Pricing for Sharing Economy with Reputation

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Sharing economy refers to the peer-to-peer fee-based resource sharing business model. Through sharing economy, individual resource owners allow potential buyers to access their under-utilized resources and gain profits. This is also beneficial to the buyers, who can usually access the resources at cheaper prices than through conventional channels. Several factors, including the increase of consumer awareness, the development of online platforms, and growth of social communities, make sharing economy increasingly popular. Successful examples of sharing economy include Fon for Wi-Fi sharing, Uber for car sharing, and Airbnb for room sharing. In all these examples, the pricing and the quality of shared resources (e.g., QoS of Fon Wi-Fi, safety of Uber taxi, and comfort of Airbnb room) have significant impact on resource owners' profits and buyers' experiences.

In an online sharing economy, reputation of the resource owner is a good indicator of the quality and reliability of her shared resource. A resource owner is more likely to have a higher level of reputation if she has stronger social relationship with buyers. On the other hand, owners with no prior social relationship with buyers may gradually build up the reputation over time. The combination of pricing and reputation of resource owners will determine the buyers' purchasing decisions.

In this work, we study the impact of reputation on the economic interactions among resource owners and buyers in an online-based sharing network. Such interactions are inherently a repeated process, and hence can be modeled as a repeated game. At the beginning of each time slot (say every week for Airbnb), owners announce their unit prices for their resources, and each buyer decides which owner to choose and the amount of resource to consume based on the prices and owner reputations during the time slot. Hence, a repeated game consists of a sequence of single-slot games, each of which is a two-stage multi-leader-multi-follower game that can be analyzed within the Stackelberg game framework.

Our analysis shows that in each single-slot game, each buyer will choose the owner with the largest reputation-price ratio. For the competition among resource owners with heterogeneous reputations, there exists a unique price equilibrium. If more than one owner has the highest level of reputation, then all owners set their prices equal to the common marginal cost at the equilibrium, and receive zero profits. If only one owner has the highest level of reputation, then the unique highest reputation owner will achieve a positive profit, while all other owners achieve zero profits.

In the infinitely repeated game, owners can achieve higher profits than in the single-slot case through cooperation, and such cooperation is enforced by a punishment strategy. If the gap between owners' highest and second highest reputation levels is large enough, then the sharing network becomes a monopoly market dominated by the highest reputation owner. When owners' reputation levels are relatively close, then a subset of owners with relatively high reputations will cooperate with each other at the equilibrium. For the other low reputation owners, they will get zero profits and will not affect the cooperative owners' pricing decisions.

We further consider a random utility model, where buyers' decisions may be affected by their psychological biases or some unobserved attributes of owners. In such a case, the buyer will choose multiple owners according to a certain probability distribution, which depends on the owners' reputation-price ratio. We propose a cooperative algorithm, based on a selection of resource owners that can achieve the cooperative maximum profit in the infinitely repeated game enforced by punishment strategies. The cooperative algorithm iteratively finds a set of cooperative owners such that all owners in this set can achieve positive profits under a cooperative strategy. The other owners do not cooperate with owners in the selected set, and they achieve positive profits and increase the market competition for the cooperative owners under the random utility model.

We refer the reader to [1] for more details.

1. ACKNOWLEDGMENTS

This work was supported by the General Research Funds (Project Number CUHK 14206315) established under the University Grant Committee of the Hong Kong Special Administrative Region, and the CUHK Global Scholarship Programme for Research Excellence.

2. REFERENCES

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