2010

Whose Click Fraud Data Do You Trust? Effect Of Click Fraud On Advertiser's Trust And Sponsored Search Advertising Decisions

Vikas Jain
University of Tampa, vjain@ut.edu

Vishal Midha
University of Texas - Pan American, vmidha@utpa.edu

Animesh Animesh
McGill University, animesh.animesh@mcgill.ca

WHOSE CLICK FRAUD DATA DO YOU TRUST? EFFECT OF CLICK FRAUD ON ADVERTISER'S TRUST AND SPONSORED SEARCH ADVERTISING DECISIONS

Journal:	*18th European Conference on Information Systems*
Manuscript ID:	ECIS2010-0131
Submission Type:	Research-in-Progress Paper
Keyword:	Consumer decision making, Decision making/makers, Trust/online trust, Uncertainty avoidance

WHOSE CLICK FRAUD DATA DO YOU TRUST? EFFECT OF CLICK FRAUD ON ADVERTISER'S TRUST AND SPONSORED SEARCH ADVERTISING DECISIONS

Jain, Vikas, University of Tampa, Tampa, Florida, United States, vjain@ut.edu

Midha, Vishal, UTPA, 1201 W. University Dr , Edinburg, Texas 78539, United States, vmidha@utpa.edu

Animesh, Animesh, McGill University, Montreal, Ontario, Canada, animesh.animesh@mcgill.ca

Abstract

Online sponsored search has emerged as a dominant business model for majority of search engines and as a popular advertising mechanism for online retailers. However, sponsored search advertising is being negatively impacted by click fraud which involves the intentional clicking on sponsored links with the purpose of gaining undue monetary returns for the search engine or harming a particular advertiser by depleting its advertising budget. While search engines tend to compensate advertisers to an extent for click frauds, it still leaves an element of uncertainty in the minds of advertisers whether search engine is being faithful in reporting the click fraud numbers. Armed with additional data available from third party click fraud audit companies, advertisers may have more reasons to suspect click fraud numbers reported by search engines if there is a discrepancy between the numbers reported by two sources (search engines and third party click fraud audit companies). While the phenomenon of click fraud has been acknowledged to exist, its effect on sponsored search advertisers' trust and their decision to advertise with a particular search engine has not been given sufficient attention in the literature. As an initial step, in this research in progress study, we develop a theoretical model to examine the effect of click fraud on advertiser's trust in search engine and its subsequent impact on advertiser's decision to adjust advertising spend for different search engines. In this paper, we also outline the proposed experimental design to validate the theoretical model subsequently in future. Broadly, the research suggests that sponsored search advertisers are likely to adjust their advertising spend based on level of trust they have in search engine, click fraud numbers discrepancy, and return on investment obtained from advertising on that particular search engine.

Keywords: Click fraud, Sponsored search, Search engine Online trust, Advertising.

1 INTRODUCTION

In online sponsored search (also known as "paid search" or "pay-for-placement" or "keyword") markets, firms compete to be listed on top of search results generated in response to a user's query (keyword search) in search engines such as Google and Yahoo!. Sponsored search markets have evolved to become the dominant mechanism for customer acquisition online, with firms reallocating significant proportions of their advertising budgets from traditional media to online sponsored search. In 2005, for instance, sponsored search accounted for more than 40% of the total online advertising dollars spent by companies in the United States (Markoff and Ives 2005).

Online sponsored search markets differ from traditional advertising formats in a number of important ways. First, these markets are highly competitive; the intensity of competition being reflected in the staggering costs for the top slots for several product-keywords. Second, firms are willing to incur these costs because sponsored search markets allow them to precisely target consumers that are actively searching for specific products or services. Finally, online sponsored search markets use a pay-per-click pricing mechanism in contrast to most traditional advertising formats that adopt a lump-sum pay-per-exposure pricing mechanism. This paves the way for numerous smaller, less- established, firms to compete with their larger, well-established counterparts, diminishing the role of brand name as the key differentiating factor, and further intensifying competition for the top slots.

