ICEB 2007 Proceedings

International Conference on Electronic Business (ICEB)

Winter 12-2-2007

Competition and Integration Strategy Analysis of Advertisement-Supported Social Networked Related Services

Yung-Ming Li

Ching-Wen Chen

Yung-Shao Yeh

Proceedings of The Seventh International Conference on Electronic Business, Taipei, Taiwan, December 2-6, 2007, pp. 174-180.

COMPETITION AND INTEGRATION STRATEGY ANALYSIS OF ADVERTISEMENT-SUPPORTING ONLINE SOCIAL NETWORK RELATED SERVICES

Yung-Ming Li, National Chiao Tung University, Taiwan, yml@mail.nctu.edu.tw
Ching-Wen Chen, National Chiao Tung University, Taiwan, kisd0955@hotmail.com
Yung-ShaoYeh, National Chiao Tung University, Taiwan, dyyeh67@gmail.com

ABSTRACT

Social networking related services (SNS) become increasingly popular communication and interaction mediums over internet. As most of the SNS are free, the providers generate revenues from advertising and other extension services. This paper investigates the advertising strategy and the strategic of compatibility and co-opetition between two social networking related services.. Utilizing game theoretic model, we show that the providers will benefit from both service and business integration, however, the users are always worse when SNS services are compatibly connected. The users will always gain from the quality (features) competition, however, brand competition may hurt the customers as more disturbing ads will be exerted. In general, business integration will result in a higher diversity if ads exerted in two IM services.

Keywords: Social networking, Co-optition, Compatibility, Advertising, Network Externalities. Brand loyalty, Competition.

INTRODUCTION

By the development of Internet technology, people are connected to the internet where they communicate, interact and share information to each other. Social Networking Related Services (SNS) becomes increasingly popular communication mediums over internet, which focuses on the building and sharing of online social networks for communities of people who share knowledge, interests and activities [10]. As a result, a virtual relationship or social network is formed and gradually evolves from interactions. These web-based and interact oriented services include Instant Messenger (IM), email, video, voice, file sharing, social bookmarking, discussion groups, online album, and so on. In general, social networking related services, allow users to create a profile for describing themselves and build their friend network by SNS. Such as Myspace, Facebook, Google Orkut and Friendster, they allow users to list their interests and link to their friends, sometimes annotating these links by or quantitative ratings for selected friends [12]. For making business contact, users on LinkedIn can find new job or recruit personnel on it. And Flickr provides comprehensive online album services, Youtube provides video blogging services. Sites like LiveJournal, Blogger and Blogpulse act as blogging service aggregators, serving some useful tools and statistics data about blogging. These web-based SNS emerge extremely fast and plentiful, which is accompanied with more and more furious competitions.

Internet advertising is one of the most profitable revenue streams. SNS providers tend to derive the bulk of their revenues from information transmitters (advertisers) rather than information receivers (SNS users). Most SNS are free for users. For instance, Yahoo! Messenger charges the firms who wish to conduct advertisements to promote their products/services, but permits users to access the IM services for free [1]. In this paper, we assume that the revenue of the Internet advertising comes from the number of ads impressions, though several types of advertising contracts are developed. Therefore, the revenue is associated with the amount of the ads and the number of SNS users. The SNS providers can increase revenue by putting more ads on the services, however ads may be harmful. The higher level of adverting activities, the more users will switch to the opponent SNS channel. As a result, the overall revenue from the ads impression may decline. Therefore, it is very important to study the appropriate advertising strategy to pursue the objective of profit maximizing.

Compatibility of SNS is associated with the impact of network externality. Network externalities are positive external consumption benefits, when it is significant, so too are the benefits of having compatible products, the benefit that a consumer derives from the use of a good often depends on the number of other consumers purchasing compatible items [3]. SNS fits the classic definition of a service imbued with externality (network) effects, in which the value to each customer depends upon the number of other customers (and who they are) who also use the service.

In this paper, utilizing game theoretic model, we develop a parameterized model to analyze the advertising strategy and the strategic of compatibility and co-opetition between two social networking related services. We found that the impact of service compatibility and business integration are significant. While gaining the benefit from contacting more people, the users are always worse when SNS are compatibly connected. The providers will benefit from both service and business integration. The users will always gain from the quality (features) competition. However, brand competition may hurt the customers as more disturbing ads will be exerted. In general, business integration will result in a higher diversity if ads exerted in two SNS.

