COMPETING ADVERTISING AND PRICING STRATEGIES FOR LOCATION-BASED COMMERCE

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Abstract
Owing to the fast growth in smart phones and tablets as well as increasing number of downloading apps, it makes commercial sense to use the smart phones as another platform for advertising. While many advanced location-based service (LBS) apps have been proposed, the study of analysing their impacts on the marketing strategies is still little. In this paper, we study the issues of the promotion pricing scheme and mobile LBS advertising level of the stores. We will also investigate the impact of LBS on the store’s pricing strategy and corresponding profit when having an opportunity of being a first mover or facing the pressure of being a second mover to adopt mobile LBS advertising. Our results show that the stores will advertise more and give higher discounts to their customers when the proportion of consumers with a mobile device is increasing. The price and LBS advertising cost will affect the stores’ profits. We find that the economic intention to adopt LBS advertising is higher for a first mover than a second mover.

Keywords: Location-Based Service, Mobile Advertising, Game Theory, Pricing Scheme, Context-Awareness.

1 INTRODUCTION

Location-based services (LBS) have appealed huge attention due to their potential to transform mobile communications and the possibility for a variety of highly personalized and context-aware services (Dhar & Varshney, 2011). It makes commercial sense to use the smart phones as another platform for advertising. Many surveys predict billions of dollars in revenues for mobile advertising. One of the key benefits of mobile advertising is the ability to be in the moment and to connect with consumers wherever they are located. Imagine that you not only have the ability to reach consumers wherever they are, but now you can also understand their surroundings. Context awareness technology, based on the clues from a consumer's surroundings, can help you deliver your message to your target customers in a much more personalized and valuable way. Mobility and LBS combined with context aware advertising creates opportunities for targeted marketing and revenue generation.

LBS are a class of computer program services, including the specific location and time data as control features in computer programs, which is accessible with mobile devices and which uses information on the geographical position of the mobile device. This service has become more and more important as the growth of the market of smart phones and tablets. LBS are used in a variety of situations, such as advertising, entertainment, health, indoor object search, etc.
There are many mobile advertising platforms in the market, such as AdMob, iAD, InMobi, Facebook, and Vpon etc. Through these platforms, the application developers can easily add advertising elements into apps and share advertising revenue. The advertisers can advertise in-app ads within the applications. Compared with traditional display ads, this form of advertising more emphasize on audio, video, and is designed according to the characteristics of mobile devices. The user can enjoy the interactive advertising journey. With LBS, these platforms can provide mobile ads which are highly relevant to the user’s location. The advertisers can provide the store’s information, advertise in the assigned locations and realize online to offline. For example, Audi use InMobi’s location-enabled ads in Japan to attract consumers to local car dealers that deliver personalized ads to mobile consumers with GPS locating capabilities. The GPS locator map shows the nearest store to potential consumers and displays the information and phone number of the store. Another case is T.G.I. Friday’s restaurant, through LBS positioning advertising mechanism of Vpon, consumers can enjoy joyful advertising videos, which can immediately display the nearest store and allow consumers to share information to social websites. Consumers can go to the nearest restaurant via mobile map navigation or use the call function to call the restaurant. The combination of mobile advertising, brand, and the product attracts consumers into the practical stream of location based commerce.

Some apps features, such as LBS advertising, impact the competition strategies of the physical stores. In this paper, we develop a model of two geographically differentiated stores which sell homogeneous products. In additional to the original way of informing customers, the stores can use LBS advertising to attract more consumers. To induce more visits of customers, the store has to some exert advertising effort. From the view of the customers, the benefits of the mobile apps include both search value creation (such as value-added information and service, discount, entertainment) and search cost reduction (e.g. the support of GPS and LBS). Nevertheless, even though the popularity of mobile devices is continuously increasing, some proportion of the people still have not own one yet. In this paper, we consider two types of consumers: users with a mobile device and users without a mobile device. Each consumer is located at a different geographic position. For those customers without a mobile device, they don’t know exactly their geographic location and the distance to the stores. For those customers with a mobile device, they have a chance to be informed by a store’s LBS advertising and know their current location. With the availability of LBS apps, how to develop the appropriate LBS advertising level and product promotion discount rate to entice more customers and generate higher profit becomes a new challenge. Most of the existing LBS studies are conducted from the technical and system design perspective, the works on the economic analysis and competition strategy of LBS are still little. In this paper, we will also investigate the impact of mobile technology on the competing advertising and pricing strategies of physical stores, and analyse the impact of market structure (the first mover – invasive entry and the second mover – defensive entry) on the mobile LBS advertising adoption.

