Association for Information Systems
AIS Electronic Library (AISeL)

2009

Attracting Whom? - Managing User-Generated-Content Communities for Monetization

Liye Ma
Carnegie Mellon University, liyem@andrew.cmu.edu

Onur Kesten
Carnegie Mellon University, okesten@andrew.cmu.edu

Tridas Mukhopadhyay
Carnegie Mellon University, tridas@cmu.edu

Follow this and additional works at: http://aisel.aisnet.org/icis2009

ATTRACTING WHOM? – MANAGING USER-GENERATED-CONTENT COMMUNITIES FOR MONETIZATION

Completed Research Paper

Liye Ma
Tepper School of Business
Carnegie Mellon University
Pittsburgh, PA 15213
liyem@andrew.cmu.edu

Onur Kesten
Tepper School of Business
Carnegie Mellon University
Pittsburgh, PA 15213
okesten@andrew.cmu.edu

Tridas Mukhopadhyay
Tepper School of Business
Carnegie Mellon University
Pittsburgh, PA 15213
tridas@cmu.edu

Abstract

Successful monetization of user-generated-content (UGC) business calls for attracting enough users, and the right users. The defining characteristic of UGC is users are also content contributors. In this study, we analyze the impact of a UGC firm's quality control decision on user community composition. We model two UGC firms in competition, with one permitting only high quality content while the other not controlling quality. Users differ in their valuations and the content quality they contribute. Through analyzing various equilibrium situations, we find that higher reward value generally benefits the firm without quality control. However, when the intrinsic value of contribution is low, higher reward value may surprisingly drive high valuation users away from that firm. Also somewhat interestingly, we find that higher cost of contribution may benefit the firm that does not control quality. Our work is among the first to study the business impact of quality control of UGC.

Keywords: User-generated-content, competition, network effect, quality, differentiation

Introduction

In less than a decade, user-generated-content (UGC) based businesses have come from virtually nonexistent to becoming a mainstay phenomenon of Internet and E-Commerce (OECD 2007). UGC-based businesses exist in many forms: online social networks (MySpace, Facebook), content sharing sites (Youtube, Slashdot), blogs (Blogger.com, Technorati), virtual investment communities (SeekingAlpha, Motley Fool CAPS), etc. The highly priced sales of firms such as Youtube and MySpace, as well as Microsoft's big ticket investment in Facebook, have all but ascertained the credibility of UGC-based business. Established businesses also try to leverage the power of UGC, as evidenced by many media websites' decision to host user blogs, and novel features like CNN's iReport.

Though coming under the spotlight only recently, UGC has its root years ago. Business has always sought to leverage the contribution of users. Two widely studied examples are online reputation systems (Resnick et al. 2000) and open-source (Lerner and Tirole 2002). Major E-commerce sites such as Ebay and Amazon, in order to reduce information asymmetry, have established reputation systems where users evaluate each other and/or products (Bajari and Hortacsu 2003, Cabral and Hortacsu 2004). Open-source software firms also encourage community participation in the software development to reduce cost. Encouraging "high quality" user participation has been the theme of reputation systems (Dellarocas 2003) and open-source, as well as of UGC-based businesses in general (Chen et al. 2007). However, the current form of UGC-based businesses differs from a reputation system or open-source on one crucial point: while for reputation systems and open-source, encouraging user participation is to *help* the business, for UGC-based businesses, user participation *is* the business. In open-source, for example, user participation helps build software products which firms can then sell for profit – *firms profit from the products created by users*, and user participation factors into firm profit *indirectly*. In a UGC-based business such as Youtube, however, participation makes users exposed to paid advertisements which bring profit to the firms – *firms profit from users themselves*, and user participation factors into firm profit *directly*.

Many UGC firms are successful at attracting large communities of users. However, they are not nearly as successful monetizing the user bases. Even most popular firms such as Youtube and Facebook have struggled to profit (e.g. Reuters 2008). Many UGC business models have been proposed, with advertising and add-on selling among the most popular ones. But to date, successful monetization remains elusive (e.g. BusinessWeek 2007). Large user-base is crucial for success of UGC businesses. However, ample evidence also shows that this alone is not sufficient. *All users are not the same*. They differ in their valuation of service, and thus the profit they can bring to the firm. Attracting a large user-base is necessary, but attracting the *right* users, generally those who have higher valuation of service, is equally important.

Existing research sheds light on understanding user's motivation in contributing contents. Both intrinsic and extrinsic factors exist. Users may contribute to satisfy certain intrinsic need, such as the need to use open-source software (Shah 2006). Extrinsic factors may exist when users contribute to signal their abilities to interested parties, such as a developer signaling to potential employers her coding skills (Lerner and Tirole 2002). Furthermore, UGC firms may also provide monetary rewards to encourage user contribution, examples for which include Youtube's plan to share advertising revenue with contributors (Helft 2007), or the million dollar portfolio challenge sponsored by CNBC (CNBC.com 2008). Intrinsic and extrinsic factors differ in from one important perspective: while the former is determined by the user herself, the latter is also influenced by the participation of other users (for example, when more users participate, the chance of each individual user winning the CNBC's portfolio challenge is reduced).

The quality of content generated by users is a major concern to UGC firms (Chen et al. 2007). In reputation systems, firms have tried numerous ways to elicit honest opinion, combating potential adverse selection and moral hazard (Dellarocas 2005). In open-source software, meritocracy is commonly adopted to ensure product quality. In UGC businesses in general, quality control mechanisms vary in both format and strictness. Some quality control is people-based, such as in SeekingAlpha, which certifies contributors before their contribution can be accepted. Some is actively content-based, such as in Slashdot, which has experts review user submission to decide whether to publish. Some is passively content-based, such as in Youtube, which removes published content that it later finds as inappropriate. Some firms also do not control quality at all.

When UGC functions such as reputation systems are used to facilitate other businesses such as online retailing, maximizing content quality is desirable. However, today's UGC based firms are not there to help another business. Instead, they *are* the business. Most of these firms do not profit from their contents, but from their users. In this context, it is questionable whether higher quality always helps firms.

The defining characteristic of a UGC-based business is that users can also be contributors. Therefore, they can be differentiated along both the *consumption* and the *production* dimension. On the consumption dimension, users value the UGC platform based on both the information they can get from the platform and the extent of their own contribution to the platform. On the production dimension, users differ in the quality of the content they can contribute. Advertising based UGC business models call for attracting not just more users, but also more users who have high valuation in the consumption dimension. Those with high valuation, however, may not all have the ability to contribute high quality content, an attribute in the production dimension. Separating users based on these two dimensions gives us four groups: those who have high(low) valuation in the consumption dimension and can contribute high(low) quality content in the production dimension.

Increasing content quality through quality control mechanisms runs the risk of driving away certain types of users, whose participation also influences the participation of other types of users. This effect is not obvious to see, but very important for firms to understand. This motivates our study, where *the central question is the impact of UGC firm's quality control decision on the participation decision by different users*. This question has important managerial implications, as the size and composition of the user base directly impacts firm profit. Factors such as the cost of contribution, magnitude of extrinsic reward, dispersion of content quality, and difference in valuation, would interact with the quality control decision to influence user participation, and their effects are studied.