The remaining sections are organized as follows. Section 2 lists previous works and section 3 introduces the game setting and models the related parameters. In Section 4 we investigate the advertisements conducting quantity and SNS channel allocation equilibriums. In section 5 we analyze and compare results under incompatible and compatible situations between two SNS providers. In section 6 concludes our findings and future research directions.

RELATED LITERATURES

Social networking related services have drawn significant press from the business and academic boundary. These services are spreading interdisciplinary. Social network analysis related approaches are applied to blog network structure analysis, online recommendation system domain and online communities, and so on. In recent year, as the emergence of concept of web2.0, person interactive oriented services gradually replace traditional websites. More and more innovations and technology progresses focus on these SNS which help users find a piece of information that may be held by a friend of a friend (social tagging or bookmarking services). Previous study about behavioral into social network services, such as Myspace, Flickr and Facebook, has been performed by survey [24][4] or empirical study [2]. In this study, we focus our attentions on economical analysis of social networking, which discuss these competing services providers and analyze the impact of integration (service compatibility and business alliance) on the resulting advertising strategy and demand distribution.

Network externality plays an extremely role in social networking related services, which is a significant factor affects the profitability of SNS providers. [6] utilizes a example of telephone to demonstrate that the utility derive from the consumption of these goods is affected by the number of other people using similar or compatible products. Especially in the market of online social networking services, once the users of certain service cross the point of "critical mass", the utility of provider will exponentially increases with the number of service users. The influence of network externality widely presents in domains ranging from traditional industries: telecommunication, hardware and software industries and market of information [6], to internet service providers, such as all kinds of social networking related services or product. Network externality indeed influence both on providers and users. Digital version of products will increase the sales in stores if the externality effect is significant [5]. Yet, the size of network externality affects consumer's demand and/or willingness to pay [9].

Compatibility is especially a crucial factor in information network industries, and the value will be limited without compatibility in networking or communication related services. Typically, firms can choose whether to produce compatible products or services for the purpose of benefit improvement. A few research have be conducted on the compatibility decisions of hardware and software, for example, Gerald Brock and Robert Kurdle (1975) have targeted on the compatibility of mainframe computer and farm machinery industry. For SNS services, whether compatible or incompatible between two SNS services play an important role in evaluating the users' utility and providers' corresponding strategy. In this paper, we utilize game theoretical model to analyze the impact of service compatibility and business integration on the adoption of advertising strategy.

THE MODEL

We consider a market with two social networking related services (SNS) in which users can utilize the service to communicate and share knowledge with other users. The total number of SNS users is η_0 and the total number of users of these two SNS channels are $\forall i\ \eta_1$ and η_2 respectively ($\eta_0 = \eta_1 + \eta_2$). For analytical convenience, in this model, we assume a user choose only a SNS channel as their major bridge to communicate with other users, though people may use two channels simultaneously because they may have different groups of friends on two channels. Such as, in fact most of users use two of more IM channels to communicate [7] with others due to their different preferences on these IM services. Let parameter β_i stand for brand index about SNS *i* determined by images of SNS channels. The users are heterogeneous on the impact of the brand when selecting the SNS. Brand index of channels could be described as brand reputation which is determined by strength of brand. It's a degree of influencing power, we could quantify it by the average images scores of users. That is, we consider β_1, β_2 as the influences of brands on most users. In contrast to traditional setting of brand index, we found that it's more suitable to employ the brand index in representing the likeness degree toward SNS. In other words, the difference is that positive utility of brand index is used to replace the traditional one which models brand index with a negative utility.

Variable θ_i stands for the individual type toward the brand of SNS, and is uniformly distributed with an interval [0,1]. It's a relative indicator. Notable, a user with higher value of θ_i haves more love tendency to use SNS channel 1, vice versa. The user with value of θ_i near $\hat{\theta}$ is indifference when selecting SNS channels. That is, he/she has similar preferences toward two channels. The user will choose one channel eventually whether the facts that he/she may use the other channel simultaneously. Intuitively, $\theta_i\beta_1$ stands for brand loyalty of user *i* toward channel 1 and $(1-\theta_i)\beta_2$ means brand loyalty of user *i* toward channel 2.

