

Can Monetary Incentives Increase UGC Contribution? The Motivation and Competition Crowding Out

Completed Research Paper

Yuewen Liu

School of Management
Xi'an Jiaotong University
liuyuewen@xjtu.edu.cn

Juan Feng

College of Business
City University of Hong Kong
juafeng@cityu.edu.hk

Abstract

Monetary incentives are often introduced by UGC platforms to encourage content contribution, following the conventional economic intuition of “price effect.” However, literature also finds that monetary incentive can negatively affect contribution in prosocial behavior. We build an analytical model to study the impact of monetary incentives on UGC contribution, where contributors are differentiated by their intrinsic motivation and ability to promote their content. Our model offers explanation to the previous “contradictory” results by consider both “motivation crowding out” and “competition crowding out” effects. We find that introducing a small monetary incentive can either increase or reduce the overall content contributed, which exhibits a motivation crowding in or out effect; however, a high enough monetary incentive will increase the overall market contribution. Moreover, monetary incentives do not always enhance the overall quality of contribution. The conditions of the counterintuitive results are analyzed and discussed.

Keywords: User generated content, monetary incentive, motivation crowding out, competition crowding out

Introduction

In recent years, User-Generated-Content (UGC for short) becomes an essential part of people's daily life (such as Wikipedia, YouTube, Facebook, Instagram and various online forums or review sites) as well as business practice (such as the knowledge sharing systems within organizations.) These UGC platforms heavily rely on users to contribute contents (such as product reviews, blogs, music, pictures, videos, Q&A forums, Wikipedia, etc.) How to encourage users to contribute, therefore, becomes a critical issue for such businesses. Monetary incentives are often introduced to encourage contribution (Adam 2014; Steve 2013; Sun et al. 2013). For example, YouTube, About.com, Break, and Epinions are paying users for their contributions in the form of advertising-revenue sharing (Tang et al. 2012a); many companies use cash awards to encourage employees to contribute knowledge to their electronic knowledge repositories (Garud and Kumaraswamy 2005; Kankanhalli et al. 2005). For example, Infosys (NASDAQ: INFY), a global software services company, offers KCUs (knowledge currency units, which can be exchanged for cash) to its employees for contributing knowledge to its knowledge portal (Garud and Kumaraswamy 2005).

Will monetary incentives increase contribution of the UGC platforms? On one hand, based on the standard model of principal-agent theory, higher incentives will induce more effort and higher performance (Gneezy et al. 2011; Kreps 1997). This is recognized as the "standard price effect" or even "law of behavior" (Gneezy et al. 2011). There are well-documented cases showing the significantly positive effect of monetary incentives on worker effort and employer profit (e.g., Lazear 2000). On the other, since 1970s (e.g., Titmuss 1970), more and more researchers find that monetary incentives may sometimes "backfire", i.e., reducing the total contribution, because monetary incentives may crowd out intrinsic motivation of contribution (e.g., Bénabou and Tirole 2006; Gneezy et al. 2011; Kreps 1997). A number of empirical studies also show that monetary incentives negatively affect the contribution of prosocial behavior (e.g., Ariely et al. 2009; Gneezy and Rustichini 2000; Titmuss 1970). Due to the complex interaction between monetary incentives and contribution, researchers suggest to build up models to examine "when and why" incentives work or do not work (e.g., Kreps 1997). For example, a salient model developed by Bénabou and Tirole (2006) shows that monetary incentives may interact with a contributor's concern for image, thus may negatively correlated with her contribution of prosocial behavior.

This problem is more intriguing in the context of UGC. First, little research studies the effect of monetary incentives on UGC contribution. Most of the UGC studies in the literature focus on the psychological intentions of adoption, continuance, contributing, etc. (e.g., Bateman et al. 2011; Jin et al. 2013). Some of these papers mentioned that the crowding out phenomenon is possible without in-depth discussion (e.g., Jin et al. 2013). Second, it is not appropriate to directly adopt the existing models of prosocial behaviors (such as Bénabou and Tirole 2006), because UGC contribution is fundamentally different from prosocial behavior (e.g., blood donation). UGC contributor's intrinsic reward is correlated with the audience's attention (e.g., viewing, reading) and even interaction (e.g., Like, comment). So, there exists competition among contributors for limited audience attention. The existing models of prosocial behavior (such as Bénabou and Tirole 2006) ignore the contributors' competition, thus should not be adopted directly to answer the question.

To make up the research gap in the literature, we build an analytical model to examine the impact of monetary incentives on UGC contribution. We follow the most prevalent monetary incentive mechanisms in the real UGC platforms. We consider not only the interaction between intrinsic rewards and monetary incentives, but also incorporate the competition among contributors for audience attention. We consider four types of contributors who respond to the monetary reward differently, classified by whether they are intrinsically-motivated to contribute, and whether they are equipped with promotion skills to attract audience. Our findings show that, introducing a small monetary incentives may either increase or reduce the overall market contribution, which exhibits a motivation crowding in or out effect; however, a high enough monetary incentive will increase the overall market contribution. Moreover, monetary incentives does not always increase the overall contribution quality.

To the best of our knowledge, this model makes the first effort to model the impact of monetary incentive on UGC contributions. We consider not only the interaction between monetary incentive and contributors' intrinsic motivation, but also the competition among contributors, which is not covered in

the studies of prosocial behavior. In addition, besides the total market contribution, we also examine other market performance measures such as market structure and overall content quality in the market.

This remainder of this paper is organized as follows: the next section reviews the related literature; then the model and the analysis of the impact of monetary incentives are illustrated; then the results and discussions are presented.

Related Literature

This study is related to several literature streams, including the literature stream discussing motivations of contributing UGC, the effect of monetary incentives, and some related economic models.

Monetary Incentives in UGC Platform

UGC, which is mostly free access to all the online users, is a kind of “public goods” (Zhang and Zhu 2010). According to the “public goods” theory, the online users should “take free ride”, i.e., use the content without contribute any content. The famous “1% rule” indicates that only 1% of the users actively contribute, while the other 99% of the users just “lurk” (van Mierlo 2014). Given a specific website, the number will be more or less than 1%, but the “1% rule” reflects the reality that contributors of UGC is quite rare comparing to all the users. A lot of UGC platforms offer monetary incentives to the contributors to encourage contributions. The most widely known example is YouTube’s “advertising revenue sharing” program. Besides YouTube, more and more UGC platforms offer monetary incentives to their UGC contributors, for the product reviews, answers to questions, knowledge, pictures and videos (Tang et al. 2012b).

Researchers have noticed and investigated the commercial value of UGC (e.g., Aggarwal et al. 2012; Goh et al. 2013; Miller and Tucker 2013). Some researchers studied the contribution intention of UGC, and find that the intrinsic motivation plays a key role (e.g., Bateman et al. 2011; Goes et al. 2014; Jin et al. 2013; Rishika et al. 2013; Susarla et al. 2012; Yang et al. 2008; Zeng and Wei 2013). However, the effect of monetary incentives on UGC is barely studied in the literature. There are few studies close to this research topic. For example, Becker et al. (2010) conduct empirical studies to study the effect of financial incentives on online community usage. They find that financial incentives attract new users but do not increase usage.

Effect of Monetary Incentives

The research of monetary incentives on UGC contribution is quite rare. However, the literature stream which inspects the effect of monetary incentives in human social activities such as prosocial behaviors, education, and knowledge sharing may shed some lights to our research.

Economists commonly believed that higher monetary incentives will lead to more effort and better performance (Gneezy et al. 2011). According to the standard (simple) economic principal-agent theory: monetary incentives increase the marginal benefit of performing thus can raise the performance (Gneezy et al. 2011; Kreps 1997). This is also called the “standard price effect” (Gneezy et al. 2011). There are a lot of well-documented cases which show that “monetary incentive works” (Kreps 1997). For example, Lazear (2000) shows that monetary incentives can significantly increase worker effort and employer profit. Becker et al. (2010) find that monetary incentives can increase the adoption of online communities. Gneezy et al. (2011) review a lot of empirical studies, they find that introducing monetary incentives may improve student performance, prosocial behavior, and lifestyle habits.

