Optimal Queue Length Information Disclosure When Service Quality is Uncertain: A Bayesian Persuasion Approach

by

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(Conducted in English)

Abstract:

Consider a single server service system with uncertain quality level (which is assumed to be binary). Both the server and customers know the distribution of quality levels and are engaged in the following two-stage game. At the first stage, the server commits to a strategy (possibly mixed) which states that given a realized quality level, whether or not the queue length will be revealed to customers upon their arrival. At the second stage, quality is realized and the server’s corresponding queue disclosure action is observed by customers, who then update their belief on the service quality and decide whether or not to join the service system. The server’s decision problem is to find an optimal commitment strategy to maximize his expected effective arrival rate, anticipating customers’ equilibrium queueing behavior towards his queue-disclosure strategy. Using a Bayesian-persuasion approach, we reformulate the server’s decision problem as looking for the best resulting posterior distribution on service quality. This reformulation yields useful insights on when and why a commitment strategy helps. In particular, we demonstrate that the maximal expected effective arrival rate, as a function of the prior, can be graphed as the upper envelope of all convex combinations of points on the effective arrival rate function of the revealed queue and those of the concealed queue. We also show that when the market size is sufficiently small (large, resp.), the server always conceals (reveals, resp.) the queue regardless of the realized service quality. Under a moderate-size market, however, the server’s optimal commitment strategy is often mixed, that is, randomizing over the queue disclosure and concealment. Those results remain quite robust no matter whether customers are individual decision makers or act as one to maximize their total utility. We also find that, due to the change of the optimal disclosure strategy, customers’ total utility when they behave collectively can be less than that when they behave as selfish individuals.

Bio:

Professor Pengfei Guo currently works at the Department of Logistics and Maritime Studies, The Hong Kong Polytechnic University. He received his PhD from Duke University in 2007. His research interests include service operations management, queueing economics, operations management in public sector including health care, sharing economy and two-sided markets. He has published 15 papers on the UTD journals and is currently serving as a senior editor for the POM journal.

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All PolyU staff and students are welcome!