Application for NBER Digital Economics and AI Tutorial

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Course of graduate study

I am a fourth year PhD candidate at Yale Economics with a focus on applied microeconomics and industrial organization. My academic advisers are Professors Katja Seim, Phil Haile, Steve Berry, and Charles Hodgson and I plan on graduating in 2027 after finishing the sixth year at the PhD program.

Research interests

I study how modern technologies shape industry competition and explore effective policies to address the resulting challenges. Specifically, my research focuses on (1) the competitive and welfare effects of vertical integration in the platform economy and (2) the role of copyright policy in markets for creative goods, including its interaction with technological advancements such as generative AI. To answer these questions, I use unstructured data by developing novel empirical approaches and apply economic models to examine both positive and normative aspects.

Vertical integration by a dominant platform raises regulatory concerns as it can direct competition across industry chains. One method involves restricting users from accessing rival platforms — multi-homing restriction — by promoting an integrated service that is not (fully) interoperable. This conduct locks users into the dominant platform by increasing its exclusivity, which in turn reduces *cross-platform* competition and grants market power to the dominant platform. The welfare effects of vertical integration, however, are not necessarily negative as it often increases the efficiency of the marketplace or the extent of restriction may be marginal hence negligible. Therefore, an empirical assessment is required for addressing the policy concern.

In my research **"Multi-homing Restriction in Two-sided Markets,"** I investigate the effect of Amazon's logistics service, Fulfillment by Amazon (FBA), on cross-platform competition, particularly between Amazon and Walmart's online marketplaces. FBA imposes constraints on sellers by requiring them to store their inventory in Amazon's warehouses, which increases the cost of fulfilling orders on other platforms. To be specific, FBA sellers must either pay Amazon's relatively high multi-channel fulfillment fees or maintain separate inventories, which compromises economies of scale and raises the overall cost of serving non-Amazon orders.

One key empirical challenge is the limited availability of data that directly captures cross-platform competition. I address this by constructing a dataset of *matched products and sellers* using unstructured data. First, I use Google Image Search to identify whether the same product images appearing on Amazon also appear on other platforms. Then, I apply large language models (LLMs) to match products and sellers using textual information. With this unique dataset, I conduct regression discontinuity and difference-in-differences analyses to provide empirical evidence of the significant impact of FBA on competition. The identification strategy leverages details of and annual changes in the product-size-tier-based fee structure. Additionally, I develop a model of a vertically integrated platform economy that captures consumer behavior, as well as seller entry and pricing decisions. Using this model, I examine the anti-competitive effects of Amazon's practices that incentivize sellers to use FBA, such as preferential treatment for FBA sellers in search algorithms.

In **"Optimal Product Similarity in Copyright Policy,"** Sukjin Han and I study (1) entry and competition in a market of creatively differentiated products, (2) the role of copyright policy in protecting originality and ensuring welfare of market participants, and (3) the optimal level of allowable similarity that is the key basis for judging infringement. A common feature of products with creative elements is that their key attributes are *unstructured* and thus high-dimensional. Examples of unstructured attributes are images and text, which are in turn main creative objects protected by copyright laws. Therefore, quantifying unstructured attributes and building an economic model around them are crucial steps to achieve our research goal.

Among creative products, we focus on a particular design product — fonts — for several reasons. First, fonts are differentiated products whose visual attributes mostly describe the characteristics of the product - a unique feature to this particular product. Second, copyright issues have been important policy questions in this industry as well as the introduction of AI-assisted design of fonts. Third, the visual simplicity of the product allows for easily interpreting the unstructured attribute and the associated copyright policy within our economic model.

We first characterize images of fonts as embeddings, low-dimensional vectors in the Euclidean space, using a state-of-the-art convolutional neural network. Given the embeddings, we describe the competition of firms in the visual dimension as a spatial competition in the Euclidean space. We build entry and price models of firms accordingly. The entry model describes the firms' choices of location considering the later stage's pricing decisions. A copyright policy is modeled as imposing restrictions on the area of possible choices. We also model demand by a discrete choice model of heterogeneous consumers, in which the embeddings as product characteristics influence utility. We document that competition is local, meaning that products compete mainly with visually similar rivals, and provide significant evidence of business-stealing effects among them. Additionally, we show that stricter copyright policies may enhance consumer welfare by increasing desirable variety in the market through counterfactual simulation.