The remainder of the paper is organized as follows. In section 2, we review the related literatures. Section 3 we describe the model of this paper. In section 4, we discuss the implications of our analytical results. Finally, section 5 provides concluding remarks and offers future research directions.

2 LITERATURE REVIEW

Advertising is an important way for stores to inform customers the products. Stores can use informative advertising to let customers to know the products and so that customers can choose the best to meet they need (Soberman, 2004). Tirole (1988) distinguish two views on advertising. One is the partial view, that advertising is providing product information to the consumers and increasing competition. The other is the adverse view; advertising is persuading the consumers
and increasing barriers to entry. In the situation of not well differentiated products, the previous literatures on informative advertising show that the effect of advertising in increasing price competition is dominated the effect of decreasing competition. Ghosh and Stock (2010) show that enhance advertising level may be associated with higher profits and higher prices for competing stores.

With the increasing growth of smart phones and tablets, location-based service becomes very popular. Many surveys forecast that mobile advertising revenue will grow very quickly. For example, Gartner says that global mobile advertising revenue is expected to reach $11.4 billion in 2013 (Gartner, 2013). According to IAB (Interactive Advertising Bureau) and tech researcher Ovum, in the next two years, 19% of US mobile marketers will increase mobile advertising spending and plan to up their mobile advertising budgets by 50% or more (eMarketer, 2013). So that mobile advertising is an important issue for emerging mobile commerce. The feature of ubiquity of mobile device raises the roles of location, time, and personalization to become more important. It makes stores to provide more suitable advertisements to customers (Shoaibi & Rassan, 2012). In this study, we will consider the stores offer LBS advertising to increase their revenue in the proposed model.

Context can be any information that can be used to describe the situation of any entity. Dey (2001) proposed three kinds of features for context-aware applications are presentation, execution and tagging. Contextual advertising is the targeted delivery of advertisements; it appears on many media, such as websites, mobile browsers, and mobile apps. Many websites have offered contextual targeting as their main proposition (Zhang & Katona, 2012). With targeted advertising, the consumers who have a strong preference to the firm’s product are the targeted consumers, and firms have advertising more to this segment of consumers (Iyer, Soberman, & Villas-Boas, 2005).

The mobile devices can receive real-time information and many applications are context-aware, the ads can displayed based on consumer’s profiles and preferences. The physical stores can present the information and services to customers. However, as consumers have different preferences for products, the firms don’t have ability to advertise and sell their products to all kinds of consumers. So that the firms must limit their range of advertising to the target group of consumers (Shy, 1996). Additionally, the consumer can choose the kinds of ads that he or she want to receive on the mobile devices (Dhar & Varshney, 2011). Through the mobile device with GPS, the physical stores can push the discount information to nearby customers and attract them to visit the stores. Later we will develop the optimal discount pricing strategy and app advertising level for the competing stores.

