Are Contributions to P2P Technical Forums Private or Public Goods? – An Empirical Investigation

Bin Gu, Sirkka Jarvenpaa
University of Texas at Austin, MSIS Dept
CBA 5.202, Austin, TX 78712

I. Introduction

P2P technical support forums are widely used by information technology (IT) firms as supplements for technical support call centers. A typical technical support forum allows customers to post technical questions and receive answers from their peers. From time to time, customers may also receive answers directly from a firm's technical support teams, although many forums explicitly state that forums are not officially supported by the sponsoring firms. Technical support forums also provide archives of customer-to-customer communications and extensive search functions, thus serve as knowledge networks for information and knowledge exchange among peer customers. In the IT industry, where product complexity is rapidly escalating service demands, firms rely on these forums to reduce service demands and minimize after-sales service costs.

P2P technical support forums are special cases of P2P networks. They share a key feature that network contents are mostly or entirely contributed by individual users. Technical support forums, however, are different from many file-exchange networks that employ decentralized structures due to legal constraints. Most P2P technical support forums instead use central servers to provide search and archive functionalities. Because of the structural difference, P2P technical support forums place less burden on individual users compared to file-exchange networks. The results of this paper therefore need be read in light of this difference.

Like all P2P network, free riders, or peers that use the resources but do not contribute, are often perceived as a considerable problem for networks that rely on such peer interaction structures (Golle, et. al. 2001; Krishnan, et. al. 2002). Free-riding issue shall also become worse with increase in number of customers in the community. Casual observations on the Internet suggest otherwise. Large virtual communities with thousands of customers are ubiquitous, contradicting to theoretical predictions. In this paper, we study incentives of customer contributions and show evidences that customer contributions are mainly considered as private goods instead of public goods by contributors.

Incentives to contribute public goods have been widely studied in economic literature. The standard public goods theory suggests that individuals contribute public goods in anticipation of benefits from overall increase in public goods. Andreoni (1989) and Glazer (1996) point out that individuals may also contribute public goods due to intrinsic motivation ("warm glow" effect) in contribution itself. Using data from P2P technical support forums of a leading IT firm, we show that customer contributions are indeed

largely motivated by the "warm-glow" effect. To a much less degree, customer contributions are motivated by increases in overall public goods. Our findings indicate that firms can improve customer contribution to P2P network by designing incentive mechanism that enhances the "warm glow" effect.

II. Public Goods Theory and "Warm Glow" Effect

The standard public goods theory[1] assumes consumers have utility function $u = u(x, G)$, where x is the consumption of a private good and G is the sum of public goods. The only benefit a consumer will receive for making a public goods contribution is the utility increase due to increase in G. A number of results have been derived from this general setting (e.g. Bernheim 1986). In particular, we have

> Proposition 1a: External supply of public goods crowds out internal contribution ("crowd out" effect). This is due to the fact that consumers have less incentive to make a contribution if they can anticipate free external supply of public goods.
>
> Proposition 2a: Consumers who will benefit more from the public goods contribute more.

Andreoni (1989) is among the first to model that a consumer may receive private utility in making public goods contributions. Such private uility is termed "warm glow" effect. The cause of "warm glow" effect varies from receiving recognition to showing off social status (Glazer 1996). In the general public goods model with "warm glow" effect, a consumer has utility function $u = u(x, g, G)$, where x is the consumption of a private good, g is this consumer's individual contribution of public goods and G is the sum of all public goods. Making a public goods contribution increases consumer's utility by increasing both g and G in the utility function. In the extreme case where consumers are only affected by the "warm glow" effects, the utility function can be written as $u = u(x, g)$. In this case, public goods contribution becomes motivated by private utility. That is, a contribution becomes private goods from a contributor's perspective[2]. Based on the standard economic theory, two results can be derived from this model:

> Proposition 1b: External supply of public goods has no impact on internal contribution. Contribution is determined by a consumer's marginal benefit of contribution against his marginal costs in the extreme case. Overall supply of public goods therefore does not influence a consumer's individual decision.
>
> Proposition 2b: Consumers who have more public goods will contribute more.

---

[1] See Glazer (1996) for an excellent summary of the standard public good theory.

[2] Contributions in this case have two dimensions: they are private goods from contributors' perspective, but public goods from receivers' perspective.

In this paper, we design an empirical study to consider consumers' incentives to contribute to peer-to-peer based technical forums. If consumers are mainly motivated by increase in overall public goods, consumers will have utility function $u = u(x, G)$ and Propositions 1a and 2a will be supported. Alternatively, if consumers are mainly motivated by "warm glow" effect, we expect consumers to have utility function $u = u(x, g)$ and exhibit Propositions 1b and 2b. Our results suggest that consumers are strongly motivated by "warm glow" effect, i.e. contributions are private goods from contributor's perspective.

III. Empirical Evidence: Crowd Out Effects

We first consider the crowd out effect. The IT firm studied in this paper contributes to its technical support forums from time to time. Such contributions are equivalent to external contribution in the standard public good theory. If contributions are considered public goods by contributors (i.e., customers), we expect them to reduce contributions in response to contributions from the firm (Proposition 1a). On the other hand, if contributions are viewed as private goods by contributors, there shall be no crowd out effect (Proposition 1b).

