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Leveraging location-based services for couponing and infomediation

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ABSTRACT

Following the explosive growth of smartphone and mobile broadband networks, location-based services (LBS) have become an essential component of mobile commerce. LBS applications can assist consumers in acquiring personalized information on the spot, inducing them to make purchase decisions at nearby shops. Motivated by its unique features, we study how LBS, as a couponing channel and an infomediary, may change the way people use information for purchase decision-making. We propose a model that combines price dispersion with horizontal differentiation to investigate the impact of LBS on retail competition. Previous research on the Internet infomediary has shown that the optimal LBS adoption pattern involves one retailer choosing to join the infomediary in equilibrium. However, our results show that the optimal LBS adoption strategy is for neither or both retailers to adopt, depending on the size of the uninformed segments and reach of services. The location identification feature of LBS would allow the retailers to price more aggressively in order to build greater demand at the initial stage; however, this will limit the equilibrium profit level in the subsequent pricing stages. We compare the results for both an Internet infomediary and a LBS infomediary and discuss the implications of our findings for retailers' pricing, promotion and technology adoption strategies for LBS.

1. Introduction

As a result of the explosive growth and penetration of smartphones and tablets in recent years, more and more business activities have shifted from e-commerce on desktop computers to mobile commerce on mobile computing devices. For mobile devices, location-based services (LBS) play a significant role. LBS is broadly defined as *any application, service, or campaign that incorporates the use of the geographic location of the user to deliver a service or a marketing message* [15]. LBS is unique in utilizing the location information of users in real time. Thus, a large number of novel services do not have a counterpart in the traditional e-commerce world. Consumer and advertiser expenditures on LBS are expected to approach US$ 10 billion by 2016 [21]. More and more large retail businesses, such as Starbucks, American Express, and Wal-Mart, have already actively leveraged the features of LBS to drive store traffic, increase brand awareness and interact with consumers.

This study focuses on two key features of LBS: as a new coupon delivery channel, and as a new infomediary for price and product comparison. First, although retailers have been offering paper coupons for many years, mobile platforms provide retailers with new opportunities to offer personalized coupons to potential buyers at significantly lower costs. According to market research, 47% of mobile consumers want retailers to send coupons to their mobile devices when they are in or near a store [13]. The most successful service provider to date is Foursquare, which had more than 40 million users worldwide in 2014. Users of Foursquare can earn badges as well as coupons via check-in when they visit restaurants or local stores a number of times. Following the success of Foursquare, many entertainment and novel coupon apps have emerged. For example, using CheckPoints, shoppers can use their phone's camera to scan the barcodes of certain products at participating retailers to earn prizes without being required to buy anything [24]. CheckPoints' retail partners are banking on the fact that most users will end up buying the product being scanned. Similarly, ShopKick has partnered with Target, Macy's, Simon malls and other leading retailers to provide indoor LBS couponing services. ShopKick has installed sensors in store ceilings to track users' activities in a store. Users can collect points simply by roaming around in the retail stores. As a result, the number of store walk-ins has increased 60%, and customers with ShopKick buy twice as often as non-Shopkick users [22]. According to Nielsen [1], the majority of smartphone (63%) and tablet (53%) owners search and scan to achieve savings in store aisles. These savings continue at the checkout lane, where smartphone shoppers are more likely to use their devices for mobile coupons (34%) and for making payments (23%).

The second feature of LBS is that they act as infomediaries. LBS have changed the way consumers gather price and product information. As nearly 40% of smartphone owners use their phones for in-store price comparisons, making it the top mobile shopping-related activity [14]. During the holiday season in 2011, for example, 19% of US consumers used their phone to compare products or prices in store. This success

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resulted from the fact that app developers brilliantly utilized various features to make search and price comparison easier than their e-commerce counterparts. With a smartphone, users can compare prices using the following input methods: type in a product name; scan a barcode or QR code on a product; speak a product's name into an app; take a picture of a product; or simply point the device's camera at the product, in the case of augmented reality apps that automatically display the product information on-screen in their devices. For example, Amazon's Price Check app provides almost all of these input methods for price comparison; Google's Shopper app can show users all the places an item is available online as well as in nearby physical stores; and Consumer Reports' Mobile Shopper app provides users not only price comparisons but also expert ratings, reviews and buying advice.

These unique features motivated us to study how the adoption of LBS apps may affect retailers' pricing strategies, profitability and market competition. On the one hand, LBS couponing apps may attract more traffic to the retailers' stores. On the other hand, price comparison apps and LBS couponing may lead to price wars among retailers in the same neighborhood, resulting in lower profit margins. It is not self-evident that the increases in sales volume will outweigh the decreases in profit margin. A game-theoretic model can help us to establish the retailers' equilibrium strategies for pricing, LBS adoption, and equilibrium profits.