3 THE MODEL

With the growth of smart phones, there is a new form of advertising that integrates mobile advertising with LBS. The LBS technology is used to pinpoint consumer location and provide location-specific advertisements or information on their mobile devices. This form of mobile advertising is highly targeted and personalized. Not only does it serve customers well, it is also good for the physical stores. LBS include services to identify a location of a person, such as discovering the nearest restaurant or a friend. This kind of services can reduce the searching cost and transaction cost. LBS can expedite mobile commerce through taking the form of coupons or advertising directed at customers based on their current location. Nowadays, brick and mortar business owners have made an effort to take advantage of mobile commerce by utilizing mobile capabilities, such as location based services, and barcode scanning to improve the customer experience of shopping in physical stores. Mobile-commerce can transform business processes in terms of efficiency and service quality as well as create new consumer markets that involve highly targeted services because of its unique characteristics, such as location and context
awareness, personalization, and transaction orientation (Varshney, 2008). Advertising is gradually becoming a part of the modern people's daily life. Besides traditional advertising, physical stores can choose LBS advertising to attract customers. We want to know under what kind of conditions a physical store gets more profit. What is the optimal advertising and promotion discount pricing strategy of the physical stores when a LBS advertising app is implemented? How does the variations in profits for the physical stores, and how to choose the LBS advertising strategy under competition?

Suppose that there are two geographically differentiated stores \( S_i, i \in \{A,B\} \), selling homogeneous products with price \( p_i \), the unit cost of production is \( c \). Assume the size of the potential market is normalized to 1; the customers are continuously located at a line and indexed with \( x \in [0,1] \) and \( \phi (0 < \phi < 1) \) proportion of the consumers who have a mobile device (such as smartphone GPS). The two physical stores are located at two end points of the line. If a customer doesn’t own a mobile device or are not aware of any LBS app advertisement, the probability that he/she will visit store \( S_i \) is \( \alpha_i (\alpha_A + \alpha_B < 1) \). This kind of customers does not know precisely the stores’ locations. They visit one of the two stores arbitrarily, or don’t visit any one of the stores. The customers visit a store if they received traditional advertising or worth-of-mouth information. The utility function of the consumer who is not aware of the LBS advertising is defined as \( U^n_x = v - \delta_x - p_i \), where \( v \) is value of the product and \( \delta_x \) is the cost for user \( i \) to search and travel from his/her location to store \( S_i \). We assume the cost \( \delta_x \) is a random variable with a value drawn from the interval \([0,\delta]\), without any LBS (map) support. For those customers with a mobile device, the benefit gained from the mobile advertisement includes two parts: discount coupon and LBS support. Denote \( r_A \) and \( r_B \) (\( 0 < r_i < 1 \)) as the price discount of the app coupon offered by store \( A \) and \( B \), respectively. \( t \) is the unit of traveling cost with the support of LBS, where \( t < \delta \). The utility function of a consumer \( x \), who is aware of app advertising via a mobile device is defined as:

\[
U^m_x = \begin{cases} 
U^m_A(x) = v - tx - r_A p_A, & \text{be aware of LBS advertising and purchases at store } A \\
U^m_B(x) = v - t(1-x) - r_B p_B, & \text{be aware of LBS advertising and purchases at store } B
\end{cases}
\]

To inform and attract the visit of customer, the stores have to some exert effort in implementing LBS advertising. \( \beta_i (0 < \beta_i \leq 1) \) is the LBS advertising level of store \( S_i \), which stands for the market coverage rate. In practice, the stores advertise in the assigned locations by the mobile advertising platforms, and could change the LBS advertisement range contingent on their own competition strategy. LBS advertisement provides the store information, free coupon in exchange for a small gift, the function to share benefit or event to friends, to entice the consumers to visit. It can be interpreted as \( \beta_i \) of the consumers with a mobile device will be aware of \( S_i \)'s LBS advertisement (install app and receive a promotion message) and visit the store. Figure 1 illustrates the LBS advertising context. Following the setting of the advertising effectiveness expressed in the previous literature (Soberman 2004, Ghosh & Stock, 2010 ), the cost for LBS advertising is convex which implies that the store is increasingly difficult to reach some target consumers. Specifically, we assume that store \( i \) has a cost of \( \theta \beta_i^2 \) (\( \theta > 0 \)) if it decided to reach \( \beta_i \) of the mobile market. The notations used in the model are summarized in Table 1.
Figure 1. LBS advertising context of competing physical stores.

