

# Dynamic Pricing 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, focusing, e.g., on demand forecasting and pricing and omnichannel operations (Martínez-de-Albéniz et al., 2022). However, often, these works focus on particular characteristics without providing a comprehensive overview of the various characteristics and requirements shaping the respective platform and its operations. An overview of platform characteristics is key to evaluating their economic potential and enhancing operations. Such understanding is particularly relevant as online retail sales worldwide are expected to rise to over 8 billion US dollars by 2026<sup>1</sup>.

Due to the vast number of vendors selling similar products and the high degree of price transparency purchasers enjoy, the e-commerce sector is fiercely competitive. Vendors frequently use dynamic pricing to ensure they generate a healthy profit (Kumari et al., 2023). Nonetheless, literature on dynamic pricing algorithms often focuses on a single approach for one specific application case, e.g., “Surge Pricing” in the setting of mobility on demand. An overview and assessment of the different algorithms proposed could, therefore, benefit these platforms greatly. Such an evaluation is especially relevant as some retail giants have implemented complex, data-driven algorithms, but in general, few omnichannel retailers have fully developed this capability, even though less sophisticated algorithms could be an enabler<sup>2</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, i.e., determining the best dynamic pricing approach for the respective platforms. Based on a variety of dynamic pricing algorithms, such as Feature-Based Dynamic Pricing (Cohen et al., 2020) or Driver Surge Pricing (Garg & Nazerzadeh, 2021), 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. Furthermore, the nomenclature across the relevant literature will be consolidated to simplify the understanding of different algorithmic approaches. This thesis concludes with an exemplary implementation of a suitable dynamic pricing algorithm for the most relevant online retail marketplaces.

To fulfill the posed aims, this thesis comprises the following research tasks:

- Thorough literature review on online (retail) platforms and dynamic pricing algorithms
- Development of a clustering method of the different platforms based on their characteristics
- Determine which dynamic pricing algorithms are best suited for which type of online (retail) platform
- Exemplary implementation of a suitable dynamic pricing algorithm for relevant 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.
- 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.
- Kumari, Archana & Kumar S, Mohan & Ku, Babu Rao. (2023). A Systematic Requirement Analysis for Dynamic Pricing in Retail E-Commerce. 15. 342-346. 10.22214/ijraset.2023.49418.
- Maxime C. Cohen, Ilan Lobel, Renato Paes Leme (2020) Feature-Based Dynamic Pricing. *Management Science* 66(11):4921-4943.
- Nikhil Garg, Hamid Nazerzadeh (2021) Driver Surge Pricing. *Management Science* 68(5):3219-3235.

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

<sup>2</sup><https://www.mckinsey.com/capabilities/growth-marketing-and-sales/our-insights/the-dos-and-donts-of-dynamic-pricing-in-retail>