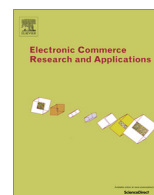Contents lists available at ScienceDirect

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Performance analysis of keyword advertising campaign using gender-brand effect of search queries

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ABSTRACT

In this research, we analyze the relationship among (1) the performance metrics of a sponsored search campaign, (2) the gender orientation of queries, and (3) the occurrence of branded terms in queries. The aim of this research is to investigate the effectiveness of increased personalization of search engine advertising in order to improve the consumer's online experience. We segregate keyphrases from a dataset covering thirty-three consecutive months from a major US retailer consisting of 7 million daily records of a real time keyword advertising campaign into three gender categories (*male*, *female* and *neutral*) each with two groups (*branded* and *unbranded*) term usage. Using ANOVA, we analyze the effect of gender and brand keyphrases on critical sponsored search performance metrics of impressions, clicks, cost-per-clicks, sales revenue, orders, items purchased and return on advertising. Research findings show that the combination of brand focus with the gender-orientation of keyphrases is a significant factor in predicting sponsored search performance and behavior. There are statistically significant variations in consumer behavior as measured by sponsored search metrics among the gender categories. Specifically, females are more attracted to the use of branded terms than males, perhaps due to the trust and customer loyalty generated by brand image. Our results establishes that positive brand reputation creates dramatic influence on consumer's loyalty over the brand and hence strongly affects their interests, activities and purchasing behavior in e-commerce environment.

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1. Introduction

In the business-to-consumer (B2C) online commerce environment, the web is the major marketing medium (Constantinides 2002). Search engines play a pivotal role in online shopping and also are the primary medium to promote online advertising. Keyword advertising (sponsored search or pay-per-click advertising) has become the most popular form of online advertising (Lieber and Syverson 2012). In order to leverage the web as the medium of commerce, retailers with brick and mortar stores have gone online, and the numbers of online only businesses has grown significantly (Roggio 2013).

Much of this online economy is driven by consumer search queries and the advertisements served by the search engines in response to these queries, which can be quite profitable for online businesses, as they direct consumers to their websites. Retailers optimize their search engine advertising strategies based on keyphrases. Two major issues marketers face when optimizing their marketing strategies are understanding the search behavior of the consumers (Constantinides 2004) and the attitude of the consumers towards the brand (Wang et al. 2002). Prior research on the role of branding and web demographics (Esch et al. 2006, Weber and Castillo 2010) illustrates the increased attention in addressing these issues. The research on web demographics in electronic commerce highlights that gender is a key predictor of purchase intent, and the notion of positive brand image enhances the business and helps retailers to withstand marketplace competition (Koças 2005).

In this research, we use real life search engine marketing data of a major US retailer to analyze the relationship among the gender specificity of terms in keyphrases, the branding focus of the keyphrases, and the resulting online consumer behavior. Our research question examines if there are differences in sponsored search performance based on gender orientation and the brand orientation of search queries.

The online shopping behavior of the consumer is measured by accepted industry standard metrics (the number of user clicks, the revenue generated by online sales, number of orders placed,

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number of items purchased, number of impressions generated, the ratio of clicks to impressions (CTR), cost that each click incurs or cost-per-click (CPC), return on advertising (ROA), etc.) that determine the performance of sponsored search. The research motivation is to investigate whether the combination of gender orientation and brand mention of the keyphrases has an effect on these performance metrics. In our research, we analyze whether the online marketers should consider the gender-brand effect as a factor for personalizing search advertising campaigns. Highlighting the implications for ecommerce, information regarding interaction between the gender of potential customers and brand effect of keyword advertisement will help retailers better formulate and optimize their marketing strategies.

We first review prior work concerning branding and gender orientation in online searching. The next section presents the research question and associated hypotheses. The research design section describes the data and the methodology for evaluation of the hypotheses. The result section presents the findings and effect size analysis. The discussion and implications section is followed by the conclusion with highlights and future research.

2. Literature review

We begin with a short overview of sponsored search, and we then discuss the prior work on brands and gender in online searching and ecommerce.

2.1. Sponsored search

In sponsored search campaigns on the major search engines, advertisers bid on keyphrases that relate to a product or service that they are providing and that they believe searchers will submit to the search engine. These keyphrases provide the linkage between the results provided from the advertiser and the queries submitted by potential customers, who are the searchers on the Web search engines. When searchers submit queries to the search engines that match a key phase, the corresponding set of results is displayed on the search engine results page (SERP). Although published data is sparse, reports are that about 15% of search engine clicks occur on these keyword advertisements (Jansen and Spink 2009).

The cost of the keyword for the advertiser is determined via online auctions. The exact cost can be in continual flux, as the amount that an advertiser *must* bid to get an ad to display depends on the overall demand for that keyphrase at a given time. The amount that an advertiser is *willing* to bid depends generally on the perceived possible value of the customer converting (take some desired action like purchasing a product). Multiple advertisers are typically bidding on the same keyphrases simultaneously, so the online auction and bid price can be quite dynamic. The search engines provide advertisers an assortment of tools to effectively manage their bids, control risk, and maximize opportunity.

The sponsored results on the SERP are usually shown above the organic results listing (the north position), to the right of the organic results listing (the east position), and below the organic results listing (the south position). The exact display method depends on the search engine, as some engines may not use all three positions. The sponsored result's rank within each listing depends on the bid price, the other bids in the auction, and a quality score (determined by several factors including bid amount, click through history and landing page relevance to the ad, although this formula varies by search engine). Given these factors, the sponsored search process is an interesting and complex integration of business processes, information technology, and information processing, making it an exciting area for multi-disciplinary study.

The sponsored search results are usually textual in nature and normally consist of a short headline, two diminutive lines of text describing the product or service, and a hyperlink that points to the advertiser's landing page (an advertiser designated Webpage). The predominant keyword advertising model is pay-per-click (PPC), where an advertiser only pays the search engine if a searcher clicks on the displayed ad hyperlink. So, the impression of an ad does not monetarily cost the advertiser.

The entire sponsored search process can be extremely complex, and this brief overview cannot do it justice. The interested reader is referred to review articles (Fain and Pedersen 2006, Jansen and Mullen 2008) of the sponsored search process.