<table>
<thead>
<tr>
<th>Notation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_i$</td>
<td>$i \in {A, B}$, two physical stores $S_A, S_B$</td>
</tr>
<tr>
<td>$p_i$</td>
<td>Product price</td>
</tr>
<tr>
<td>$c$</td>
<td>The unit cost of production</td>
</tr>
<tr>
<td>$\beta_i$</td>
<td>LBS advertising level of store $i$, the consumers will be aware that offer of store $i$</td>
</tr>
<tr>
<td>$\phi$</td>
<td>The proportion of the consumers has mobile device</td>
</tr>
<tr>
<td>$U^n_i$</td>
<td>The utility function of consumer not be aware of LBS advertising and purchase at store $i$</td>
</tr>
<tr>
<td>$U^m_i$</td>
<td>The utility function of consumer be aware of LBS advertising and purchase at store $i$</td>
</tr>
<tr>
<td>$\delta_x$</td>
<td>The total search cost without location (map) based support</td>
</tr>
<tr>
<td>$t$</td>
<td>The unit transaction cost with location (map) based support</td>
</tr>
<tr>
<td>$v$</td>
<td>Consumer reservation value</td>
</tr>
<tr>
<td>$\alpha_i$</td>
<td>The proportion of the consumers not be aware of LBS advertising buy the product of store $i$</td>
</tr>
<tr>
<td>$r_i$</td>
<td>The discount proving by store $i$</td>
</tr>
<tr>
<td>$\theta$</td>
<td>An LBS advertising cost parameter</td>
</tr>
<tr>
<td>$z_i$</td>
<td>The demand of store $i$ that consumers not be aware of LBS advertising</td>
</tr>
<tr>
<td>$x_i$</td>
<td>The demand of store $i$ that consumers be aware of LBS advertising (two stores without competition)</td>
</tr>
<tr>
<td>$y_i$</td>
<td>The demand of store $i$ that consumers be aware of LBS advertising (two stores with competition)</td>
</tr>
<tr>
<td>$\pi_i$</td>
<td>The profit of store $i$</td>
</tr>
</tbody>
</table>
3.1 Status scenario 1: None of the two physical stores implements LBS advertising

If both of the two physical stores don’t implement LBS advertising (provide app ads), the customers will visit store $S_i$ with probability of $\alpha_i$. Specifically, the customers arbitrarily choose a direction to go as they have no location information of them and the two physical stores. Among these customers who visited store $S_i$, $z_i = (v - p_i)/\delta$ proportion of them will purchase the products of $S_i$. We can represent the profit functions of the store $S_i$ as:

$$\pi_{i, NE} = \alpha_i z_i (p_i - c) .$$

(1)

Note that $z_i$ is derived from the rationality constraint of the customers, which should satisfy $U^n_x \geq 0$. In his research, we assume the product price has been pre-determined by the upstream firms, such as franchisers, or determined the store based on the cost structure and competition environment the previous market. Here, instead of changing price, we assume the physical stores provide promotion discount to the consumers in advertising activities.

3.2 Status scenario 2: One of the two physical stores implements LBS advertising

Assume store $S_i$ deploys LBS advertising, while store $S_j$ dose not. The total population of customers who are not aware of LBS ads but visits store $S_i$ is $((1-\phi) + \phi(1-\beta_j))\alpha_i$. The population of customers who are aware of LBS ads and visit store $S_i$ will be $\phi\beta_i$. As the consumers aware will buy a product from store $S_i$ as long as $U^m_x \geq 0$, the total demand from the customers aware of $S_i$ ’s LBS advertisement is $x_i = (v-r_1p_i)/t$. The population of customers who visit store $S_j$ is $((1-\phi) + \phi(1-\beta_j))\alpha_j$. The profit function of the two physical stores can be respectively formulated as:

$$\pi_i^E = ((1-\phi) + \phi(1-\beta_j))\alpha_i z_i (p_i - c) + \phi\beta_i x_i (r_1p_i - c) - \theta(\beta_j)^2 ,$$

$$\pi_j^E = ((1-\phi) + \phi(1-\beta_j))\alpha_j z_j (p_j - c) .$$

(2)  (3)

