



## Sequential multi-store location in a duopoly

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### ABSTRACT

This paper focuses on multi-store sequential locations between two firms within a confined geographical area over the short term. Based on the model of Teitz (1968), we incorporate a fixed cost for opening stores, as well as every possible asymmetry regarding an upper limit on the number of store openings. These two factors have an impact on firms' location strategies as constraints, which yield only two opposing types of equilibrium strategies for the leader. One is the segmentation strategy, where the leader monopolizes a market segment by partially deterring the follower's entry. The other is the equidistant location strategy, where stores are opened at equidistant locations throughout the market. Both maximum and minimum differentiation can result in equilibrium at the firm level. This seems to reflect real-world location patterns well, particularly those observed in some retail industries such as cafes and fast fashion retailers. We also obtain welfare implications of multi-store competition by analyzing the case where the social planner can optimize the upper limit on the number of store openings.

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### 1. Introduction

Many modern retailers sell their goods through chain stores, particularly those in retail industries such as cafes, fast fashion retailing, convenience stores, supermarkets, and fast food restaurants. As Janssen et al. (2005) noted, this is because retailers gain considerable benefits from chains, such as increased consumer recognition, increased bargaining power in purchasing, more effective advertisement, and lower distribution costs. Determination of store location in competitive environments is an important consideration for maximizing the benefits of establishing chains.

We note two characteristics of multi-store competition. One is that multi-store firms generally adopt a uniform pricing policy within geographical areas where product pricing is not differentiated between stores. Dobson and Waterson (2005) theoretically explain this observation by showing that uniform prices can relax price competition among stores. On the other hand, in many industries resale price maintenance precludes price competition. The other characteristic is that all chain stores owned by the same firm are generally homogeneous, employing similar designs and product offerings. These characteristics can be observed in the chain stores of major international brands such as Starbucks, McDonald's, and Subway. A theoretical explanation for this phenomenon is examined in Loertscher and Schneider

(2011), where a chain with standardized products and homogeneous stores has superior profitability as consumer mobility increases. We therefore note that short-term strategic focus is on the number of stores to open and where to open them, given current financial constraints.<sup>1</sup>

Observing such real-world examples, focusing in particular on those in geographically confined areas, we can find characteristic patterns in competitive multi-store placement. One frequently observed pattern is concentration of investment efforts in a particular geographical area in the manner of a local monopoly, resulting in market segmentation. Closely examining first-entrant locations indicates that opening many stores too closely results in cannibalization of sales. Fig. 1(a) shows the locations of Starbucks in Chicago and Shinjuku (Tokyo) as an example. As seen in the figure, Starbucks monopolizes the region by opening many stores in a confined area, as compared with its competitors (Caribou Coffee and Tully's Coffee are the strongest Starbucks competitor in these respective areas). As a result, the firms asymmetrically segment the market. Such location patterns, where both firms open fewer stores, are also observed in relatively small cities (Fig. 1(b)). This type of segmentation is also observed for major convenience stores

<sup>1</sup> In fact, multi-store firms face financial constraints that limit the number of store openings, as indicated by Starbucks' announcement pertaining plans for new store openings (see Starbucks' fiscal report at [http://news.starbucks.com/article\\_display.cfm?article\\_id=651](http://news.starbucks.com/article_display.cfm?article_id=651), 26 April 2012). Store openings may also be constrained by other factors, such as limited available real estate. However, some factors may constrain not only the number of stores but also their locations. To maintain consistency with a model having no locational constraints, we assume that the cap on the number of stores is due to financial constraints, and maintain this assumption throughout the paper.

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(a) Locations in Chicago and Shinjuku (Tokyo).



(b) Locations in Shin-Yokohama and Tsukuba.



Fig. 1. Segmentation between Starbucks and competitors.

like Seven-Eleven Japan, as well as for fast-fashion retailers such as H&M, Mango, and Zara.

On the other hand, a different location pattern is seen in other areas. As shown in Fig. 2, both Starbucks and its competitor opened fewer stores, with each store in close proximity to a rival. Similarly, for H&M, Mango, and Zara, in competitive locations such as London's Oxford St. and Regent St., we can also observe a quite different location pattern from segmentation, in which several stores are in close proximity to rivals. These are head-to-head locations, which exhibit a special type of interlacing.

These two location patterns are opposites in terms of differentiation at the chain or firm level. In the former case, the market segmentation is a variant of maximum differentiation, because the chains do not intersect. In contrast, the latter location pattern is clearly a minimum differentiation between chains or firms.<sup>2</sup> Our interest is in how

<sup>2</sup> The areas in Fig. 2 are not necessarily small relative to those in Fig. 1, which would suggest that the location pattern with fewer stores in Fig. 2 is not due to market size. In fact, according to investigations in Japan by the East Japan Railways Company (<http://www.jreast.co.jp/e/index.html>) and the Metropolitan Intercity Railway Company (<http://www.mir.co.jp/en/>), the number of passengers per day using Gotanda station (Fig. 2a) and Higashi-Totsuka station (Fig. 2b) are 127,966 and 57,520, respectively, while those using Shin-Yokohama station and Tsukuba station (Fig. 1b) are 56,666 and 15,638, respectively.

these opposing patterns can both result in equilibrium. In this paper, we attempt to explain these outcomes by analyzing multi-store Stackelberg competition between two firms.

Hotelling (1929) provided a seminal analysis of location competition, formulating a duopoly game on a line segment onto which consumers are uniformly distributed. Teitz (1968) incorporated multiple stores into the Hotelling model. Unlike the original Hotelling model, Teitz (1968) assumes that price competition between firms is not involved, and thus they determine only locations. However, that analysis unfortunately leads to the negative result that no pure-strategy equilibrium exists in the model where firms simultaneously determine the locations of multiple stores. Nevertheless, we should note that Teitz (1968) attempts to solve this problem by introducing the Stackelberg framework and, in fact, finds an equilibrium with a kind of minimum differentiation when the leader firm opens multiple stores at equidistant locations. Indeed, this outcome partially coincides with our results. However, our other location pattern does not appear in Teitz's results, implying that such assumptions are insufficient to explain real-world multi-store locations such as those mentioned above.

In this paper, we incorporate a fixed cost for opening stores into the original framework of Teitz (1968). Specifically, given a fixed opening cost and an upper limit on the number of store openings, two firms determine a number of store openings and store locations

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