

# Optimal Matching Algorithms for Online (Retail) Platforms

## Problem definition

Online platforms such as WeWork, Uber Eats, and Uber have grown in business presence and economic relevance over the past years (Chen et al., 2022). Two-sided market models for retail platforms (e.g., Amazon Marketplace, Zalando, Decathlon) also exist, discussing, e.g., demand forecasting and pricing and omnichannel operations (Martínez-de-Albéniz et al., 2022). Additionally, the literature on retail marketplaces also sheds light on the behavior of customers, e.g., their reaction to specific delivery characteristics (Wagner et al., 2023).

However, often, these works focus on particular characteristics of online (retail) platforms and do not provide a comprehensive overview of the various characteristics and requirements shaping the respective platform and its operations. A general overview of the different characteristics of these platforms is relevant to both gauge their economic potential and aid in improving their operations. It is particularly relevant to further understand this business model as online retail sales worldwide are expected to rise to over 8 billion US dollars by 2026, with a large amount of this stemming from online retail platforms bringing together multiple retail suppliers in one online marketplace<sup>1</sup>.

## Aims and scope of the thesis

It is the subject of this thesis to first conduct a thorough literature review on which online marketplaces exist and to develop a distinctive clustering of the existing online retail marketplaces among them. The goal is to detect relevant characteristics that the different marketplaces share among themselves or that differentiate them clearly from others. This clustering will form the basis for the next step, determining the best solution approach for the respective platforms. Based on classical matching algorithms such as the Winner Determination Problem (Lau & Li, 2021), the Assignment Problem, and the Envy-free Matching Problem, the goal is to outline which mathematical model is best suited for which online retail marketplace. Herein, it is relevant to determine the factors that make some algorithms work better for some marketplaces. This thesis concludes with the implementation of some suitable matching algorithms for a selection of the most relevant online retail marketplaces based on instances from the literature.

To be able to answer the posed research questions, this thesis comprises the following research tasks:

- Thorough literature review on online (retail) platforms
- Development of a clustering method of the different platforms based on their characteristics
- Determine which matching algorithms are best suited for which type of online (retail) platform
- Comparison and evaluation of suitable matching algorithms for a selection of online retail marketplaces

## Related Research

- Chen, Y. J., Dai, T., Korpeoglu, C. G., Körpeoğlu, E., Sahin, O., Tang, C. S., & Xiao, S. (2020). Innovative online platforms: Research opportunities. *Manufacturing & Service Operations Management*, 22(3), 430-445.
- Lau, H. C., & Li, B. (2021). Solving the winner determination problem for online B2B transportation matching platforms. *Transportation Research Part E: Logistics and Transportation Review*, 150, 102324.
- Martínez-de-Albéniz, V., Pinto, C., & Amorim, P. (2022). Driving supply to marketplaces: Optimal platform pricing when suppliers share inventory. *Manufacturing & Service Operations Management*, 24(4), 2367-2386.
- Wagner, L., Calvo, E., & Amorim, P. (2023). Better Together! The Consumer Implications of Delivery Consolidation. *Manufacturing & Service Operations Management*, 25(3), 903-920.

**Begin:** as soon as possible

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<sup>1</sup><https://www.forbes.com/advisor/business/ecommerce-statistics/>