The store $S_i$ which provides LBS ads has profit $\pi_i^E$, which contains two parts of revenue. One part is the revenue from the customers who are not aware of LBS ads and without any promotion discount; the other part is the revenue from the revenue of the customers who are aware of LBS advertisement and purchase with a promotion discount. However, the store $S_i$ has the additional cost in implementing LBS advertising, and price discount to induce consumers. The store $S_j$ which does not adopt LBS advertising has profit $\pi_j^E$. Obviously, when the population of consumers who are aware of LBS advertising from store $S_i$ increases, the store $S_j$’s profit will decrease. For analytical convenience, we consider the two stores have symmetric characteristics and assume $z_i = (v - p_i)/\delta = z_j = \alpha = \alpha_j = \alpha$, and $p_i = p_j = p$. The store $S_i$ decides the
discount rate and LBS advertising level simultaneously to achieve the objective of profit-maximization. We can solve and obtain

\begin{align}
    r_i &= \frac{v+c}{2p}, \\
    \beta_i &= \frac{\phi(v-c)^2 - 4\phi \alpha z (p-c)}{8\theta t}.
\end{align}

**3.3 Status scenario 3: Both of the two physical stores implements LBS advertising**

The consumers who are aware of store $S_i$’s LBS ads but not aware of $S_j$’s LBS ads will visit store $S_i$. The total population of them is $\phi \beta_i (1 - \beta_j)$. In total, $\phi \beta_i \beta_j$ consumers are aware of the LBS ads from both stores. These consumers compare the net value of $U^m_i$ and $U^m_j$, and visit the store which can make them a higher utility. In this competition situation, the demand of store $S_i$ is $y_i = \left( r_i, p_j - r_i, p_i + t \right) / 2t$. The total population of customers who have a mobile device but are not aware of any LBS ads is $\phi (1 - \beta_i) (1 - \beta_j)$. According to the aforementioned information, if both of the physical stores provide LBS ads, we can represent the profit function of the stores respectively as

\begin{align}
    \pi_i &= \left( (1 - \phi) + \phi (1 - \beta_i) (1 - \beta_j) \right) \alpha_z (p_i - c) + \left[ \phi \beta_i (1 - \beta_j) x_i + \phi (\beta_i \beta_j) y_i \right] (r_i, p_i - c) - \theta (\beta_i)^2, \\
    \pi_j &= \left( (1 - \phi) + \phi (1 - \beta_j) (1 - \beta_i) \right) \alpha_z (p_j - c) + \left[ \phi \beta_j (1 - \beta_i) x_j + \phi (\beta_i \beta_j) y_j \right] (r_j, p_j - c) - \theta (\beta_j)^2.
\end{align}

We analyze a sequential marketing game in which both competing stores decide their discount rate and LBS advertising level simultaneously. Afterwards, consumers make a decision to visit and purchase at a store. Since both stores will choose the best response discount rate and LBS advertising level to maximize their profits. Similarly, under the symmetric store setting, by solving \( \frac{\partial \pi_i}{\partial r_i} = 0 \) and \( \frac{\partial \pi_i}{\partial r_j} = 0 \), we have

\begin{align}
    r_i &= \frac{3c \beta_i \beta_j + 4t \beta_j - 3t \beta_i \beta_j + 2t \beta_j}{3 \beta_i \beta_j p}, \\
    r_j &= \frac{3c \beta_i \beta_j + 4t \beta_j - 3t \beta_i \beta_j + 2t \beta_i}{3 \beta_i \beta_j p}.
\end{align}

By solving \( \frac{\partial \pi_i}{\partial \beta_i} = 0 \) and \( \frac{\partial \pi_j}{\partial \beta_j} = 0 \), we have

\begin{align}
    \beta_i &= \left( 2t \phi (1 - \beta_j) + \phi \beta_j (r_i, p - r_i, p + t) \right) (r_i, p - c) - 2t \phi (1 - \beta_j) \alpha z (p - c) \\
    \beta_j &= \frac{2t \phi (1 - \beta_j) + \phi \beta_j (r_j, p - r_j, p + t) \right) (r_j, p - c) - 2t \phi (1 - \beta_j) \alpha z (p - c)}{4 \theta t}.
\end{align}
\[
\beta_j = \frac{2t\phi(1-\beta_t) + \phi\beta_t(r, p - r, p + r)}{4\theta t} \left( r, p - c \right) - 2t\phi(1-\beta_t)z(p - c). \tag{11}
\]