By studying two UGC platforms with different quality control policies in competition, one allowing anyone to contribute while the other permitting only high quality contents, we characterize the equilibrium under different situations. We show that higher reward value generally benefit the platform that does not control quality, because more users will contribute in the other platform and the per person reward value is lower there. A *key insight* of our study is that the *relative cost* of the users with low and high valuation determines which type will respond to the reward value and choose the platform that does not control quality. We show that because the relative cost of users change as the reward value changes, higher reward value may bring more low valuation users to the platform that does not control quality while at the same time *drive the high valuation users out*. We also show that though higher cost of contribution is generally detrimental to the platform which does not control quality, it can also benefit that platform under certain circumstances, again because of the change of this relative cost.

The rest of the paper is organized as follows. In the next section we review related literature. The following section describes the model used in our study. Equilibrium scenarios and their implications are discussed in detail subsequently. And finally we conclude.

Literature Review

Academic research on UGC is still growing. The research can be grounded on several stream of work in economic theories. Demonstrated in many UGC communities are various forms of network externalities, either positive or negative, which have a rich related economic literature (e.g., Katz and Shapiro 1985). As is detailed below, our study recognizes a form of negative externality, since users compete for the reward value in UGC platforms. UGC community has similar structure to a platform or two-sided market (Rochet and Tirole 2003, Parker and Van Alstyne 2005) through which users both create and consume content, or information. The difference is that whereas in a two-sided market producers and consumers are two distinct groups, in UGC communities they are the same group of users that cannot be separated ex ante. The existence of consumer heterogeneity is long recognized in economic research and differentiation strategies have been studied extensively (Shaked and Sutton 1983, Vandenbosch and Weinberg 1995). The differentiation in our study is unique in that each of the users is potentially both a producer and a consumer, and they are differentiated along both dimensions. Information asymmetry is also studied in economic research (Akerlof 1970), and is related to us in that, first, signaling skills (Spence 1973) may be one of the reasons that users contribute in UGC platforms, and second, that UGC firms cannot tell the types of users restricts their ability to attract the profitable ones.

A rich literature exists on two special forms of UGC, namely open-source and online reputation systems, that are used in assisting product development and electronic-commerce. In the case of open-source, the "content" generated by users are the computer program that comprise the software products which are used by users and other people. Three categories of open-source research exist: motivation for contributions, governance of open-source initiatives, and competitive dynamics (von Krogh and von Hippel 2006). Closely related to our study is the first stream of work (e.g. Roberts et al. 2006, Shah 2006), which studies incentive to voluntarily contribute to open-source projects. Roberts et al. (2006) finds through investigating the Apache project that both intrinsic and extrinsic motivations

exist for users to contribute. While Shah (2006) finds that a developer's contribution is often first driven by her need to use the software, and the contribution gradually evolves into a hobby. Contributing to online communities can be considered as a form of private provision of public goods, which has a long literature in the economics community (Olson 1965, Andreoni 1988). This view is also empirically tested and confirmed using data acquired from Wikipedia. (Zhang and Zhu 2007).

The emergence of online communities enabled the creation of online reputation systems (Resnick et al. 2000), which can be used to reduce information asymmetry in online communities. Dellarocas (2003) provides a comprehensive survey on research related to reputation systems and the corresponding design challenges. Similarly, Dellarocas (2005) investigates reputation system design in pure moral hazard settings.

The existence of different types of users and the effect of content quantity and quality on their participation in online communities are already recognized in literature. Gu et al. (2007) hypothesize that users differ in demand for quality and information processing cost, and through empirical analysis of several virtual investment communities, find that the communities engage in differentiation based on the tradeoff of quality and quantity. Our study bears similarity to Gu et al. (2007) as we both account for user types and information quality, but our study is different, in that Gu et al. (2007) empirically verify the effect of content volume on information quality but do not consider the quality control decision, while we analyze the effect of quality control decision on content quality and the participation of different types of users.

Controlling content quality in online communities has also been studied. Chen et al. (2007) investigates the effect of moderation and reputation systems in online communities. They find that moderation in general improves information quality, but the strategic reaction from contributors may actually reduce the quality of contribution in certain stage of the dynamic process. Not considered in that paper, though, is the participation decision of different types of users. Ren and Kraut (2007) build an agent-based model to study the moderation mechanisms in online communities, and find that personalized moderation is more effective than community-level moderation in increasing contribution. Lampe and Resnick (2004) investigate the feasibility of distributed moderation performed by users themselves in online communities. Other work also studies the factors that influence the effectiveness of blog advertising (Zhu and Tan 2007), and the effect of the volume of online product review on sales (Etzion and Awad 2007).

The Model

We study how UGC platforms with or without quality control attract user participation. There are two firms in our model, each providing a UGC platform where users can view and contribute content. Contents, contributed by users, are of either high quality, q_H, or low quality, q_L, where $q_H > q_L$. The quality dimension is vertical in that all users prefer high over low quality content, though maybe to different degrees.

Firms differ in their quality control practice. Firm 1, subsequently referred to as the "qualifying" firm, or simply the *Q* platform, controls quality by allowing only high quality content to be contributed. Firm 2, subsequently referred to as the "not-qualifying" firm, or simply as the *NQ* platform, does not control quality, allowing both high and low quality contributions. In real-world, firms leverage a variety of quality control mechanisms. Some imposes a high standard, such as qualifying the contributor before accepting any of her articles, or actively inspecting each article before deciding whether to publish; some imposes lower standard, such as removing articles which some readers complain about; some "outsource" the control to readers, such as by asking readers to rate an article and sorting article based on their ratings. Since our focus is the quality control decision itself, we make the simplifying assumption that when a firm controls quality, it does so strictly by permitting only high quality content. The optimal level of quality control can be studied in an extended model, which we leave for future work.

There are a group of users, the mass of which is normalized to 1. Each user chooses to join the platform provided by one of the firms. In the platform, she can participate in one of two ways. First, she can be a read-only user (or be forced to). Second, she can be a reader as well as contributor. Users differ in two orthogonal dimensions: the consumption dimension, which characterizes their valuation of the read and write service provided by the platform, and the production dimension, which characterizes the quality of the content they contribute to the platform. On the consumption dimension, a user has either high valuation H or a low valuation L of service. On the production dimension, a user can create content of either high quality q_H or low quality q_L. We assume that half of the users have high valuation of service, and half have low valuation. We also assume that a portion α, $\alpha \in (0, 1/2)$ of

users can contribute high quality content, and the rest can contribute low quality content. There are two reasons for the assumptions that more people can contribute low quality contents than can contribute high quality ones. First, being high quality means it is not easy to be created. And second, it is perceived that typically user generated contents have relatively low quality. There are thus four types of users, which we denote as type $ij, i \in \{L, H\}, j \in \{L, H\}$, where i represents the type in the consumption dimension and j the type in the production dimension (for example, a user of type *LH* has low valuation of service but can create high quality content).

A user derives value from both reading the content and, provided she contributes, writing contents. The net value derived from reading is a function of user's valuation type and the content quality she reads[1]:

$$V_r(i, q_j) = \theta_i q_j$$

In the equation, $i \in \{L, H\}$, $j \in \{L, H\}$. We assume that when reading, users come across content randomly that exist in the UGC platform. Assuming users are risk neutral, the expected value from reading on the UGC platform with average quality q_{avg} is thus:

$$V_r(i) = \theta_i q_{avg}$$

Only users who contribute derive the writing value, which contains two elements. First, contribution satisfies certain intrinsic needs, such as expressing an opinion or interacting with other users. Second, contribution may bring extrinsic reward value to the contributor, through signaling the contributor's ability, being paid for contribution, etc. The intrinsic value depends on the user's valuation of service. We assume that the intrinsic value derived by high valuation users, denoted as v_H, is higher than that derived by low valuation users, denoted as v_L. The extrinsic reward value, meanwhile, depends not only on user's type in the production dimension but also other people who contribute in the same UGC platform. We expect the reward value to be higher for contributors who can contribute higher quality content, and expect the value to be negatively correlated with the number of contributors (the more users contribute, the less chance a particular user gets noticed or wins a reward). Users incur a cost c_w when contributing. To make the difference among the users material, we assume that only users who contribute high quality content can derive the reward value, and that $v_L < c_w < v_H$ (so only high valuation users would contribute if reward value is not considered). Specifically, the value from contributing content is

$$V_w(i, H) = v_i - c_w + \frac{S}{\#_H}$$

for users who can contribute high quality content and

$$V_w(i, L) = v_i - c_w$$

for users who contribute low quality content.