2.2. Branding

Branding has three components that may influence consumers in the e-commerce domain. These components are: (1) brand awareness, (2) brand image, and (3) brand relationship (Esch et al. 2006). The first component emphasizes the consumer's ability to memorize and recognize the brand under different market conditions (Percy and Rossiter 1992). Brand image deals with whether or not the brand can make a mark in the consumer's memory (Keller 1993). Brand relationship is the component that represents the customer's satisfaction over that brand (Esch et al. 2006), including that of search engines (Jansen et al. 2009, 2012; Zhang et al. 2012).

Prior research has studied the brand effects as the antecedents of online trust relating to the company, its website, and the product (Schultz 2004), along with the search engine and search process (Jansen et al. 2009, 2012; Zhang et al. 2012). A brand can distinguish an organization or a product from its competitors. Positive branding can have a dramatic effect on consumer reactions as affirmative brand attitude leads to emergence of customer loyalty towards the brand. The brand components are strongly interconnected and portray different aspects of a consumer's perception and trust concerning the brand (Sicilia et al. 2006). Ha and Perks (2005) studied the kinship between brand familiarity, customer satisfaction, brand experience, and trust in online environment. Their findings assert that search for information, association, and customer's observation precede the customer's trust of the brand. Online reviews about the brand will also affect the consumer's trust of the brand and hence their buying behavior (Corbitt et al. 2003, Lee et al. 2008). So, brand knowledge has a direct and positive effect on consumers' willingness to support an online retailer in keyword advertising (Chen and He 2003). Based on this prior work, it seems reasonable that companies may want to leverage this brand knowledge directly in their keyword advertising campaigns. It is reported that among advertisers, brand awareness is one of the top objective of large company's sponsored search campaigns (Rutz and Bucklin 2008), as the reputation of a company can have a profound influence on online sales (Lee et al. 2009).

However, limited research has measured the effect of keyphrases with branded terms on the performance metrics of sponsored search. Amblee and Bui (2008) suggest that brand reputation has a correlation with online product reviews. Other studies (Ghose and Yang 2007, 2008) reported that brand terms have an effect on SEM performance where retailer specific brands achieve high CTR. Researchers (Jansen et al. 2011) investigated the influence of brand effect on SEM performance with a large dataset from a real time keyword advertising campaign and infer that the brand term in keyphrases has a dramatic effect in performance of sponsored search. They show that the combination of branded phrase and branded advertisement generates 15 times more sales revenue than any other combination. Their findings imply that mentioning the brand term in keyphrases increases sponsored search

performance. In their study, the branded term is the textual representation of the brand.

2.3. Gender

Regarding the research on the effect of gender on information processing behavior on the web, studies (Garbarino and Strahilevitz 2004, Lorigo et al. 2006) have found significant behavioral differences based on gender. There are several studies based on the gender differentiated behavior in online shopping, although Ulbrich et al. (2011) found that there are no differences between genders in online shopping. Other researchers (Abraham et al. 2010) found that propensity of spending money online and participation in online activities for females are increasing. Sanchez-Franco (2006) identified that attitude plays a strong role for women's shopping, from a view of gender as a social category (Deaux 1984). Garbarino and Strahilevitz (2004) found that female consumers exhibit a higher perceived risk in online shopping compared to their male counterpart, which would indicate a possible difference in clicks and in converts. Research on online shopping behavior by gender found that men prefer interactivity features of the ads, while women consumers explore the ad website's communication features (Yeh et al. 2012), which would again point to a possible higher click and convert rate. This is consistent with the reported women customers' risk-averse attitude in online shopping (Zhou et al. 2007), which would might point to a higher need of trust in online businesses. Findings indicate that women consider all information whereas men consider the most conspicuous pieces of information and ignore the rest (Carsky and Zuckerman 1991). Hence, women are more integrative, seeking more data in their decision making, while men prefer a less complicated approach (Meyers-Levy and Maheswaran 1991, Meyers-Levy and Sternthal 1991). Kirouac and Dore (1983) report that women are better at processing non-verbal information cues, and Prakash and Flores (1985) state that women are more subjective than men in their information processing. Meyers-Levy (1988) find that men are persuaded if there are information choices and value self-generated information.

Jansen et al. (2013) conducted research on demographic targeting measuring the effect of gender orientation of queries on the sponsored search performance. Although they discuss the effect of gender on the users' online searching behavior, they do not investigate the interaction effect of gender and branding focus of terms in keyphrases on sponsored search campaigns. The effect on searching behavior using the gender orientation alone may be different to that using combination of branding with gender orientation. This is important to know as the results can help retailers identify in a more nuanced manner whether the gender affects keyword advertising cost and profits.

2.4. Synthesis of prior work

Prior work has shown that branding aspect can affect online searching and ecommerce. Other prior work has shown that gender can play a role in inline searching and ecommerce behavior. However, there are no prior works that we could locate investigating the combined gender and brand effect of keyphrases on user's behavior, even though both aspects could possibly impact performance of a keyword advertising campaign.

The lack of research leads to the emergence of several open questions. Does branding and gender together impact searching behaviors? If so, what are these possible behavior changes? What is the impact of such behaviors on the keyword advertising performance? These are some of the questions that motivate our research.

3. Research question

Our research question is: *Are there significant differences in sponsored search metrics based on the interaction effect of the gender orientation and the brand orientation of search queries?*

The understanding of the relationship between gender and branding focus can assist retailers in optimizing the SEM strategies for their online businesses. The results obtained from this research can help marketers to create ad recommendations for a particular gender, leverage the brand awareness/brand image targeting a specific gender, and provide valuable research to support the use of more advanced marketing methods.

To investigate our research question, we classified keyphrases as:

- *Branded keyphrases*: The keyphrases that are associated with the textual representation of brand name.
- *Unbranded keyphrases*: The keyphrases that do not mention the brand name.

Brand name is the label that identifies the retailer or retailer's products distinct from those of other retailers.

In addition to the brand related classes, we generated three categories based on the gender orientation of the keyphrases. Gender orientation of keyphrase is the probabilistic classification of the search phrase to determine whether it is male or female oriented.

- *Female keyphrases*: The keyphrases that are classified as female with a probability greater than 60%.
- *Male keyphrases*: The keyphrases that are classified as male with a probability greater than 60%.
- *Neutral keyphrases*: The keyphrases that are neither classified as male nor as female.

Taking the union of the categories formed on brand effect and gender difference, we ultimately have six different classes of keyphrases: *female-branded, female-unbranded, male-branded, male-unbranded, neutral-branded* and *neutral-unbranded*. We are evaluating the effect of these six categories on different performance metrics of sponsored search result. Standard metrics of sponsored search are defined in Table 1.