Solving the equations (8), (9), (10), (11) simultaneously, we have the equilibrium results:

\[
r_i = r_j = r^* = \frac{c - t}{p} + \frac{8\theta t - 4t\phi\alpha z(p - c) - 2\phi t^2}{p - 2t\phi - \phi\alpha z(p - c) + \sqrt{\left(\phi\alpha\mu\right)^2 (p - c)^2 - 4\phi^2 t\alpha z(p - c) + 16\theta t\phi}} . \tag{12}
\]

\[
\beta_i = \beta_j = \beta^* = \frac{-2t\phi - \phi\alpha z(p - c) + \sqrt{\left(\phi\alpha\mu\right)^2 (p - c)^2 - 4\phi^2 t\alpha z(p - c) + 16\theta t\phi}}{4\theta - t\phi - 2\phi\alpha z(p - c)} . \tag{13}
\]

We first examine the impact of the proportion of the mobile consumers on the LBS advertising level. By deducing \( \frac{\partial \hat{\beta}}{\partial \phi} \), we obtain that \( \frac{\partial \hat{\beta}}{\partial \phi} > 0 \).

**PROPOSITION 1.** When the proportion of the consumers having a mobile device increases, the physical stores will enhance their LBS advertising level.

Proposition 1 suggests that with the market growth of smart phones, the competing physical stores will exert more effort and invest more resource in implementing LBS advertising to attract consumers to visit their stores. In addition to expanding the location range of LBS advertising, through providing the benefits to consumers, such as value-added information and entertainment, joyful store description videos, free coupon in exchange for a small gift, the function to share benefit or event to friends, the consumers have higher incentive to visit the store.

With the increasing growth of smart phones and mobile Internet connection, mobile advertising is increasing gradually. For example, Facebook’s mobile advertising revenue has reached 30% of total advertising revenue in 2013 in the first quarter, with a growth rate of 7% from the previous quarter. As LBS ads are delivered to consumers when they are close to the location of the stores, the mobile advertising CTR (click through rates) will increase significantly. Therefore, LBS advertising are growing rapidly in many mobile advertising platforms. For example, the CTR of McDonald’s LBS ads, combined store navigation, reaches at 6.4%. The cosmetics company CLINIQUE, combining the nearest store information and share activities on Facebook into LBS advertising, has a CTR of 2%.

Then, we examine the impact of the proportion of the mobile consumers on the promotion discount. By deducing \( \frac{\partial r}{\partial \phi} \), we obtain that \( \frac{\partial r}{\partial \phi} < 0 \).

**PROPOSITION 2.** When the proportion of the consumers having a mobile device increases, the physical stores will give more discounts to their customers aware of LBS advertisement.

Product price discount is a benefit to consumers that are aware of LBS advertising. The physical stores deliver the discount information or coupon to will entice the consumers to visit their store. With the increasing proportion of consumers has mobile device, the stores will give consumers higher benefits as the increasing number of purchases will sufficiently make up the loss from discount.
4 RESULTS AND IMPLICATIONS

As aforementioned, the two physical stores can choose whether to implement LBS advertising to enhance the market coverage or make no change (remain state quo). We next analyze the two scenarios: (1) The state quo is both physical stores have not adopted LBS advertising. Whether one of them will choose to be the first mover to adopt LBS advertising can be examined by comparing the store’s profit $\pi_i^{NE}$ (both stores don’t adopt LBS advertising) and $\pi_i^{E}$ (only store $S_i$ adopts LBS advertising). (2) The state quo is one store has already implemented LBS advertising. Whether the other one will become the second mover to adopt LBS advertising can be examined by comparing the store’s profit $\pi_j^{E}$ (store $S_j$ has not adopted LBS advertising but store $S_j$ has not) and $\pi_i$ (both stores have adopted LBS advertising). We use numerical analysis to get a better understanding of the economic insights. Figure 2 shows the entry strategy for the physical store to make a decision on LBS advertising adoption.

