Do Financial Incentives Induce More Online Participatory Behaviors?

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Short Paper

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Abstract

Online community-based Question and Answer (Q&A) websites is popular in recent years. The main challenge for Q&A websites is how to motivate participations. Using a natural experimental dataset collected from a Chinese Q&A site, we apply difference-in-differences model with propensity score matching to evaluate the effect of emergency of a paid-for knowledge sharing activity on changes in the free sharing behaviors and social activities. Our results show that the paid-for activity allows users to share more knowledge freely and build more social ties in the site. The results suggest that the financial incentive can increase users’ participatory behaviors significantly.

Keywords: online participatory behaviors, knowledge sharing activity, social activity, financial incentive, online question and answer website

Introduction

In recent years, online community-based Question and Answer (Q&A) websites have become popular among the world, such as Quora, Stack Overflow in English, and Zhihu in Chinese. Millions of users actively post various questions, provide answers and share their knowledge or experience in these websites. The social ties among users in the site are built up due to shared interest and expertise. These Q&A websites regularly rely on users’ voluntarily contributions and social activity (Khansa et al. 2015; Lou et al. 2013). So the main challenge for online knowledge sharing sites is how to motivate members’ participatory behaviors.

There is a growing literature on the effects of incentive mechanisms on participatory behaviors. The types of incentive mechanisms has been widely studied, researchers have made a clear distinction between intrinsic and extrinsic motivations (Ryan and Deci 2000). Intrinsic motivations refer to the inherent desire to do something, because the action itself provides satisfaction or enjoyment. In contrast, extrinsic
motivation means that an act is performed not due to its satisfaction, but because there are external reasons to do (Goes et al. 2016). Previous literatures showed that intrinsic motivations including altruism, enjoyment of helping others would encourage users to share knowledge (Chiu et al. 2006; Ma and Agarwal 2007; Ma and Chan 2014; Wasko and Faraj 2005). Some research has suggested that extrinsic motivators affect knowledge sharing (Chen et al. 2010c; Garnefeld et al. 2012; Hung et al. 2011; Roberts et al. 2006; Sun et al. 2017). A large body of studies have focused on the effect of nonfinancial extrinsic incentives, such as reputation (Vasilescu et al. 2014), rank (Goes et al. 2016), status (Heo and Toomey 2016; Roberts et al. 2006), identity verification (Ma and Agarwal 2007), social image (Qiu and Kumar), social benefits (Zhang and Zhu 2011) and reciprocity norms (Feng and Ye 2016; Wasko and Faraj 2005) on driving users to contribute. Roberts et al. (2006) suggested that the intrinsic motivation for contributing knowledge is not undermined in the presence of monetary incentives using data from an open source software (OSS) community. Based on social comparison theory, Chen (2010a) suggested that the social information of monetary payment can motivate contributions to an online movie recommender community. Other studies indicated that indirect financial incentives, such as career-related incentives, drive people to contribute in virtual communities (Hann et al. 2013; Phang et al. 2015).

However, existing literatures have several limitations. First, the online community-based Q&A site is not only a knowledge repository but also a social networking site. Most of previous studies focused on the incentive factors driving on online knowledge sharing behavior. Nevertheless, we still lack knowledge about how the incentive factors affect other participatory behavior, such as social activities in the site. Especially, few studies examined the effect of financial incentive on both knowledge sharing behaviors and social activities in Q&A community. Second, most literature studies the direct effect of the financial incentive on user behaviors that it targets. However, how the financial incentives influence other related behaviors in online Q&A websites has rarely been studied. If the incentive-based interventions have some unintended negative effects, such as reducing some voluntary participatory behaviors, it will hamper overall development of sites. Thus, it is important to understand the extended effect of emergency of profitable knowledge sharing feature on free knowledge sharing behaviors and social behaviors in the sites. Third, previous studies primarily used survey to study the relationship between the incentives and participatory behaviors. That cannot fully uncover the underlying association between the incentives and participatory behaviors. And some research relied on the controlled laboratory experimental data to investigate such a relationship (Heo and Toomey 2016) However, the controlled laboratory experiment may subject to serious external validity problem. And the results from laboratory experiments are less generalizable than natural experimental counterparts (Al-Ubaydli and List 2013; Al-Ubaydli and List 2015; Levitt and List 2007). In addition, previous studies have demonstrate that natural experiments allow the study of casual effects of exogenous variation on explanatory variables (Meyer 1995). In our context of study, the new financial incentive feature “Live” is launched by the website which is seen as an exogenous change, it is appropriate to evaluate the casual effect of the financial incentive on participatory behaviors by using the natural experiment.