There are also a lot of “opponents” who believe that monetary incentives may “backfire”. This can be traced back to Titmuss (1970), who argues that paying people who donate blood could reduce the number of blood donors. Since 1970s, researchers find a lot of evidence that monetary incentives do not work (see Deci et al. 1999; Frey and Jegen 2001; Gneezy et al. 2011 for surveys).

Researchers have spent great efforts to examine whether, when and why monetary incentives work or do not work (Gneezy et al. 2011). We summarize this literature stream from the following perspectives:

(1) Researchers find that monetary incentives may interact with intrinsic motivations (Frey and Jegen 2001). On the one hand, monetary incentives may crowd out intrinsic motivations which are important to producing desired behavior (Gneezy et al. 2011). This is known as the “crowding out effect”, or “over-

justification effect” (Lepper et al. 1973). For example, Titmuss (1970) argue that monetary incentives may cause the reduction of blood donation because the monetary incentives may broke the established social norms about voluntary contribution. Kreps (1997) asserts that providing monetary incentives could be counterproductive, because it may destroy workers' intrinsic motivation. Bénabou and Tirole (2006) indicate that providing rewards to foster prosocial behavior may have a perverse effect and reduce the total contribution. A lot of empirical studies also show that monetary incentives have negative impacts on prosocial behavior (e.g., Ariely et al. 2009; Frey and Oberholzer-Gee 1997; Gneezy and Rustichini 2000; Mellström and Johannesson 2008). On the other hand, monetary incentives may positively impact the intrinsic motivation, thus the marginal benefit of performing is further increased beyond the standard price effect. This is known as the “crowding in effect”. Crowding in effect is seldom reported in the literature, possibly because the monetary incentives may change the perception of contribution behavior from “altruism driven” to “greed driven”, especially in the prosocial behavior context (Bénabou and Tirole 2006). However, in the context of UGC contribution, contributors may be proud of the ability of earning money through contributing. For example, Michelle Phan was a no-name YouTuber in 2008. She posted hundreds of makeup videos, attracted a lot of viewers and earned advertising revenue sharing for her. Now she is Lancôme’s first video makeup artist, and an idol of successful contributor on YouTube (Tang et al. 2012b). Therefore, when study the effect of monetary incentives on UGC contributing, we should consider both crowding in and out effect.

(2) Empirical studies show that the level of monetary incentive may play a key role. Bénabou and Tirole (2006) suggest that the effect of monetary incentives could be a discontinuity at zero point. At the zero point, the contributors switch from “unprofitable” to “profitable”, which may be interpreted as “greedy” rather than “disinterested”. Therefore, they argue that a small monetary incentive is sufficient to cause a sharply reduction of contribution. Moreover, after reviewing a lot of empirical studies, Gneezy et al. (2011) speculate that if monetary incentives are large enough, the positive standard price effect will be larger than the potential negative crowding out effect, thus show an overall positive effect. Gneezy and Rustichini (2000) conduct a field experiment which require high school students to collect donations. They find that the students who receive a small compensation perform worse than the students who are not compensated; but they also find that, the students who receive a relatively big compensation perform better than the students who receive a small compensation. Therefore, they suggest that the sponsor should “pay enough or don’t pay at all”. Although the researchers noticed that the monetary incentive level may play a key role, however, it is not thoroughly examined in the literature.

(3) Some empirical studies find that monetary incentives may work for some people, but may not for the others (Gneezy et al. 2011). Croson and Gneezy (2009) show that male and female have different reactions to monetary incentives. Mellström and Johannesson (2008) find that offering \$7 for donating blood has a significant negative impact on female but no significant impact on male. When introducing monetary incentives in education, researchers find that incentives seem to work only for the top tier students (Bettinger and Baker 2011; Leuven et al. 2010). Bettinger and Baker (2011) shows that incentives can improve math scores only for the students at the top of the distribution. Leuven et al. (2010) find that providing incentives to first-year college students for their academic performance has a positive impact on the top students, but a negative impact on the low-ability students. Upton (1973) find that monetary incentive for blood donation bring in new donators, but reduce donations by those who has regularly been donating for free. Kreps (1997) argue that the crowding out effect applies only to the employees who have high initial levels of intrinsic motivation. Therefore, when building a model to examine the effect of monetary incentives on UGC contribution, we should consider its different effect on different contributors in the market.

(4) Since the monetary incentives may encourage some but have no effect on (or even discourage) others, after a monetary incentive is introduced, the market composition may change and some related market indices may drop (Lukyanenko et al. 2014). Kreps (1997) argues that, when monetary incentives are imposed on work force, the mix of workers will change, which may cause a net drop in some aspects of productivity. For example, monetary incentives may lead to lessened levels of quality-weighted effort and lower net profits (Kreps 1997). Gneezy et al. (2011) survey a large scale of empirical studies and find that monetary incentives have mixed results on effort and achievements. Therefore, examining the effect of monetary incentives on some the overall market indices is also necessary.

In summary, the effect of monetary incentives is still under-investigated. Ariely et al. (2009) indicate that “less is known, however, about the mechanisms by which this unintended consequence occurs.” Kreps (1997) indicates that there is a need to develop theoretical models to understand when and why monetary incentive works. Kreps (1997) said that “once the theory is well developed there will be good grist for the empirical mill.” Similarly, to understand the effect of monetary incentives on UGC contribution, theoretical models are also necessary and vital.

Related Economic Models

To the best of our knowledge, there is still no model to study the effect of monetary incentives on UGC contribution. The models which study the crowding out effect is also quite rare. The model most close to this paper is the prosocial behavior model developed by Bénabou and Tirole (2006), which shows that extrinsic incentives could interact with a contributor’s image concern, thus may negatively correlated with the contribution of prosocial behavior. However, since Bénabou and Tirole (2006)’s model focuses on the prosocial behavior, without considering the competition between the contributors, thus is not proper to be directly adopted into the UGC contribution context.

Another model which also discusses competition in the UGC context is developed by Zhang and Sarvary (2014). The competition they consider is between the firms rather than contributors, for the purpose of market differentiation. Therefore, although seemingly close to this research, Zhang and Sarvary (2014)’s model is essentially about another research topic.

In this paper, extended from Bénabou and Tirole (2006)’s model, we develop an innovative model to study the effect of monetary incentives on UGC contribution, by combining the motivation crowding theory and contributor competition in the same model. Inspired from the four aspects of empirical results on the effect of monetary incentives, we also make our best effort to synchronize these empirical findings: (1) we allow both a crowding in and out effect in our model; (2) we separately study the effect of the introduction of monetary incentives (from zero to small) and the increasing of monetary incentives (from small to big); (3) we divide the contributors to four types according to whether they are intrinsically-motivated and their promotion skills, study whether they response differently to monetary incentives in equilibrium; (4) we study the effect of monetary incentives on not only the overall market contribution, but also market structure and other related market indices. Our model will also be meaningful in understanding the effect of monetary incentives in other contexts.