In the equation, S is the total reward value endowed to the UGC platform and $\#_H$ is the mass of users who contribute high quality content in the platform. In real world, this endowed reward value can come in many forms, such as the UGC firm offering prize to certain highly ranked users, or potential employers going through the platform looking for the top performers. In either case, it is expected that the more people contribute, the lower this reward value to each individual contributor.

Table 1 lists and describes all the parameters of the model. Note that certain symbols, such as q_{avg} or $\#_H$, are used to denote characteristics of interest but are derived values instead of exogenous model parameters (e.g. q_{avg}, the average platform quality, is determined by how many users of each type contribute to the platform in equilibrium). The type of users and their utility functions are summarized in figure 1.

---

[1] The cost of reading is normalized to zero in this model, because we focus on the impact of different quality control decisions and do not ex ante assume a lower cost of reading (e.g. arising from superior design of user interface) for either platform. The model can be easily extended to handle positive reading cost.

Table 1. Parameters of the Model	
Parameter	Description
q_H, q_L	Content quality (high or low)
θ_H, θ_L	Valuation of quality (high or low)
v_H, v_L	Intrinsic value of contribution (high or low)
c_w	Cost of writing
s	Reward value endowed to the platform
α	Portion of users who can contribute high quality content

One assumption made in our study is that a high valuation user values both reading (content quality) and writing (intrinsic contribution value) higher than a user with low valuation. We believe this is a reasonable assumption, as the valuation is the characteristic of a user on the consumption dimension, rather than of a specific activity such as reading or writing. From another perspective, if a user has different valuations on reading and writing, then it would be unclear how she values the add-on products that the UGC platform is selling or carrying advertisement for, i.e., her profitability to the firm is ambiguous. In this case, not much can be said about the implication of gaining or losing such a user. Another point to note is that we consider the cases where a user can be read-only or read-write, but not write-only. This is not itself an assumption, but comes directly from our model setup where all users derive positive net utility from reading (the cost of reading is normalized to zero). Extension can be made to consider the case with significant information processing cost. However, we do not expect this to materially change the result, since the relative attractiveness of the two platforms is unlikely to change when an outside option of not using either platform is present.
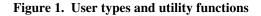

Figure 1. User types and utility functions

Equilibrium Analysis

Our study uses the game theoretic approach to account for the optimizing behavior of agents and their strategic interaction in an integrated setting. In the UGC platform choice game, each user chooses the platform and the type of participation to maximize her own utility[2]. An equilibrium is characterized by user distribution between the two

---

[2] We allow each user to choose only one platform in the game. Although in real world a user can theoretically use multiple platforms, there is usually considerable adoption cost in using each platform, in the form of subscription fee, learning cost, etc. A user in the model can be interpreted as an individual visit by a user in the real-world, and only one platform can be visited each time.

platforms, where no user can increase her utility by unilaterally choosing the other platform or a different participation type. This user distribution has significant impact on UGC firm profits as it influences the willingness-to-pay of advertisers for each platform. Understanding the various equilibrium scenarios is thus critical to decision makers.

Characteristics of Equilibria

Each individual user chooses the platform and the type of participation that maximizes her utility. In doing so, she may face a tradeoff between the value derived from reading and that from writing. Since the qualifying platform permits only high quality content while the not-qualifying one allows both quality levels, the average content quality of the qualifying platform is likely higher than that of the not-qualifying platform. Therefore, a user may derive higher value from reading when using the qualifying platform. However, if the user can contribute only low quality content, then to use the qualifying platform she would have to give up the value from contributing content. If the user can create high quality content, she could contribute in either platform and derive the intrinsic value from contribution, but she may still derive lower reward value if she uses the qualifying platform if there are more high quality contributors in that platform.

As will be shown in the following sections, the equilibrium scenarios vary according to factors such as content quality and cost of contribution. Nonetheless, these equilibria share some common characteristics, which are determined by the fundamental structure of the game. We summarize these characteristics in the proposition below and discuss them subsequently.

> *Proposition 1: All following properties hold in any equilibrium of the UGC platform choice game:*
>
> *1.1 Both platforms attract strictly positive number of users*
>
> *1.2 At least a portion of the type LH or HH users will contribute in the NQ platform.*
>
> *1.3 $q_Q > q_{NQ}$.*
>
> *1.4 All type LL users will choose the qualifying platform and only read.*
>
> *1.5 At least a portion of type HL users will choose to contribute in the NQ platform.*
>
> *1.6 All type HL and LH users who choose the NQ platform will contribute there.*
>
> *1.7 All type HH users will contribute regardless of which platform they choose.*
>
> *1.8 $s_{NQ} > s_Q$, where s_I is the reward value derived by each individual user who contributes high quality content in platform I, $I \in \{Q, NQ\}$.*
>
> *1.9 If any type LH user chooses to contribute in the Q platform, all type HH users will contribute in the Q platform.*

If either platform attracts all users, then any *LH* or *HH* user can move to the other platform and derive large reward value. Such a scenario thus cannot be an equilibrium (thus property 1.1 holds). Furthermore, it shows that in an equilibrium both platforms will have some users contributing high quality content in them (thus property 1.2 holds).

Since the *Q* platform permits only high quality content, we certainly have $q_Q \geq q_{NQ}$. To have the equality hold, no type *HL* user can contribute in the *NQ* platform. But if that is the case, then a type *HL* user can increase her utility by choosing to contribute in the *NQ* platform, since she now derives additional positive utility from contributing without sacrificing any utility from reading. Thus a scenario like this cannot be an equilibrium (thus property 1.3 holds).

In an equilibrium, type *LL* users will not contribute, since doing so will result in negative intrinsic value from writing and no reward value. Given 1.3, then, this type of user must be in the qualifying platform to sustain the equilibrium (thus property 1.4 holds).

Given property 1.4, if no type *HL* user contributes in *NQ* platform, then $q_{NQ} = q_Q = q_H$. From property 1.3, we know this cannot be an equilibrium (thus property 1.5 holds). Given property 1.3, if any type *LH* or *HL* user chooses

the NQ platform but does not contribute there, then she can increase her utility by moving to the qualifying platform as a read-only user. A scenario like this thus cannot be an equilibrium (thus property 1.6 holds).

Regardless of the platform she chooses, a type *HH* user can derive higher utility contributing than if she only reads (thus property 1.7 holds).

Given property 1.2, some type *LH* or *HH* users will contribute in the *NQ* platform. If $s_{NQ} = s_Q$, then given property 1.3, any of these users can increase her utility by contributing in the qualifying platform. This cannot be a equilibrium (thus property 1.8 holds).