Parameter f_i means functions (or features) of SNS *i* determined by their own service quality level (such as services accessibility, the familiarity of user interface, system stability, and file transferring capacity). Since the users prefer to a SNS with larger number of users because he/she can communicate with more potential users utilizing the same SNS. We describe the effect of this type of externality by parameter α . Higher α indicates stronger effect of the externality. Finally, parameters a_i is the advertising quantity conducted on SNS channel *i*.

Individual And Demand Functions

Incompatible SNS Services

Considering the above factors (brand loyalty, features, externality, and ads disturbance), the utility of user *i* in a market with incompatible independent SNS providers can be formulated as

$$U_i^n = \begin{cases} \theta_i \beta_1 + f_1 + \alpha\eta_1 - a_1 & \text{if subcribe to SNS 1} \\ (1-\theta_i)\beta_2 + f_2 + \alpha\eta_2 - a_2 & \text{if subcribe to SNS 2} \end{cases} \quad (1)$$

Let $\hat{\theta}$ denote the user type who is indifferent between using two channels. From the utility function, we can get

$$\hat{\theta}^n = \frac{\beta_2 - \Delta f - \alpha\Delta\eta + a_1 - a_2}{\beta_1 + \beta_2}, \quad (2)$$

Where $\Delta f = f_1 - f_2$ and $\Delta\eta = \eta_1 - \eta_2$. The users with type indexed by $\theta_i \in [0, \hat{\theta}]$ will use SNS channel 2, whereas the users with type indexed by $\theta_i \in [\hat{\theta}, 1]$ will prefer SNS channel 1. According to conditions $\eta_2 = \hat{\theta}^n \eta_0$ and $\eta_0 = \eta_1 + \eta_2$, we get the demand functions of two channels:

$$\eta_1^n = \frac{\eta_0(\beta_1 + \Delta f - a_1 + a_2 - \alpha\eta_0)}{\beta_1 + \beta_2 - 2\alpha\eta_0}, \eta_2^n = \frac{\eta_0(\beta_2 - \Delta f + a_1 - a_2 - \alpha\eta_0)}{\beta_1 + \beta_2 - 2\alpha\eta_0} \quad (3)$$

And the difference of demand between two SNS channels are obtained as

$$\Delta\eta^n = \eta_1^n - \eta_2^n = \frac{\eta_0(\beta_1 - \beta_2 + 2\Delta f - 2a_1 + 2a_2)}{\beta_1 + \beta_2 - 2\alpha\eta_0} \quad (4)$$

Compatible SNS Services

Now we consider two SNS channels are compatible, that is, the users of one channel could communicate with users of another channel, vice versa. For example, currently SNS like Yahoo and MSN messengers can contact each other's users after utilizing specific bridge software. In the case, both users could benefit form the aggregate externality effect, $\alpha(\eta_1 + \eta_2)$. The utility of a typical user *i* is rewritten as

$$U_i^c = \begin{cases} \theta_i \beta_1 + f_1 + \alpha\eta_0 - a_1 \\ (1-\theta_i)\beta_2 + f_2 + \alpha\eta_0 - a_2 \end{cases} \quad (5)$$

Similarly, we can obtain the use type who is indifference in using SNS channel 1 and SNS channel 2, under compatible situation,

$$\hat{\theta}^c = \frac{\beta_2 - \Delta f + a_1 - a_2}{\beta_1 + \beta_2} \quad (6)$$

Then, the demand functions of two channels are derived as

$$\eta_1^c = \frac{\eta_0(\beta_1 + \Delta f - a_1 + a_2)}{\beta_1 + \beta_2}, \eta_2^c = \frac{\eta_0(\beta_2 - \Delta f + a_1 - a_2)}{\beta_1 + \beta_2} \quad (7)$$

, and the difference of demand between two SNS channels are obtained as

$$\Delta\eta^c = \eta_1^c - \eta_2^c = \frac{\eta_0(\beta_1 - \beta_2 + 2\Delta f - 2a_1 + 2a_2)}{\beta_1 + \beta_2} \quad (8)$$

Comparing $\Delta\eta^n$ and $\Delta\eta^c$, as intuitive, we can find the provider with stronger brand, more features (high quality) , and less ads will acquire higher market share in both market environments. However, in a market with incompatible service strategy, we could observe that the difference of the demand of heterogeneous SNS increase as the externality effect α increases, whereas if network effect α has no impact on the demand distribution if these two SNS services are coordinated to be compatible. $\partial|\Delta\eta^n|/\partial\alpha > 0$ and $\partial|\Delta\eta^c|/\partial\alpha = 0$.