The Model

The Contributors

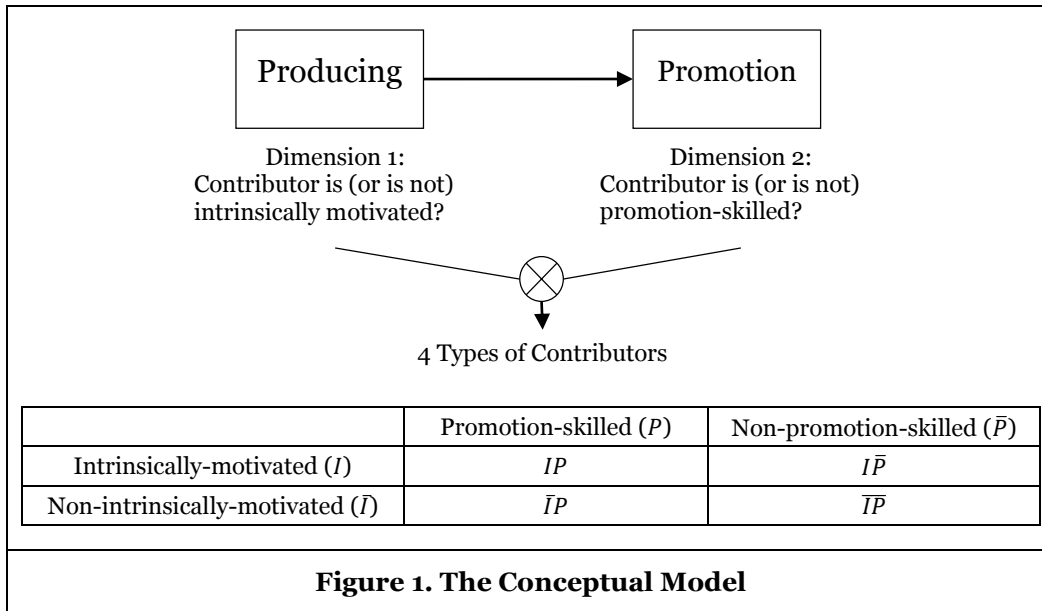
For the contributors in UGC platforms, producing UGC is not the only issue they need to consider, especially when there is monetary incentive. Tang et al. (2012a) indicate that “They [contributors] not only post videos, but also take the initiative to promote their videos and channels, connect with audience, and their feedback”. Accordingly, we separate the contribution of UGC into 2 steps: producing and promotion.

(1) In the UGC producing step, we need to consider the quality of the UGC produced. The literature shows that, intrinsically motivated contributors contributes relatively higher quality content, while non-intrinsically motivated contributors contributes relatively lower quality content (Garud and Kumaraswamy 2005; Lou et al. 2013). The intrinsically-motivated contributors enjoy intrinsic rewards via contributing content, while the non-intrinsically-motivated contributors enjoy no intrinsic rewards, and the only incentive for them to contribute is the monetary rewards (Lou et al. 2013; Stoeckl et al. 2007). Following the literature, we classify the contributors to be either *Intrinsically-motivated* (denoted by footnote I) or *Non-intrinsically-motivated* (denoted by footnote \bar{I}). Let C_I represent the effort needed to contribute one unit of UGC by the intrinsically motivated contributors, and $C_{\bar{I}}$ represent that of the non-intrinsically motivated contributors. Since the intrinsically-motivated contributors contribute higher quality content than the non-intrinsically-motivated contributors, we let $C_I > C_{\bar{I}}$. Given the same effort level c ($c \geq 0$), the intrinsically-motivated contributors contribute less content than the non-intrinsically-motivated contributors $\left(\frac{c}{C_I} < \frac{c}{C_{\bar{I}}}\right)$. This is consistent with the empirical findings that the

intrinsically-motivated contributors contribute high quality but low quantity content, while the non-intrinsically-motivated contributors contribute low quality but high quantity content (Garud and Kumaraswamy 2005; Lou et al. 2013).

(2) In the UGC promotion step, we need to consider the contributors' ability to promote. Contributors can be either *Promotion-skilled* (denoted by footnote P) or *Non-promotion-skilled* (denoted by footnote \bar{P}). Promotion-skilled contributors are more efficient in promoting their UGC, comparing to the non-promotion-skilled contributors. Given the same effort level c ($c \geq 0$), the promotion-skilled can attract more audience $Q_p(c)$, while the non-promotion-skilled contributor can only attract $Q_{\bar{p}}(c) < Q_p(c)$. Let $Q_p(c) = c$ and $Q_{\bar{p}}(c) = (1 - \alpha)c$, where α ($0 < \alpha < 1$) indicates the difference between the promotion-skilled and non-promotion-skilled contributors' ability in terms of audience being attracted.

According to contributors' characteristics/abilities in each step, we classify the contributors to 4 types, which will be described in detail later. Figure 1 demonstrates the conceptual model of this paper.



Competition of Audience

The attention of the audience is always limit. Specifically, in a short term, the total number of views can be treated as a fixed value. Then the contributors have to compete for the views (In other words, when the effort of all the contributors increase, the number of views get from each unit of effort decreases.) Without loss of generality, let the total number of views to be 1, then the number of views each contributor can get is the market share. Denote the total market contribution as $Q = \sum_i Q_i$, and contributor i 's market share as $N_i = \frac{Q_i}{Q}$. In this market, each contributor maximizes his/her net benefit by choosing the optimal effort level $c_i \geq 0$, given the other contributors' optimal level of effort levels. We will discuss the equilibrium outcomes under two market scenarios: without monetary incentive and with a positive monetary incentive.

Intrinsic Rewards

Researchers classify the motivation of behavior as intrinsic motivation and extrinsic incentives (Gneezy et al. 2011; Kreps 1997). The intrinsic rewards of contributing may include reputation, interpersonal ties, direct reciprocity, and enjoyment (Wasko and Faraj 2005; Zhang and Zhu 2010), and increases with the group size of audience (Zhang and Zhu 2010), or the number of recipients (Andreoni 2007). Following this line of literature, we assume that the intrinsic rewards that an intrinsically-motivated contributor obtains is proportional to this contributor's market share (volume of audience) N_i . Simply, we let the intrinsic rewards to be βN_i , where $\beta > 0$ and $i \in \{IP, I\bar{P}\}$.

When there is no monetary incentive, the intrinsically-motivated contributors IP and $I\bar{P}$ get positive intrinsic rewards, so they will contribute; the non-intrinsically-motivated contributors $\bar{I}P$ and $\bar{I}\bar{P}$, however, get no intrinsic rewards, so they will not contribute. Let π_i denote contributor i 's net benefit when making effort c_i in contributing content. Each contributor maximizes the net benefit by choosing the optimal effort level c_i , given the other contributor's action. Therefore, the decision problem is:

$$\begin{aligned} & \max. \begin{cases} \pi_{IP} = \beta \frac{c_{IP}}{Q} - c_{IP} \\ \pi_{I\bar{P}} = \beta \frac{(1-\alpha)c_{I\bar{P}}}{Q} - c_{I\bar{P}} \end{cases} \\ & \text{s. t. } \pi_i \geq 0 \text{ and } c_i \geq 0, \text{ where } i \in \{IP, I\bar{P}\} \end{aligned}$$

Accordingly, the total market contribution is $Q = \frac{\beta(1-\alpha)}{(2-\alpha)}$, the two contributors' effort levels are $c_{IP} = c_{I\bar{P}} = \frac{\beta(1-\alpha)}{(2-\alpha)^2}$ and their market shares are $N_{IP} = \frac{1}{(2-\alpha)}$, and $N_{I\bar{P}} = \frac{(1-\alpha)c_{I\bar{P}}}{Q} = \frac{(1-\alpha)}{(2-\alpha)}$. So we have

Lemma 1:

When there is no monetary incentive, the equilibrium is that the intrinsically-motivated contributors IP and $I\bar{P}$ make the same amount of effort $\frac{\beta(1-\alpha)}{(2-\alpha)^2}$, but the promotion-skilled contributor IP attracts more audience and obtains a larger market share.

Monetary Incentives

The most prevalent monetary incentive mechanism is the “advertising revenue sharing” mechanism, which is usually “pay per click”. When a monetary incentive is introduced, it may induce two effects: a direct standard price effect and an indirect psychological effect (Frey and Jegen 2001; Gneezy et al. 2011). The direct standard price effect is widely acknowledged in the economics literature. It is recognized as a basic “law of behavior” that higher monetary incentives will lead to higher marginal benefit or lower marginal cost, thus will lead to more effort and better performance (Frey and Jegen 2001; Gneezy et al. 2011). This effect is also commonly seen in the standard principal-agent models (Gneezy et al. 2011): when a monetary incentive is performance based, it may improve the performance. In practice, the monetary incentives are also correlated with performance. For example, YouTube’s “Advertisement Sharing Plan” pays monetary rewards according to the number of visits that the video attracts. So, we assume that the monetary incentive is proportional to the market share (performance) N_i as well as the contribution quality. Simply, let the monetary rewards be γN_i for the intrinsically-motivated contributors. Here γ ($\gamma > 0$) represents the rate of monetary incentives.