The metrics identify the critical user behaviors, including showing potential interest in search engine results. As such, any gender-brand differences will highlight the effect of gender orientation with branded or unbranded keyphrases in keyword advertising user behavior.

As positive brand image has a dramatic effect on consumers' interests in advertisements and purchasing behavior (Jansen et al. 2011), we believe that the gender categories mentioning brand names will result in improvement of interaction than the gender-unbranded counterparts. Moreover from prior work (Sanchez-Franco 2006), we observe that female consumers prefer lesser purchasing risk. Therefore, it leads us to assume that *female-branded* category will generate more interactions than the other gender categories. Based on the research question and the stated assumptions, we develop the following hypotheses:

Hypothesis 1. *There will be a significant difference in the number of impressions based on specific gender orientation of branded and unbranded keyphrases.*

Impressions are one of the key metrics of sponsored search campaign. It identifies the number of times an advertisement appears on the SERP as triggered by the keyphrase submitted as query by a user. Analyzing the count of impressions sheds light on gender-brand differences in terms of ecommerce searching frequency of both branded and unbranded keyphrases.

Table 1
Performance metrics for sponsored search advertising with definitions.

Metrics	Description
Impression	Response of search engine shown in SERP against a user query
Clicks	Potential clicks by the users on the hyperlinks of ads shown in SERP
Click Through Rate (CTR)	The ratio of clicks to impressions
Cost-per-click (CPC)	The amount billed by search engine to an ad agent for each user click
Sales revenue	Revenue generated by the advertiser by selling the products/items online
Orders	The number of orders from the advertisement for that day for a given keyphrase
Items purchased	Number of items purchased from that advertisement on that day for a given keyphrase from all orders. One order could have one or more items

Hypothesis 2. *There will be a significant difference in CTR based on specific gender orientation of branded and unbranded keyphrases.*

CTR is one of the most commonly used yardsticks that measure the potential interest of the user in the ads. It is also a critical user behavior in many aspects of online searching. The objective of most of the sponsored search campaigns is to get potential customers to click on the ads and go to the landing pages. So, the click is a commonly used measure of consumer's interest in search engine results. Therefore gender-brand differences on CTR will provide intuition on gender specific brand effect in user behavior and sponsored search.

Hypothesis 3. *There will be a significant difference in the CPC based on specific gender orientation of branded and unbranded keyphrases.*

Advertisers place different bid values for different keyphrases depending on the value they have assigned for those keyphrases and the competition from other advertisers. One would expect the keyphrases that advertisers anticipate would receive more clicks will be the most expensive. So, higher CPC for certain keyphrases classified along gender specific branding lines may indicate retailers' preferences for those keyphrases, being an indication of expectation of user specific brand value.

Hypothesis 4. *There will be a significant difference in the average of sales based on specific gender orientation of branded and unbranded keyphrases.*

Sales revenue is a concrete measurement of potential profitability of online marketers. It is the goal of the advertisers to generate a sale or identify the need of potential customers. So, the interaction between gender-brand differences and sales revenue provide intuitive understanding about the willingness of the searchers for purchasing of products or services.

Hypothesis 5. *There will be a significant difference in the average number of orders based on specific gender orientation of branded and unbranded keyphrases.*

Number of orders is related to the sales revenue generated in keyword advertising. The retailer monitors the number of orders placed online against the keyphrases by the potential customers. The difference in number of orders versus keyphrases with gender-brand focus indicate the variance of online shopping behavior of the users such as readiness to buy, trust, degree of perception of risk, etc.

Hypothesis 6. *There will be a significant difference in the average number of items purchased based on specific gender orientation of branded and unbranded keyphrases.*

The number of items purchased is correlated with the number of orders placed against a keyphrase. Online retailers will put more emphasis on the customers who purchase multiple items than those who buy single items. So, differences in number of items purchased against the keyphrases in the line of gender-brand categories are of profound importance to the advertisers.

Hypothesis 7. *There will be a significant difference in the average return on advertising based on specific gender orientation of branded and unbranded keyphrases.*

ROA is associated with generated sales and cost of advertising. Final evaluation of any advertising campaign is assessed by the profit generated by the advertising effort. The ROA is calculated by subtracting the cost of advertising from the gross revenue generated by the advertising campaign. If ROA is positive the advertising effort is effective; otherwise, it is ineffective. A negative ROA means the cost of running the campaign is more than the generated revenue.

4. Research design

4.1. Data

The data used for this research contains daily information from a sponsored search campaign from a large nationwide US retail chain that has both a brick and mortar and an online sales presence. This retailer sells a variety of electronic and household products covering a wide price range for both men and women. Over the years, the retailer has developed its brand image in the marketplace. The nationwide existence, the brand presence, wide range of products for all genders, and both physical and virtual stores make the retailer an excellent source of data for studying the performance of sponsored search.

The data records the sponsored search advertisement efforts by the company during a 33-month period, spanning 4 calendar years, from 30 September 2005 to 09 June 2008. The log contains a rich data set with the keyphrases that trigger the ad, searcher responses, and sales information. There are approximately 7 million records from nearly 40,000 keyphrases. The data log contains a record for every day in which one of the keyphrases triggers an ad. There is a unique record for each keyphrase for a given day with the number of impressions that keyphrase generates on that day, the number of clicks, the average CPC, the number of orders, the revenue generated and total number of items purchased. Given the four years of data collection, we believe that our data log is rich and robust to examine our research question and the associated hypotheses concerning the gender-brand effect on sponsored search performance. A description of the data log used in this research is provided in Table 2.

To address our research question and associated hypotheses, we categorize the keyphrases from the sponsored search campaign of the US based retailer into brand-focused and non-brand focused categories. The process was rather straightforward. We classify the keyphrase as brand focused if the keyphrase contains a term that is associated with the retailer's brand name. We implemented

Table 2
Fields and descriptors of the data log.

Attribute	Description
Keyphrase	Keyphrase that triggered the advertisement
Impressions	Total number of impressions for that day for the given advertisement with the given key phrase
Clicks	Number of clicks on the advertisement for that day for a given key phrase
Cost	Total cost for the day for a given key phrase for a given advertisement
Sales	Revenue generated from that advertisement on that day for a given key phrase
Orders	Number of orders from the advertisement for that day for a given key phrase
Items	Number of items purchased within the order for a given day, advertisement, and key phrase; one order could have one or more items
Classification	Gender orientation of the keyphrases
Client Brand Phrase	=0 for unbranded keyphrases; >0 for branded keyphrases

Table 3
Occurrences of branded and unbranded keyphrases.

