Economics of Search Design on E-commerce Platforms

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Abstract

One of the fundamental distinctions between online and conventional retailing is the widespread use of recommendation systems and search tools that assist buyers and sellers in searching for trading partners. Growing research interests in marketing, economics, and computer science have been directed toward the design of ranking and recommendation algorithms to increase search targetability and make the search results more customized to consumers' preferences. However, most of the existing studies focus on (1) the short-run effects of platform designs on consumer search and purchase behaviors and (2) the changes from the demand side, abstracting away from the possibility of changes from the supply side in the long run that can affect market equilibrium outcomes. To fill these gaps, I take advantage of a 2019 quasi-experiment in Alibaba – one of the world's largest e-commerce platforms - to examine the value of improving search precision in shaping consumer behaviors and firm competition strategies.

In the Chapter 1 of my dissertation, I illustrate the role of product categorization in e-commerce search design and introduce the 2019 quasi-experiment in Alibaba that caused a sharp increase in the quality of search results for consumers in some categories. E-commerce platforms such as Alibaba, Amazon, and Rakuten create product catalogs to categorize millions of products into a multi-level taxonomy tree with thousands of leaf categories. Product categorization can not only directly navigate consumers to the products they want, but also organize all products for the search engine to retrieve. In 2019, Alibaba refined some product categories into finer subgroups in order to return more targeted search results to online shoppers. As a result, the matching outcomes between consumers' preferences behind the search query and relevant products in the search results are substantially improved after the category refinement. Since consumers are not aware of these behind-the-scenes adjustments of search algorithms, I can causally identify how consumers respond to the improvement in search targetability (See Chapter 2). With the estimates from the demand side, I further examine the supply side responses to the changes in search algorithms (See Chapter 3).

In the Chapter 2 of my dissertation, **"Exploitation and Exploration: Improving Search Precision on E-commerce Platforms (Job Market Paper)"**, I examine the impacts of improving search precision on consumer search and purchase behaviors. A more precise search algorithm may improve search targetability, however it may also reduce cross-selling and up-selling opportunities because of less time that consumers spend

exploring different products. I empirically quantify these tradeoffs through the 2019 quasi-experiment on Alibaba that refined some broader categories into narrow ones. Using a flexible difference-in-differences design, I provide estimates of the effects of improving search precision by examining the effect of the category refinement. The estimated results suggest that increasing search precision can improve click-through rates and purchase rates in the short run, especially for "goal-directed" searchers who care about the efficiency of gathering information in the search process. However, too precise search results may take away the pressure of exploration, thus decreasing continued engagement and unplanned spending of "exploratory" searchers in the long run. As the first empirical study of the long-run impacts of search algorithms, my study indicates that e-commerce platforms should balance the short-term gains from increasing the search precision with the long-term benefits of encouraging consumer exploration. Most of existing search algorithms can immediately boost search engine revenues but may be unsustainable in a longer time horizon. My results imply that e-commerce platforms can increase consumer engagement and generate long-term impacts of user value by encouraging consumers to explore diverse, novel, and serendipitous product categories.

In the Chapter 3 of my dissertation, **"Competing for Search Traffic in Query Markets: Entry Strategy, Platform Design, and Entrepreneurship"**, I look at the supply side of the market and investigate the value of improving search precision in helping entrepreneurs to succeed in decentralized online marketplaces. E-commerce platforms guide consumers' search traffic toward online retailers that are classified into different product categories. An online retailer can either list itself under a broad category to reap larger search traffic, or choose a narrow category, often a subcategory of a broad category, to target a niche audience. Using detailed data on search queries, search exposure, and seller revenue from Alibaba, I estimate a structural model of online retailers' location decisions in the digital world. In my framework, each market is defined by a search query, which matches an online retailer's product either closely or distantly. The platform allocates search traffic into different categories, and online retailers compete for the search traffic in each product category with heterogeneous abilities to convert search traffic into revenue. I find that online retailer faces a tradeoff between market size and competition intensity, and a retailer is better at converting closely matched search traffic into revenues. By refining a broader category into narrow subcategories, the e-commerce platform gives retailers the flexibility to forgo higher volumes of search traffic in order to gain a better conversion rate. My findings suggest that e-commerce platforms as entrepreneurial incubators can help small business owners thrive on the platform through targeted search traffic allocation.