However, monetary incentive may also have an indirect psychological effect (Gneezy et al. 2011), such as the “Motivation Crowding Effect” (Frey and Jegen 2001), “Over-justification Effect” (Lepper et al. 1973), or “Cognitive Evaluation Effect” (Deci et al. 1999), etc. The indirect psychological effect could be either positive or negative. In some cases, the monetary incentives enhance contributors' intrinsic motivation to contribute. This is known as the “crowding in effect” (Frey and Jegen 2001). In some other cases, monetary incentives may “backfire” to crowd out the intrinsic motivations of contributing. This is also known as the “crowding out effect”. One classical example of “crowding out effect” is the blood donation example: paying people to donate blood may break established social norms and thus result in a reduction in the blood donation (Titmuss 1970). In summary, the monetary incentives may modify the intrinsic motivations of contribution. Denote the modified intrinsic rewards as $\beta' = \beta + \delta$, where δ can be either positive, 0 or negative, indicating the modification of intrinsic rewards by the monetary incentive.

When a monetary incentive is introduced, the intrinsically-motivated contributors IP and $I\bar{P}$ get the modified intrinsic rewards and monetary rewards, thus $\pi_i = (\beta' + \gamma) \frac{Q_i}{Q} - c_i$, where $i \in \{IP, I\bar{P}\}$ and $c_i \geq 0$; the non-intrinsically-motivated contributors $\bar{I}P$ and $\bar{I}\bar{P}$ obtain only monetary rewards, thus $\pi_i = \gamma \frac{Q_i}{Q} - c_i$, where $i \in \{\bar{I}P, \bar{I}\bar{P}\}$ and $c_i \geq 0$. Again, each contributor maximizes his/her net benefit by

choosing the optimal effort level c_i , given all the other contributors' actions. Therefore, the decision problem for each of the contributor is:

$$\max. \begin{cases} \pi_{IP} = (\beta' + \gamma) \frac{c_{IP}}{Q} - c_{IP} \\ \pi_{I\bar{P}} = (\beta' + \gamma) \frac{(1 - \alpha)c_{I\bar{P}}}{Q} - c_{I\bar{P}} \\ \pi_{\bar{I}P} = \gamma \frac{c_{\bar{I}P}}{Q} - c_{\bar{I}P} \\ \pi_{\bar{I}\bar{P}} = \gamma \frac{(1 - \alpha)c_{\bar{I}\bar{P}}}{Q} - c_{\bar{I}\bar{P}} \end{cases}$$

s. t. $\pi_i \geq 0$ and $c_i \geq 0$, where $i \in \{IP, I\bar{P}, \bar{I}P, \bar{I}\bar{P}\}$

Results

Equilibrium

In equilibrium, each contributor i decides its optimal contribution level given other contributors' contribution levels. The contributions can be either positive ($c_i > 0, \pi_i > 0$ and $\frac{\partial \pi_i}{\partial c_i} = 0$) or zero (which means no contribution, $c_i = 0, \pi_i = 0$ and $\frac{\partial \pi_i}{\partial c_i} \leq 0$). We present in Table 1 the conditions for each contributor to contribute.

Contribute?	IP	$I\bar{P}$	$\bar{I}P$	$\bar{I}\bar{P}$
Yes	$Q < (\beta' + \gamma)$	$Q < (1 - \alpha)(\beta' + \gamma)$	$Q < \gamma$	$Q < (1 - \alpha)\gamma$
No	$Q \geq (\beta' + \gamma)$	$Q \geq (1 - \alpha)(\beta' + \gamma)$	$Q \geq \gamma$	$Q \geq (1 - \alpha)\gamma$

Since each of the four contributors has two options, there are altogether $2^4 = 16$ "possible cases", illustrated in Table 2. Fortunately, most of the cases can be excluded in equilibrium. For example, $Q < (1 - \alpha)(\beta' + \gamma)$ implies $Q < (\beta' + \gamma)$, that is, if the contributor $I\bar{P}$ is in the market, the contributor IP is also in the market. According to this logic, cases 9~12 can be excluded. Following similar logics, we can exclude 6 more impossible cases. The remained 6 possible cases include Case 1 (all in), 2 (all except $\bar{I}\bar{P}$), 4 (purely intrinsically-motivated), 5 (all except $I\bar{P}$), 6 (purely promotion-skilled), and 13 (purely non-intrinsically-motivated) are highlighted in Table 2.

1	IP	$I\bar{P}$	$\bar{I}P$	$\bar{I}\bar{P}$	5	IP	$I\bar{P}$	$\bar{I}P$	$\bar{I}\bar{P}$	9	IP	$I\bar{P}$	$\bar{I}P$	$\bar{I}\bar{P}$	13	IP	$I\bar{P}$	$\bar{I}P$	$\bar{I}\bar{P}$
2	IP	$I\bar{P}$	$\bar{I}P$		6	IP		$\bar{I}P$		10		$I\bar{P}$	$\bar{I}P$		14			$\bar{I}P$	
3	IP	$I\bar{P}$		$\bar{I}\bar{P}$	7	IP			$\bar{I}\bar{P}$	11		$I\bar{P}$		$\bar{I}\bar{P}$	15				$\bar{I}\bar{P}$
4	IP	$I\bar{P}$			8	IP				12		$I\bar{P}$			16				

We now solve the model for the remaining 6 cases. The calculation results, including the conditions for each case and the total market contribution Q are summarized in Table 3. Each contributor's market share can be calculated using Q : $N_{IP} = 1 - \frac{q}{(\beta' + \gamma)}$, $N_{I\bar{P}} = 1 - \frac{q}{(1 - \alpha)(\beta' + \gamma)}$, $N_{\bar{I}P} = 1 - \frac{q}{\gamma}$, and $N_{\bar{I}\bar{P}} = 1 - \frac{q}{(1 - \alpha)\gamma}$.

Table 3, Calculation Results

Case No.	Contributors				Conditions	Q
No Incentive	IP	$I\bar{P}$			N/A	$\frac{(1-\alpha)\beta}{(2-\alpha)}$
Case 1 All	IP	$I\bar{P}$	$\bar{I}P$	$\bar{I}\bar{P}$	$\beta' \geq 0, (1-2\alpha)\gamma > (1+\alpha)\beta'$ $\beta' < 0, (2\alpha-1)\gamma < (2-\alpha)\beta'$	$\frac{3(1-\alpha)\varphi\gamma}{(2-\alpha)(\varphi+\gamma)}$
Case 2 Without $\bar{I}\bar{P}$	IP	$I\bar{P}$	$\bar{I}P$		$\beta' \geq 0, \gamma > (1-\alpha)\beta', (2\alpha-1)\gamma < (1-\alpha)\beta'$ and $(1-2\alpha)\gamma \leq (1+\alpha)\beta'$	$\frac{2(1-\alpha)\varphi\gamma}{\omega}$
Case 4 Intrinsically- motivated	IP	$I\bar{P}$			$\beta' \geq 0, \gamma \leq (1-\alpha)\beta'$	$\frac{(1-\alpha)\varphi}{(2-\alpha)}$
Case 5 Without $I\bar{P}$	IP		$\bar{I}P$	$\bar{I}\bar{P}$	$\beta' < 0, (1-2\alpha)\gamma > \alpha\beta', (2\alpha-1)\gamma \geq (2-\alpha)\beta'$ and $\gamma > -(2-\alpha)\beta'$	$\frac{2(1-\alpha)\varphi\gamma}{\beta'+\omega}$
Case 6 Promotion-skilled	IP		$\bar{I}P$		$\beta' \geq 0, (2\alpha-1)\gamma \geq (1-\alpha)\beta'$ $\beta' < 0, (2\alpha-1)\gamma \geq -\alpha\beta'$	$\frac{\varphi\gamma}{(\varphi+\gamma)}$
Case 13 Non-Intrinsically- motivated			$\bar{I}P$	$\bar{I}\bar{P}$	$\beta' < 0, \gamma \leq -(2-\alpha)\beta'$	$\frac{(1-\alpha)\gamma}{(2-\alpha)}$

Note: to shorten the expressions, we temporarily let $\varphi = \beta' + \gamma$ and $\omega = \gamma + (1-\alpha)(\varphi + \gamma)$ in this table.