Keyphrases	Count
Branded	2655
Unbranded	36,917

this classification via a key word matching methodology. If the keyphrases contained the brand term, it was classified as branded. Otherwise, it was classified as unbranded. Table 3 displays the count of the branded and unbranded keyphrases that exists in the data.

For gender categorization, we classified the keyphrases from the key word advertising campaign of the major retailer based on the probability of being *male*, *female*, or *neutral* using Microsoft adCenter Labs Demographics Prediction Tool accessed by means of the link (http://adlab.microsoft.com/Demographics-Prediction/DPU-Laspx). Demographics prediction tool infers the gender of the searchers based on the search query. The tool takes a query as an input and generates the probability of gender orientation within range of 0–1 inclusive. The application provides the probability values for both male and female orientation for each query.

From the tool's website, the Demographics Prediction tool assists advertisers in learning the demographic-orientation of keyphrases before bidding on these terms, with the goal of improving demographic targeting. With this knowledge, advertisers could determine whether they are reaching their target audience and decide if current keyword bidding strategies are effective. The gender-orientation probabilities are based on a one-month MSN Live Search user log.

Note that the gender-oriented prediction is specific to the query, not necessarily the searcher. So, although the gender of the searcher may not be specifically known, the query has a gender-orientation based within a certain confidence interval. The probability is based on Microsoft's predictive model that determines whether or not a particular query fits gender-specific trends of online behavior based on a log analysis.

Concerning how accurate is the demographic classification, we could locate no published manuscripts addressing this question. However, the MSN adCenter Labs has access to large numbers of user profiles (Hotmail and MSN Passport), so it is a trivial matter to link queries to demographic profiles. Therefore, we would expect the accuracy of the gender classification tool to be high. However, to evaluate the effectiveness of the tool, we conducted an additional experiment comparing the MSN Demographics Prediction with a similar tool, Yahoo! Clues.

Yahoo! Clues is a comparable tool to the MSN Demographics tool although it is less robust than its MSN counterpart, as Yahoo! Clues has less demographic data. We addressed this problem by stemming out search terms that were too descriptive, so that the Yahoo! Clues tool would be able to recognize them. We then used the resulting term set of keyphrases to collect data from both the MSN Demographics and Yahoo! Clues tools and compared the re-

sults. We considered the tools in agreement if the gender probability was within ten percentage points, which is a rather rigid standard. Inter-rater agreement based on Cohen's Kappa was 0.75 ($p < 0.01$), indicating substantial agreement (Landis and Koch 1977). So, this finding indicated that our gender classifications were reliable.

Using the MSN Demographics Prediction tool, we classified the nearly 40,000 keyphrases in the data set for gender-orientation using an automated script that submitted the query and then retrieved the resulting gender-orientation probabilities. The script operated using an automated submission to the MSN Demographics Prediction Tool via a RESTful request, which sends a GET or a PUT to a website in order to collect specific data from the site. Once a response was given, the script extracted, separated, and stored the response in a flat text file. We then used the date in this file for our statistical analysis.

We devised three categories of gender-orientation classification strength based on the probability returned by the MSN adCenter Labs predictive model. Table 4 provides the range of probability values to identify a query to be male or female or gender neutral.

Table 5 displays the distribution of the gender orientation of keyphrases that belongs to the data log.

Using the gender and brand categories, we constitute six groups of keyphrases: female-branded (F-B), female-unbranded (F-UB), male-branded (M-B), male-unbranded (M-UB), neutral-branded (N-B) and neutral-unbranded (N-UB).

4.2. Methodology

Once the six gender-brand categories were constructed, we imported the data into SPSS. Our data follows the power law distribution and hence is not multivariate normal. To use ANOVA, we have to normalize the data by means of Box–Cox transformation

Table 4
Probability range for gender of each keyphrase.

Probability range	Gender
Female: ($\geqslant 0.0$ to $\leqslant 0.4$)	Male
Male: ($\geqslant 0.6$ to $\leqslant 1$)	Male
Female: ($\geqslant 0.6$ to $\leqslant 1$)	Female
Male: ($\geqslant 0.0$ to $\leqslant 0.4$)	Female
Female: (>0.4 to <0.6)	Neutral
Male: (<0.6 to >0.4)	Neutral

Table 5
Occurrences of gender orientation of keyphrases.

Gender-orientation	Count
Male	10,860
Neutral	19,495
Female	9,217

(Box and Cox 1964). We transformed the data via the Box–Cox transformation by using log transformation function *log*(*variable* + 0.5). Using the log transformation, the data is successfully normalized though a bit of skewness exists on the left as the data is weighed toward a lower number of clicks, sales, impressions, etc. (the histogram of the log-transformed data generally follows a normal distribution). Despite the existing skewness on the left, prior work has shown that ANOVA is robust even if the data deviates from normality (Box and Andeeson 1955, Hull 1993). The use of power transformation ensured that our statistical approach is valid. Using SPSS, we ran the ANOVA procedure among six groups to test the differences between the means of clicks among the six gender-brand categories, along with post hoc analysis to find out the significant groups.

5. Results

The results section contains the evaluation of hypotheses and the post hoc analysis to find the significance among the gender-brand categories. We also provide some aggregate results of our data analysis. Table 6 displays the basic statistics (mean and standard deviation) of different performance metrics for nearly 40,000 keyphrases. The following entries represent the statistics of log-transformed data.