However, recently, click fraud, a kind of advertising fraud, is becoming a cause of concern to sponsored search advertisers (Delaney 2007; Noonan 2007; SEMPO 2007). Click fraud in context of sponsored search advertising refers to an intentional act where sponsored links of the advertisers are clicked so that it might result in monetary returns for the search engine or might harm a particular advertiser by depleting its advertising budget. In the sponsored search market, three entities are involved: search engines, advertisers, and potential customers. Customers click on the sponsored advertisement links that show up when they search for a particular product or service using a search engine. Advertisers are billed based on the number of clicks made on their sponsored link by potential customers. If these clicks are made fraudulently with no intention to buy or interest in advertiser's products or services, advertisers could end up paying for the fraudulent clicks with no direct benefit to them. These fraudulent clicks can have significant negative impact on the advertising budget of an advertiser. According to a recent survey, the overall click fraud rate has grown to 17% in 2008 (Click Forensics, 2008).

The sponsored search advertisers have to rely on click fraud numbers reported by search engines because many of them lack adequate mechanisms and expertise to track click fraud. The other alternative available to advertisers is to engage the services of an independent click fraud audit company. While getting click fraud numbers audited by an independent audit company is beneficial, this alternative is not without limitations. One, it could be expensive and second, search engines may not compensate the advertiser based on the click fraud numbers reported by the independent click fraud audit company in case audit company reports higher click fraud.

While search engines usually compensate the advertisers for fraudulent clicks, such compensation is based on the fraudulent clicks tracked by the search engine. Reporting and compensating for fraudulent clicks present a paradoxical situation for search engines. A search engine stands to gain financially if it does not report fraudulent click numbers honestly. At the same time, it is not in the interest of the search engine to hide the fraudulent clicks because advertising spend is likely to be influenced if advertisers perceive that search engine is not acting in their best interest. There have been reports where search engines have tried to downplay the issue of click fraud and have been perceived to be reporting lower click fraud numbers than actually perceived to exist (Click Quality Team 2006). This situation is made more complicated by the fact that there is usually a significant divergence in the click fraud numbers reported by search engines

and those reported by third party click fraud audit companies such as Click Forensics (Mills 2006). From a sponsored search advertiser's perspective, discrepancy in the click fraud number reported by search engines and those reported by independent click fraud audit companies is likely to either enhance (in case of positive deviation) or reduce (in case of negative deviation) the trust in search engine's integrity. Therefore, click fraud has the potential to destroy the trust between online advertisers and publisher networks including the search engines.

With the growing sponsored search market, it is important to understand how the phenomenon of click fraud influences the trust relationship between search engine and the sponsored search advertiser and subsequent decision of a sponsored search advertiser to adjust his/her advertising spend with a particular search engine. While the phenomenon of click fraud has been acknowledged to exist (IAB Press Release 2007), its effect on sponsored search advertisers' trust and their decision to advertise with a particular search engine has not been given sufficient attention in the literature.

In this research in progress study, our objective is to develop a theoretical model that examine the effect of two factors, click fraud discrepancy and level of trust a sponsored search advertiser has in a search engine, on the advertiser's decision to adjust advertising spend. This research contributes to literature on sponsored search advertising in many ways. First, to the best of our knowledge, despite the increasing number of click frauds, there is no published study analyzing the effect of click fraud on the level of trust a sponsored search advertiser has in a search engine, and its subsequent impact on advertising decision. We contribute to the sponsored search advertising by building a theoretical model that analyzes trust relationship between sponsored search advertisers and the search engines. Second, by conceptualizing trust as a multi-dimensional construct based on current literature, this study helps search engines to develop interventions to address specific aspects of trusts to strengthen their relationship with sponsored search advertisers. Finally, this research is likely to open up avenues for further research by incorporating additional antecedents of trust and their effect on advertising decisions.