Equilibrium Shifts

Note that all the inequalities in Table 3 are related to the parameters α , β' and γ . Recall that the parameter α describes the difference of the productivities between a promotion-skilled contributor and a non-promotion-skilled contributor, which is assumed to be exogenous in this model. The parameter β' represents the modified intrinsic rewards from contributing, which is commonly assumed to be exogenous too, because it is difficult to influence or control by the sponsor (Frey and Jegen 2001). The monetary incentive γ , however, is easily manipulated by the sponsor, which could be treated as an endogenous parameter. Therefore, we focus on the effect of γ given α and β' . Reorganizing the inequalities, we are able to refine the results.

Proposition 1 (Equilibrium Shifts):

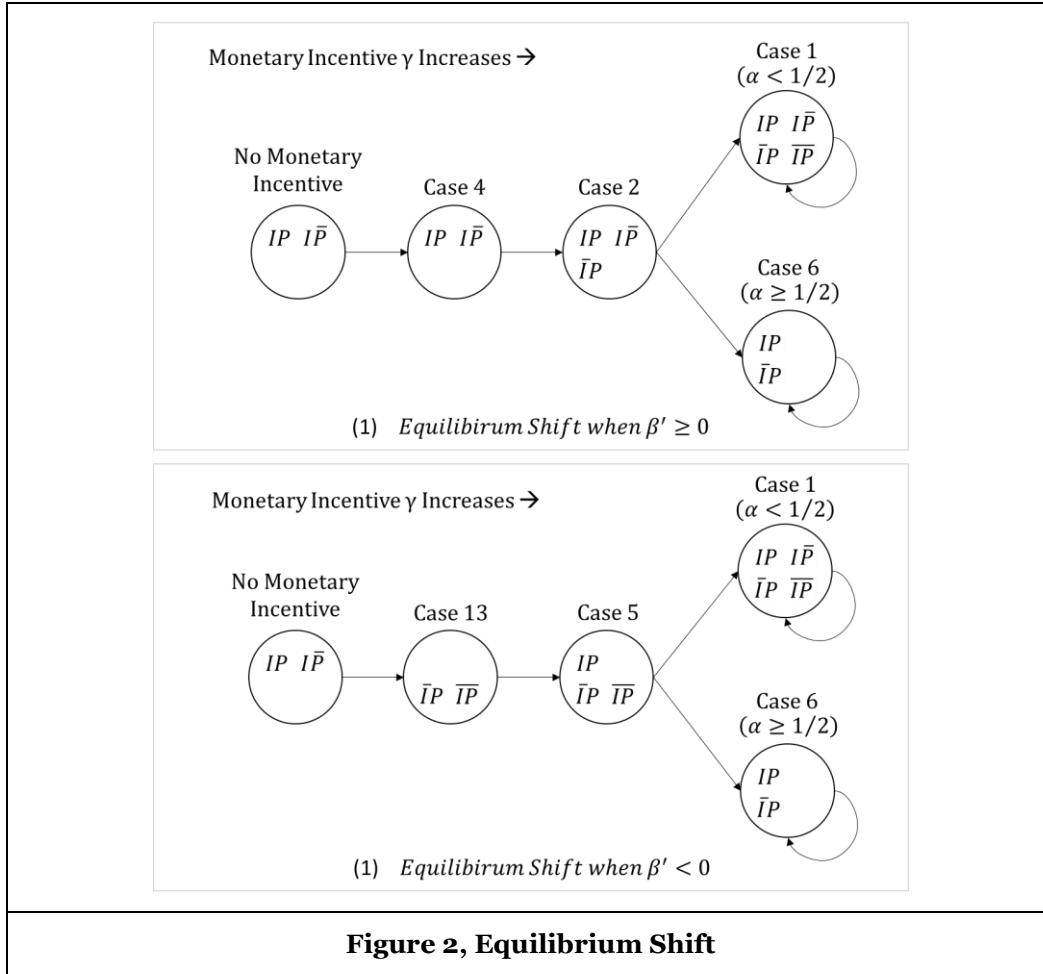
Each contributor decides whether to contribute based on the magnitude of monetary incentive γ , given the modified intrinsic rewards β' as well as the difference between productivities of the promotion-skilled and non-promotion-skilled contributors α . Specifically,

(1) If the modified intrinsic reward is positive ($\beta' \geq 0$), as the monetary reward increases, the equilibrium cases may shift from case 4 (purely intrinsically-motivated IP and $I\bar{P}$), to case 2 ($\bar{I}P$ joins), to case 1 ($\bar{I}\bar{P}$ joins, when $\alpha < 1/2$) or case 6 ($I\bar{P}$ quits, when $\alpha > 1/2$).

(2) If the modified intrinsic reward is negative ($\beta' < 0$), as the monetary reward increases, the equilibrium cases may shift from case 13 (purely non-intrinsically-motivated $\bar{I}P$ and $\bar{I}\bar{P}$), to case 5 ($I\bar{P}$ joins), to case 1 ($I\bar{P}$ joins, when $\alpha < 1/2$) or case 6 ($\bar{I}\bar{P}$ quits, when $\alpha > 1/2$).

To facilitate the discussion, here we defined a term *Ultimate Case*: If the market stays in a case in regardless of the monetary incentive, it is an Ultimate Case. Obviously, case 1 and case 6 are two ultimate cases.

Proposition 1 shows that raising the monetary incentives can both attract in and crowd out some types of contributors. Proposition 1(1) and 1(2) illustrate the shift of equilibrium outputs when monetary incentive increases. We illustrates the shift of equilibrium outcomes with an increasing monetary incentive in Figure 2. Sub-figure 2(1) shows the case when the modified monetary incentive β' is non-negative, sub-figure 2(2) shows the case when the modified monetary incentive β' is negative.



Note: Subfigure (1) illustrates the shift of equilibrium as the monetary incentive γ increases when the modified intrinsic reward is positive ($\beta' \geq 0$), following the process NMI(No Monetary Incentive) \rightarrow 4 \rightarrow 2 \rightarrow 1(or 6). In detail, when there is no monetary incentive, only the intrinsically-motivated contributors IP and $I\bar{P}$ contribute. As the monetary incentive increases, the equilibrium cases may shift from case 4 (purely intrinsically-motivated contributors IP and $I\bar{P}$), to case 2 ($I\bar{P}$ joins), to case 1 ($I\bar{P}$ joins, when $\alpha < 1/2$) or case 6 ($I\bar{P}$ quits, when $\alpha \geq 1/2$). Similarly, subfigure (2) illustrates the shift of equilibrium as the monetary incentive γ increases when the modified intrinsic reward is negative ($\beta' < 0$.)

Proposition 1 shows that, raising the monetary incentive can both attract in and crowd out certain types of contributors. More specifically:

(1) Case 1 (all in) is possible only when $\alpha < 1/2$, i.e., when the difference of production efficiencies is small, which implies that the four types of contributors are more similar. Case 6 (purely production-efficient) is possible only when $\alpha \geq 1/2$, i.e., the difference of production efficiencies is large. Under this condition the production-efficient contributors are more competitive than the non-production-efficient ones, and they crowd out the non-production-efficient contributors when there is a large monetary incentive.