5.1. Hypothesis testing

To evaluate our six hypotheses, we use one way ANOVA to compare the means between the groups. In one way ANOVA, the gender-brand categories are used as the independent variable. ANOVA test identifies that means of the performance metrics of at least one category is significantly different from others. The critical value of the *F*- statistic is 2.214 at the 95% confidence interval. We also use Games–Howell test for post hoc analysis across the groups with unequal sizes as the assumption of homogeneity of variances is not satisfied (the significance level of Levene statistic should be greater than 0.05). In our gender-brand data, we observe that the larger group sizes have relatively smaller variances. The Games–Howell test takes both unequal variances and the unbalanced sample sizes into account by suggesting a critical difference between means, separately for every pair of means with Gaussian-*q* distribution (Osborne 2008). The modification is derived from Tukey–Kramer test and is recommended for sample sizes greater than five. The test is significantly more powerful than other tests in terms of confidence interval and rejection rates (De Muth 2006, Keselman and Rogan 1978). We adopt the Games–Howell test as the most suitable method for post hoc analysis of the data with unequal group sizes and unequal variances where the sample size and sample variance are inversely paired. The Games–Howell modification always remains close to the level of significance and maintained control over Type-1 error under such a condition (Keselman and Rogan 1978). As the assumption of homogeneity of variances does not hold and the group sizes are unbalanced, we resort to Welch statistic to test the equality of group means assumption. We observe that our data follows the equality of means assumption

(i.e. the value of Welch statistic is always <0.05). The satisfaction of equality of means assumption is the precondition before carrying out Games–Howell test in post hoc analysis.

Hypothesis 1. The result indicates that there is a significant difference of means of impressions among the gender-brand categories of keyphrases ($F(5) = 29.35$, $p < 0.05$).

The Games–Howell test for impression data is reported in Table 7. It is seen from the magnitude of reported *t*-values that there is significant difference of means of impressions among all six categories. Hypothesis 1 is fully supported as the ANOVA result indicates that there is a significant interaction between impressions and different gender-brand categories. The result of post hoc analysis indicates that *F-B* and *N-B* are the dominant interaction groups from the perspective of impressions. This would indicate that females are more inclined towards branded items for online shopping.

Hypothesis 2. The result indicates that there is a significant difference of means of clicks between the gender-brand categories of keyphrases ($F(5) = 88.13$, $p < 0.05$). The Games–Howell test for click data is reported in Table 8. It is seen from the magnitude of reported *t*-values that there is significant difference of means of clicks among all six categories. Hypothesis 2 is fully supported.

The ANOVA result shows a significant interaction between number of clicks and different gender-brand categories of keyphrases. The post hoc analysis shows that *F-B* and *N-B* categories exhibit significant differences across the remaining groups (see Table 8). It can be inferred that given the number of clicks for both branded and unbranded keyphrases with specific gender orientation, the branded female and branded neutral keyphrases are more focused and valuable objects for attracting potential customers to the website. Combined with the higher rate of impressions, it is evident that females show willingness to engage themselves in keyword advertising to search for ads with branding focus.

Hypothesis 3. The result indicates that there is a significant difference of means of CPC between the gender-brand categories of keyphrases ($F(5) = 74.92$, $p < 0.05$). The Games–Howell test for cost-per-click (CPC) data is reported in Table 9.

It is seen from the magnitude of reported *t*-values that there is significant difference of means of CPC among the groups except *F-B* category. Hypothesis 3 is fully supported. Though ANOVA result shows a significant interaction between CPC and different gender-brand classes, the post hoc analysis shows that unbranded keyphrases with all three gender orientations constitute the predominant interaction group. So, even if F-B and N-B categories are prevalent categories for impressions and clicks, the interaction effect between CPC and gender-brand categories leads to different results (female-branded keyphrases cost less). *M-UB* category has a greater average CPC than other categories. The *N-UB* group appears second. Though, we found earlier that *F-B* category generates more impressions and clicks, the male and neutral gender orientation of

Table 6
Basic statistics of log-transformed metrics.

Metric	Mean	Std. deviation
Impression	1.334	1.486
CTR	1.59	1.606
Sales	5.295	1.960
CPC	3.925	1.047
Orders	0.016	0.108
Items purchased	0.025	0.148

Table 7
Magnitude of *t*-values for impressions between categories (bold = significant).

	M_B	M_UB	N_B	N_UB	F_B	F_UB
M_B		**12.35**	**6.00**	**13.89**	**9.09**	**11.43**
M_UB	**12.35**		**5.25**	**3.94**	**4.68**	**1.89**
N_B	**6.00**	**5.25**		**7.00**	**6.26**	**4.29**
N_UB	**13.89**	**3.94**	**7.00**		**4.03**	**5.53**
F_B	**9.09**	**4.68**	**6.26**	**4.03**		**5.00**
F_UB	**11.43**	**1.89**	**4.29**	**5.53**	**5.00**	

Table 8
Magnitude of *t*-values for clicks between different categories (bold = significant).

	M_B	M_UB	N_B	N_UB	F_B	F_UB
M_B		2.76	**5.08**	0.52	**7.57**	0.86
M_UB	2.76		**16.18**	**10.76**	**12.27**	**8.27**
N_B	**5.08**	**16.18**		**11.58**	**5.13**	**12.07**
N_UB	0.52	**10.76**	**11.58**		**10.37**	1.58
F_B	**7.57**	**12.27**	**5.13**	**10.37**		**10.56**
F_UB	0.86	**8.27**	**12.07**	1.58	**10.56**	

Table 9
Magnitude of *t*-values for CPC between different categories (bold significant).

	M_B	M_UB	N_B	N_UB	F_B	F_UB
M_B		**4.69**	0.65	**3.71**	1.21	0.57
M_UB	**4.69**		**7.86**	**4.12**	1.13	**22.78**
N_B	0.65	**7.86**		**6.41**	1.67	0.29
N_UB	**3.71**	**4.12**	**6.41**		0.62	**16.95**
F_B	1.21	1.13	1.67	0.62		1.66
F_UB	0.57	**22.78**	0.29	**16.95**	1.66	

keyphrases with no branding has a higher average CPC. This would indicate that advertisers value the searchers performing web search with male-unbranded and neutral-unbranded keyphrases more as potential customers, even though analysis would indicate otherwise.

Hypothesis 4. The result indicates that there is a significant difference of means of sales between the gender-brand categories of keyphrases ($F(5) = 80.59$, $p < 0.05$). The Games–Howell test for sales revenue data is reported in Table 10. It is seen from the magnitude of reported *t*-values that there is significant difference of means of revenue generated among all six categories. Hypothesis 4 is fully supported, as the ANOVA result indicates significant interaction between revenue and different categories. The post hoc analysis identifies *F-B*, *N-B*, and *N-UB* as the prevalent groups (see Table 10) as far as the interaction between revenue and the gender-brand categories are concerned *F-B* and *N-B* keyphrases are the predominant ones for sales.

F-B category generates more revenue than the remaining categories. This would indicate that females prefer to purchase using the branded keyphrases. This shows the influence of brand reputation on the female customers. Advertisers should have higher CPCs for the branded keyphrases with female gender orientation rather than the unbranded ones with male and neutral gender orientations.