Finally, if any *LH* user contributes in qualifying platform but not all *HH* users contribute there, we must have some *HH* contribute in the *NQ* platform per property 1.7. To sustain this as an equilibrium, then, we must have $\theta_H q_{NQ} + s_{NQ} \geq \theta_H q_H + s_Q$, i.e. an *HH* user derives higher value from the *NQ* platform. However, this implies that $s_{NQ} - s_Q \geq \theta_H(q_H - q_{NQ}) > \theta_L(q_H - q_{NQ})$, so any *LH* user who contributes in qualifying platform can increase her utility by moving to the *NQ* platform and contribute there. Such a scenario thus cannot be sustained as a equilibrium (thus property 1.9 holds).

Property 1.9 is the first glimpse of the interactions between users of types *LH* and *HH*. As we can see, the reason property 1.9 holds is that type *LH* users are in a sense *cheaper* (less costly) than type *HH* users, making them easier to be attracted to the NQ platform. This *LH* being *cheaper* is because of their relatively lower sensitivity to quality degradation ($\theta_L < \theta_H$). This holds for sure, however, only when *LH* would contribute in qualifying platform, to sustain which the reward value must be significant enough to compensate the net intrinsic disutility of contributing of this type of user.

In the following sections, we analyze separately the scenarios where the intrinsic value of contributing is high relative to the quality difference, and where the intrinsic value is low. The difference between these two cases can be clearly seen if we ignore the reward value: absent reward value, all *HL* users will choose the *NQ* platform in the former scenario, while they will all choose the *Q* platform in the latter. We show below that as the reward value increases progressively, the contribution decision of *LH* and *HH* users evolve in similar ways between the two cases, though only in the latter case does their contribution influence the decision of *HL* users.

Equilibria under High Contribution Value

In this section, we study the scenario where $v_H - c_w \geq \theta_H(q_H - q_L)$. This is described as the *high contribution value* case, because the intrinsic value of contribution for a high valuation user outweighs the quality difference. As a result, all *HL* users will choose to contribute in the *NQ* platform regardless of the decisions of other users: even if no *LH* or *HH* user contributes in the *NQ* platform, the net intrinsic contribution value that a *HL* user can gain by moving to *NQ* platform, $v_H - c_w$, is still higher than the reduction of the value of reading arising from choosing the platform with low content quality, $\theta_H(q_H - q_L)$.

It is shown in the previous section that all *LL* users will choose the *Q* platform. The question that remains is which platform *LH* and *HH* users will choose. Due to the presence of reward value, a portion of them will choose the *NQ* platform. When an *LH* user chooses the *Q* platform, she gets reading value $\theta_L q_H$ and, if she chooses to contribute, reward value s_Q while incurring a net cost of contribution $c_w - v_L$. Her utility from choosing the *Q* platform is thus $\theta_L q_H + \max\{0, s_Q - (c_w - v_L)\}$. When she chooses the *NQ* platform, her reading value is reduced to $\theta_L q_{NQ}$. In return, she gets reward value s_{NQ} while incurring the net contribution cost $c_w - v_L$. Therefore, to an *LH* user, the *NQ* platform will be more attractive than the *Q* platform, if we have:

$$\theta_L q_{NQ} + s_{NQ} - (c_w - v_L) > \theta_L q_H + \max\{0, s_Q - (c_w - v_L)\} \qquad (1)$$

An *HH* user faces a similar tradeoff, but the situation is simpler in that she for sure will contribute. To an *HH* user, *NQ* will be more attractive if:

$$\theta_H q_{NQ} + s_{NQ} \geq \theta_L q_H + s_Q \qquad (2)$$

To better understand the tradeoff, we could first consider that the users are in the Q platform, and then think of the *cost* incurred by a user when *moving* from the Q platform to the NQ platform. This cost must be compensated by the reward value. From (1), the cost to an LH user is $\theta_L(q_H - q_{NQ}) + \max\{c_w - v_L, s_Q\}$, and from (2), the cost to an HH user is $\theta_H(q_H - q_{NQ}) + s_Q$. If an LH user incurs a lower cost than an HH user, then some LH users will choose the NQ platform first; if the cost of an HH user is lower, then some HH users will do so first; and if the costs are close, both types may see a portion of them choose the NQ platform.

This cost to an LH or HH user, however, is not a constant. It certainly depends on the overall reward value S that is endowed to each platform. In addition, it also depends on the decisions of other users, which influence the average content quality as well as the per-person reward value.

The equilibrium situation crucially depends on the magnitude of the reward value. To help understand the equilibria corresponding to different values of these exogenous factors, we could first consider the case that the overall reward value S is close to zero, and consider how the equilibrium evolves as increases[3]. In the following, we discuss separately the scenario where the cost to LH users is "initially" lower, and the scenario where the cost to HH users is initially lower. By initially, we mean when S is close to zero. In this case, the costs are largely determined by the net contribution cost of LH users and the reading value of HH users, i.e. $c_w - v_L$ vs. $(\theta_H - \theta_L)(q_H - q_L)$.

The equilibrium situations for the case where LH users initially have lower cost is formally specified in proposition 2[4].

> *Proposition 2: If $v_H - c_w \geq \theta_H(q_H - q_L)$ and $c_w - v_L < (\theta_H - \theta_L)(q_H - q_L)$, then the game has a unique pure strategy equilibrium, in which:*
>
> o *All LL and HH users choose the Q platform*
>
> o *All HL users choose the NQ platform*
>
> o *LH users split between the two platforms. Those who choose the NQ platform will contribute there. If $S \in (0, \hat{S}_1^{HL})$, those who choose the Q platform will not contribute; if $S \in [\hat{S}_1^{HL}, \hat{S}_2^{HL})$, a portion of those who choose the Q platform will contribute; and if $S \in [\hat{S}_2^{HL}, \infty)$, all those who choose the Q platform will contribute. The two delimiting values are:*
>
> $\hat{S}_1^{HL} = \alpha(c_w - v_L)/2$, *and $\hat{S}_2^{HL}$ solves the following system of equations together with x, the portion of LH users who choose the NQ platform:*
>
> $$\begin{cases} c_w - v_L = 2S/(\alpha + \alpha(1-x)) \\ 2S/\alpha x = c_w - v_L + \theta_L(1-\alpha)(q_H - q_L)/(1-\alpha+\alpha x) \end{cases}$$

> *Corollary 2: When $v_H - c_w \geq \theta_H(q_H - q_L)$ and $c_w - v_L < (\theta_H - \theta_L)(q_H - q_L)$, the higher the reward value S, the more LH users, and in turn total users, choose the NQ platform.*

As shown in Proposition 2 and will be in the following propositions, the equilibrium situation depends on factors including content quality difference, valuation difference, and the magnitude of the reward value. To help compare these equilibria, consider the equilibrium as it evolves along the dimension of reward value, with other factors fixed. Initially when there is no reward value, i.e. $S = 0$, all LH and HH users choose the Q platform, with the former read-only and the latter contributing. When reward value becomes positive, even if very small, i.e. $S = \varepsilon > 0$, certain LH or HH user will move to the NQ platform in the equilibrium. In this case, since an LH user is cheaper, i.e. has lower cost, than an HH user, LH users will move and HH users will remain in the Q platform. As S increases, more LH

---

[3] It is important to keep in mind that the games are static. Although the discussion in the text uses words such as "initially", "evolve", or "move", it is only to give the insight on how the equilibrium changes when exogenous factors change. That is, it is comparing the equilibria of different games (each game indexed by a specific parameter value). Each individual game is static, however, in that all users make decisions once simultaneously.