(2) Among all the cases, IP is absent only in Case 13. This is because IP is the dominant contributor in the market: it contributes high quality content and has high production efficiency. The only reason for it not to be in the market is when it suffers from the negative intrinsic reward brought by the monetary incentive (Case 13). However, when the monetary incentive is large enough to offset this negative intrinsic reward, the contributor IP will be attracted back into the market.

(3) Among all the cases, the contributor $I\bar{P}$ contributes only in the Case 1, Case 13 and Case 5. This is because $I\bar{P}$ is the weakest contributor in the market: it contributes low quality content and has low

production efficiency. The contributor \overline{IP} can join the market either when the market “welcomes” all the contributors (Case 1) or when the intrinsically-motivated contributors suffers from the negative intrinsic reward but the non-intrinsically-motivated contributors suffers nothing (Case 13 and Case 5).

Total Market Contribution

From Lemma 1, the total market contribution when there is no monetary incentive is $Q = \frac{(1-\alpha)\beta}{(2-\alpha)}$. According to Proposition 1, when there is a small monetary incentive ($\gamma = 0^+$), if the modification of intrinsic rewards δ is positive, the total market contribution will suddenly jump to $\frac{(1-\alpha)(\beta'+\gamma)}{(2-\alpha)}$ (note that $\beta' = \beta + \delta > \beta$ and $\gamma = 0^+$). This is known as the motivation crowding in effect (Frey and Jegen 2001). If there is no modification on the intrinsic rewards ($\delta = 0$), the total market contribution will not change. If the modification of intrinsic rewards δ is negative yet $\beta' = \beta + \delta > 0$, the total market contribution will drop to $\frac{(1-\alpha)(\beta'+\gamma)}{(2-\alpha)}$ (note that $\beta' < \beta$); further, if δ is so negative that $\beta' = \beta + \delta < 0$, the market contribution will drop to $\frac{(1-\alpha)\gamma}{(2-\alpha)}$ (note that $\gamma = 0^+$), i.e. there will be barely market contribution. This is known as the motivation crowding out effect (Frey and Jegen 2001) or over-justification effect (Lepper et al. 1973). Figure 3 illustrates the relationship between monetary incentive and market contribution given different modification of intrinsic rewards δ .

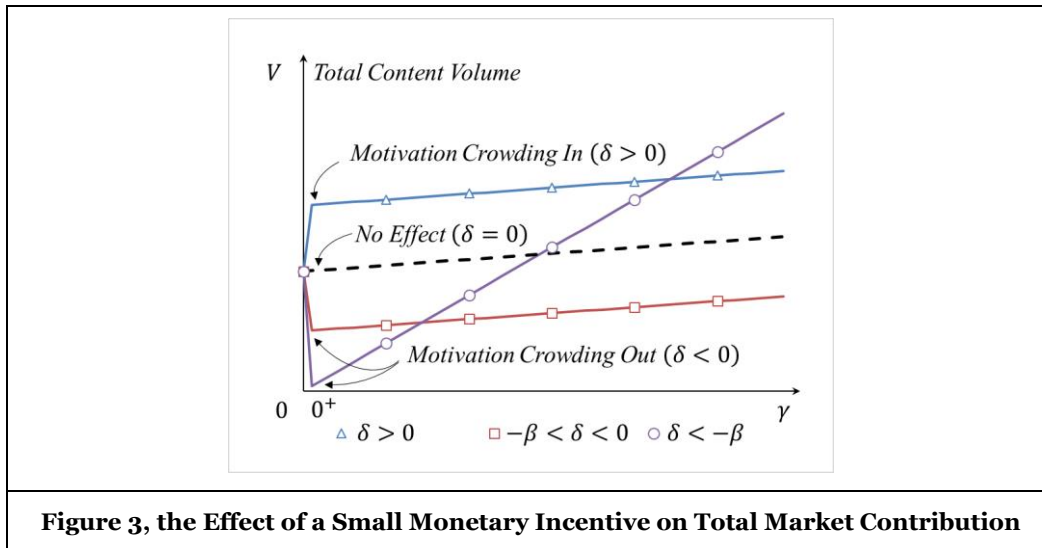


Figure 3, the Effect of a Small Monetary Incentive on Total Market Contribution

Based on the analysis, we have the following corollary:

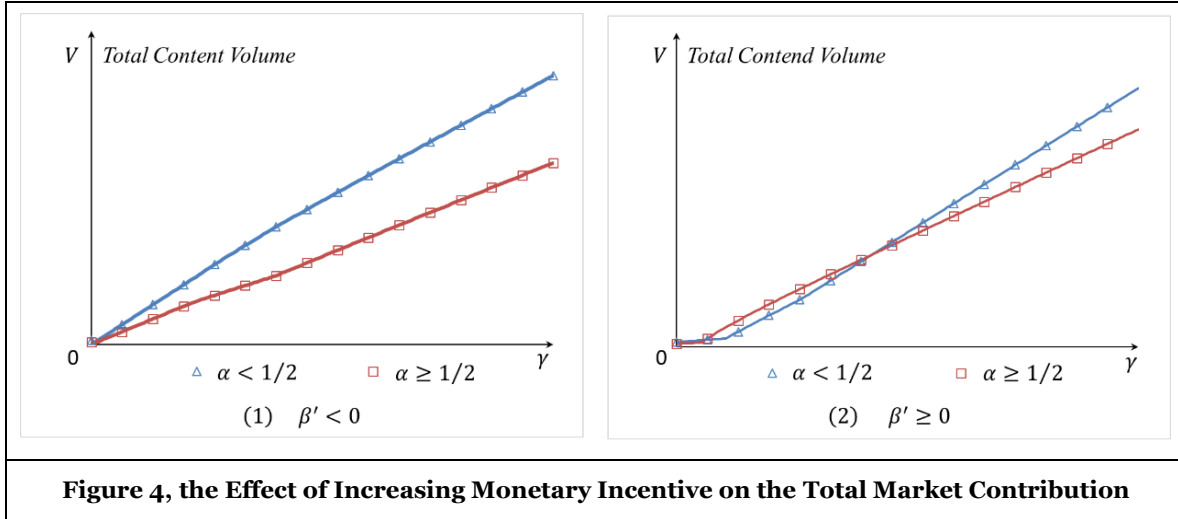
Proposition 2 (Motivation Crowding In/Out Effect):

When a small monetary incentive is introduced, the total market contribution could either increase or reduce: when the monetary incentive is associated with a positive modification on intrinsic rewards, the total market contribution increases; when there is no modification on the intrinsic rewards, the total market contribution remains unchanged; when the modification is negative, the total market contribution will reduce, and may even drop to close to 0.

Proposition 2 indicates that the previously seemingly contradictory results in literature can be explained by the magnitude of the modification effect of monetary reward in our model: when a small monetary incentive is introduced, either a “crowding in” or “crowding out” can happen, depending on the modification of intrinsic rewards by the monetary incentive. The “crowding in” effect can happen if the monetary incentive is perceived to enhance the intrinsic rewards (Frey and Jegen 2001), e.g., the ability to make money via contributing content is admirable (Tang et al. 2012b); the “crowding out” effect can happen if the monetary incentive breaks some established social norms (Titmuss 1970) or social reputation (Bénabou and Tirole 2006), e.g., the contributors may avoid to be perceived as greedy rather

than altruism when contribution is paid (Bénabou and Tirole 2006). Proposition 2 also shows that the market contribution could even dramatically disappear given a small monetary incentive.

Now we study the effect of increasing monetary incentive starting from a small positive monetary incentive. When $\gamma > 0$, it is easy to find that $\frac{dQ}{d\gamma} > 0$ and $\frac{dQ}{dk} \leq 0$. Therefore, given there is a positive monetary incentive, the higher the monetary incentives, the more the total market contribution. Figure 4 shows the relationship between monetary incentive and total market contribution when monetary incentive is large than 0.