Hypothesis 5. The ANOVA result indicates that there is a significant difference of means of orders placed between the gender-brand categories of keyphrases ($F(5) = 167.13$, $p < 0.05$). The Games–Howell test for orders data is reported in Table 11.

Table 10
Magnitude of *t*-values for sales revenue between categories (bold = significant).

	M_B	M_UB	N_B	N_UB	F_B	F_UB
M_B		1.44	**10.19**	**4.40**	**8.65**	2.12
M_UB	1.44		**14.26**	**8.43**	**9.27**	1.81
N_B	**10.19**	**14.26**		**6.41**	1.70	**12.77**
N_UB	**4.40**	**8.43**	**6.41**		**7.26**	**5.43**
F_B	**8.65**	**9.27**	1.70	**7.26**		**8.69**
F_UB	2.12	1.81	**12.77**	**5.43**	**8.69**	

Table 11
Magnitude of *t*-values for orders placed between categories (bold = significant).

	M_B	M_UB	N_B	N_UB	F_B	F_UB
M_B		**3.14**	**7.16**	1.96	**5.01**	1.45
M_UB	**3.14**		**7.78**	**12.26**	**5.27**	**3.73**
N_B	**7.16**	**7.78**		**6.89**	1.57	**7.50**
N_UB	1.96	**12.26**	**6.89**		**4.87**	**6.29**
F_B	**5.01**	**5.27**	1.57	**4.87**		**5.15**
F_UB	1.45	**3.73**	**7.50**	**6.29**	**5.15**	

It is observed from the magnitude of reported *t*-values that there is significant difference of means of orders placed among all six categories. Hypothesis 05 is fully supported. The interaction effect between gender-brand categories of keyphrases and the number of orders placed seems consistent with that observed for impressions, clicks and sales. With the help of Table 11, *F-B* and *N-B* categories seem to be the leading groups regarding the number of orders. The *F-B* category generates highest number of orders followed by the *N-B*. The average orders placed by unbranded keyphrases are similar irrespective of gender orientations.

Hypothesis 6. The result indicates that there is a significant difference of means of purchased items between the gender-brand categories of keyphrases ($F(5) = 305.49$, $p < 0.05$). The Games–Howell test for purchased items data is reported in Table 12.

It is observed from the magnitude of reported *t*-values that there is significant difference of means of items purchased online among all six categories. So, hypothesis 06 is fully supported, as the ANOVA result shows significant interaction effect between number of items purchased and gender-brand categories of keyphrases. From Table 12, F-B and N-B keyphrase categories have higher average number of items purchased online. *F-B* category has most items purchased online. It is followed by the *N-B* group. The average items sold for unbranded keyphrases are similar irrespective of gender orientations.

The ANOVA result indicates that there is a significant difference of means of ROA between the gender-brand categories of keyphrases ($F(5) = 248.77$, $p < 0.05$). The Games–Howell test for purchased items data is reported in Table 13.

It is observed from the magnitude of reported *t*-values that there is significant difference of means of ROA among all six categories. So, hypothesis 07 is fully supported. The result of post hoc analysis (from Table 13) identify *F-B* and *N-B* as the dominant interaction groups from the perspective of ROA and is consistent with the results of other metrics (i.e. impressions, clicks, sales, orders placed and items purchased) except CPC.

F-B category generates the highest return among all categories. The ROA returned by female branded category is about three times that generated by the next highest category *N-B*. This is consistent with the preference of online purchase of branded items by the female users. So, brand reputation appears to play a significant role for female customers' buying behavior. Advertisers should have higher CPCs for the branded keyphrases with female gender orientation, as the use of branded keyphrases for female users seems most profitable for the advertisers, factoring in both revenue and cost.

Table 12
Magnitude of *t*-values for items between categories (bold = significant).

	M_B	M_UB	N_B	N_UB	F_B	F_UB
M_B		**2.80**	**7.68**	1.46	**5.35**	1.10
M_UB	**2.80**		**8.67**	**13.44**	**5.70**	**4.62**
N_B	**7.68**	**8.67**		**7.51**	1.75	**8.21**
N_UB	1.46	**13.44**	**7.51**		**5.20**	**5.79**
F_B	**5.35**	**5.70**	1.75	**5.20**		**5.51**
F_UB	1.10	**4.62**	**8.21**	**5.79**	**5.51**	

Table 13
Magnitude of *t*-values for ROA between different categories (bold = significant).

	M_B	M_UB	N_B	N_UB	F_B	F_UB
M_B		**5.85**	**7.83**	2.48	**8.88**	**6.44**
M_UB	**5.85**		**19.75**	**13.92**	**12.91**	2.88
N_B	**7.83**	**19.75**		**15.32**	**4.53**	**20.39**
N_UB	2.48	**13.92**	**15.32**		**11.17**	**15.42**
F_B	**8.88**	**12.91**	**4.53**	**11.17**		**13.20**
F_UB	**6.44**	2.88	**20.39**	**15.42**	**13.20**	

5.2. Effect Size

Although the results show that there are statistically significant differences in the gender-brand categories, a proportion of this difference may be assigned to large sample sizes. So, we perform an additional analysis to assure that the observed differences among the categories are practically significant. We perform *Cohen's d* test to determine the effect size of each pair of categories across the performance metrics (Cohen 1988). The obtained *d*-values are displayed in Table 14. The corresponding ranges of *d*-values for small, medium and large effects are ($\geqslant$0.2 to <0.5), ($\geqslant$0.5 to <0.8) and ($\geqslant$0.8) respectively.

Table 14 shows that approximately 70% of the comparison show differences that are practically significant (not due only to effect size). More than one third (36% of the comparisons) of the effect size analyses indicate a small but significant effect. In addition, 17% of the comparisons have a moderate effect, and 17% of the comparisons have a large effect. The remaining 30% of the comparisons indicate negligible effect.

From Cohen's *d* test results, we find that branded keyphrases with female and neutral gender orientation generate most of the large and moderate effect sizes relative to the remaining categories. So, *F-B* and *N-B* categories are clearly most different from the remaining ones in both statistical and practical terms. This strong differential is observed in most of the performance metrics, except CPC difference appear negligible. The analysis of effect sizes indicates that female and neutral gender oriented keyphrases with branding focus are proved effective in the sense of generating significantly more ROA.