[4] Due to page limit, detailed proofs of the propositions are omitted. They are available from authors upon request.

users will move to the *NQ* platform, and the per-person reward value in both platforms increase. When S crosses a certain threshold, $\hat{S}_1^{HL}$, a portion of the *LH* users in Q platform also find it worthwhile to contribute there. This portion also increases as S goes up further. When S crosses the second threshold, $\hat{S}_2^{HL}$, all *LH* users in the Q platform will contribute.

More relevant to a decision maker is the knowledge that higher reward value increases the number of users who choose the *NQ* platform. This may not be obvious at first, since both platforms have the same reward value endowed. But it is not difficult to understand. Since the Q platform has higher content quality, naturally more *LH* and *HH* users will choose it. An equal increase in the overall reward value of each platform thus translates to a higher increase in the per-person reward value for the *NQ* platform than the Q platform. Thus as the overall reward value increases, more users will be attracted to the *NQ* platform.

The case where *HH* users initially have lower cost is specified in proposition 3 and discussed subsequently. It bears considerable similarity with the above case, though significant difference also exists.

> *Proposition 3: If $v_H - c_w \geq \theta_H(q_H - q_L)$ and $c_w - v_L \geq (\theta_H - \theta_L)(q_H - q_L)$, then the game has a unique pure strategy equilibrium, in which:*

> o *All LL users choose the Q platform*

> o *All HL users choose the NQ platform*

> o *If $S \in (0, \hat{S}_1^{HH})$, HH users split between the two platforms. All LH users choose the Q platform and only read. The portion of HH users that choose the NQ platform, $x_{HH}(S)$, satisfies:*

$$\frac{S}{\alpha x_{HH}/2} = \frac{S}{\alpha(1-x_{HH})/2} + \theta_H \frac{1-\alpha}{1-\alpha+\alpha x_{HH}}(q_H - q_L)$$

> *And the threshold value $\hat{S}_1^{HH}$ satisfies:*

$$\frac{S}{\alpha x_{HH}/2} = c_w - v_L + \theta_L \frac{1-\alpha}{1-\alpha+\alpha x_{HH}}(q_H - q_L)$$

> o *If $S \in [\hat{S}_1^{HH}, \hat{S}_2^{HH})$, both HH and LH users split between the two platforms. The portion of HH users that choose the NQ platform, $x_{HH}(S)$, and the portion of LH users that do so, $x_{LH}(S)$, satisfy:*

$$\begin{cases} \frac{S}{\alpha(x_{HH}+x_{LH})/2} = \theta_H \frac{1-\alpha}{1-\alpha+\alpha(x_{HH}+x_{LH})}(q_H - q_L) + \frac{S}{\alpha(1-x_{HH})/2} \\ \frac{S}{\alpha(x_{HH}+x_{LH})/2} = \theta_L \frac{1-\alpha}{1-\alpha+\alpha(x_{HH}+x_{LH})}(q_H - q_L) + c_w - v_L \end{cases}$$

> *And the threshold value $\hat{S}_2^{HH}$ satisfies:*

$$\begin{cases} \frac{S}{\alpha x_{LH}/2} = \theta_H \frac{1-\alpha}{1-\alpha+\alpha x_{LH}}(q_H - q_L) + \frac{S}{\alpha/2} \\ \frac{S}{\alpha x_{LH}/2} = \theta_L \frac{1-\alpha}{1-\alpha+\alpha x_{LH}}(q_H - q_L) + c_w - v_L \end{cases}$$

> o *If $S \in [\hat{S}_2^{HH}, \infty)$, all HH users choose the Q platform, and LH users split between the two platforms. Among those LH users who choose the Q platform, if $S \in [\hat{S}_2^{HH}, \hat{S}_{21}^{HH})$, none of them will contribute; if $S \in [\hat{S}_{21}^{HH}, \hat{S}_{22}^{HH})$, a portion of them will contribute; and if $S \in [\hat{S}_{22}^{HH}, \infty)$, all of them will contribute there. The two delimiting values are:*

> $\hat{S}_{21}^{HH} = \alpha(c_w - v_L)/2$, *and $\hat{S}_{22}^{HH}$ solves the following system of equations together with x, the portion of LH users who choose the NQ platform:*

$$\begin{cases} c_w - v_L = \dfrac{2S}{\alpha + \alpha(1-x)} \\ \dfrac{2S}{\alpha x} = c_w - v_L + \dfrac{\theta_L(1-\alpha)(q_H - q_L)}{1-\alpha+\alpha x} \end{cases}$$

Corollary 3.1: When $v_H - c_w \geq \theta_H(q_H - q_L)$ *and* $c_w - v_L \geq (\theta_H - \theta_L)(q_H - q_L)$, *the higher the reward value* S, *the more users overall choose the NQ platform.*

Corollary 3.2: When $v_H - c_w \geq \theta_H(q_H - q_L)$ *and* $c_w - v_L \geq (\theta_H - \theta_L)(q_H - q_L)$, *if* $S \in [\hat{S}_1^{HH}, \hat{S}_2^{HH})$, *the higher the reward value* S, *the **fewer** HH users choose the NQ platform.*

Again, consider the equilibrium situation as evolving along the reward value dimension. This time some *HH* users will first respond to a small reward value by moving to the *NQ* platform. This is because initially *HH* users are cheaper, i.e. have lower cost: $(\theta_H - \theta_L)(q_H - q_L) \leq c_w - v_L$. As reward value increases, more *HH* users will be attracted to the *NQ* platform, similar to the case where *LH* users are cheaper.

However, a significant difference exists between the two cases. While in the case where *LH* users are initially cheaper, *LH* remains cheaper as the reward value increases, in the case where *HH* users are initially cheaper, *HH* users do not stay that way. As the overall reward value increases, the per-person reward value in the *Q* platform, s_Q, increases as well. This increases the cost to an *HH* user. The cost to an *LH* user is not increased, however, because *LH* users will not contribute in the *Q* platform and is indifferent (at least when S is small) to this change of s_Q. The gap between the two costs therefore gets smaller as S increases. When S crosses the threshold value $\hat{S}_1^{HH}$, *HH* users are no longer strictly cheaper, and a portion of *LH* users and a portion of *HH* users will both choose the *NQ* platform. Between threshold values $\hat{S}_1^{HH}$ and $\hat{S}_2^{HH}$, as S increases, more *LH* users will choose the *NQ* platform. At the same time, however, fewer *HH* users will do so. In another word, *HH* users are *crowded out* by *LH* users as S increases. When S increases beyond the threshold value $\hat{S}_2^{HH}$, *LH* becomes cheaper than *HH* users, so only a portion of *LH* users will choose the *NQ* platform, while all *HH* users will stay in the *Q* platform. After this, the situation is similar to that where *LH* users are initially cheaper: the *LH* users who choose the *Q* platform will first only read; when S crosses the threshold $\hat{S}_{21}^{HH}$, a portion of them will begin to contribute; and when S finally crosses the threshold $\hat{S}_{22}^{HH}$, all *LH* users who choose the *Q* platform will contribute there.

The finding that fewer *HH* users choose the *NQ* platform as S increases between $\hat{S}_1^{HH}$ and $\hat{S}_2^{HH}$ both is surprising and has important managerial implications. As we have discussed, the number of users choosing the *NQ* platform increases as the overall reward value S goes up, and this phenomenon is relatively easy to understand. However, it is not easy to see that though the total number of users increases, the number of *HH* users actually *decreases*. The key insight behind this is the *relative cost* of *LH* and *HH* users: as the reward value increases, *HH* users become more and more expensive to attract, and are *crowded out* of the *NQ* platform by *LH* users. This is probably not what the *NQ* firm wants to see. *HH* users have higher valuation than *LH* users, and would be more profitable to the firm[5]. In the case where the reward value can be influenced by the firm, then, the *NQ* firm should be cautious about increasing this value. Though higher reward value attracts more users, it may attract the *wrong* users to the platform.