Profit Functions

SNS such as instant messenger do not earn any revenue from the IM subscribers but derive revenue commonly from online advertising, LBS (Location-Based Services), IVAS (Internet Value Added Services) such as online dating and data storage services, avatars (virtual icons representing user identity) and casual games, and MVAS (Mobile Value Added Services), such as subscription service for IM message forwarding to mobile phones [8]. In this context, only advertising revenue is considered and modeled as profits of providers. We especially focus on what is the impact of integration (service compatibility and business alliance) on the resulting advertising strategy and demand distribution.

The advertising spaces of SNS channel are divided into several AD slots, each advertisement statically occupied a slot (space) in a period of time, so advertising quantity in a certain time means the number of advertisements (slots) which was conducted on the SNS channels. Denote φ the fee (price) of unit advertisement (for example, per ads impression) charged to the sponsors by SNS providers. Notice that the benefit of operating SNS include directly benefit (such as revenue generated from advertising) and indirect one (for example, IM service is strategically provided to retain the visitors and receive future gain from the lock ins). The payoff functions of the two SNS providers in the long run can be formulated as

$$\pi_1 = \eta_1 a_1 \varphi + K(\eta_1) - c(\beta_1,\ f_1, \eta_1),$$
$$\pi_2 = \eta_2 a_2 \varphi + K(\eta_2) - c(\beta_2,\ f_2, \eta_1) \tag{9}$$

, where $K(\eta_i)$ stands for the indirect benefit (asset) of the services which is associated with the number of the users of the SNS services. The cost function of SNS services $c(\beta_i,\ f_i, \eta_i)$ include the investments of brand promotion, functionality and quality development, the operational cost to accommodate and coordinate the activities of the users. Here, we first consider the model for the operation in short run. That is, in the short run, the costs of branding, product development and capacity are sunk cost and focus on the decision of appropriate advertising strategy and corresponding profit. We reduce the profit (only revenue is consider here) function as

$$\pi_1 = \eta_1 a_1 \varphi,\ \pi_2 = \eta_2 a_2 \varphi \tag{10}$$

THE SNS MARKETS

In this section, according to the service functionalities (brand loyalty, service quality, and compatibility) and business activities (competition and integration), we analyze advertising strategies of the SNS providers. We derive subgame perfect Nash equilibrium (advertising level and channel distribution) with respect to different market environments. Various market structures discussed in our model are described in Table 1.

Table 1: Market Structure

	Technology Independent	Technology Integration
Business Independent	NO (section 4.1)	Only Technology integration (section 4.3)
Business Integration	Only Business Integration (section 4.2)	Both Technology and Business Integration (section 4.4)

On business integration dimension, section 4.1 and 4.3 emphasize on independent services providers under different strategy of compatibility. However, section 4.2 and 4.4 focus on merged providers (business integration). On technology integration dimension, section 4.1 and 4.2 issue on incompatible service of each channel and section 4.3 and 4.4 centre on technology integration where two channels are compatible.

Independent Providers And Incompatible Services

First, we consider two incompatible SNS operated by independent providers. In this business scenario, the providers decision his own advertising strategy to maximize his own profit and either side of users can access only the users of networks he/she registers. Thus, the objective function of each SNS provider can formulated as

$$\max_{a_1} \pi_1 = \eta_1 a_1 \varphi = \frac{\eta_0 \varphi(\beta_1 + \Delta f - \alpha\eta_0 - a_1 + a_2) a_1}{\beta_1 + \beta_2 - 2\alpha\eta_0}$$
$$\max_{a_2} \pi_2 = \eta_2 a_2 \varphi = \frac{\eta_0 \varphi(\beta_2 - \Delta f - \alpha\eta_0 + a_1 - a_2) a_2}{\beta_1 + \beta_2 - 2\alpha\eta_0} \tag{11}$$

Solving first order condition, $\partial\pi_1 / \partial a_1 = 0$ and $\partial\pi_2 / \partial a_2 = 0$ simultaneously, we get the Nash Equilibrium results:

$$a_1^n = \frac{2\beta_1 + \beta_2 + \Delta f - 3\alpha\eta_0}{3}, a_2^n = \frac{\beta_1 + 2\beta_2 - \Delta f - 3\alpha\eta_0}{3} \tag{12}$$

, and we have overall ads amount in the market $\sum \hat{a^n} = a_1^n + a_2^n = \beta_1 + \beta_2 - \alpha\eta_0$ and the difference of ads amount two SNS $\Delta a^n = a_1^n - a_2^n = (\beta_1 - \beta_2 + 2\Delta f)/3$.

