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Determinants of online sellers' advertising:

An empirical study on Chinese C2C market

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Abstract: This paper studies the determinants of sellers' paid search advertising adoption and their spending on the advertisement. Based on the theory of advertising, we proposed the hypotheses. By an empirical study on a unique dataset of the largest e-commerce platform in China, we find the U shape of the relationship between sellers' reputation and their decision on advertising. Compared to the sellers with medium reputation, the sellers with low and high reputation are more likely to use paid search advertising. And the more loyal customers a seller has, the less chance he adopts paid search advertising. Meanwhile, for those sellers that decide to use paid search advertising, the increased page views with spending on advertisement during last period makes the seller spend more in this period. This study contributes to the advertising literature by providing empirical evidence how sellers make decision on using paid search advertising. And it also provides some managerial implications to the e-commerce platform.

Keywords: Advertisement, Online Market, Heckman Selection Model

1. INTRODUCTION

Different from eBay, which charges both listing fees and sales commission from sellers, the largest e-commerce platform in China, Taobao, doesn't charge anything for listing products on the platform. The "free" policy helps Taobao beat eBay China, and millions of the sellers and buyers are active on this platform. Later on Taobao started monetizing the large traffic through paid search advertising.^[1]

Similar to Google search result, paid search advertisements are displayed alongside the organic search results based on buyers' search queries. Taobao adopted CPS (cost per click-through), which means that sellers only get charged for advertisement that are clicked on. There are conflicting results from different researches on whether advertisement helps the performance. Some studies found that on an average the performance of paid search advertisement (i.e., conversion rates and order values) are better than those from natural search^[2], while some studies found that the average returns on the advertising expenses might be negative^[3]. Although the profitability of paid search advertisement is questionable, we still observe that a lot of sellers compete for paid search advertisement on Taobao and spend significant amount of money month after month. Therefore we raise the research questions: What are the determinants of sellers' decision on advertisement? What influence the sellers, if they choose to advertise, in deciding their advertisement spending?

We collect monthly data of sellers from Taobao, the largest e-commerce platform in China. By observing whether or not the sellers opt in the paid search advertisement, and how much they spent each month, we model sellers' decision-making on advertising in two steps. First, whether to adopt advertisement is modeled as a result of its perception of its competitiveness. And then the decision on advertising spending is modeled as a result of its visitors in the last period. We found that advertising is an option for expanding the number of loyal customers because the more loyal customers a seller has, the less he tends to advertise. We also found that the sellers with low and high reputation are more likely to adopt advertising than those sellers with medium reputation. It implies the different roles advertisement play in the development of the sellers. Meanwhile, as to how much they would spend on advertising, we found that the more positive feedback from the investment during last period, the more they tend to spend on paid search advertisement in current period.

This study contributes to the literature of advertising and sellers' behavior. First, our study extends the advertising literature by empirically examining the characteristics of sellers who adopt paid search advertising. We found that, compared to the sellers with medium reputations, sellers with low and high reputation are more likely to adopt paid search advertisement. As there's evidence that paid search advertising is not profitable on average, this result provides indirect evidence that advertisement are playing different roles in different stage of sellers' development. Also we found that for those sellers that decide to use paid search advertising, positive feedback from the investment on advertisement motivate them to spend more. It reveals how sellers make decisions on the amount to spend on advertising.

2. THEORY AND HYPOTHESES

There have been some empirical studies on the effectiveness of paid search advertisement for individual online retailers on click through rates^[4], conversion performance^[5], and future visits^[6]. Also there're a bunch of studies modeling how sellers bid for the key words^[7] and how buyers interact with keyword advertising campaigns on the buying funnel^[8]. And there have been a lot of discussions on the reasons why advertisements influence consumers' behavior, among which the persuasive view^[9], the informative view^{[10][11]} and the complimentary view^{[12] [13]} are the most widely accepted points. From the persuasive view, entry deterrence happens because it changes customers' utility function by making advertisers' products first choice. Later on, the relationship between advertisement and entry invites a number of analytical studies. According to Needham^[14] and Cubbin^[15], if advertisement does connect to entry deterrence, it only happens when there is a link between pre-entry advertising and the entrant's post-entry expected profit. As advertisements create "noise" in the market and new entrants have to "shout" louder to be heard, we proposes the following hypothesis:

H1: The tendency to advertise decrease first and increase later on as reputation rise.