The rest of the paper will be organized as follows. At first, the hypotheses are developed. Then, the research context is given. The econometric model will be presented, followed by the results in the next section. Finally, we conclude the study.

Hypotheses Development

In general, the activities in the Q&A site can be divided into two types before introducing a financial incentive. The first type of activity called free knowledge sharing activity includes freely contributing answers, questions, articles in the site. The second type of activity is called social activity, including following someone and being followed by others in the site.

We hypothesize that the extended effect of the emergence of profitable knowledge sharing feature on free knowledge sharing behavior is negative. First, some studies have argued that people’s time, energy and knowledge are limited (Davenport and Prusak 1998; Hung et al. 2011). To the extent that the free and profitable behaviors are seen as substitute behaviors, as increase in one may bring about reducing in the other. Second, the monetary rewards received from the profitable knowledge sharing activities generate a kind of contrast effect that knowledge is a commodity likely any other that has the potential to be sold.
Based on economic exchange theory (EET) (Hung et al. 2011), people seek the maximum economic benefits when they make a choice. When users are aware of the commodity property of knowledge, they will reduce to share knowledge freely.

While for social activities in the site, we assume that the extended effect of the emergence of profitable knowledge sharing feature is positive. The loyalty rewards programs used in marketing have shown that the monetary reward can establish a long-run relationship between the company and customers (Bolton et al. 2000; Meyer-Waarden 2007). Similarly, when users receive monetary rewards from answering others questions, they will feel more loyal to the site and closer to others. Thus the benefit from participating profitable knowledge sharing activity enables them to get in touch with like-minded others, establish more social ties with others in Q&A sites (Garnefeld et al. 2012).

Therefore, we hypothesize that

HYPOTHESIS 1 (H1). Users will decrease free knowledge sharing activities if they receive monetary rewards from the paid-for Q&A activity.

HYPOTHESIS 2 (H2). Users will build more social ties in the site if they receive monetary rewards from the paid-for Q&A activity.

Research Context

Our research context is a popular online Q&A website in China, where members ask, answer questions, post articles and build social ties. Until March, 2017, nearly 70 million users have registered on this website. This website rolled out a new feature “Live” in May 16, 2016. The Live feature is a new website function provided by a popular online Q&A website in China. It aims to help users to earn money by sharing their knowledge. With this feature, any website users can hold a Live session, which is a paid-for, real-time and online question-and-answer seminar. It normally lasts for about an hour at a specific time. Live holders set entry cost for each Live session and make a brief introduction about what they will share in the session. If other users are interested about the Live session, they can attend the Live by paying entry costs to Live holders. We call these users Live audiences. For Live audiences, they may attempt to solve particular questions. While for Live holders, the primary task is to share their knowledge and answer the questions raised by Live audiences. At the same time, Live holders can also earn money from Live audiences.

We use a quasi-experimental design in which contribution activities data are collected from the site between January 17, 2016 and September 17, 2016. The new feature “Live” presents a natural shock in our eight-month sampling window, which has an exogenous effect of introducing a monetary incentive in the site (i.e., treatment). From January 17, 2016 to the launch time of the new feature “Live”, we define this stage as pretreatment stage. From the launch time of the new feature “Live” to September 17, 2016, we define this stage as post-treatment stage. We focus on the users who have held a Live and have registered on the website before the start date of the sampling. The sample size of this treat group is 213. Additionally, we randomly select 5000 users, having not held any “Live” session within the study period, who were registered on the site before January 17, 2016. We use these samples as the control group. Figure 1 illustrates the experimental timeline.

<table>
<thead>
<tr>
<th>Neither the treat group or control group receive the financial incentive</th>
<th>the treat group receive the financial incentive, while the control group not receive it</th>
</tr>
</thead>
<tbody>
<tr>
<td>pretreatment stage</td>
<td>post-treatment stage</td>
</tr>
<tr>
<td>2016.01.17</td>
<td>2016.05.16</td>
</tr>
<tr>
<td>Launch “Live”</td>
<td>2016.09.17</td>
</tr>
</tbody>
</table>

Figure 1. Experimental Timeline
A key challenge is to identify the effect of monetary incentive of Q&A activities on change in online participatory behavior. Due to the endogeneity problem, we cannot make a plausible conclusion that the different post-treatment behavior between the treat group and the control group is caused by the financial incentive feature “Live”. The Live holders usually have greater incentive motivation and are more likely to share more knowledge and build more social ties in the website than those non-holders over time. Therefore, regardless of whether the financial incentive exists, the members belong to the treat group appear to contribute more and build more social ties in the website. To resolve the endogeneity problem, we will use some econometric techniques to reduce the potential differences across the two groups.

