A Spatial Analysis of Online and Offline Competition in Regulatory Markets

Wen-Chung Guo

Extended Abstract

This study aims to establish a spatial oligopoly model to analyze the competition between online and offline economies, with a special focus on the impacts within price-regulated markets, as well as examining the relationship between quality competition and social welfare. A prime focus of this exploration is the healthcare industry, where we witness a burgeoning rivalry between traditional hospital services and emerging telemedicine offerings. This sector, especially in nations with comprehensive universal healthcare systems, is typically subject to stringent price regulation. However, the regulatory framework for telemedicine, a relatively new entrant, might not be as robust or equivalent, presenting a unique competitive landscape. Another pertinent example is the media industry, where traditional television, constrained by price regulation, finds itself in fierce competition with the rising tide of Over-the-Top (OTT) internet streaming services. Additionally, sectors like education and finance sectors have similar trends of online-offline competition and regulatory challenges.

In regulated markets, competition between online and offline businesses can present several distinct issues, which often stem from the differences (namely, *regulatory imbalances*) in how these businesses operate and are regulated. Firstly, offline businesses are often subject to more stringent regulations compared to online businesses. For instance, physical stores have to comply with local zoning laws, health and safety regulations, and accessibility standards. Online businesses, on the other hand, may operate with fewer constraints, giving them a potential advantage in terms of compliance costs and flexibility. Secondly, Online businesses generally collect more customer data than offline businesses, which can raise concerns about privacy and data security. Regulations like GDPR in Europe impose strict requirements on data handling, which can be challenging for online businesses to comply with. Thirdly, offline businesses are often more familiar with local consumer protection laws, which can be more rigorously enforced in a physical setting. Online businesses, especially those operating internationally, may find it challenging to navigate varying consumer protection standards. Finally, in the banking sectors, starting and scaling an offline business often requires significant capital investment in physical space and inventory. In contrast, online businesses might scale more rapidly with lower initial capital outlay, leading to disparities in growth potential.

When unregulated online firms enter markets where offline firms are regulated, the dynamics between quality and price are often altered. This situation raises several important questions: How does quality

competition evolve in regulated offline markets when facing online and offline regulatory imbalances? Can quality competition in these markets achieve social objectives, and if so, how? Is the presence of online competition always beneficial in enhancing the overall quality level? How does online competition affect the socially optimal regulatory prices? These questions are crucial in understanding the impact of regulatory disparities between online and offline firms on market quality and competition.

This research aims to bridge the existing gaps in academic literature regarding the interplay and competition between online and physical businesses in regulated markets, which contributes to the previous literature of quality competition in regulated markets (Spence (1975), Brekke et al. (2006, 2011, 2017), Gravelle et al. (2014), Gutacker et al. (2016), Ghandour (2021), Ghandour et al. (2022)). This study also intends to develop a theoretical spatial framework for understanding the competition between online and physical entities, focusing on quality and pricing issues within regulated markets. The study leader brings a wealth of experience in digital economy and spatial theory research, which provides a foundational advantage in addressing issues and methodologies in this field. Drawing from the legacy of spatial model literature, such as the works of Hotelling (1929), Salop (1979), d'Aspremont et al. (1979), Hwang and Mai (1990), and Irmen and Thisse (1998), Guo and Lai (2014a, 2014b, 2017, 2020), Guo et al. (2015, 2018) and Guo and Lai (2022).

We start to examine the benchmark model with only offline competition in a regulated market. Following Brekke et al. (2012), Cellini and Lamantia (2015) and Ghandour et al. (2022), consider a Hotelling model framework with two firms, 1 and 2, located at the endpoints of a unit interval $x \in [0, 1]$, specifically at $x = 0$ and $x = 1$, respectively. Consider the following game structure: In the first stage, the government sets the regulatory prices. Subsequently, both firms choose their quality investments in the second stage. Finally, consumers decide on their purchasing behaviors. We list the following main results.

Proposition 1. In markets with online and offline competition under regulation, offline quality increases with the regulatory price, similar to scenarios without online competition. However, the response of offline quality to competition varies, unlike in the benchmark case. Specifically, offline quality decreases with competition intensity (measured by t) only if the distaste cost is low and the regulatory price is high, and may increase otherwise. Online quality, on the other hand, always increases with the regulatory price and can also increase with competition intensity under similar conditions.

Proposition 2. Consider the markets with online and offline competition. The socially optimal regulatory prices generally increase with the online distaste cost z. The association of this price with respect to transportation

cost t depends on the level of z; it increases when z is small and decreases when z is large. Under the socially regulatory prices, offline quality increases with z, and may decrease with t if z is large. Conversely, online quality decreases with both z and t.

Proposition 1 suggests that in regulated markets with both online and offline competition, the quality offered by offline firms increases with the regulatory price, a trend consistent with markets without online competition. However, how offline quality reacts to increased competition (lower transportation costs) differs from the benchmark case. It may decrease when the distaste for online products is low and regulatory prices are high, or increase in opposite conditions. Online quality, conversely, consistently rises with the regulatory price and may also rise with increased competition under certain conditions. This reflects a nuanced interplay between competition intensity, consumer preferences, and regulatory influences. Under the socially optimal regulatory price, the equilibrium quality levels for offline and online markets can be calculated. They indicate how the equilibrium quality levels in both offline and online markets adjust in response to the optimal regulatory price, considering the distaste for online products and the transportation costs in a regulated market.

Proposition 2 implies that in markets with both online and offline competition, the optimal regulatory price is sensitive to consumer preferences (distaste for online services). This price increases with higher online distaste costs and varies with transportation costs based on the level of online distaste. Moreover, offline quality is positively affected by online distaste, but negatively by higher transportation costs, especially when online distaste is significant. Online quality, in contrast, diminishes with both increasing online distaste and transportation costs, indicating a strategic interplay between these factors in shaping market dynamics.

Our finding can be compared with Brekke et al. (2020) who suggested that the relationship between competition and quality is complex, influenced by various factors. The way competition is measured also affects this relationship. Increased competition indicated by more providers doesn't necessarily lead to better quality, depending on Income effects and risk aversion. This result contrasts with the benchmark case where quality level is independent of competition intensity and achieves the first-best solution. In a scenario with online and offline competition, the first-best solution is unattainable under socially optimal regulatory prices.

Keywords: Regulated markets; regulatory imbalances; spatial oligopoly; quality competition; social welfare; market structure