In the next section, we review the literature on online sponsored search advertising and click fraud. We then develop the theoretical model followed by outline of the proposed research methodology. We conclude the paper by discussing the next steps in validating the proposed theoretical model.

2 LITERATURE REVIEW

Current research in sponsored search field predominantly adopts an auctions perspective to examine the interaction between the search intermediary who conducts the sponsored search auction and sellers who bid in these auctions. Researchers have focused on designing better rank/position allocation mechanisms from the perspective of the search intermediary (Aggarwal et al. 2006; Asdemir 2006; Edelman et al. forthcoming; Feng et al. forthcoming; Lahaie 2006; Varian forthcoming), identified optimal bidding strategies from the perspective of sellers (Borgs et al. 2006; Kitts and Leblanc 2004; Rusmevichientong and Williamson 2006), and examined the market dynamics that result from these sponsored search auctions (Animesh et al. 2006; Edelman and Ostrovsky forthcoming). However, limited research has taken a trust perspective and examined the trust issues related to search intermediary in the context of sponsored search. Recently, researchers have examined the consumers' trust in sponsored search results and its impact on consumer behavior (Jansen and Resnick 2005). In this paper, we suggest that trust in search intermediary also plays an important role in advertiser's budget allocation decisions due to the concerns related to click fraud and develop a model to understand the impact of information inconsistency about click fraud on advertiser's advertisement allocation decision.

Click fraud results in invalid clicks (i.e., those clicks which had a zero conversion probability) on sponsored search advertisements which may have adverse impact on advertiser if search engine does not accurately account for such invalid clicks and consequently advertiser has to pay for such fraudulent

clicks. Increasing concerns related to click fraud and its potential adverse impact on the sponsored search markets have generated a significant interest among the research community to investigate the click fraud phenomenon. However, the research on sponsored search advertising and click frauds is still in a nascent stage.

The current literature on click-fraud can primarily be categorized into three research streams – journalistic, detective, and preventive (Midha 2008). The journalistic stream of research focuses on investigating click frauds and providing how-to guides for safeguarding businesses from click frauds (Eroshenko and Bloch 2004; Jansen 2007; Mahdian and Tomak 2007). Most of the publications advise taking precautionary steps including limiting daily spending, putting frequency cap on clicks, measuring depth of visits, recording visitors per IP address and paid clicks per IP, setting filters by country, performing log analysis, and displaying warning messages to frequent clickers (Eroshenko and Bloch 2004).

The detective stream of research focuses on developing machine learning algorithm based techniques to improve detection of fraudulent clicks in the data. Metwally et al (2005) developed a data mining technique based on Bloom Filters to detect fraudulent clicks in click data collected by the pay-per-click (PPC) program providers. They also developed another algorithm for detecting coalition click frauds, where affiliates generating fraudulent clicks share their resources in order to generate increased traffic from different IP addresses and locations. Immorlica et al (2005) showed that some of the common click-through-based algorithms were not resistant to frauds and proposed a new click-based rank-by-revenue mechanism to overcome it.

The preventive stream of research attempts to prevent click fraud by devising new payment models for online advertising. This stream aims to reduce click fraud by lowering the associated incentives. For example, Goodman (2005) proposed selling advertisers a particular percentage of all impressions rather than user clicks. Some researchers have suggested using pay-per-conversion models to alleviate click fraud problem. Mahdian and Tomak (2007) also proposed a similar pay-per-action (PPA) model where payments are related to 'actions' such as sales, phone calls, or online orders. This model includes pay-per-conversion along with online user behavior, such as phone-calls etc, reported by advertisers.