**Econometric Model**

To resolve the potential endogeneity problem, we apply a difference-in-differences model (Meyer 1995) combined with propensity score matching (Heckman et al. 1998). The difference-in-differences model is commonly used to examine the effect of a treatment or intervention in a given time period. To reduce the potential differences between the treat and control group, we rely on the propensity score matching to find members in control group who are similar to members in treat group in terms of observed characteristics.

**Propensity score matching**

To reduce the potential differences between the treat and control group, we rely on the propensity score matching method to find members in control group who are similar to members in treated group in terms of observed characteristics. First, we obtain the propensity score that statistically balance the covariates between treated and control subpopulations by using logit model. Whether being treated by financial incentive serves as the dichotomous outcome in the logit model and a set of observed pretreatment characteristics as covariates (including gender, the total amount of answers, the total amount of questions, the total amount of articles contributed by members in the website before May.16, 2016, the total amount of up-votes, the total amount of thanks, and the total amount of favorites that users received before May.16, the total amount of followers, the amount of people that users followed before May.16). The propensity score is defined as the probability to be exposed to the treatment(Iacus and Porro 2004). Second, we match treated and controls on the basis of their propensity scores according to nearest four neighbor matching method with replacement. From the control group, four individuals are chosen as matching partners for a treated individual that are closest in terms of the propensity score (Caliendo and Kopeinig 2008). One individual in the control group may be matched more than one time. After matching method, we get 441 matched users. Third, we conduct a balance check by comparing the standardized bias before and after matching. The standardized bias before and after matching are calculated by referencing Xu et al. (2016. The standardized bias of all the covariates is largely reduced after matching. The t-test results show that the means of the two groups are similar after matching. These checks validate that the matching method is appropriate to produce similar groups.
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Thirty Seventh International Conference on Information Systems, South Korea 2017

Table 1. Summary Statistics of Control and Treat Group Before and After Matching

<table>
<thead>
<tr>
<th></th>
<th>logthanks</th>
<th>logfavorite</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.05</td>
<td>211.1</td>
<td>28.9</td>
</tr>
<tr>
<td>8.35</td>
<td>8.30</td>
<td>2.6</td>
</tr>
<tr>
<td>0.27</td>
<td>0.790</td>
<td>98.7</td>
</tr>
<tr>
<td>9.41</td>
<td>205.0</td>
<td>29.2</td>
</tr>
<tr>
<td>9.26</td>
<td>9.15</td>
<td>6.2</td>
</tr>
<tr>
<td>0.61</td>
<td>0.544</td>
<td>97.0</td>
</tr>
</tbody>
</table>

Table 1. Summary Statistics of Control and Treat Group Before and After Matching

**Difference-in-Differences**

Then we use the matched 441 users information data to examine the differences in knowledge sharing behaviors between members who have received the financial incentive and those who haven’t received in a given time. Our estimating equation for members i in stage t is:

\[ y_{it} = \beta_0 + \beta_1 \times (\text{TreatGroup}_i \times \text{PostTreatment}_t) + \beta_2 \text{TreatGroup}_i + \gamma \text{PostTreatment}_t + X_i + \varepsilon_{it} , t = 0, 1, n = 1, \ldots, N \]

Where \( y_{it} \) is the average number of free answers, questions and articles, the average increased number of followers and followees (following others) per month in the pretreatment stage and post-treatment stage. The outcome variable in our model is log-transformed to produce an elasticity interpretation. \( \text{TreatGroup}_i \) is denoted with 1 if a member has ever held a Live session within the study period and 0 if otherwise. This binary variable controls for the time-invariant group-differences between the treat and control group. \( \text{PostTreatment}_t \) is 0 for the pretreatment stage, 1 for the post-treatment stage. This variable accounts for potential temporal factors that may simultaneously influence the “Live” feature adoption and participatory behaviors across various users. The coefficient \( \beta_1 \) of interaction term \( \text{TreatGroup}_i \times \text{PostTreatment}_t \) examines how the contribution behaviors in the treat group change after launching the financial incentive feature in contrast to that of control group in the same period. Because the outcome variable is log-transformed, \( \beta_1 \) captures the average incremental effect of the financial incentive on the participatory behaviors. In our specification, we also control for observed covariates, \( X_i \) that includes gender, contribution behavior before launching the financial incentive feature (including the total amount of answers, questions, articles contributed by members), and social activities (including the total amount of followers, the total amount of people that you followed, the total amount of up-votes, thanks, and favorites). These covariates control for observed differences across all users.