When the modification of an intrinsic reward is negative ($\delta < 0$), as illustrated in Figure 3, the introduction of a small amount of monetary incentive reduces the total market contribution; however, if the monetary incentive is sufficiently large, the total market contribution is higher than the case when there is no monetary incentive. Therefore, as frequently emphasized by economists, “incentives matter” (Gneezy et al. 2011). Whatever the initial direction of monetary incentive is, if the monetary incentive is large enough, it increases the total market contribution. Therefore, we have:

Corollary 1 (Total Market Contribution):

Comparing to no monetary incentive, a small monetary incentive may either increase or decrease the overall market contribution, depending on the modification of intrinsic rewards δ ; a large enough monetary incentive $\gamma > \gamma^$ increases the total market contribution.*

Corollary 1 indicates that if monetary incentive is offered, it's better above a threshold value γ^* , otherwise the total market contribution may drop. It also provides theoretical explanations for some empirical results. For example, after reviewing a plenty of empirical studies, Gneezy et al. (2011) show that when the monetary incentives are larger enough, the direct price effect outweigh the crowding out effect. (Gneezy and Rustichini (2000)) also proposes to “Pay Enough or Don’s Pay at All”.

Overall Contribution Quality

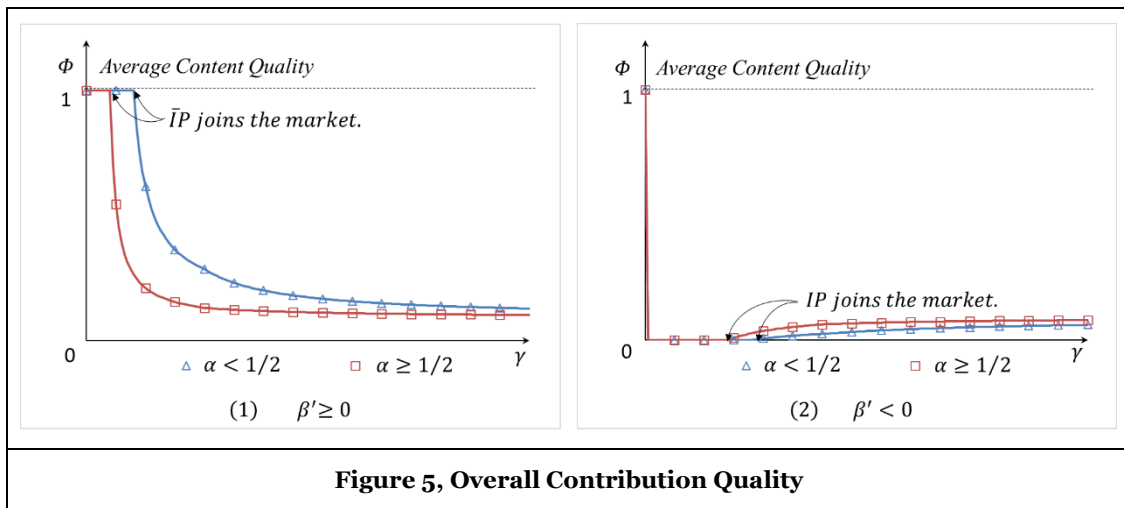
Let the contribution quality of the intrinsically motivated contributors is k_1 , and the contribution quality of the non-intrinsically motivated contributors is k_2 , where $0 \leq k_2 < k_1 \leq 1$. Then the overall contribution quality is $\bar{k} = \frac{k_1(Q_{IP}+Q_{IP})+k_2(Q_{IP}+Q_{IP})}{Q}$. Let $\Phi = \frac{(Q_{IP}+Q_{IP})}{Q}$, we have $\Phi = \frac{(k_1-k_2)}{(k_1-k_2)}$, then $\Phi \in [0,1]$ is the standardized value of \bar{k} irrelevant to k_1 and k_2 . Therefore, we use the standardized overall contribution quality Φ in the following discussions. Figure 5 shows the change of Φ with an increase in the monetary incentive.

When the modified intrinsic rewards $\beta' < 0$ and a small monetary incentive ($\gamma = 0^+$) is introduced, there is a market turnover from pure intrinsically motivated contributors to pure non-intrinsically motivated

contributors, then the market contribution quality drops from k_2 to k_1 (the standardized market contribution quality drop from 1 to 0). Therefore, comparing with no monetary incentive, introducing a small monetary incentive may cause a sudden drop of market contribution quality when the modified intrinsic rewards is negative. If the modified intrinsic rewards is non-negative ($\beta' \geq 0$), the market quality level drops since the non-intrinsically-motivated contributors are attracted into the market. If the modified intrinsic rewards is negative ($\beta' < 0$), the market turns from all-intrinsically-motivated contributors to all-non-intrinsically-motivated contributor, thus the overall quality index becomes 0. As the monetary incentive increases, the intrinsically-motivated contributors are attracted into the market, which enhances the market quality level. In summary, we have:

Proposition 3 (Overall Contribution Quality):

When the modified intrinsic rewards is non-negative ($\beta' \geq 0$), introducing (or increasing) the monetary incentive reduces the overall contribution quality level; when the modified intrinsic rewards is negative ($\beta' < 0$), introducing the monetary incentive reduces the overall contribution quality level, but an increase of the monetary incentive increases the overall contribution quality level.



Discussions and Conclusions

In this paper, we build a model to examine the impact of monetary incentives on UGC contribution. We model four types of contributors differentiated by whether they are intrinsically-motivated in contributing and whether they are promotion-skilled in attracting audience (IP , IP , \bar{IP} and \bar{IP} .) The introduction of monetary incentive interacts with the intrinsic incentives of contributors; at the same time, contributors compete for audience attention in the market. In equilibrium, the four types of contributors respond to the monetary incentives differently. Our findings show that, introducing a small monetary incentives may either increase or reduce the overall market contribution, which exhibits a motivation crowding in or out effect; however, a high enough monetary incentive will increase the overall market contribution. Moreover, monetary incentives does not always increase the overall contribution quality.

Understanding the impact of monetary incentives of UGC contribution is important in many aspects. To the best of our knowledge, this paper makes the first effort to address this research problem using analytical modeling. We incorporate both contributor motivation and the competition among contributors in our model, and examine not only the total market contribution, but also the market structure (each participating contributor's market share), as well as the quality level of the contribution.

Our results offer guidelines to UGC platforms in introducing monetary incentive. The optimal magnitude of the monetary incentive depends on the objective of the campaign. According to our findings, if the objective is to increase the total market contribution, the monetary incentive should be above a threshold level, otherwise it will reduce the total market contribution. If the objective is to attract all the contributors into the market, the monetary incentive should not be too high or too small; if it is too small,

the no more contributors will join; if too high, the intrinsically-motivated contributors will be driven out of the market. If the objective is to increase the contribution quality, the monetary incentive should not be too big, in order to avoid attracting too much contribution from the non-intrinsically-motivated but promotion-skilled contributors, which hurt the overall contribution quality.

This study has several limitations. First, for tractability, we assume that a contributor's reward is a linear function of her market share. This linear reward function represents only one type of monetary incentive mechanisms. In reality, the reward function can be either convex or concave in its market share. It is worthwhile to relax this assumption and explore the impact of non-linear functions. Second, we assume that the four types of contributors are of equal size. This model can be extended to allow the four types of contributors with non-equal size, which will not fundamentally change the results.

Future models may consider the competition between social media websites. In this model we consider only one social media website, considering in practice that there is basically one established social media website that dominates the field, e.g., Facebook, Twitter, YouTube, etc. It is possible that -new social media websites compete with the established social media website by offering significantly higher monetary incentive. It will be interesting to model such competition. Second, it is also interesting to model the promotion skill and quality as endogenous parameters. For example, to let the content quality depends on a contributor's effort. In such models, we can study a contributor's choice in contributing high quality content, or promoting a low quality content. Finally, it is valuable to collect field data or conduct field experiments to verify our research findings. Gneezy et al. (2011) indicate that, "Incentives do matter, but in various and sometimes unexpected ways". Our paper shows some initial efforts on understanding the effect of monetary incentive on UGC contribution. A lot of efforts are still needed in future.