Clearly, most of the previous research has focused on either detecting click frauds after it has happened, or preventing click frauds from happening. Recently, researchers have started to examine the consumers' trust in sponsored search results and its impact on consumer behavior (Jansen and Resnick 2005, Midha 2008). However, limited research has taken a trust perspective and examined the trust issues related to search intermediary in the context of sponsored search. While online trust has been examined in number of prior studies (Ba and Pavlou, 2002; McKnight et al., 2002a, Pavlou et al., 2003; Gefen et al., 2003), it has not been studied in context of click fraud. Trust has been shown to be a critical element for facilitating economic dealings in markets, especially electronic markets. Trust can serve as a catalyst that minimizes information asymmetry and transaction-based risks between economic agents (Ba and Pavlou 2002; Pavlou and Gefen 2004). Recently, McKnight et al. (2002a) explained the theoretical nuances attached to trust by identifying its several strands, and developed a 'web trust model' that is particularly conducive to understanding the role of trust in e-commerce.

In this study, we try to explore multi-dimensional nature of trust and attempt to understand how click fraud impacts advertisers' trust in search intermediary such as Google and Yahoo!. In particular, we explore how advertisers' budget allocation decision depends on their trust in search intermediary's technical competence to detect fraudulent clicks, integrity and benevolence to report those fraudulent clicks. In the next section, we present theoretical underpinnings for our model to understand the impact of information inconsistency about click fraud on advertiser's advertisement allocation decision.

3 HYPOTHESES DEVELOPMENT

In this section, we develop arguments to suggest that click fraud data inconsistency between search engine and another data source would impact the allocation of advertisement budget to a search engine by influencing the trust beliefs in the search engine. We also propose that trusting belief in the other source of data and net return on investment from advertising on the search engine will act as moderating variables. A research model of all the constructs of interest in this study and their proposed relationships is shown in Figure 1.

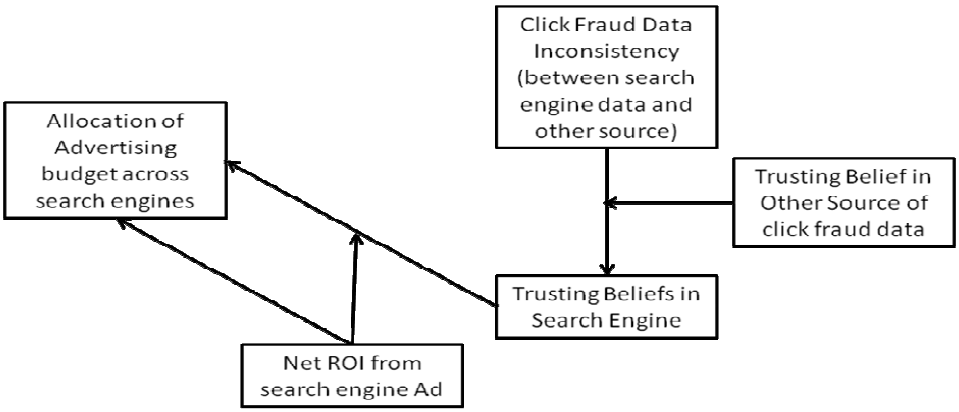

Figure 1: Conceptual Model

Search engines, acknowledging the presence of click fraud and their inability to prevent it, compensate the advertisers by not charging for the clicks identified by them as fraudulent. However, cognizant of the incentive structure of the search engine, advertisers are skeptical of the click fraud identification algorithms employed by search engines and suspect the credibility of the click fraud percentage data reported by the search engines. Therefore, to minimize the losses due to click fraud, advertisers often rely on their own IT department or a third party firm to track the fraudulent clicks. Given the lack of an industry standard to determine the use of filtering mechanisms and algorithms to identify click fraud, most often the click fraud numbers reported by different sources vary significantly and advertisers are faced with two conflicting reports about click fraud percentages – e.g., one from search engine and other from internal IT department. In situations where the click fraud data inconsistency is unfavorable1 from the perspective of the advertiser (i.e., the search engine reports lower click fraud percentage as compared to internal IT department report which leads to lower compensation for click fraud to the advertiser), an advertiser faces cognitive dissonance where advertiser has to chose between the belief that search engine is competent and trustworthy and the data reported by internal IT department must be incorrect or the