**Results**

Using Stata software, The column 1-3 of Table 2 respectively show the effect of financial incentive of paid-for Q&A on contributing answers, questions, articles per month freely. Additionally, the column 4, 5 show the effect of financial incentive of paid-for Q&A on social activities. The coefficients of the interaction term \( \text{TreatGroup} \times \text{PostTreatment} \) of the first and second column are non-significant. The results indicate that the amount of contributing answers and questions freely per month did not change overall after the members receiving financial incentive. While for free article posting activity, the average number of article per month increased by 34.4% after users receiving the monetary rewards. These results totally reject H1. While for social activities, the fourth and fifth columns show that the amount of new follower increased by 50.2%, whereas the amount of persons that users newly follow also increased by 27% after receiving the monetary rewards from paid-for Q&A activities. These results support H2.

<table>
<thead>
<tr>
<th></th>
<th>Coef. (Std.Err.)</th>
<th>Coef. (Std.Err.)</th>
<th>Coef. (Std.Err.)</th>
<th>Coef. (Std.Err.)</th>
<th>Coef. (Std.Err.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TreatGroup*PostTreatment</td>
<td>0.044 (0.099)</td>
<td>0.010 (0.031)</td>
<td>0.344*** (0.065)</td>
<td>0.502*** (0.122)</td>
<td>0.270*** (0.104)</td>
</tr>
<tr>
<td>TreatGroup</td>
<td>0.092 (0.070)</td>
<td>-0.041* (0.024)</td>
<td>-0.049 (0.045)</td>
<td>0.716*** (0.083)</td>
<td>0.157** (0.075)</td>
</tr>
<tr>
<td>PostTreatment</td>
<td>-0.036 (0.064)</td>
<td>-0.010 (0.025)</td>
<td>0.014 (0.043)</td>
<td>0.010 (0.088)</td>
<td>-0.024 (0.073)</td>
</tr>
<tr>
<td>gender</td>
<td>0.082 (0.055)</td>
<td>0.019 (0.016)</td>
<td>0.123*** (0.034)</td>
<td>0.077 (0.074)</td>
<td>0.160* (0.067)</td>
</tr>
<tr>
<td>total_answer</td>
<td>0.455*** (0.033)</td>
<td>-0.014* (0.008)</td>
<td>0.028 (0.017)</td>
<td>0.108*** (0.036)</td>
<td>-0.053* (0.030)</td>
</tr>
</tbody>
</table>
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| total_ask | -0.053** (0.024) | 0.115*** (0.015) | 0.010 (0.018) | -0.114*** (0.029) | -0.045* (0.027) |
| total_article | 0.047 ** (0.020) | 0.003 (0.007) | 0.273*** (0.017) | 0.087*** (0.023) | -0.009 (0.021) |
| total_follower | -0.129 *** (0.025) | -0.014* (0.007) | -0.009 (0.015) | 0.559*** (0.036) | -0.049** (0.024) |
| total_follower | -0.075*** (0.018) | -0.011** (0.005) | -0.030*** (0.011) | -0.092*** (0.026) | 0.429*** (0.024) |
| total_agree | 0.165 *** (0.048) | 0.042** (0.018) | 0.047 (0.037) | 0.227*** (0.070) | 0.056 (0.059) |
| total_fav | -0.006 (0.108) | -0.005 (0.029) | -0.037 (0.054) | -0.080 (0.114) | 0.208** (0.094) |
| total_thanks | -0.056 (0.186) | -0.012 (0.014) | -0.008 (0.030) | 0.131* (0.072) | -0.169*** (0.051) |
| total_fav | -0.620*** (0.186) | -0.092 (0.058) | -0.136 (0.130) | -2.509*** (0.269) | -0.902** (0.210) |
| _cons | -0.006 (0.108) | -0.005 (0.029) | -0.037 (0.054) | -0.080 (0.114) | 0.208** (0.094) |
| R-squared | 0.4269 | 0.2659 | 0.5028 | 0.7527 | 0.4135 |
| Clusters | 441 | 441 | 441 | 441 | 441 |

Table 2. Estimation Results of the DID Model

Notes: Robust standard errors are in parentheses. All outcome variables are log transformed.
*significant at 10%;  ** significant at 5%; *** significant at 1%

To better understand the extent to which the entry costs “motivate” live holders, we split the Live holders into two groups by the total fee received by Live holders. The minimum value of Live session fees is 1134 RMB, while the maximum value is 17134 RMB. In addition, the median value is 8203 RMB. If the Live fee received by Live holders exceeds the median, we call these people high-income earners, otherwise, low-income earners. Table 3 shows the effect of monetary rewards on high-income earners versus low-income earners. The main results demonstrate the strong effect of monetary reward on posting articles, being followed by others and following others among both high-income earners and low-income earners. Meanwhile, the effects on posting articles and following others are stronger for high-income earners than low-income earners. In addition, the low-income earners have higher probability to be followed by others.