6. Discussion and implications

6.1. Discussion of results

In this research, we investigated the gender orientation of keyphrases with branding focus from the perspective of personalization of web results and human information processing. From a human information processing perspective, our result highlights the differences between male and females in terms of information behavior. Intuitively, personalization of search results will lead to better searching experience and help retailers to accrue increased revenue. Our results show that for all metrics investigated, branded keyphrases for female searchers perform the best overall based on standard SEM metrics.

The keyphrases with female gender orientation concentrating on branded terms generate more impressions and clicks than any other category. The number of clicks generated for *F-B* category is more than twice of the next highest performing group (*N-B* category). This indicates that the keyphrases with brand reputation for female customers are mostly searched for (impressions) and receives the most consumer interest (clicks).

As far as the online revenue generation and ROA are concerned, the *F-B* keyphrases are the most profitable. This category generates sales revenue that is about 1.5 times the revenue generated by the nearest category (*N-B*). Profit (ROA) generated by *F-B* keyphrases is

Table 14
Cohen's *d* values to measure effect sizes.

	M_B	M_UB	N_B	N_UB	F_B	F_UB
Impression						
M_B		**0.501**[b]	**0.314**[a]	**0.503**[b]	**0.841**[c]	**0.44**[a]
M_UB			0.16	0.05	**0.35**[a]	0.026
N_B				0.16	**0.49**[a]	0.13
N_UB					**0.28**[a]	0.072
F_B						**0.36**[a]
Sales						
M_B		**1.69**[c]	**0.965**[c]	**0.38**[a]	**1.18**[c]	0.19
M_UB			**0.83**[c]	**0.25**[a]	**1.041**[c]	0.063
N_B				**0.57**[b]	**0.20**[a]	**0.75**[b]
N_UB					**0.77**[b]	0.18
F_B						**0.95**[c]
Clicks						
M_B		**0.25**[a]	**0.39**[a]	0.04	**0.82**[c]	0.072
M_UB			**0.58**[b]	0.17	**0.98**[c]	0.15
N_B				**0.38**[a]	**0.40**[a]	**0.41**[a]
N_UB					**0.77**[b]	0.025
F_B						**0.80**[c]
CPC						
M_B		**0.28**[a]	0.044	**0.23**[a]	0.13	0.042
M_UB			**0.30**[a]	0.056	0.11	**0.36**[a]
N_B				**0.25**[a]	0.16	0.013
N_UB					0.06	**0.30**[a]
F_B						0.18
Orders						
M_B		**0.25**[a]	**0.35**[a]	0.07	**0.59**[b]	0.07
M_UB			**0.38**[a]	0.18	**0.62**[b]	0.08
N_B				**0.33**[a]	0.14	**0.36**[a]
N_UB					**0.55**[b]	0.11
F_B						**0.60**[a]
Items						
M_B		**0.21**[a]	**0.39**[a]	0.07	**0.62**[b]	0.06
M_UB			**0.42**[a]	**0.20**[a]	**0.66**[b]	0.10
N_B				**0.36**[a]	0.15	**0.40**[a]
N_UB					**0.59**[b]	0.11
F_B						**0.63**[b]
ROA						
M_B		**0.36**[a]	**0.50**[b]	0.146	**0.96**[c]	**0.40**[a]
M_UB			**0.80**[c]	0.19	**1.24**[c]	0.04
N_B				**0.60**[b]	**0.41**[a]	**0.83**[c]
N_UB					**1.03**[c]	**0.23**[a]
F_B						**1.27**[c]

M_B: male_branded, M_UB: male_unbranded, N_B: neutral_branded, N_UB: neutral_unbranded, F_B: female_branded, F_UB: female_unbranded, ROA: Return on advertising.
[a] Small effect.
[b] Medium effect.
[c] Large effect.

about three times the profit returned by *N-B* keyphrases. In addition, the results illustrate that *F-B* category generates more orders and items purchased (conversions) than any other category. Combined with impressions, CTR, sales, orders, ROA and online purchase of items, it appears that female searchers engage themselves with branding focus more than males.

However, this is not reflected in CPC. The *F-B* category is cheaper than the *M-UB* and *N-UB* groups. Advertisers bid more on these unbranded keyphrases to draw more potential customers towards them. However, it is not justified from our analysis, as branded keyphrases with female gender orientation generate higher revenue and ROA. However, most the CPC differences are small, which would indicate that advertisers are taking this into account somewhat.

It is interesting of the examined metrics, the keyphrases associated with brand names particularly for female and neutral gender orientations perform better than their unbranded counterparts. The findings are also consistent with the results obtained by anal-

ysis of effect sizes, as most of the large and medium size effects are for the *F-B* and *N-B* categories. It is worth mentioning that the keyphrases searched by male users do not rely much on the branding focus. It can be inferred that brand reputation does not influence the male searchers as much relative to female searchers.

6.2. Theoretical implications

In our research, we observe that females are more willing to click on the links of sponsored search based on branded searches, and females also prefer to buy based on such clicks. Brand is considered as an important intangible asset that highlights the positioning, reputation, and potential growth of a company. Hence, it identifies the customer loyalty for the company. In this research, we focus on customer perspective of branding and retailers' perspective of personalization of web results by providing a branding focus.

The theory of social categories (Deaux 1984) is a basis of personalization in advertising, which indicates that keyphrases with a particular gender orientation should perform better. The theory of social categories analyzes gender in terms of gender as a subject (S) variable, individual differences between male, female and neutral gender, and gender as a social category. The gender-as-subject differences appear less pervasive as the main effects of gender are qualified by the situational interactions such as branding. The issues of gender via measures of masculinity, femininity, and neutrality is an active area of research as knowledge of differences on individual traits under circumstances will prove valuable to uncover the relationship between role and gender.

The theory of social categories finds considerable evidence that gender serves as a social category in terms of influencing decisions, performance explanation, and behavioral expectations. The research reported in this paper justifies the proposition (Deaux 1984) that gender is a social category, and there are differences in gender specific choices of products or services in e-commerce environment. In our research, the personalization of keyphrases having brand value performs better (i.e. in an online market condition, the female consumers choose products for purchase resulting from branded searches). The personalization of branded product in the online market condition clearly justifies that gender serves as social category as the brand loyalty influences the online purchasing decision of the female consumers and thus indicates a possible risk-averse attitude of female searchers.