Plug a_1^n and a_2^n into demand function η_1^n and η_2^n, the demand functions are written as

$$\eta_1^n = \frac{\eta_0(2\beta_1 + \beta_2 + \Delta f - 3\alpha\eta_0)}{3(\beta_1 + \beta_2 - 2\alpha\eta_0)}, \eta_2^n = \frac{\eta_0(\beta_1 + 2\beta_2 - \Delta f - 3\alpha\eta_0)}{3(\beta_1 + \beta_2 - 2\alpha\eta_0)} \tag{13}$$

Finally, the profits of SNS providers are obtained:

$$\pi_1^n = \frac{\eta_0\varphi(2\beta_1 + \beta_2 + \Delta f - 3\alpha\eta_0)^2}{9(\beta_1 + \beta_2 - 2\alpha\eta_0)}, \pi_2^n = \frac{\eta_0\varphi(\beta_1 + 2\beta_2 - \Delta f - 3\alpha\eta_0)^2}{9(\beta_1 + \beta_2 - 2\alpha\eta_0)} \tag{14}$$

Proposition 1. (**Independent Providers and Incompatible Services**)

(a) Increase the service features and quality will decrease the ads level of his opponent, however, increase the investment on the branding will result in the rise of both providers' ad level. That is $\partial a_i^n / \partial f_j < 0$ and $\partial a_i^n / \partial \beta_j > 0$, where $i \neq j$.

(b) Both providers' ad level will decrease as the size of the market increase and the intensity of network externality increases. That is $\partial a_i^n / \partial \eta_0 < 0$ and $\partial a_i^n / \partial \alpha < 0$, $\forall i$.

(c) The difference of ad level between two SNS providers was determined by users' brand loyalty and service features but is

independent with the total number of the SNS users. That is $\partial \Delta a_i^n / \partial \eta_0 = 0$.
(d) The total amount of ads exerted in the SNS market is positively associated with the strength of both brand loyalty, negatively associated with the network externality effect, but is independent with the features of the SNS software provided. That is, $\partial \sum a_i^n / \partial f_i = 0$, $\forall i$.

Independent Providers And Compatible Services

Next, we consider the situation that these independent providers make the services compatible. Solving first order condition of profit function, $\partial \pi_1 / \partial a_1 = 0$ and $\partial \pi_2 / \partial a_2 = 0$ simultaneously, we get the Nash Equilibrium results

$$a_1^c = \frac{2\beta_1 + \beta_2 + \Delta f}{3}, a_2^c = \frac{\beta_1 + 2\beta_2 - \Delta f}{3} \tag{15}$$

, and

$$\sum a^c = \beta_1 + \beta_2,\ \Delta a^c = (\beta_1 - \beta_2 + 2\Delta f)/3. \tag{16}$$

Then, the demand functions can be obtained as

$$\eta_1^c = \frac{\eta_0(2\beta_1 + \beta_2 + \Delta f)}{3(\beta_1 + \beta_2)}, \eta_2^c = \frac{\eta_0(\beta_1 + 2\beta_2 - \Delta f)}{3(\beta_1 + \beta_2)} \tag{17}$$

Consequently, we have profit of SNS providers:

$$\pi_1^c = \frac{\eta_0\varphi(2\beta_1 + \beta_2 + \Delta f)^2}{9(\beta_1 + \beta_2)}, \pi_2^c = \frac{\eta_0\varphi(\beta_1 + 2\beta_2 - \Delta f)^2}{9(\beta_1 + \beta_2)} \tag{18}$$

Proposition 2. (**Independent Providers and Compatible Services**)
(a) Both SNS providers exert higher level of ads if their service are compatible (can communicate with the users in other networks). That is $a_i^c > a_i^n, \forall i$, hence
(b) Both SNS providers earn higher profit. That is $\pi_i^c > \pi_i^n, \forall i$.
(c) The market size has no impact on the ads amount exerted on both SNS. That is $\partial a_i^c / \partial \eta_0 = 0, \forall i$.
(d) The difference of ads level between two SNS providers keep unchanged after the SNS become compatible. That is $\Delta a_i^c = \Delta a_i^n$.
(e) The total amount of ads exerted in the SNS market is only positively associated with the strength of both brand loyalty. That is, , $\partial \sum a_i^n / \partial f_i = 0$, $\partial \sum a_i^n / \partial \eta_0 = 0$, $\forall i$.