<table>
<thead>
<tr>
<th>High-Income Earners</th>
<th>TreatGroup*PostTreatment</th>
<th>TreatGroup*PostTreatment</th>
<th>TreatGroup*PostTreatment</th>
<th>TreatGroup*PostTreatment</th>
<th>TreatGroup*PostTreatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer</td>
<td>0.126</td>
<td>(1.68)</td>
<td>0.300</td>
<td>(5.53)***</td>
<td>0.299</td>
</tr>
<tr>
<td>Question</td>
<td>0.022</td>
<td>(1.04)</td>
<td>0.38</td>
<td>(0.38)</td>
<td>0.73</td>
</tr>
<tr>
<td>Article</td>
<td>0.34</td>
<td>(0.19)</td>
<td>2.665</td>
<td>(2.665)</td>
<td>2.651</td>
</tr>
<tr>
<td>Follower</td>
<td>2.530</td>
<td>(338)</td>
<td>339</td>
<td>(339)</td>
<td>338</td>
</tr>
<tr>
<td>Followee</td>
<td>-0.050</td>
<td>(0.80)</td>
<td>0.270</td>
<td>(5.98)***</td>
<td>0.289</td>
</tr>
<tr>
<td>Low-Income Earners</td>
<td>TreatGroup*PostTreatment</td>
<td>0.35</td>
<td>0.35</td>
<td>2.746</td>
<td>2.724</td>
</tr>
<tr>
<td>Clusters</td>
<td>2.608</td>
<td>(348)</td>
<td>348</td>
<td>(348)</td>
<td>347</td>
</tr>
</tbody>
</table>

Table 3. The effect of monetary rewards on high-income earners versus low-income earners

Notes: Robust standard errors clustered by each user are in parentheses. All outcome variables are log transformed. *significant at 10%;  ** significant at 5%; *** significant at 1%

Conclusion

This paper draws on economic and psychological theory to examine the effect of the financial incentive on member contribution activities in an online knowledge sharing website. And our study uses the difference-in-differences method combining with propensity score matching to make reliable causal
inference based on the natural experimental data. The results show that users will leave unchanged the free questions and answers activities if they receive monetary rewards from paid-for Q&A activities. What is more, the users increase the free article posting activities after receiving the monetary rewards. The results don’t suggest that there exists substitution effect among the paid-for and free knowledge sharing behavior. Actually, the paid-for activity promote the free knowledge sharing behaviors. A potential explanation for the complementarities is that a user who receive the financial incentive will likely to put more time and energy into the site. Additionally, the rewards received from the site will make users feel indebtedness. The feeling of indebtedness will motivate users to reciprocate others in the site by sharing more free knowledge (Feng and Ye 2016; Mathews and Green 2010). We find users build more social ties in the site after receiving the monetary incentive. This finding is consistent with our expectation. Due to the financial incentive, the users feel loyalty to the site and build more social ties in the sites. This finding echoes the potential explanation that users increase the overall input of time and energy to the site.

There are several limitations of this study. First, in our study, we only examine the effect of financial incentive on the quantity of participatory behaviors. Nevertheless, the quality of participatory activity is equally important for Q&A sites (Chen et al. 2010b). The effect of financial incentive on the quality of participatory behaviors would need to be examined in future study. Second, we only use the nearest four neighbors matching to select the matched samples. In future, we will apply more matching methods to test the robustness of our results. Third, after using the matching method to select matched users who don’t receive the monetary rewards, the number of samples is much smaller. The small samples may not provide significant effect information.

Notwithstanding the above limitations, our paper contributes to the existing literatures from three aspects. First, we explore how the emergence of a paid-for activity impact other free knowledge sharing activities and social activities. Second, we examine the casual effect by using natural experiment data. The natural experimental data is better than the laboratory controlled experimental data in reflecting the reality. Third, we use a difference-in-difference approach to estimate the effect of financial incentive on members’ participatory behaviors. To resolve the self-selective problem, we rely on the propensity score matching method to select the appropriate samples. By combining the two aforementioned methods, we can examine the causal relationship between the financial incentive and participatory behaviors on an online Q&A community.

Our study also has important managerial implications. Launching a profitable service in the site can impact both other free knowledge sharing activities and social activities. If an online Q&A website is to implement a financial incentive, the effect on all types of activities should be carefully analyzed. This should also be considered in other UGC communities, like open source software sites, online user reviews communities.

References


