Although the compensation seizes a part of total revenue from the SE advertising provider, the compensation mechanism expands the number of subscribers compared with original FF pricing model. In return, the increasing number of subscribers amplifies the revenue of the extra subscribers' fees. The direct revenue increases of PPC and extra subscribers' fee, and the loss of revenue due to compensation mechanism simultaneously impact on the total revenue of the SE advertising provider.

Figure 4 shows an illustrative chart to present the change of revenue from original FF pricing model to the new hybrid pricing model. Though the compensation for special subscribers reduces the total revenue, the incremental number of subscribers promotes the total revenue.

Now, the subscriber j's profits function of SE advertising service from the hybrid pricing scheme:

$$\pi_j = Q(\alpha_j, v_L, v_H, q_L, q_H) = h_j + S_j(c_j(\alpha_j), v_j(\alpha_j)) - q_H [(v_j - v_H) + |v_j - v_H|] / 2 + q_L [(v_L - v_j) + |v_L - v_j|] / 2 - r \quad (8)$$

$$s.t.\ \Sigma_{j=1}^{M} v_j \leq A$$

The profits function for the subscribers having a positive profit in the FF pricing scheme:

$$\pi_j = Q(\alpha_j, v_L, v_H, q_L, q_H) = h_i + S_j(c_j(\alpha_j), v_j(\alpha_j)) - q_H [(v_j - v_H) + |v_j - v_H|] / 2 - r \quad (8)'$$

The profits function for the subscribers having a negative profit in the FF pricing scheme:

$$\pi_j = Q(\alpha_j, v_L, v_H, q_L, q_H) = h_j + S_j(c_j(\alpha_j), v_j(\alpha_j)) + q_L [(v_L - v_j) + |v_L - v_j|] / 2 - r \quad (8)''$$

Since the number of clicks is observable in the SEAM, properly choosing v_H, and q_H can always maintain a positive profit level for those affected subscribers. Hence an SE advertising provider will have a positive R_c to fund L for the compensation expenses. Similarly, properly choosing v_L, and q_L can always help those low-click subscribers to earn a positive profit. This will eventually result in a positive ΔR. In this way, the hybrid pricing scheme is superior to the FF pricing scheme.

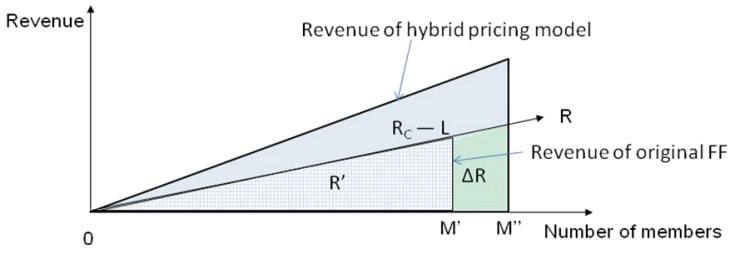

Figure 4: the comparison of the total revenue between the hybrid pricing model and the FF scheme

5. Conclusion

This paper investigates the effect of pricing schemes for the SE advertising service in the proprietary SEAM. The FF scheme fails to differ services in the SEAM and results in inequality of service surplus among subscribers. This eventually reduces the number of subscribers. The proposed hybrid SE service pricing scheme incorporates the PPC pricing model into the FF pricing scheme. It provides certain incentive-compatible mechanism to attract more subscribers to the SE advertising service in the SEAM.

As an analytical model, the hybrid model has its limitation. We treat the efficiency of each click of different subscribers without distinction. Thus, the proposed incentive-compatible mechanism might not encourage all of the subscribers in the SEAM.

Several avenues present for future research. First, we may distinguish the efficiency of clicks for different subscribers, including conversion rate and the utilities of different transactions. If so, the proposed model would be better to encourage the subscribers in the SEAM through avoiding under-compensation and overcompensation. Second, we will analyze the implementation of the hybrid pricing strategies for the SEAM via computational stimulations after completing the relevant math model. Laboratory experiments will determine the concrete strategies of SE compensation and PPC pricing for subscribers in the proposed model. Laboratory will find the optimized situation in the hybrid pricing model for revenue of the SEAM.

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