Incompatible Services Operated By A Single Merged Company

Duo to the market strategies of earning market share or segmentation, the merged firms may consider operate duo-brands related services to earn more profits. Now, we consider a business scenario that two incompatible SNS providers are integrated as a company or SNS provider or form a strategic alliance to maximize joint profit. Since $a_1 = \hat{\theta}\beta_1 + f_1 + \alpha(1-\hat{\theta})\eta_0$ and $a_2 = (1-\hat{\theta})\beta_2 + f_2 + \alpha\hat{\theta}\eta_0$, we plug a_1, a_2 into the objective function and replace η_1, η_2 with $(1-\theta)\eta_0$ and $\theta\eta_0$ respectively. In the following analysis, we assume the amount of SNS 1 is lower that that of SNS 2 ($\Delta a^n < 0$). Then, we rewrite the objective function as

$$\max_{a_1, a_2} \pi_{1+2} = \left(\eta_1 a_1 + \eta_2 a_2\right)\varphi = \left((\hat{\theta}\beta_1 + f_1 + \alpha(1-\hat{\theta})\eta_0)(1-\hat{\theta})\eta_0 + ((1-\hat{\theta})\beta_2 + f_2 + \alpha\hat{\theta}\eta_0)\hat{\theta}\eta_0\right)\varphi \tag{19}$$

where lowercase 1+2 of SNS provider payoff function means integrated channel of two SNS providers. Notice the new profit function includes only one variable $\hat{\theta}$, we solve $\partial \pi_{1+2} / \partial \hat{\theta} = 0$ instead of solving the first order condition with respect to a_1 and a_2, then we directly yield the $\hat{\theta}^{n*}$,

$$\hat{\theta}^{n*} = \frac{\beta_1 + \beta_2 - \Delta f - 2\alpha\eta_0}{2(\beta_1 + \beta_2 - 2\alpha\eta_0)} \tag{20}$$

Then optimal ads levels of SNS 1 and SNS 2, $a_1^{\hat{n}}$ and $a_2^{\hat{n}}$ will obtain,

$$a_1^{\hat{n}} = \frac{\beta_1 + \beta_2 - \Delta f - 2\alpha\eta_0}{2(\beta_1 + \beta_2 - 2\alpha\eta_0)}(\beta_1 - \alpha\eta_0) + f_1 + \alpha\eta_0$$

$$a_2^{\hat{n}} = \frac{\beta_1 + \beta_2 + \Delta f - 2\alpha\eta_0}{2(\beta_1 + \beta_2 - 2\alpha\eta_0)}(\alpha\eta_0 - \beta_2) + f_2 + \beta_2 \tag{21}$$

And the difference of the ads level is

$$\Delta a^{\hat{n}} = (\beta_1 - \beta_2 + \Delta f - 4\alpha\eta_0)/2\,. \tag{22}$$

Then we direct yield optimal channel allocation of SNS channel 1and 2 as below

$$\eta_1^{\hat{n}} = (1-\hat{\theta}^{n*})\eta_0 = \frac{\eta_0(\beta_1 + \beta_2 + \Delta f - 2\alpha\eta_0)}{2(\beta_1 + \beta_2 - 2\alpha\eta_0)}, \eta_2^{\hat{n}} = \hat{\theta}^{n*}\eta_0 = \frac{\eta_0(\beta_1 + \beta_2 - \Delta f - 2\alpha\eta_0)}{2(\beta_1 + \beta_2 - 2\alpha\eta_0)} \tag{23}$$

Compatible Services Operated By A Single Merged Company

Last, we consider the situation that two SNS providers make its SNS channels compatible with each other, each user of either side could communicate with the other side. The utility of each user is remaining unchanged as the situation of compatible market structure as these two SNS services are coexisting. Similarly, we rewrite the objective function as

$$\max_{a_1,a_2} \pi_{1+2} = \left(\eta_1^c a_1 + \eta_2^c a_2\right)\varphi = \left((\hat{\theta}\beta_1 + f_1 + \alpha\eta_0)(1-\hat{\theta})\eta_0 + ((1-\hat{\theta})\beta_2 + f_2 + \alpha\eta_0)\hat{\theta}\eta_0\right)\varphi \tag{24}$$