H2: Seller with more bookmarks will have low intention on using paid search advertisement.

As to how much sellers would spend on the advertisement, Schmalensee^[16] suggested that advertising is a durable investment and it requires a forward-looking seller with a long-term business plan and continuous profit. Therefore, when the sellers make their decision on how much they should spend on the advertisement, the new sellers, who are facing much uncertainties, tend to spend less. While the sellers with high reputation, which are established in the market, tend to spend less compared to sellers with medium reputation. Meanwhile, the increased page views resulted from spending on advertisement in last period increase the capability and intention of the sellers to spend more in this period. Hence we propose the hypothesis H3 and H4:

H3: reputation is related to the sellers' decision on advertising spending.

H4: Seller with more page views resulted from spending on advertisement in last period will spend more on advertisement in this period.

3. DATA AND MODEL

A panel dataset of 1,162 Taobao sellers of baby diapers, with monthly observations from August, 2009 to April, 2010, are used in this study. Of all the sellers, 257 of them have used advertisement at least once (22.1 %). The summary statistics of the main variables are presented in Table 1.

Advertisement (Ads) is a dummy variable showing whether a seller used paid search advertisement in a month. *Ads_Spending* is the total amount of money a seller spends on paid search ads in a month. *Tenure* is the number of months a seller had joined the platform in this month. *Page_view* is the number of the visits to the pages of the products a seller have. *Purchase* is the number of the orders a sellers have during the month. *Bookmark* is the number of times that customers clicked the button of "bookmark". *Reputation* is the cumulative reputation score a seller has. *Sales* is the number of products a seller sold during the month. *Revenue* is the amount of money a seller gain during the month. The correlations between these variables are presented in Table 2.

Table 1: Summary Statistics

Variable	Mean	Std.Dev.	Min	Max
Advertisement	0.151	0.358	0	1
Ads_spending	11235	70420	0	2.204e+06
Tenure	16.28	7.773	4	39
Page_view	6696	23667	0	853820
Purchase	145.0	422.4	0	11299
Bookmark	8.458	14.43	0	227
Reputation	3525	11676	14	322197
Sales	1890	14252	0	746606
Revenue	39603	112324	0	2.558e+06

Table 2 Correlation matrix of major variables

	Tenure	Page_view	Purchase	Bookmark	Ads_spending	Reputation	Sales	Revenue
Tenure	1							
Page_view	0.168	1						
Purchase	0.165	0.891	1					
Bookmark	0.146	0.477	0.487	1				
Ads_spending	0.0917	0.525	0.462	0.134	1			
Reputation	0.275	0.921	0.901	0.467	0.426	1		
Sales	0.0248	0.172	0.200	0.0878	0.0776	0.175	1	
Revenue	0.161	0.737	0.853	0.406	0.306	0.748	0.296	1

In this study, we apply the Heckman Selection Model to sellers' decision-making. First, we model sellers' decision on whether to adopt advertisement or not. Then, we model their decisions on spending. We assume that sellers make their first decision based on their perception of their status as follows:

$$\begin{aligned}
 Ads_{it}^* &= \omega_0 + \omega_1 Reputation_{i,t-1} + \omega_2 Reputation_{i-1}^2 + \omega_3 Purchase_{i,t-1} + \omega_4 Bookmark_{i,t-1} + u_{it} \\
 Ads_{it} &= 1 \text{ if } Ads_{it}^* > 0, \text{ and } Ads_{it} = 0 \text{ otherwise}; u_{it} \sim N[0,1]
 \end{aligned}
 \tag{1}$$

We assume that a seller's decision on whether to use paid search advertisement, Ads_{it} , to be related to their reputation, number of orders during the last month, bookmark, which shows the number of the loyal customers. To be more specific, based on the interviews to the sellers, we found that there is nonlinear relationship between reputation and their decision on advertisement. For the new sellers with little reputation, they need advertisement to gain initial customers urgently. Later on, after they have some loyal customers, the desire to use advertisement to get new customers is not as high as it was. Then when they want to expand the business, advertisement becomes an important option for them again, so we observe the tendency rise with the reputation after a threshold.