In the prior research (Jansen et al. 2011), brand value was determined by number of impressions, number of clicks and number of items purchased. The number of impressions refers to the brand awareness, while number of clicks indicates the brand image, and number of items purchased (the number of conversions from click to purchase) relates to brand relationship. In our study, the branded keyphrases searched by female users perform better than the other categories in terms of the all three aforementioned brand metrics.

The experience of consumers to purchase the branded items online can predict their e-commerce behavior (Constantinides et al. 2010) (females may perceive less risk for online shopping of branded items while male searchers do not differentiate much between branded and unbranded products or services). Such prediction of user behavioral proclivity towards brand presence indicates that the components of brand value in the context of the gender orientation of the users play a significant role in online commercial searching and ascertaining the worth of search results. So, the gender-brand effect relates the sponsored search campaign with the online business efforts that embeds user specific brand management.

6.3. Practical implications

From retailer's point of view, the implication is that improved personalization of web results based on gender and brand increases the retailer's revenue and profit from online advertising campaigns. In our research, female searchers prefer to engage in online shopping of branded items. Keyphrases with branding focus searched by the female users prove to be most successful for all metrics that characterize the sponsored search performance. This view is supported by the results observed in sales revenue, orders placed, items purchased, and ROA.

On the other hand, the unbranded keyphrases proved less effective across the three gender orientations compared to the branded ones. This implies that to gender target keyphrases, a retailer should include the niched female-oriented keyphrases common to branded queries, along with the generic phrases for unbranded queries in keyword advertising campaigns. Overall, it is beneficial for the retailers to devote resources to create ad recommendations, and leverage the brand image or reformulate marketing strategies targeting the female gender oriented keyphrases.

From the results shown, the unbranded keyphrases with male and neutral gender orientations are most expensive. It implies that the advertisers bid more for these unbranded keyphrases. Higher CPC with lower performance across the remaining metrics signify that targeting such unbranded keyphrases with male and neutral gender orientation is not justified for advertisers.

The combination of brand concept with the gender orientation of the searchers plays an important role in user specific brand management in online marketing. Our research shows that branded keyphrases with female gender orientation perform best for most of the sponsored search metrics (even CPC, since the cost is lower). The results differ from that of the prior research (Jansen et al. 2013) where gender neutral keyphrases performed best across the same performance metrics of the sponsored search if the brand effect is not considered. This indicates the effectiveness of using the combination of gender and branding focus for predicting user behavioral tendencies from the perspective of brand knowledge.

Moreover the results of the effect sizes displayed in Table 14 exhibits that large and medium effect sizes constitute more than one third of the total comparisons (34% with 17% each) compared to 17% (11% for large effect, 6% for medium effects) shown in the prior research (Jansen et al. 2011) and only small and negligible effect sizes generated by the previous gender based study (Jansen et al. 2013). This implies that though the practical significance of the performance of sponsored search metrics based solely on gender and solely on brand is limited, the observed differences among the categories formed with the combination of gender and branding focus is more impactful.

From the consumers perspective, the personalized web results for branded ads implies that female users are more inclined to rely on the branded advertisements compared to males. This in turn emphasizes the view that women shoppers might perceive less risk for branded advertisements, as corroborated in prior work (Sanchez-Franco 2006). Our result establishes that positive brand reputation creates dramatic influence on consumer's loyalty over the brand and hence strongly affects their interests, activities and purchasing behavior in e-commerce environment (Jansen et al. 2011). Moreover, it should be noted that for male searchers, the performance of keyword advertising does not differ between branded and unbranded keyphrases. This implies that male consumers do not care as much about the perception of risk-seeking or risk-averse e-commerce environment relative to their female counterparts, if we assume brand implies a risk adverse context. So, retailers should focus more on female orientation of branded

ads to enhance the revenue and profit generation via sponsored search.

7. Limitations

Our research has limitations, as with any research. First, the data set we use in our study may have a cultural bias. The dataset is obtained from one large US retailer, though the size is considerably large in terms of number of records and time span. We may have obtained different result in terms of gender-brand effect on sponsored search performance if we consider other large retail companies from other countries.

Second the gender oriented classification is based on the search queries, not specific to the searchers. The application we used gives a prediction of gender orientation once the keyphrase is specified. As such, we do not have certainty about the gender of the searchers but classify them within a certain confidence interval based on the queries.

Finally, the dataset used in this research does not include the offline behavior of the searchers. Neither does it consider the consumer's attitude on the landing pages of the advertisers (Jansen et al. 2007). For example, a user may use the search engine to get the results for a keyphrase and click on an ad displayed in SERP, but while purchasing the product, the customer may use some other information system or resource (e.g. call a brick and mortar store of the advertiser).

The research also has several strengths. The dataset we use in this paper is quite rich, and the data collection is longitudinal. The log contains 7 million daily records capturing searching and buying behavior of the users for a considerably lengthy temporal span (33 consecutive months through a four year period). The dataset contains a varied and valuable set of information regarding user interactions (impressions, clicks, revenue, profit, orders placed, items purchased, etc.) along with real time branded and unbranded keyphrases. So, the research findings present significant insights on user searching and purchasing behavior in the real world e-commerce domain.

8. Conclusion

The results regarding evaluation of online advertisement performance reported in this research indicate that the combination of female gender orientation and brand focus for keyphrases generates higher sales, more profit, and are relatively cheaper than other combinations. We believe that the outcome observed from this research is an important step for demographic targeting and managing positive brand reputation in sponsored search. Therefore, it is beneficial for the advertisers to devote resources to target the branded keyphrases with female gender orientation to improve advertising performance.

Based on the statistical significance of the findings, we believe that the research results reported in this paper provide valuable contribution on user behavior for brand preference to growing body of research in sponsored search domain. Our research helps retailers formulate their marketing strategies based on the gender specific preferences of brands and optimize brand management. Given the substantial impact that technology for sponsored search and the associated business process have on the growth and use of web in online commercial process, it is an area that needs extensive investigation from researchers belong to different academic disciplines.

For future work, we plan to perform an additional analysis to investigate the effect of the ranks of ads displayed in SERP on the number of impressions, clicks, sales revenue, CPC, orders placed, the number of items purchased and ROA for each gender-brand category. We further want to investigate small and medium sized companies to find out whether the results translates to these enterprises, especially in regards to different product categories. It would be interesting to see if gender-stereotype products would also see a different in the gender-brand association.

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