After solving $\partial\pi_{1+2}/\partial\hat{\theta} = 0$, we have optimal $\hat{\theta}^{c*}$,

$$\hat{\theta}^{c*} = \frac{\beta_1 + \beta_2 - \Delta f}{2(\beta_1 + \beta_2)} \tag{25}$$

Then the optimal ad levels are,

$$a_1^{\hat{c}} = \frac{\beta_1(\beta_1 + \beta_2 - \Delta f)}{2(\beta_1 + \beta_2)} + f_1 + \alpha\eta_0, a_2^{\hat{c}} = \frac{\beta_2(\beta_1 + \beta_2 + \Delta f)}{2(\beta_1 + \beta_2)} + f_2 + \alpha\eta_0 \tag{26}$$

The difference of the ads level is $\Delta a^{\hat{c}} = (\beta_1 - \beta_2 + \Delta f)/2$. (27)

Thus, corresponding demand functions are obtained as

$$\eta_1^{\hat{c}} = \frac{\eta_0(\beta_1 + \beta_2 + \Delta f)}{2(\beta_1 + \beta_2)}, \eta_2^{\hat{c}} = \frac{\eta_0(\beta_1 + \beta_2 - \Delta f)}{2(\beta_1 + \beta_2)} \tag{28}$$

CONCLUSION

In this paper, we discuss the adoption of advertising strategy on the SNS based on four types of market structures on. Utilizing game theoretic model, we analyze the impact of integration (service compatibility and business alliance) on the resulting advertising strategy and demand distribution. We have shown that the impact of service compatibility and business integration is significant. While gaining the benefit from contacting more people, the users are always worse when SNS are compatibly connected. The providers will benefit from both service and business integration. The users will always gain from the quality (features) competition, however, brand competition may hurt the customers as more disturbing ads will be exerted. In general, business integration will result in a higher diversity if ads exerted in two SNS.

For the ease of modeling, firstly we assume user's benefits are negatively associated with the number of advertisements while the service provider's profit increases with it. Although these service providers are now trying to alleviate the disturbance of advertisements by inserting ad tabs on the side or dividing a separated ad section for users to view. This may cause the users match with the proper ads with a higher probability. For future extensions, we will refine the parameter of ad by multiplying an extra variable which uniformly distributed from -1 to 1. In order to closer to the reality, we will adjust the advertisement variable by making it not always a negative utility for users. That is $U_i = \theta_i\beta_1 + f_1 + \alpha\eta_1 - \upsilon_i a_1$ where $\upsilon_i \sim U[-1,1]$.

ACKNOWLEDGEMENTS

This research was supported by the National Science Council of Taiwan (Republic of China) under the grant NSC 96-2416-H-009-017.

REFERENCES

[1] Baye, M. R. and Morgan, J. (2000)"A Simple Model of Advertisement and Subscription Fees", *Economics Letters*, Vol. 9, No. 14.

[2] Golder, S., Wilkinson, D. M. and Huberman, B. A. (2006) "Rhythms of social interaction: messaging within a massive online network", *3rd International Conference on Communities and Technologies*.

[3] Katz, M. L. and Shapiro, C. (1986) "Technology adoption in the presence of network externalities," *The Journal of Political Economy*, Vol. 94 No. 4, pp. 822-841.

[4] Kolbitsch, J. and Maurer, H. "The growing Importance of e-communities on the web," *Proceedings of the IADIS International Conference on Web Based Communities*, pp. 165-174.

[5] Li, Y.-M., (2006)"Pricing Heterogeneous Content Distribution Channels: Efficiency and Profitability," *Proc. 5th*

Workshop on e-Business, pp. 1-9.

[6] Shy, o. (2001) “The economics of network industries,” *Cambridge University Press*.

[7] Viard. V. B. and Fan. S. (2005) “The long battle for an instant messaging standard,” *Stanford GSB case*.

[8] Vogiazou, Y., (2002) “Wireless presence and instant messaging,” *JISC Report*.

[9] Wang, K.-C., Andy, C.-H., A. Lin and J.-R., Chiou (2004) “An investigation on fulfilled expectations equilibrium of network externality,” *Review of Industrial Organization*.

[10] “Wikipedia: social network service”, http://en.wikipedia.org/wiki/Social_network_service.