Figure 2. The entry strategy of the physical stores.

Figure 2 shows the strategy map on the physical store’s decision on the first mover (light plus dark grey areas) and the entry strategy of the second mover (dark grey area) in adopting LBS advertising. As we can observe when price is high and LBS advertising cost is low, the stores have higher intention to adopt LBS advertising. In the gray region, the store will adopt LBS advertising and gain more profits.

In Figure 2, the light gray region (one entered) shows the situation of only one store implements the LBS advertising, in which its promotion discount rate of the entrant is $r_i = (c + v) / 2p$. We can find that the higher the price, the lower promotion discount rate. Therefore, when the price is high, the store gives more benefits to the consumers, which diminishes the profit generated from the LBS advertising market. The profit of the store which adopt the LBS advertising is $\pi_i^{E}$, that contains the original customers who buy a product without
a promotion discount and the consumers with promotion discount. When the LBS advertising cost is low, the store will exert a higher advertising level to enlarge the demand of customers with a mobile device. In Figure 2, the dark gray region (two entered) shows the entry strategy of the two physical stores in adopting LBS advertising. Comparing the gray blocks of Figure 2, at the same price level, the LBS advertising cost in the dark gray region is lower than that in the light gray region. When there are two stores implementing LBS advertising in the market, the competition becomes more intense, it is harder for physical stores to make more profit from the LBS customers.

![Figure 3](image_url)

(a) The impact of $p$ on promotion discount  
(b) The impact of $p$ on advertising level $\beta$

*Figure 3. The impact of price on discount and LBS advertising level.*

We analyze and compare the advertising levels and promotion discounts of LBS advertising strategies under different market statuses. Figure 3(a) shows the impact of price on promotion discount under the status scenarios in which only one store implements and both two stores implement LBS advertising. In the same price level, the promotion discount rate when only one store implements LBS advertising is higher than the promotion discount rate when two stores implement LBS advertising. The first mover does not face competition in implementing the LBS advertising strategy. Therefore, less promotion discount is provided. However, when there are two stores implementing LBS advertising, the market becomes more competitive, which forces the stores to give more promotion to attract consumers. Comparing the two lines of Figure 3(b), the LBS advertising level in the market status in which only one store implementing LBS ads is higher than the advertising level in the market status in which both two stores implement LBS ads. The result reveals that when a store faces less competition, the store will exert more effort in increasing the LBS advertising level to attract consumers to visit, instead of providing more promotion discount to consumers.

## 5 CONCLUSION

LBS advertising brings the benefit of information awareness, promotion discount, search and travel support for the customers and new market opportunity for the physical stores. In this paper, utilizing the methodology of game theoretic and economic modelling, we analyze the promotion discount strategy and LBS advertising level for competing two physical stores. The impact of
LBS on the physical stores is examined in various types of competitive environments. We analyze entry strategy of a physical store in implementing LBS advertising when the firm has the opportunity to be the first mover or have to face the challenge to be the second mover. We find that the physical stores will advertise more but give higher discounts to their customers when the proportion of consumers with a mobile device is increasing. The price and LBS advertising cost will affect the stores’ decision on the adoption of LBS advertising. We find that the economic intention to adopt LBS advertising is higher for a first mover than a second mover.

There are several issues which can be further studied. First, we assume that the probability of a customer aware of a store’s LBS add is the same. It would be interesting to develop a model that the customers have different probability of being aware. Second, the product price is pre-determined in our model. The decision of product price can be further analyzed by considering different supply chain scenarios. Third, the role of traditional advertising can be incorporated into the model. It would be interesting to design the mixing strategy of traditional and LBS advertising. Fourth, with the support of GPS and LBS, the transaction cost is reduced; we can investigate the influence of reduced transaction cost on store’s LBS advertising level and profits.

References