We collect forum user activities from 28 technical support forums of the IT firm under study. The IT firm is a leading global provider of computer equipment to consumers and businesses. Out of the 28 forums, 8 are eliminated due to data availability. Another 5 are eliminated because the nature of these forums is administrative oriented thus incomparable with other forums. For the remaining 15 forums, we calculate bi-weekly firm contributions[3] and customer contributions (in percentage terms) for 2002. A two-way fixed effect model is estimated for the crowd out effects:

$$\text{PrivateContribution} = \mu + \beta \text{FirmContribution} + \alpha_i + \lambda_t + u_{it}$$

The result in Table 1 suggests that an increase in a firm's contribution does not decrease customer contributions. Therefore, there exists little crowd out effect in public goods contributions, providing support to "warm glow" effect.

Table 1: Empirical Result for Crowd-out Effect

	Coefficients
Intercept	0.74** (0.03)
Firm Contribution (%)	0.05 (0.04)

[3] The result is not sensitive to the choice of time interval. Each answer to questions posted in the support forums is counted as one contribution.

IV. Empirical Evidence: Warm Glow Effect

In this section, we consider incentives of individual forum users (i.e., customers). Public goods theory suggests that an individual's incentive to contribute is positively associated with potential benefits that she may receive from forums (Proposition 2a). On the other hand, if a forum user is motivated by the "warm-glow" effects, her contribution shall be positively associated with her overall level of knowledge (Proposition 2b). To distinguish between the two propositions, we need to measure a customer's potential benefits from the forums, and his over level of knowledge.

1. We use number of questions a user posts to the forums to measure potential benefits he receives from the forum. It is important to note that a user not only benefits from questions he posts on the forums, but also benefits from reading questions and answers posted by other users. However, the IT firm sponsors the forums did not track individual users' reading history. Instead, we consider a typical user that search forum archive for a particular question, and if he can not find answer in the archive, he posts the question on the forums. Number of questions posted by a user is therefore highly correlated with his usage and overall benefits from the forums. We use the number as the proxy variable for benefits a user receives from the forums. The more questions posted by a forum user, the higher the benefits that he receives. If users are mainly motivated by increase in overall public goods, we expect a positive association between a user's benefits from the forums and his total contributions (Proposition 2a)

2. If users are mainly motivated by "warm glow" effect, Proposition 2b suggests a positive association between a user's knowledge level and his total contributions. The P2P technical support forums under study do not provide detailed information on an individual user's technical background and competency. However, the forums do allow peer customers to rate each answer in the forum. We therefore use average rating of a customer as a proxy variable for his level of technical knowledge.

We estimate the following log-linear model to test the two propositions:

$$\log(\text{IndividualContribution}) = \alpha + \beta_1 \log(\text{TotalQuestionsPosted}) + \beta_2 \text{AverageRating} + \varepsilon$$ [4]

Results in Table 2 reveal that forum users with high level of knowledge contribute substantially more than other customers. It provides support for both the warm-glow effect that consumers consider their contribution as private goods and the public goods theory that consumers benefit more from the forums contribute more. However, it is worth noting that although increase in the number of questions posted has a statistically significant coefficient, the magnitude of the coefficient is not economically significant[5]. Since both the dependent variable and the independent variable are in log terms, the coefficient can be understood as a 1% increase in number of questions posted results in a

[4] Both individual contributions and total question posted are measured in log term for year 2002

[5] Economic significance considers magnitude of the impacts.

0.01% increase in contribution to the support forums. Such increase is trivial compared to effects of increases in a customer's knowledge level. We therefore conclude that users are mainly motivated by private utility from making contributions compared to utility from overall increase in public goods.

Table 2: Empirical Result for Individual Contributions

	Coefficients
Intercept	0.25** (0.00)
Log(Total Question Posted)	0.01** (0.005)
Average Rating	0.63** (0.01)

V. Conclusion and Limitation

We provide preliminary evidence that contributions to online technical support forums are considered as private goods rather than public goods by contributors. This finding helps explain survivals of many P2P networks despite presence of free-riders. Our results also provide guidance for designing incentive mechanism for P2P networks. We need to emphasize that P2P technical support forums are structurally different from many P2P file-exchange networks, which place a larger burden on users to provide content, storage and search funcationalities. Our results therefore shall be read in light of these structure differences.

References

Andreoni, J. **Giving with Impure Altruism: Applications to Charity and Ricardian Equivalence** *The Journal of Political Economy*, Vol. 97, No. 6. (Dec., 1989), pp. 1447-1458.

Ansolabehere, S., de Figueiredo, J. M. and Snyder Jr., J. M. **Why is There so Little Money in US Politics?** *Journal of Economic Perspectives, Vol 17, No. 1, Winter 2003, pp. 105-130*

Bernheim, B. D., **On the Voluntary and Involuntary Provision of Public Goods**, *The American Economic Review*, Vol. 76 No. 4. (Sep., 1986), pp. 789-793

Glazer, A., Kai A. K., **A Signaling Explanation for Charity**, *The American Economic Review*, Vol. 86, No. 4. (Sep., 1996), pp. 1019-1028

Golle, P., Leyton-Brown, K. Mironov, I. and Lillibridge, M. **Incentives for Sharing in Peer-to-Peer Networks**. Working paper, Stanford University (2001).

Krishnan, R., M. D. Smith, Z. Tang, and R. Telang. **The Virtual Commons: Why Free-riding can be Tolerated in File Sharing Networks.** Working paper, Canegie Mellon University (2002)