In the second stage, we focus on the sellers who have decided to use paid search advertisement. We try to model the sellers' decision on how much they would spend on advertising during the month. In this stage, the dependent variable is seller i 's total spending on advertising in period t ($Ads_Spending_{it}$). Similar to the decision in stage 1, we model the U shape of the relationship between ads spending and reputation, i.e. both reputation and reputation square are included in the model. Besides that, we also take the interaction term of number of visitors during last period and ads spending of last period into account. We expect that the increased page views resulted from spending on advertisement during last period will encourage the sellers to spend more in this period. Therefore, we estimate the model as follows:

$$\begin{aligned}
 Ads_Spending_{it} &= \\
 &\omega_0 + \omega_1 Reputation_{i,t-1} + \omega_2 Reputation_{i-1}^2 + \omega_3 Pageview_{i,t-1} + \omega_4 ads_spending_{i,t-1} +
 \end{aligned}$$

$$\omega_5 \text{Pageview}_{i,t-1} * \text{ads_spending}_{i,t-1} + \varepsilon_{it},$$

$$\text{Ads_Spending}_{it} \text{ observed only when } \text{Ads}_{it} = 1 \quad (2)$$

Although we model sellers' decision sequentially, we estimate the two equations simultaneously using maximum likelihood approach suggested by Greene^[17].

4. RESULT

The results are presented in Tables 3. Sellers' decisions of using advertisement are significantly affected by their reputation and the effect is not linear as we expected ($\omega_1=0.246$, $p < 0.001$; $\omega_2 = -0.009$, $p < 0.001$), suggesting that sellers who are more likely to use advertising are the sellers with very low reputation and pretty high reputation. The sellers with medium reputation are the group of sellers who are not very into advertisements. Therefore, hypothesis 1 is supported. Meanwhile, advertisement is used as a tool to gain loyal customers, because the sellers, who have a number of loyal customers, lower the intention of advertisement. ($\omega_1=-0.0936$, $p < 0.001$). It is shown that the greater the number of bookmarks, the less the seller tends to advertise. H2 is supported.

Among those sellers that use paid search advertising, we still observe the U shape between the reputation and advertisement spending. However, the direction is opposite. Sellers with low reputation and very high reputation spend less on advertisement than the sellers with medium reputation ($\beta_1 = -0.171$, $p < 0.01$; $\beta_2 = 0.008$, $p < 0.01$), so H3 is supported. Also, we find that the interaction term has a positive coefficient ($\beta_5 = 0.0176$, $p < 0.01$) which means that if the sellers observe that they have a lot of page views resulted from advertisement spending during the last period, they will increase the spending in this period. H4 is supported.

Table 3: Estimates for Heckman Selection Model

Variables	Selection model	Spending model
Constant	-2.415*** (0.0630)	10.61*** (0.671)
Reputation _{t-1}	0.244*** (0.0318)	-0.203*** (0.0617)
Reputationx ² _{t-1}	-0.00914*** (0.00136)	0.00862*** (0.00259)
Bookmark _{t-1}	-0.0919*** (0.0168)	
Purchase _{t-1}	0.351*** (0.0178)	
Page_view _{t-1}		-0.0936 (0.0624)
Ads_spending _{t-1}		0.0838 (0.0514)
Page_view _{t-1} * Ads_spending _{t-1}		0.0176*** (0.00585)

Note: ***, **, * ==>significance at 1%, 5%, 10% level. All the continuous variables are log-transformed

5. CONCLUSIONS

This study tries to reveal the determinants of sellers' decision on advertisement and we found the U shape of the relationship between sellers' reputation and their decision to use paid search advertising. We demonstrated the ads' effect of gaining loyal customers by showing that the sellers with more bookmarks will have less intention of using paid search advertising. For the sellers that decide to use paid search advertising, U shape of the relationship between sellers' reputation and their spending is also revealed, though different direction from their adoption model. And the increased page views from advertisement spending during last

period makes sellers spend more on advertisement in this period.

There are still some limitations in this study. First, the dataset is limited to the sellers of diapers. It is possible that the sellers of durable goods make decisions in another way. More empirical studies are required to ensure the generalizability of this result. Second, although we try our best to control the factors which would influence the decision of sellers, the result is limited by the innate limitations of observed data. So we explain the association cautiously rather than strong casual effects. Third, this study assumes that the sellers are stable in their decision behavior while we might also take the dynamics of sellers' behavior or the learning effect into account. Panel data with longer period will be collected to deal with this problem.

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