

Social Influence and Social Norm in Peer-to-peer Networks – A Longitudinal Analysis of Individual Contributions and Peer Enforcement in a Music Sharing Network

Bin Gu

University of Texas at Austin
2100 Speedway B6500
Austin, TX 78712
bin.gu@mcombs.utexas.edu

Yun Huang

Northwestern University
2145 Sheridan Road
Evanston, IL 60208
yun@northwestern.edu

Wenjing Duan

George Washington University
2201 G St NW, Fungler Hall 515
Washington, DC 20052
wduan@gwu.edu

Andrew B. Whinston

University of Texas at Austin
2100 Speedway B6500
Austin, TX 78712
abw@uts.cc.utexas.edu

Extended Abstract

Peer-to-peer networks have become an important channel for online media distribution. Compared to a centralized distribution infrastructure, peer-to-peer networks have a number of benefits. First, it requires little network resource from content creators. Second, it scales with demand and avoids server congestion commonly observed in centralized distribution infrastructure. Third, it enables faster distribution and more efficient use of the network by connecting users with nearby servers. Because of these benefits, peer-to-peer networks have been widely used by online media distributors such as iMesh, Groovshark and Joost (Hosanagar et al. 2009).

A main challenge in using peer-to-peer networks for online media distribution is the free riding phenomenon. The phenomenon is the result of the *Tragedy of Commons* problem (Hardin 1968). Contributions to peer-to-peer networks are public goods. They benefit others in the networks except for the contributor. The action of contributing also often incurs significant costs. The combination of low benefits and high costs indicates that economically rational individuals will provide little contributions to peer-to-peer networks.

The free riding phenomenon raises an important question on the viability of peer-to-peer networks - what motivates individual contributions to peer-to-peer networks? To answer this question, many prior studies use surveys or cross-sectional data to identify different motivations among individual users (see e.g. Shah 2006, Hann et al. 2006, Kankanhalli 2006, Wasko and Faraj 2005). However, these studies do not capture the dynamic and social nature of peer-to-peer networks. The goal of this paper is to identify the social dynamics between individuals and their environments using a panel data of 103,330 users' activities in a peer-to-peer network over 121 days.

The use of panel data addresses a number of challenges that face earlier researchers that adopt cross-sectional analysis. First, the time series aspect of the panel data allows us to observe individual behavior over time and identify how their behavior changes with social environment.

Second, panel data enables us to control for individual heterogeneity, thus isolating social influences from individual motivations.

We have two main findings. First, we reveal that individuals are heavily influenced by their social environment. An individual's likelihood of contribution changes with the social environment, particularly with others' contribution level in the network. The individual increases his contribution probability when he observes an increase in the number of contributors while decreases his contribution probability when he observes an increase in the number of free-riders. The finding is consistent with the literatures on social influence. Second, we find that individuals have incentive to voluntarily enforce social norm on others to encourage contribution. They do so through the setting of servers that allows discrimination among downloaders. When the number of free riders increases, a contributor is more likely to change the server settings to provide priority services to other contributors and lesser services to free riders. When the number of contributors increases, a contributor is less likely to provide priority services to contributors. Our results indicate that social influence and social norm plays a key role in moderating individual behavior in peer-to-peer networks and in maintaining and sustaining private contributions to peer-to-peer networks.

Social Influence and Social Norm in A Peer-to-peer Network		
Model	Contribution Status	Server Status
# Non-Pure Contributors	1.72*** (0.20)	-1.45** (0.64)
# Free Riders	-1.17*** (0.19)	1.41** (0.63)
# Pure Contributors	0.05 (0.05)	-0.05 (0.19)
Experience	0.11*** (0.01)	0.15*** (0.05)
Reputation	1.84*** (0.03)	1.26*** (0.21)
Incentive	1.13* (0.65)	-3.14 (2.16)
Wait x Current Downloads	0.02*** (0.00)	
Current Downloads	0.40*** (0.02)	-1.05*** (0.04)
Wait	-0.04*** (0.02)	0.06*** (0.02)
<i>Individual and time fixed effects included but not reported</i>		
Number of Observation	45,125	6,495
Log likelihood	-14,250.372	-1,265.19