Equilibria under Low Contribution Value

In this section, we study the scenario where $v_H - c_w < \theta_H(q_H - q_L)$. This is described as the *low contribution value* case, because in contrast to the previous section, the intrinsic value of contribution for a high valuation user here does not automatically outweigh the quality difference. In fact, if no *LH* or *HH* user contributes in the *NQ* platform, then all *HL* users will choose the *Q* platform, forgoing their permission to contribute in the *NQ* platform.

---

[5] Suppose that a product firm is advertising on the UGC platform. A high-valuation user will be more interested in the product, so the firm is willing to pay more for the advertisement when more high-valuation users use the platform. A complete profit analysis with advertisers as players of the game is a topic for future research.

Due to the presence of reward value, some *LH* or *HH* users will contribute in the *NQ* platform. This will help attract some of the *HL* users to the *NQ* platform as well, (consider this: the "first" *HL* user who chooses the *NQ* platform does not sacrifice any reading value in doing so, for the average content quality in *NQ*, before she joins, is also q_H).

In the discussion that follows, we focus on the situation where only a portion of *HL* users will choose *NQ* platform[6]. (The case where all *HL* users may choose *NQ* platform is similar to the case of high contribution value studied in the previous section, the analysis of which does not offer additional insights.)

> *Proposition 4: If $v_H - c_w < \theta_H(q_H - q_L)$ and $c_w - v_L < (\theta_H - \theta_L)(v_H - c_w)/\theta_H$, then the game has a unique pure strategy equilibrium, in which:*
>
> o *All LL and HH users choose the Q platform*
>
> o *HL users split between the two platforms.*
>
> o *LH users split between the two platforms. Those who choose the NQ platform will contribute there. If $S \in (0, \hat{S}_1^{LL})$, those who choose the Q platform will not contribute; if $S \in [\hat{S}_1^{LL}, \hat{S}_2^{LL})$, a portion of those who choose the Q platform will contribute; and if $S \in [\hat{S}_2^{LL}, \infty)$, all those who choose Q platform will contribute there. The two delimiting values are:*
>
> $\hat{S}_1^{LL} = \alpha(c_w - v_L)/2$, *and $\hat{S}_2^{LL}$ solves the following system of equations together with x, the portion of LH users who choose the NQ platform:*
>
> $$\begin{cases} c_w - v_L = 2S/(\alpha + \alpha(1-x)) \\ 2S/\alpha x = c_w - v_L + \theta_L(v_H - c_w)/\theta_H \end{cases}$$
>
> o *HL users split between the two platforms. The portion of HL users who choose the NQ platform is*
>
> $x_{HL} = \gamma x_{LH}$, *where* $\gamma = \dfrac{\alpha(v_H - c_w)}{(1-\alpha)(\theta_H(q_H - q_L) - (v_H - c_w))}$

> *Corollary 4: When $v_H - c_w < \theta_H(q_H - q_L)$ and $c_w - v_L < (\theta_H - \theta_L)(v_H - c_w)/\theta_H$, the higher the reward value S, the more LH users, and in turn total users, choose the NQ platform.*

> *Proposition 5: If $v_H - c_w < \theta_H(q_H - q_L)$ and $c_w - v_L \geq (\theta_H - \theta_L)(v_H - c_w)/\theta_H$, then the game has a unique pure strategy equilibrium, in which:*
>
> o *All LL users choose the Q platform*
>
> o *If $S \in (0, \hat{S}_1^{LH})$, HH users split between the two platforms. All LH users choose the Q platform and read only. The portion of HH users that choose the NQ platform, $x_{HH}(S)$, satisfies:*
>
> $$\frac{S}{\alpha x_{HH}/2} = \frac{S}{\alpha(1 - x_{HH})/2} + v_H - c_w$$
>
> *And the threshold value $\hat{S}_1^{HH}$ satisfies:*
>
> $$\frac{S}{\alpha x_{HH}/2} = c_w - v_L + \frac{\theta_L}{\theta_H}(v_H - c_w)$$
>
> o *If $S \in [\hat{S}_1^{LH}, \hat{S}_2^{LH})$, both HH and LH users split between the two platforms. The portion of HH users that choose the NQ platform, $x_{HH}(S)$, and the portion of LH users that do so, $x_{LH}(S)$, satisfy:*

---

[6] A sufficient but not necessary condition for this is $v_H - c_w < \theta_H \dfrac{1-\alpha}{1+\alpha}(q_H - q_L)$. In this case, that all *HL* users choose the *NQ* platform cannot be an equilibrium, because any *HL* user in that situation can gain by deviating to the *Q* platform.

$$
\begin{cases}
\dfrac{S}{\alpha(x_{HH}+x_{LH})/2} = v_H - c_w + \dfrac{S}{\alpha(1-x_{HH})/2} \\
\dfrac{S}{\alpha(x_{HH}+x_{LH})/2} = \theta_L(v_H - c_w)/\theta_H + c_w - v_L
\end{cases}
$$

And the threshold value $\hat{S}_2^{LH}$ *satisfies:*

$$
\begin{cases}
\dfrac{S}{\alpha x_{LH}/2} = v_H - c_w + \dfrac{S}{\alpha/2} \\
\dfrac{S}{\alpha x_{LH}/2} = \theta_L(v_H - c_w)/\theta_H + c_w - v_L
\end{cases}
$$

o *If* $S \in [\hat{S}_2^{LH}, \infty)$, *all HH users choose the Q platform, and LH users split between the two platforms.*
Among those LH users who choose the Q platform, if $S \in [\hat{S}_2^{LH}, \hat{S}_{21}^{LH})$, *none of them will contribute; if*
$S \in [\hat{S}_{21}^{LH}, \hat{S}_{22}^{LH})$, *a portion of them will contribute; and if* $S \in [\hat{S}_{22}^{LH}, \infty)$, *all of them will contribute there.*
The two delimiting values are:

$\hat{S}_{21}^{LH} = \alpha(c_w - v_L)/2$, *and* $\hat{S}_{22}^{LH}$ *solves the following system of equations together with* x, *the portion of*
LH users who choose the NQ platform:

$$
\begin{cases}
c_w - v_L = \dfrac{2S}{\alpha + \alpha(1-x)} \\
\dfrac{2S}{\alpha x} = c_w - v_L + \dfrac{\theta_L}{\theta_H}(v_H - c_w)
\end{cases}
$$

o *HL users split between the two platforms. The portion of HL users who choose the NQ platform is*
$x_{HL} = \gamma(x_{LH} + x_{HH})$, *where* $\gamma = \dfrac{\alpha(v_H - c_w)}{(1-\alpha)(\theta_H(q_H - q_L) - (v_H - c_w))}$

Corollary 5.1: When $v_H - c_w < \theta_H(q_H - q_L)$ *and* $c_w - v_L \ge (\theta_H - \theta_L)(v_H - c_w)/\theta_H$, *the higher the reward*
value S, *the more HL and LH users choose the NQ platform.*

Corollary 5.2: When $v_H - c_w < \theta_H(q_H - q_L)$ *and* $c_w - v_L \ge (\theta_H - \theta_L)(v_H - c_w)/\theta_H$, *if* $S \in [\hat{S}_1^{LH}, \hat{S}_2^{LH})$, *the*
higher the reward value S, *the **fewer** HH users choose the NQ platform. Meanwhile, more HL users will*
choose the NQ platform. The increase in the number of HL users may be either higher or lower than the
decrease of the HH users.