Acknowledgements

Yuewen Liu would like to acknowledge the financial support from the National Natural Science Foundation of China under grant number 71331005 and 71301128, and financial support from the China Postdoctoral Science Foundation under grant number 2015T81039 and 2014M560795. Juan Feng would like to acknowledge the financial support for GRF grant 9042133, and for the National Natural Science Foundation of China under grant number 71401148.

References

- Adam 2014. "Revenue Sharing Sites That Can Help You Earn."
- Aggarwal, R., Gopal, R., Gupta, A., and Singh, H. 2012. "Putting money where the mouths are: The relation between venture financing and electronic word-of-mouth," *Information Systems Research* (23:3-part-2), pp 976-992.
- Andreoni, J. 2007. "Giving gifts to groups: How altruism depends on the number of recipients," *Journal of Public Economics* (91:9), pp 1731-1749.
- Ariely, D., Bracha, A., and Meier, S. 2009. "Doing good or doing well? Image motivation and monetary incentives in behaving prosocially," *American Economic Review* (99:1), pp 544-555.
- Bénabou, R., and Tirole, J. 2006. "Incentives and Prosocial Behavior," *American Economic Review* (96:5), pp 1652-1678.
- Bateman, P. J., Gray, P. H., and Butler, B. S. 2011. "Research Note-The Impact of Community Commitment on Participation in Online Communities," *Information Systems Research* (22:4), pp 841-854.
- Becker, J. U., Clement, M., and Schaedel, U. 2010. "The impact of network size and financial incentives on adoption and participation in new online communities," *Journal of Media Economics* (23:3), pp 165-179.
- Bettinger, E., and Baker, R. 2011. "The effects of student coaching in college: An evaluation of a randomized experiment in student mentoring," National Bureau of Economic Research.
- Croson, R., and Gneezy, U. 2009. "Gender differences in preferences," *Journal of Economic literature* (47:2), pp 448-474.
- Deci, E. L., Koestner, R., and Ryan, R. M. 1999. "A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation," *Psychological bulletin* (125:6), p 627.
- Frey, B. S., and Jegen, R. 2001. "Motivation crowding theory," *Journal of economic surveys* (15:5), pp 589-611.
- Frey, B. S., and Oberholzer-Gee, F. 1997. "The cost of price incentives: An empirical analysis of motivation crowding-out," *American Economic Review* (87:4), pp 746-755.
- Garud, R., and Kumaraswamy, A. 2005. "Vicious and virtuous circles in the management of knowledge: The case of Infosys Technologies," *MIS quarterly* (29:1), pp 9-33.
- Gneezy, U., Meier, S., and Rey-Biel, P. 2011. "When and why incentives (don't) work to modify behavior," *The Journal of Economic Perspectives* (25:4), pp 191-209.
- Gneezy, U., and Rustichini, A. 2000. "Pay enough or don't pay at all," *Quarterly journal of economics* (115:3), pp 791-810.
- Goes, P. B., Lin, M., and Au Yeung, C.-m. 2014. "'Popularity Effect' in User-Generated Content: Evidence from Online Product Reviews," *Information Systems Research* (25:2), pp 222-238.
- Goh, K.-Y., Heng, C.-S., and Lin, Z. 2013. "Social media brand community and consumer behavior: Quantifying the relative impact of user-and marketer-generated content," *Information Systems Research* (24:1), pp 88-107.
- Jin, X.-L., Zhou, Z., Lee, M. K., and Cheung, C. M. 2013. "Why users keep answering questions in online question answering communities: A theoretical and empirical investigation," *International Journal of Information Management* (33:1), pp 93-104.
- Kankanhalli, A., Tan, B. C., and Wei, K.-K. 2005. "Contributing knowledge to electronic knowledge repositories: an empirical investigation," *MIS quarterly* (29:1), pp 113-143.
- Kreps, D. M. 1997. "Intrinsic motivation and extrinsic incentives," *American Economic Review* (87:2), pp 359-364.
- Lazear, E. P. 2000. "Performance Pay and Productivity," *American Economic Review* (90:5), pp 1346-1361.
- Lepper, M. R., Greene, D., and Nisbett, R. E. 1973. "Undermining children's intrinsic interest with extrinsic reward: A test of the "overjustification" hypothesis," *Journal of Personality and social Psychology* (28:1), p 129.
- Leuven, E., Oosterbeek, H., and Klaauw, B. 2010. "The Effect of Financial Rewards on Students' achievement: Evidence from a Randomized Experiment," *Journal of the European Economic Association* (8:6), pp 1243-1265.
- Lou, J., Fang, Y., Lim, K. H., and Peng, J. Z. 2013. "Contributing high quantity and quality knowledge to online Q&A communities," *Journal of the American Society for Information Science and Technology* (64:2), pp 356-371.
- Lukyanenko, R., Parsons, J., and Wiersma, Y. F. 2014. "The IQ of the Crowd: Understanding and Improving Information Quality in Structured User-Generated Content," *Information Systems Research* (25:4), pp 669-689.
- Mellström, C., and Johannesson, M. 2008. "Crowding out in blood donation: was Titmuss right?," *Journal of the European Economic Association* (6:4), pp 845-863.
- Miller, A. R., and Tucker, C. 2013. "Active social media management: the case of health care," *Information Systems Research* (24:1), pp 52-70.

- Rishika, R., Kumar, A., Janakiraman, R., and Bezawada, R. 2013. "The effect of customers' social media participation on customer visit frequency and profitability: an empirical investigation," *Information Systems Research* (24:1), pp 108-127.
- Steve 2013. "Top 5 Review Writing Websites To Earn Money Online."
- Stoeckl, R., Rohrmeier, P., and Hess, T. Year. "Motivations to produce user generated content: Differences between webloggers and videobloggers," BLED 2007 Proceedings2007, p. 30.
- Sun, Y., Dong, X., and Du, J. 2013. "An Empirical Investigation of Intrinsic and Monetary Incentives for Product Review Contribution in a Connected Community."
- Susarla, A., Oh, J.-H., and Tan, Y. 2012. "Social networks and the diffusion of user-generated content: Evidence from YouTube," *Information Systems Research* (23:1), pp 23-41.
- Tang, Q., Gu, B., and Whinston, A. Year. "Content Contribution in Social Media: The Case of YouTube," System Science (HICSS), 2012 45th Hawaii International Conference on, IEEE2012a, pp. 4476-4485.
- Tang, Q., Gu, B., and Whinston, A. B. 2012b. "Content contribution for revenue sharing and reputation in social media: A dynamic structural model," *Journal of Management Information Systems* (29:2), pp 41-76.
- Titmuss, R. M. 1970. *The gift relationship*, (London, George Allen and Unwin Ltd.
- Uptom, W. E. 1973. *Altruism, attribution, and intrinsic motivation in the recruitment of blood donors*, Cornell University, August.
- van Mierlo, T. 2014. "The 1% rule in four digital health social networks: an observational study," *Journal of medical Internet research* (16:2).
- Wasko, M. M., and Faraj, S. 2005. "Why should I share? Examining social capital and knowledge contribution in electronic networks of practice," *MIS Quarterly* (29:1), pp 35-57.
- Yang, J., Adamic, L. A., and Ackerman, M. S. Year. "Competing to Share Expertise: The Taskcn Knowledge Sharing Community," ICWSM2008.
- Zeng, X., and Wei, L. 2013. "Social ties and user content generation: Evidence from Flickr," *Information Systems Research* (24:1), pp 71-87.
- Zhang, K., and Sarvary, M. 2014. "Differentiation with User-Generated Content," *Management Science* (61:4), pp 898-914.
- Zhang, X. M., and Zhu, F. 2010. "Group size and incentives to contribute: A natural experiment at Chinese Wikipedia," *American Economic Review* (101:4), pp 07-22.