

# Pricing Externalities in Online Resource Allocations

## Problem definition

The increasing popularity of online platforms like Amazon, eBay, and Alibaba has sparked significant research interest in online commerce and resource allocation. In contrast to traditional retail models, where goods are produced and stored by retailers, online platforms operate differently by primarily connecting producers or retailers with customers and determining prices through algorithms (Pang et al., 2022). These platforms are expected to continue growing in terms of user numbers and retail sales volume. Consequently, it is essential to critically assess and carefully design the algorithms that govern these platforms to ensure they meet various relevant criteria and sustain online business successfully.

One of the critical characteristics of platforms where multiple suppliers and customers may come together is the potential of externalities, i.e., costs or benefits that are by-products of the economic activities of a platform participant and not suffered or enjoyed by the same actor. This thesis aims to understand better which externalities can potentially occur in online resource allocation settings, which are used to model the business process of online platforms, and how they influence the overall social welfare of platform participants. One example is the pricing decisions (Abhishek et al., 2021) of the participants in the online resource allocation, which may result in externalities for the other participants. While it needs to be discussed how these externalities influence the overall outcomes of the allocation procedures, it is the goal of this thesis to also discuss whether and how they should be mitigated. A numerical experiment on the influence of pricing externalities on overall welfare in online allocations completes the gathered insights. This experiment can be based on existing datasets and/or instances from the literature.

## Aims and scope of the thesis

It is the subject of this thesis to better understand the influence of pricing externalities on online allocations. This comprises the following research tasks:

- Literature review on which externalities may occur in online allocation settings
- Particular focus on pricing-based externalities on social welfare in the allocation
- Discussion of externality-mitigation procedures
- Performance and evaluation of numerical experiments on pricing externalities in online allocations based on instances from the literature

## Related Research

- Abhishek, V., Dogan, M., & Jacquillat, A. (2021). Strategic timing and dynamic pricing for online resource allocation. *Management Science*, 67(8), 4880-4907.
- Asadpour, A., Wang, X., & Zhang, J. (2020). Online resource allocation with limited flexibility. *Management Science*, 66(2), 642-666.
- Bateni, M., Chen, Y., Ciocan, D. F., & Mirrokni, V. (2022). Fair resource allocation in a volatile marketplace. *Operations Research*, 70(1), 288-308.
- Pang, J., Lin, W., Fu, H., Kleeman, J., Bitar, E., & Wierman, A. (2022). Transparency and control in platforms for networked markets. *Operations Research*, 70(3), 1665-1690.

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