The case of low contribution value bears similarity to the case of high contribution value discussed earlier. In both cases, a portion of either *LH* or *HH* users will initially choose the *NQ* platform depending on which have lower cost. In both cases, if *LH* users are initially cheaper, they will stay that way as the reward value increases, yet if *HH* users are initially cheaper, they will become more expensive as the reward value increases, and be *crowded out* eventually. Therefore, combining this propositions in this section with those in the previous section, we know that the results that higher reward value normally benefits the *NQ* platform, yet in certain situations may crowd out high valuation users from the *NQ* platform, hold with considerable generality.

The case of low contribution value differs from the high contribution value case in terms of *HL* users, however. In the case of high contribution value, the intrinsic contribution value alone is high enough to attract *HL* users to the *NQ* platform, regardless of the decisions of other users. In the case of low contribution value, however, *HL* users will not choose the *NQ* platform unless some of the *LH* or *HH* users would choose to contribute high quality content there. Moreover, the more *LH* and *HH* users choose the *NQ* platform, the more *HL* users will choose it. From the firm's perspective, this amplifies the effect of reward value to make it benefit the *NQ* platform more than it does in the case of high contribution value. Meanwhile, it also moderates the crowding out effect should it exist: even though *HH* users are crowded out of the *NQ* platform when reward value increases, the combined number of *LH* and *HH* users increases, which in turn increases the number of *HL* users, who are also high valuation users. This increase in *HL* users may more than offset the decrease of *HH* users, making higher reward value always beneficial to the *NQ*

platform. As shown in proposition 5, the higher the value of γ, the more *HL* users will be attracted to the *NQ* platform per *LH* or *HH* user there. Therefore, the closer the net intrinsic contribution value ($v_H - c_w$) to the difference in content quality valuation ($\theta_H(q_H - q_L)$), the more easily *HL* users will be attracted to the *NQ* platform.

The Role of the Cost-of-Contribution

In addition to the reward value, the cost of contribution, c_w, also has significant impact on the equilibrium situations and warrants closer scrutiny. From user's perspective, the *Q* platform is attractive because of its higher content quality, while the *NQ* platform may be attractive because of the freedom to contribute. Since a higher c_w reduces the net intrinsic utility of contribution, one would expect that higher c_w reduces the appeal of the *NQ* platform and benefits the *Q* platform. However, as will be shown below, the effect of c_w is more subtle than that.

To understand the role of c_w, two types of changes should be considered, a marginal change, or a significant one. The former would impact the percentage of certain types of users who choose one platform but would not change the equilibrium situation qualitatively as classified in previous sections, while the latter may cause the equilibrium to change from one scenario to another. Both types are discussed below.

We first investigate the effect of a *marginal* increase of c_w. In the case of high contribution value, where all *HL* users choose the *NQ* platform, if *LH* users initially have lower cost (i.e. $c_w - v_L < (\theta_H - \theta_L)(q_H - q_L)$), then when $S \in (0, \hat{S}_2^{HL})$, a marginal increase in c_w reduces the number of *LH* users who contribute in the *NQ* platform, while when $S > \hat{S}_2^{HL}$, such a marginal increase has no effect because c_w does not enter the equations that characterize the equilibrium. If initially *HH* users have lower cost, then when $S \in (0, \hat{S}_1^{HH})$, a marginal increase in c_w does not impact the resulting user composition, as it does not enter the equilibrium equation; when $S \in (\hat{S}_1^{HH}, \hat{S}_{22}^{HH})$, such a marginal increase reduces the percentage of *LH* and *HH* users who choose the *NQ* platform; and when $S > \hat{S}_{22}^{HH}$, a marginal increase again has no additional impact because c_w drops out of the equilibrium equation. Generally, in the case of high contribution value, a marginal increase in c_w will either reduce the number of users who choose *NQ* platform or have no effect. The intuition that higher c_w benefits the *Q* platform indeed holds.

In the case of low contribution value, where all *HL* users choose the *Q* platform initially, if *LH* users initially have lower cost (i.e. $c_w - v_L < (\theta_H - \theta_L)(v_H - c_W)/\theta_H$), then when $S \in (0, \hat{S}_2^{LL})$, a marginal increase in c_w reduces the number of *LH* users who contribute in the *NQ* platform; when $S > \hat{S}_2^{LL}$, however, a marginal increase in c_w actually *increases* the number of *LH* users who choose the *NQ* platform. Similarly, if *HH* users initially have lower cost, when $S \in (0, \hat{S}_1^{LH})$, a marginal increase in c_w increases the number of *HH* users who choose the *NQ* platform; when $S \in (\hat{S}_1^{LH}, \hat{S}_2^{LH})$, such an increase reduces the combined number of *LH* and *HH* users who choose the *NQ* platform but still increases the number of *HH* users who do so (a *reverse crowding out* effect); when $S \in (\hat{S}_2^{LH}, \hat{S}_{22}^{LH})$, a marginal increase in c_w reduces the number of *LH* users who choose the *NQ* platform; yet when $S > \hat{S}_{22}^{LH}$, such a marginal increase again increases the number of *LH* users who choose the *NQ* platform. As we can see, in the case of low contribution value, a marginal increase in c_w can in many situations increase the number of *LH* and *HH* users in the *NQ* platform. This may at first look counterintuitive. However, we should note that in the case of low contribution value, the group of *HL* users is divided between the two platforms in equilibrium, so that the difference in content quality between the platforms is exactly compensated by the net intrinsic contribution value for the high valuation users. As the value of c_w increases, the net intrinsic contribution value decreases. This also reduces the difference in content quality and in turn attracts more *LH* and *HH* users to the *NQ* platform. Certainly a higher value of c_w may reduce the number of *HL* users in *NQ* platform at the same time as more *LH* and *HH* users, but the net result can still be beneficial to the *NQ* platform.

We next look at the effect of a *significant* change in c_w, which may change the equilibrium scenario. The cases are rather easy to see. First, a significant increase in c_w may change the situation from that of high contribution value to low contribution value, making *HL* users who may otherwise choose the *NQ* platform choose the *Q* platform instead. Such a change would certainly benefit the Q platform. On the other hand, if an increase in c_w is not significant enough to change this, but is enough to make *LH* users more expensive than *HH* users, then such a change could actually benefit the *NQ* platform, especially when reward value is low, as *HH* users instead of *LH* users will choose the *NQ* platform. The different effects of c_w in various scenarios, some of which surprising at first look, call for considerable precaution of UGC business practitioners.

Discussion And Conclusion

User-generated-content (UGC) based business is rapidly growing in industry, reaching virtually every corner of the Internet and changing the competitive landscape. The success of a UGC business depends on attracting a user base that is both large and composed of those with genuine interest in the content and related products. Attracting a large user base is not easy but many firms have managed to do so. Attracting the *right* users and successfully monetizing from it, however, has proven to be a daunting challenge to industry practitioners.

Academic research on UGC is in its early phase. Existing research on open-source software and online reputation systems sheds light on several aspects of the UGC phenomenon due to the close proximity. However, research on open-source and reputation systems focuses on improving the quality of the end product generated by users, instead of analyzing user participation itself. Our study is among the first attempts to fill this gap, by addressing this central question of attracting the right users, which is the key to successful monetization.