[1] We focus on search engine reporting lower invalid clicks for an advertiser (i.e., lower click fraud percentage) vis-à-vis another source of click fraud data obtained by advertiser. Thus the data reported by search engine is unfavorable to the advertiser vis-à-vis other source of data but it does not mean that data reported by search engine is necessarily less accurate than the other data source. Given that the algorithms used by advertising networks to detect invalid clicks are prone to error, algorithms may produce false negatives by identifying invalid clicks as valid, and false positives by identifying valid clicks as invalid. A false negative implies that an advertiser has been unfairly billed for a click that could not lead to a conversion. A false positive, on the other hand, is a valid click that the advertiser has received for free. Similarly, another source of data may also suffer from these errors and may report inaccurately identify clicks ads valid or invalid.

belief that search engine is likely to under report the click fraud due to conflict of interest and cannot be trusted. We argue that it is more likely that an advertiser will chose an explanation that is in advertiser's self interest and thus will attribute the lower click fraud percentage reported by the search engine to search engine's conflict of interest. As a result, unfavorable inconsistency in the click fraud numbers will lead an advertiser to suspect that search engines is not competent, benevolent and lacks integrity. Formally, we posit:

H1: Larger (unfavorable) inconsistency between the click fraud data reported by a search engine and advertiser's own IT department will be associated with lower perceived trust in the search engine.

Further, advertisers who strongly believe in the capability of their IT department are more likely to consider the data reported by internal click tracking system as reliable. Thus, it would be easier for them to rationalize that the click fraud data reported by search engine is not correct. Given stronger belief in the inaccuracy of the number reported by search engine, advertisers are more likely to resolve their cognitive dissonance by forming belief that search engine must have under reported click fraud percentage intentionally to maximize their profits and therefore cannot be trusted. Therefore, we suggest that belief in the competence of internal IT system will moderate the relationship between inconsistent click fraud data and perceived trust in search engine and posit:

H2: Stronger beliefs in the competence of own IT department will strengthen the negative relationship between click fraud data inconsistency and perceived trust in the search engine.

Trust is considered as a critical element of economic dealings, especially in electronic markets. Trust serves as an economic precursor that facilitates transactions of goods and services by minimizing information asymmetry and transaction-based risks between economic agents (Ba and Pavlou 2002; Pavlou and Gefen 2004). In the context of sponsored search advertising, among other risks, an advertiser faces the risk that the advertisements are being clicked by non-intended audience (i.e., who are not prospective consumers). Such clicks increase the cost of the advertiser without increasing the probability of sales. Advertisers can minimize this risk by using more focused and target keywords and varying their advertisements' position on the sponsored search listing. They, however, still face the risk of being charged for the fraudulent clicks on targeted advertisements. Trust in the search engine's ability and willingness to accurately track fraudulent clicks and compensate the advertiser for the payments made for such invalid clicks would lower the risk of wasteful advertisement expenditure and thus would encourage more advertisement budget allocated to the search engine which is considered more trustworthy. Therefore, we posit:

H3: Higher perceived trust in search engine will be associated with larger advertisement budget allocation to the search engine.

As a rational being, the advertiser should try to maximize the net return on investment (ROI)[2] after taking into account the click fraud compensation. Therefore, the decision to allocate advertising budget to a search engine should depend on the net ROI. Formally, we hypothesize:

[2] ROI accounts for the involved switching costs and any other intangible factors such as satisfaction and performance

H4: Higher return on investment (ROI) - after deducting click fraud compensation given by search engine - will be associated with larger advertisement budget allocation to the search engine.

In fact, based on the economic theory and assumption of rationality, the advertiser should not be influenced by the inconsistency in the click fraud data reported by search engine and another source as long as the net return on investment (ROI) after click fraud compensation is higher than the next best alternative available to the advertiser. Kitts et al. (2006) also state that "If an advertiser is rational, its bid price for clicks should track the actual conversion value of the click. If there is a sudden influx of fraud (for instance, 1/G clicks are now valid), the rational response will be for advertisers to drop their bid prices by the same factor (1/G). The result is that there is no change in search engine fees, advertiser acquisitions or cost per-acquisition". However, we argue that given the reports in media about prevalence of click fraud and under reporting by search engines combined with the conflict of interest of search engine, advertisers may rely on their trust beliefs, especially if the net return is low. Therefore, we posit:

H5: Higher return on investment (ROI) - after deducting click fraud compensation given by search engine - will negatively moderate the relationship between perceived trust in search engine and advertisement budget allocation to the search engine.