In this study, we build a model that integrates the two most popular pricing models in the literature: the Hotelling pricing model for the analysis of location differentiation, and the "model of sales" for analyzing couponing strategy. We will model a retail market with two distant shopping malls, each of which has two retailers, at the two ends of a Hotelling line. On the line, there are three groups of consumers distinguished by their information heterogeneity. This assumption is the same as one that is used by Varian [23] in his "Model of Sales". Among the three groups of consumers, two consumer segments are uninformed and only aware of the prices that one store has set. The remaining segment consists of informed, smart shoppers who know the prices of both retailers. We consider a game in which the retailers first decide whether to adopt LBS. LBS allows them to provide discount prices to consumers, and the consumers can use LBS to compare the prices of participating retailers; as a result, LBS in our model plays the role of both a new coupon delivery channel and a price comparison engine. In Stage 2, consumers will decide which mall to visit, based on the retailers' expected prices. Last, once consumers reach the mall, a proportion of them with LBS will receive additional discounted prices from participating retailers. Consumers will make final purchase decisions based on the lowest price offered to them. Our model assumes that consumers make their shopping mall choice and store choices separately, based on several strategic pricing-related variables of the retailers.

We analyze the model by considering three separate cases for the retailers' LBS adoption decisions. In each case, we solve the game by backward induction and derive the equilibrium prices for each retailer. In particular, the third stage of the store pricing game supports results similar to those seen in the existing literature on price dispersion [7,23,16]. We treat LBS as a type of price referral infomediary. In Stage 2, we incorporate the posted prices and distance between two malls into the model to capture the critical feature of LBS, the location. We then derive the optimal LBS adoption strategy based on the retailers' equilibrium profits in each of the three cases. We find that, first, the equilibrium adoption strategy of LBS is that neither retailer joins the LBS or that both retailers join the LBS, depending on the size of uninformed segment of consumers and the reach of LBS. The equilibrium for the Internet infomediary, in contrast, is that only one retailer will choose to adopt the infomediary. Essentially, the location feature of LBS is likely to intensify the price competition because retailers need to price more aggressively to compete for consumers in various segments. This will limit the profit in the subsequent pricing stage. This negative competitive effect overwhelms the positive effect due to price discrimination and the additional demand resulting from adopting LBS.

The rest of the paper is organized as follows. Section 2 reviews the related literature from economics, marketing and information systems. Section 3 introduces the model set-up. Section 4 presents the analysis of the solution and discusses the results. Section 5 concludes the paper.

2. Literature review

Our study is related to three streams of research. First, this study relates to the economics literature on price dispersion [20,23,5]. In these models, only a subset of consumers, called informed consumers or smart shoppers, are assumed to have access to a complete list of product prices and therefore to be able to identify the product with the lowest price. For instance, Varian [23] shows that firms tend to charge either very high prices or randomly offer different levels of discounts in a mixed strategy equilibrium. In this way, price dispersion is a price discrimination device between uninformed and informed consumers in the homogeneous goods market. The heterogeneity between these two types of consumers is also known as "informational differentiation". In other words, firms have the options of serving only uninformed customers at a very high price or serving both informed and uninformed customers at a lower price. The seminal finding is that the equilibrium pricing strategy among competing retailers is a mixed strategy pricing equilibrium in which the retailers may randomly choose discounted prices to compete for the informed customers.

Second, by extending the solution concept of Varian [23], several marketing studies have investigated various marketing issues such as consumer loyalty, sales and promotion strategy [11,16], and referral infomediary [7]. The focal variables in these studies include the size of the loyal consumer segment [11,16], the magnitude of consumer loyalty [11,17], and the depth [18] and frequency of the promotion [18,16]. In contrast to the economic literature, these marketing studies focus more on modeling the demand-side properties as the explanations of price dispersion. Consistent with this stream of literature on price infomediary, our study models promotional price competition using the similar setup, because one role of mobile LBS promotion, similar to that of the Internet infomediary, is essentially a channel to enable consumers to become more informed about the price information from nearby retailers. One difference in our context is that consumers have access to the in-store price since they are physically in the store and, therefore, the mobile channel price must be lower than the in-store price. In contrast, e-commerce retailers can set different prices on different websites, and the customers may not be aware that they are buying at a higher price at a price comparison site. Moreover, unlike most marketing studies, we focus on information differentiation instead of brand differentiation to model the price dispersion under LBS.

Lastly, several related studies in the information systems literature have investigated the impact of the Internet referral infomediary in the context of e-commerce and e-business. For instance, Bakos [3] models the role of buyer search costs and examines the impact of electronic marketplaces on consumers' price discovery behavior. In the supply-chain setting, a study by Ghose et al. [8] finds that referral services play a critical role in enabling retailers to discriminate across consumers with different valuations. Moreover, Weber and Zheng [25] analyze the firms' bidding strategies in an intermediated search market, given consumers' equilibrium search behavior. Xu et al. [26] study online search strategy and equilibrium oligopolistic pricing. Bandyopadhyay et al. [4] have derived the mix-strategy pricing equilibrium for sellers in the context of online exchanges. Finally, Iyer and Pazgal [10] have examined the impact of Internet shopping agent on market competition and pricing. Our model is in line with these studies. To the best of our knowledge, none of the existing studies have adopted a similar type of model to investigate the impacts of LBS price promotion.

Our study can be considered as an extension of Chen et al. [7], who analyze the effect of the Internet referral infomediary on retail markets. Specifically, we extend Chen et al. [7] to model the mobile infomediary