The defining characteristic of a UGC platform is that users are also contributors. Whereas allowing more users to contribute may reduce the overall content quality of the platform, restricting the contribution by performing quality control may take away from many users the potential benefit that can be derived from contributing content and drive them away to competitors.

We focus in this study on the tradeoff between content quality and the freedom to contribute. By studying two UGC platforms with different policies in competition, one allowing anyone to contribute while the other permitting only high quality contents, we characterize the equilibrium under various situations. Factors such as difference in user valuation, difference in content quality, cost of contribution, and magnitude of reward value are incorporated in our analysis. Our study shows that different types of users will respond to various incentives to different degrees, and that their decisions influence one another as well. We show that higher reward value generally benefit the platform that does not control content quality, due to the higher per person reward value it implies, that the key determinant of the equilibrium is the *relative cost* of users who have low valuation and those with high valuation, and that because the relative cost of users change as the reward value changes, under certain situation higher reward value will bring more low valuation users to the platform without quality control while at the same time drive the high valuation users out, thus benefiting the other platform that controls quality. We also analyze how cost of contribution influence the equilibrium, and find that though higher cost of contribution is generally detrimental to the platform without quality control, it can also help that platform under certain circumstances, again because the change in relative cost of different types of users.

As one of the first attempts to address the unique nature of UGC and its effect on firm profit, our study has a few limitations which call for future work. First, firms may differ in their reward values and their costs of contribution. The asymmetric scenario can be analyzed to shed light on the effect of other decisions in addition to quality control. Alternative reward mechanisms, especially individual-specific ones, may also be considered. Second, quality can have a horizontal dimension as well as the vertical one addressed in our study. This horizontal dimension may represent the difference in taste among users and could be included in the model. In this case, the quantity of information would also be considered when users choose the platform, since higher quantity increases the likelihood of a user finding content close to her taste. Third, positive network externalities may exist and may be of interest for investigation. Finally, content quality may be a continuous dimension instead of the somewhat simplified binary classification in our study. Extending the model to account for continuous quality can help answer another important question, namely how strict firms should perform quality control. With the rapid growth of user-generated-content in industry, further research is needed to help understand this important phenomenon.

References

Akerlof, G., "The Market for Lemons: Quality Uncertainty and the Market Mechanism", Quarterly Journal of Economics, 1970, 89, 488-500.

Andreoni, J., "Privately Provided Public Goods in a Large Economy: The Limits of Altruism", Journal of Public Economics, 1988, 35(1), 57-73.

Baldwin, C.Y., and Clark, K.B., "The Architecture of Participation: Does Code Architecture Mitigate Free Riding in the Open Source Development Model?", Management Science, 2006, Vol. 52, No. 7.

Bajari, P. and Hortacsu, A., "Winner's Curse, Reserve Prices and Endogenous Entry: Empirical Insights From eBay Auctions", Rand Journal of Economics, 2003, Vol. 34, No. 2.

BusinessWeek, "Newscorp.'s Chernin: Little Opportunity to Make Money in User Generated Content", BusinessWeek, January 2007.

Cabral, L. and Hortacsu, A., "The Dynamics of Seller Reputation: Theory and Evidence from eBay", 2004, CEPR Discussion Paper No. 4345.

Chen, J., Xu, H. and Whinston, A.B., "Moderated Online Communities", Twenty Eighth International Conference on Information Systems, 2007.

CNBC.com, "Million Dollar Portfolio Challenge", 2008, http://contests.cnbc.com/milliondollar/main.do.

Dellarocas, C., "The Digitization of Word of Mouth: Promise and Challenges of Online Reputation Systems", Management Science, 2003 Vol. 49, No. 10, 1407-1424

Dellarocas, C., "Reputation Mechanism Design in Online Trading Environments with Pure Moral Hazard", Information Systems Research, 2005 Vol. 16, No. 2.

Etzion, E. and Awad, N., "Pump Up the Volume? Examining the Relationship Between Number of Online Reviews and Sales: Is More Necessarily Better?", Twenty Eighth International Conference on Information Systems, 2007.

Gu, B., Konana, P., Rajagopalan, B. and Chen, H.M, "Competition Among Virtual Communities and User Valuation: The Cases of Investing-Related Communities", Information System Research, Vol. 18, No. 1.

Helft, M., "Contributors on YouTube May Share Advertising Revenue", New York Times, May 2007.

Katz, M. and Shapiro, C., "Network Externalities, Competition, and Compatibility", The American Economic Review, 1985, Vol. 75, No. 3.

Lampe, C. and Resnick, P., "Slash(dot) and Burn: Distributed Moderation in a Large Online Conversation Space", CHI 2004, Vol. 6, No. 1.

Lerner, J. and Tirole, J., "Some Simple Economics of Open Source", The Journal of Industrial Economics", 2002, Volume L, No. 2.

MacCormack, A., Rusnak, J., and Baldwin, C.Y., "Exploring the Structure of Complex Software Designs: An Empirical Study of Open Source and Proprietary Code", Management Science, 2006, Vol. 52, No.7.

Olson, M., "Logic of Collective Action: Public Goods and the Theory of Groups", Harvard University Press, 1965.

Organisation for Economic Co-operation and Development, "Participative Web: User Created Content", Report to Working Party on the Information Economy, 2007

Parker, G.G. and Van Alstyne, M.W., "Two-Sided Network Effects: A Theory of Information Product Design", Management Science, Vo. 51, No. 10

Ren, Y. and Kraut, R.E., "An Agent-Based Model to Understand Tradeoffs in Online Community Design", Twenty Eighth International Conference on Information Systems, 2007.

Resnick, P., Zeckhauser, R., Friedman, E. and Kuwabara, K., "Reputation Systems", Communications of the ACM, Vol. 43, (12), 45-48.

Reuters, "Google's YouTube Ad Revenue Short of Expectations: Report", Reuters, July 2008.

Roberts, J.A., Hann, I.H., and Slaughter, S.A, "Understanding the Motivations, Participation, and Performance of Open Source Software Developers: A Longitudinal Study of the Apache Projects", Management Science, 2006, Vol. 52, No.7.

Rochet, J.C. and Tirole, J., "Platform Competition in Two-Sided Markets", Journal of the European Economic Association, 2003, Vol. 1, No. 4

Shah, S.K. "Motivation, Governance, and the Viability of Hybrid Forms in Open Source Software Development", Management Science, 2006, Vol. 52, No.7.

Shaked, A. and Sutton, J., "Natural Oligopolies", Econometrica, 1983, Vol. 51, 1469-1483.

Spence, M., "Job Market Signaling", Quarterly Journal of Economics, 1973, Vol. 87, No. 3.

Vandenbosch, M. and Weinberg, C.B., "Product and Price Competition in a Two-Dimensional Vertical Differentiation Model", Marketing Science, 1995, Vol. 14, No. 2.

Von Krogh, G. and von Hippel, E., "The Promise of Research on Open Source Software", Management Science, 2006, Vol. 52, No. 7.

West, J., "How open is open enough? Melding proprietary and open source platform strategies", Research Policy, 2003, 32.

Zhang, X. and Zhu, F., "Group Size and Incentive to Contribute: A Natural Experiment at Chinese Wikipedia", Manuscript, 2007.

Zhu, J.Y. and Tan, B.C.Y., "Effectiveness of Blog Advertising: Impact of Communicator Expertise, Advertising Intent, and Product Involvement", Twenty Eighth International Conference on Information Systems, 2007.