4 RESEARCH METHODOLOGY

We propose a field experiment for this research. Specifically, we intend to invite MBA students to visit our experimental website to fill out a survey about click fraud information and advertising decisions. A 2 X 2 X 2 experimental design will be used to study the effect of click fraud information on trust and its subsequent effect on advertising decisions of sponsored search advertisers. The experiment will employ a scenario of a fictitious company which advertises through sponsored search on two different search engines. It must be noted that the search engines will be generically labeled as Search Engine A and Search Engine B to control for the confounding effects of search engine's reputation or advertiser's familiarity with the search engine on trust. In this study, we propose to use click fraud information provided by internal IT department of the fictitious company as a way to assess under reporting of click fraud numbers by the search engines.

We propose to create two scenarios of the company, one which indicates high competence level of internal IT department to track click frauds and second which indicates low competence level of internal IT department to track click frauds. In future, we intend to use click fraud information provided by independent click fraud tracking companies as a way to assess under reporting of click fraud numbers by the search engines. The reason for making this distinction between click fraud numbers tracked by internal IT department of an advertiser company and by independent third party companies is that it introduces an element of conflict of interest if numbers from independent companies are used. It is likely that independent click fraud tracking companies would tend to report higher click fraud numbers because their business model is based on over reporting. If these companies report lower numbers than what search engines report, it is unlikely an advertiser is going to see value in retaining their services. From the research model perspective, this requires incorporating a new variable for trusting beliefs about the third party click fraud tracking companies in addition to trusting beliefs about search engine. Therefore, for the purpose of this study, we focus on click fraud tracking by internal IT department of the advertiser company which does not require incorporating trusting beliefs variable. In future, we would consider incorporating the trust variable related to third party click fraud tracking companies. However, the current

study does require incorporating perceptions about the competence level of internal IT department to correctly track the click fraud numbers.

As outlined in the proposed model in Figure 1, the key variables that ultimately impact advertiser's advertising decision are return on investment, trusting beliefs about the search engine, click fraud data, and competency level of internal IT department of the advertiser's company. To manipulate click fraud information, difference in click fraud numbers reported by the search engine and that tracked by the internal IT department of the advertiser's company will be used. This is referred to as inconsistency in click fraud number from the two sources. This inconsistency is unfavorable to advertiser if search engine reports lower click fraud numbers than the internal IT department and favorable to advertiser if search engine reports higher click fraud numbers than the internal IT department. Obviously, favorable inconsistency will not negatively affect advertiser' trust and therefore, is not likely to provide any meaningful insights. Therefore, favorable inconsistency is being excluded from consideration in this study at this stage. Since, we propose to manipulate click fraud information through extent of unfavorable inconsistency between fraudulent clicks reported by a search engine and those reported by internal IT department of the advertising company, we intend to use two levels for unfavorable inconsistency (high and low).

The perceived competency level of the internal IT department of the company in tracking click frauds is proposed to be manipulated using two levels, high and low. For return on investment, we propose to use two levels of return on investment (ROI) but this variable will be manipulated for within subject variance and not for across subjects. This means that every subject will be exposed to both levels of ROI (high and low). Therefore, the proposed experimental design is 2 X 2 X 2 design with two levels for perceived competency of internal IT department of the advertiser's company, two levels for unfavorable inconsistency, and two levels for ROI.

For operationalizing trusting beliefs about the search engine, it is proposed to use two search engines in the experiment labeled as search engine A and search engine B. The use of two search engines will allow us to observe the shift in advertising dollars from one search engine to another in light of trusting beliefs, click fraud information (negative inconsistency and absolute value of fraudulent clicks from both search engines), and competency of internal IT department. We intend to measure trusting beliefs using three dimensions of competence, integrity, and benevolence (McKnight et al 2002). The subjects will be asked to indicate their perception about the trust in search engines A and B.

We intend to recruit MBA students as subjects for this study. The proposed experimental design requires at least 150 subjects for meaningful analysis of data. Currently, we have developed the fictitious company scenario and the instrument for measuring trust beliefs. We are in the process of conducting a pilot test. The research instrument and the company scenario are available upon request.

5 EXPECTED CONTRIBUTIONS AND NEXT STEPS

The issue of click fraud is important for sponsored search advertisers. Considering the lack of transparency in reporting of click fraud numbers by search engines, the advertisers have to rely on numbers from other sources in order to protect their interests. While the issue of click fraud has been the focus of some studies in the literature (Eroshenko and Bloch 2004; Jansen 2007; Mahdian and Tomak 2007, Jansen and Resnick 2005, Midha 2008) but its effect on advertisers' trust and their advertising decisions has not been analyzed. From this standpoint, this study is one the first to develop a trust model that analyzes impact of click fraud information on advertisers' decision to advertise with a particular search engine. It is expected that the findings of this study will underline the extent of rationality in advertisers' decision to modify their advertising decision with respect to a search engine in light of click fraud information and their trust beliefs. For a rational advertiser, return on investment from sponsored

search advertising should determine the advertising decision. However, this study aims to highlight that trusting beliefs also tend to play a significant role in determining advertising decision in additional to return on investment. The findings of this study are likely to be important for search engines to understand how they can work toward building the trust of advertisers. As a next step of this study, we plan to conduct the proposed experiment over the summer and early fall of 2009. The analysis results will be available for presentation at the conference in fall.

References

Aggarwal, G., Goel, A., and Motwani, R. (2006). Truthful auctions for pricing search keywords. Proc. 7th ACM Conference on Electronic Commerce, Ann Arbor, MI, pp. 1-7.

Animesh, A., Ramachandran, V., and Viswanathan, S. (2006). Quality Uncertainty and Adverse Selection in Online Sponsored Search Markets. Working Paper, R. H. Smith School of Business, University of Maryland.

Asdemir, K. (2006). Bidding Patterns in Search Engine Auctions. Working Paper, University of Alberta.

Ba, S., and Pavlou, P. A. (2002). Evidence of the effect of trust building technology in electronic markets: Price premiums and buyer behaviors. MIS Quarterly, 28(3), 243–268.

Borgs, C., Chayes, J., Etesami, O., Immorlica, N., Jain, K., and Mahdian, M. (2006). Bid optimization in online advertisement auctions. Proc. Second Workshop on Sponsored Search Auctions, Ann Arbor, Michigan

Click Quality Team. "How Fictitious Clicks Occur in Third-Party Click Fraud Audit Reports" Google, Inc. (August 8, 2006). http://www.google.com/adwords/ReportonThird-PartyClickFraudAuditing.pdf

Delaney, K.J. (2007) Search-Ad Buyers Have New Worry: 'Click Fraud'. http://www.findbase.com/headlines/click-fraud/2005.04.08-search-ad-new-worry click-fraud-wsj.htm, accessed on Nov 20, 2007

Edelman, B., and Ostrovsky, M. (2007). Strategic Bidder Behavior in Sponsored Search Auctions. Decision Support Systems, 43 (1).

Edelman, B., Ostrovsky, M., and Schwarz, M. (2007). Internet Advertising and the Generalized Second Price Auction: Selling Billions of Dollars Worth of Keywords. American Economic Review, 1, 242-59

Eroshenko. D., and Bloch, M. (2004) How to Defend Your Website against Click Fraud. ClickLab White Paper.

Feng, J., Bhargava, H.K., and Pennock, D.M. (2007). Implementing Sponsored Search in Web Search Engines: Computational Evaluation of Alternative Mechanisms. Informs Journal on Computing, 19 (1).

Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in online shopping: An integrated model. MIS Quarterly, 27(1), 51–90.

Goodman, J. (2005) Pay-per-percentage of impressions: An advertising method that is highly robust to fraud. Workshop on Sponsored Search Auctions.

IAB Press Release. (2007) The interactive industry commits to the development of click measurement guidelines. http://www.iab.net/news/pr_2006_08_02.asp, accessed on March 10, 2007

Immorlica, N.; Jain, K.; Mahdian, M.; and Talwar, K. (2005). Click fraud resistant methods for learning click-through rates, Proceedings of the First International Workshop on Internet and Network Economics (WINE), Lecture Notes in Computer Science 3828, 34-45

Jansen, B. Click Fraud. Computer, (July 2007), 85-86

Jansen, B.J. & Resnick, M. (2005). Examining Searcher Perceptions of and Interactions with Sponsored Results. Paper Presented at the Workshop on Sponsored Search Auctions at ACM Conference on Electronic Commerce (EC'05), 5 – 8 June 5, Vancouver, BC, Canada

Kitts, B., and Leblanc, B. (2004). Optimal Bidding on Keyword Auctions. Electronic Markets, 14(3) pp 186-201

Kitts, B., LeBlanc, B., Meech, R., Laxminarayan, P. (2006) Click fraud. Bulletin of the American Society for Information Science and Technology, 32(2), 23-24

Lahaie, S. (2006). An Analysis of Alternative Slot Auction Designs for Sponsored Search. 7th ACM Conference on Electronic Commerce

Mahdian, M. and Tomak, K. (2007) Towards a pay-per-action model in sponsored search. Proceedings of the Ninth International Conference on Electronic Commerce. New York, NY; ACM, 87-88.

Markoff, John, and Ives, Nat. (2005, February 4). Web search sites see clicks add up to big ad dollars [Business/Financial Desk]. New York Times, p. 1.

Mayer, R. C., Davis, J. H. and Schoorman, F. D. (1995). An integrative model of the organizational trust, Academy of Management Review 20(3), 709-734

McKnight, D.H., Choudhury, V., and Kacmar, C. (2002), "Developing and Validating Trust Measures for e-Commerce: An Integrative Typology," Information Systems Research, 3 (September), 334–59.

Metwally, A.; Agrawal, D.; and El Abbadi, A. (2005). Duplicate detection in click streams. Proceedings of the International WWW conference, 12-21

Midha, V. (2008) The Glitch in On-line Advertising: A Study of Click Fraud in Pay-Per-Click Advertising Programs, International Journal of Electronic Commerce, 13(2), p.91-112, Winter 2008-9

Mills, E. (2006). http://news.cnet.com/Google-calls-click-fraud-estimates-overblown/2100-1024_3-6103387.html

Noonan, J.S. (2007). "Click Fraud" imperils internet marketing. Click-fraud costs may hit $1 billion yearly. CRM Today. http://www.crm2day.com/news/crm/115036.php, accessed on May 1, 2007

Pavlou, P. A., & Gefen, D. (2004). Building effective online marketplaces with institution-basedtrust. Information Systems Research, 15(1), 667–675.

Rousseau, D., Sitkin, M., Burt, R., & Camerer, C. (1998). Not so different after all: A cross-discipline view of trust. Academy of Management Review, 23(3), 393-404

Rusmevichientong, P., and Williamson, D.P. (2006). An Adaptive Algorithm for Selecting Profitable Keywords for Search-Based Advertising Services. Proc. Seventh ACM Conference on Electronic Commerce, pp. 260-269.

SEMPO. (2007). Click Fraud, an Industry Crisis, or Blip on the Search Engine Marketing Landscape? http://www.sempo.org/news/releases/click_fraud/, accessed on May 1, 2007

Varian, H.R. (2007) Position Auctions. International Journal of Industrial Organization, 26(6).